Incidence of Type 1 diabetes in Australia 2000–2006

First results

The Australian Institute of Health and Welfare is Australia's national health and welfare statistics and information agency. The Institute's mission is *better information and statistics for better health and wellbeing.*

Incidence of Type 1 diabetes in Australia 2000–2006

First results

2008

Suggested citation

Australian Institute of Health and Welfare

Board Chair
Hon. Peter Collins, AM, QC

Director
Penny Allbon

Contents

Acknowledgments

Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
APEG	Australasian Paediatric Endocrine Group
ASR	Age-standardised rate
CI	Confidence interval
GDM	Gestational diabetes mellitus
LADA	Latent autoimmune diabetes in adults
NDR	National Diabetes Register
NDSS	National Diabetes Services Scheme

Summary

This report presents the latest results on new cases (the incidence) of Type 1 diabetes in Australia based on data from the Australian Institute of Health and Welfare's National Diabetes Register (NDR). This is the first time that results from the NDR on Type 1 diabetes in people aged over 40 years have been published.

Results for the period 2000–2006 on the incidence of Type 1 diabetes in children aged 0–14 years show that:

- Australia's average annual rate (22 per 100,000 population) is high when compared with available data from other countries.

- There were over 6,000 new cases, which equates to more than 2 new cases each day.

- The rate is increasing in Australia at almost 3% per year. The age-adjusted rate increased significantly from 19 per 100,000 to 23 per 100,000 over the period.

- The average annual rate peaked in children aged 10–14 years at 29 per 100,000, which was twice as high as the rates for children aged 0–4 years.

Type 1 diabetes does not only develop in childhood but can arise at any age. Over the period 2000–2006:

- There were almost 9,000 new cases in people aged 15 years or over which equates to around 3 new cases per day.

- Among this age group the incidence rate was highest for 15–24 year olds (15 per 100,000) and lowest for people aged 40 years or over (5 per 100,000).

- Males aged 15 years or over were almost twice as likely as females of the same age to develop Type 1 diabetes.

1 Introduction

Purpose

This report presents a snapshot of the latest results on new cases (incidence) of Type 1 diabetes in Australia from the National Diabetes Register (NDR). The NDR is described in more detail in Box 1. The NDR now has eight years of data on over 94,000 cases of people who began using insulin to manage their diabetes over the period 1999–2006. Just over 15,600 people on the NDR (17%) have Type 1 diabetes. This report provides incidence estimates for Type 1 diabetes by age, sex, year of first insulin use and state or territory of usual residence. 'Incidence' refers to the number of new cases of an illness occurring during a given period.

Box 1: The National Diabetes Register

The NDR, maintained at the Australian Institute of Health and Welfare, is a prospective population-based register of people living in Australia with insulin-treated diabetes who began using insulin to manage their diabetes on or after 1 January 1999. It holds information on people with all forms of insulin-treated diabetes, including Type 1, Type 2, gestational and other types of diabetes. This scope includes all new cases of Type 1 diabetes because they all require insulin treatment. However, only a proportion of Type 2 and gestational diabetes cases require insulin treatment so those that do not are excluded from the NDR. The NDR has two sources of ascertainment: the National Diabetes Services Scheme database, administered by Diabetes Australia, and the Australasian Paediatric Endocrine Group's state and territory databases for 0–14 year olds.

Type of diabetes

There are three main types of diabetes covered by the NDR—Type 1, Type 2 and gestational diabetes. This report covers Type 1 diabetes only (see Box 2).

As previously described, reported diabetes type may not always be reliable, particularly with people reporting Type 1 diabetes when they actually have Type 2 (AIHW: Catanzariti et al. 2007). Thus, in order to obtain a more accurate measure of type of diabetes, an algorithm (a method of calculation which is shown in Box 3 in the appendix) has been developed that assesses 'reported type of diabetes', based on age at diagnosis and the period of time between diagnosis and date of first insulin use, to create 'derived type of diabetes'. More detailed information is provided in the appendix.

Use of the algorithm helps to reduce any misclassification of Type 1 diabetes on the NDR. For this reason, tables in this report involving type of diabetes are based on 'derived type of diabetes' and not 'reported type of diabetes', unless otherwise stated. However, even with the algorithm, some level of misclassification may remain.

Box 2: Type 1 diabetes

What is Type 1 diabetes?

Type 1 diabetes mostly arises in children or young adults, although it can occur at any age. It is marked by severe insulin deficiency. People with Type 1 diabetes need insulin replacement for survival.

In adults, Type 1 diabetes sometimes occurs as a slowly progressive condition known as latent autoimmune diabetes in adults (LADA). At presentation, LADA appears to be similar to Type 2 diabetes, and can be treated with lifestyle changes or tablets, but in fact it is a slowly progressive form of autoimmune or Type 1 diabetes that ultimately requires insulin injections.

What causes Type 1 diabetes?

Most cases are caused by autoimmune destruction of the cells of the pancreas that produce insulin. While it is thought that a combination of genetic and environmental factors are involved in the development of the disease (Daneman 2006), the exact factors are unclear and research into the cause of Type 1 diabetes continues.

Complications of Type 1 diabetes

Type 1 diabetes is a serious, life-long disease that causes a major health, social and economic burden for individuals with the disease, their families and the community. Type 1 diabetes is associated with many complications including kidney disease, diabetic eye disease, cardiovascular disease and nerve damage, as well as a reduced quality of life and a shortened life expectancy.

2   Incidence of Type 1 diabetes in children aged 0–14 years

This chapter presents incidence estimates for the 7-year period from 2000 to 2006 for children with Type 1 diabetes aged 0–14 years at their first insulin use. The incidence estimates in this chapter are presented by age, sex, year of first insulin use and state or territory of usual residence. Ninety-five per cent confidence intervals for the incidence estimates are shown in the tables and figures. Note that results for 1999 have been excluded because coverage was noticeably lower in that year; please refer to the Methods section in the appendix for more details.

Age and sex

- Between 2000 and 2006, there were 6,279 new cases of Type 1 diabetes among children aged 0–14 years registered on the NDR—3,284 among boys and 2,995 among girls (Table A1). The total number of new cases equates to more than 2 new cases per day.

- The average age-adjusted incidence rate of Type 1 diabetes for children was 22.4 new cases per 100,000 population each year (Table 1; Figure 1). This is high when compared with available data from other countries (AIHW: Catanzariti et al. 2007). In worldwide research conducted by the International Diabetes Federation, Australia was found to be one of the top 10 countries in incidence rates for Type 1 diabetes in children (IDF 2006).

- The rate of new cases of Type 1 diabetes in children is increasing in Australia. Between 2000 and 2006, the age-adjusted incidence rate increased significantly from 19.2 to 22.6 per 100,000, which equates to an annual average increase of 2.7% per year (Table 1). The increase in the rate of new cases of Type 1 diabetes in children is not unique to Australia and has also been observed internationally in Asia, Europe and North America (DIAMOND Project Group 2006).

- Among 0–4 and 5–9 year olds the increase in incidence between 2000 and 2006 did not reach statistical significance. However, among 10–14 year olds a significant increase was observed, from 24.5 per 100,000 in 2000 to 30.8 in 2006.

- When comparing boys and girls in different age groups over the 7-year period, the incidence rate was significantly higher among boys aged 0–4 years (15.9 per 100,000) than girls of the same age (13.3). However, there was no evidence of differences in incidence rates between boys and girls aged 5–9 years or 10–14 years.

- In every year, the incidence of Type 1 diabetes increased significantly with age for both sexes. The average annual incidence rate was lowest in the 0–4 year age group (14.6 per 100,000) and highest in the 10–14 year age group (28.6 per 100,000), with the 5–9 year age group sitting in between at 23.4 per 100,000 (Table 1; Figure 1).

Table 1: Incidence rate of Type 1 diabetes among 0–14 year olds, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
				Number per 100,000 population				
Males								
0–4	12.8	16.1	16.4	18.8	16.2	16.3	14.4	15.9 (14.7–17.0)
5–9	20.1	20.6	22.2	22.8	25.5	23.0	22.8	22.4 (21.1–23.8)
10–14	25.1	29.1	28.4	30.3	32.3	28.6	34.1	29.7 (28.2–31.3)
Males 0–14 ASR[b] (95% CI)	**19.4** (17.6–21.5)	**22.1** (20.1–24.2)	**22.4** (20.4–24.6)	**24.0** (22.0–26.3)	**24.8** (22.7–27.0)	**22.8** (20.8–24.9)	**23.9** (21.9–26.1)	**22.8** (22.0–23.6)
Females								
0–4	11.4	12.2	13.8	15.0	13.5	15.0	12.4	13.3 (12.2–14.4)
5–9	21.3	23.4	24.4	28.0	26.8	24.1	23.3	24.5 (23.0–25.9)
10–14	23.8	25.1	29.4	30.1	29.8	26.8	27.3	27.5 (26.0–29.0)
Females 0–14 ASR[b] (95% CI)	**18.9** (17.1–21.0)	**20.4** (18.4–22.5)	**22.7** (20.6–24.9)	**24.5** (22.4–26.8)	**23.5** (21.4–25.8)	**22.1** (20.1–24.3)	**21.1** (19.2–23.3)	**21.9** (21.1–22.7)
Persons								
0–4	12.1	14.2	15.1	16.9	14.9	15.7	13.4	14.6 (13.8–15.4)
5–9	20.7	22.0	23.3	25.3	26.1	23.6	23.0	23.4 (22.4–24.4)
10–14	24.5	27.2	28.9	30.2	31.1	27.8	30.8	28.6 (27.6–29.7)
Persons 0–14 ASR[b] (95% CI)	**19.2** (17.9–20.6)	**21.2** (19.8–22.7)	**22.5** (21.1–24.1)	**24.3** (22.8–25.9)	**24.2** (22.7–25.8)	**22.5** (21.0–24.0)	**22.6** (21.1–24.1)	**22.4** (21.8–22.9)

(a)   The rate is the average annual rate for the 7 years.

(b)   Age-standardised to the 2001 Australian population—see the Methods section in the appendix.

Source: National Diabetes Register (data extracted April 2008).

Number per 100,000 population

Age at first insulin use (years)

Note: The total rate for 0–14 years is age-standardised to the 2001 Australian population.

Source: National Diabetes Register (data extracted April 2008).

Figure 1: Incidence rate of Type 1 diabetes among those aged 0–14 years, by age and sex, 2000–2006
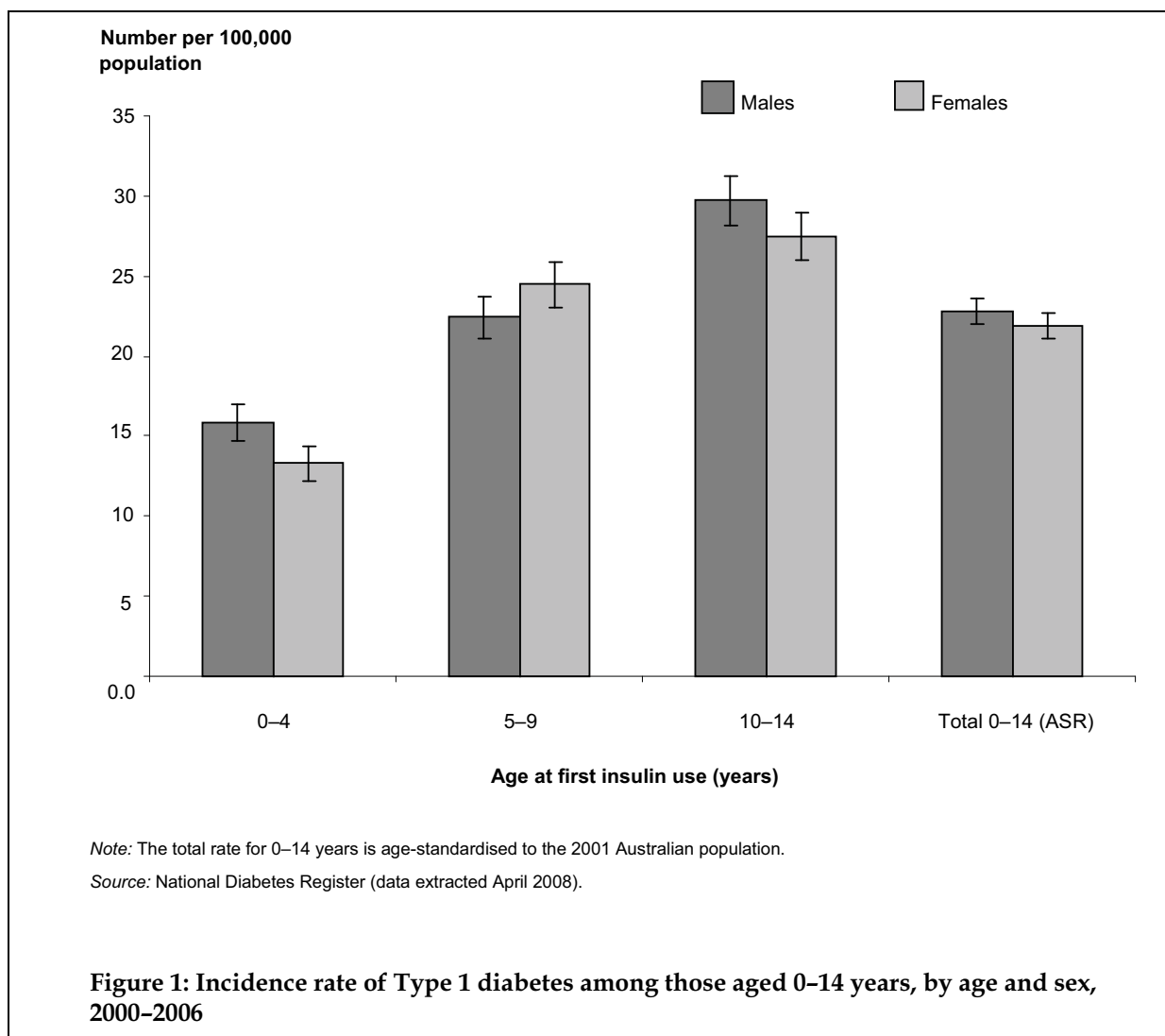
States and territories

Care should be taken when interpreting rates for the smaller states and territories because of the small numbers involved (Table A2).

- On average, Tasmania had the highest incidence rate of Type 1 diabetes among 0–14 year olds, with 28.9 new cases per 100,000 population between 2000 and 2006. This was significantly higher than the rate of new cases in New South Wales (20.6), Victoria (23.5), Queensland (23.0), Western Australia (21.9) and the Northern Territory (10.3) (Table 2).

- The Northern Territory had the lowest incidence rate with 10.3 per 100,000 and this was significantly lower than all other states and territories (Table 2).

Table 2: Incidence rate of Type 1 diabetes among 0–14 year olds, and state or territory of usual residence, 2000–2006

Year of first insulin use	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
				Number per 100,000 population[a]					
2000	18.7	19.1	20.7	17.2	24.1	14.9	15.3	12.0	19.2
2001	20.1	22.1	22.8	21.1	20.8	24.1	22.9	8.2	21.2
2002	21.5	23.9	20.9	24.8	25.7	25.5	24.4	6.0	22.5
2003	20.7	26.2	25.5	25.4	30.9	31.7	16.8	10.3	24.3
2004	23.4	23.6	24.4	23.2	28.0	30.6	31.4	18.3	24.2
2005	20.2	24.5	23.3	20.2	21.1	40.9	32.1	5.9	22.5
2006	19.9	24.8	23.1	21.2	27.1	34.8	17.6	11.7	22.6
Average 2000–2006	**20.6**	**23.5**	**23.0**	**21.9**	**25.4**	**28.9**	**22.9**	**10.3**	**22.4**
(95% CI)	**(19.7–21.6)**	**(22.3–24.7)**	**(21.8–24.3)**	**(20.2–23.7)**	**(23.2–27.6)**	**(25.0–33.2)**	**(18.7–27.8)**	**(7.2–14.3)**	**(21.8–22.9)**

(a)   Age-standardised to the 2001 Australian population—see the Methods section in the appendix.

Source: National Diabetes Register (data extracted April 2008).

3   Incidence of Type 1 diabetes in people aged 15 years or over

This chapter presents incidence estimates for Type 1 diabetes in people aged 15 years or over at their first insulin use. This is the first time that results from the NDR on Type 1 diabetes in people aged 40 years or over have been published. Ninety-five per cent confidence intervals for the incidence estimates are shown in the tables and figures.

Type 1 diabetes not only develops in childhood but can arise at any age. However, the disease develops at a lower rate throughout adulthood compared to during childhood (AIHW: Catanzariti et al. 2007; Bruno et al. 2005; Daneman 2006; Lammi et al. 2007; Molbak et al. 1994). Some adults may present with a slowly progressive form of autoimmune disease known as latent autoimmune diabetes in adults (LADA) (see Box 2).

Age and sex

- Data from the NDR indicate that, between 2000 and 2006, an estimated 15,105 new cases of Type 1 diabetes occurred in Australia. While the majority (58%) of these new cases occurred in people aged 15 years or over (8,826 cases), the age-specific incidence rates per 100,000 population among this group (Table A3b) tend to be lower than those for 0–14 year olds (Table 1).

- Among people aged 15 or over at first insulin use there was an average of 1,260 new cases per year (Table A3a), or more than 3 new cases per day.

- Around one-third (32%) of these cases occurred among people aged 15–24 years, 34% among 25–39 year olds and 34% among people aged 40 years or over (Table A3a).

- The rate of new cases of Type 1 diabetes among people aged 15 years or over decreased significantly with age until around the age of 45 years where it plateaued (Figure 2; Table A3b). The highest rate occurred in people aged 15–19 at diagnosis, at 16.7 new cases per 100,000 each year, and fell to around 4–6 new cases for people aged 45 years or over.

- The rate for people aged 15–24 years was notably lower (14.8 per 100,000) than the rate for 0–14 year olds (22.4) (Table 1) and thus it appears that the peak incidence rate of Type 1 diabetes occurs before the age of 15 years.

- Over the 7-year period, males aged 15 years or over had a significantly higher incidence of Type 1 diabetes than females of the same age. Males accounted for 63% of new cases while females accounted for 37% (Table A3a). Among 15–24 year olds, the average age-adjusted incidence rate for males (17.5 per 100,000) was 1.5 times as high as that for females (12.0) (Table A3b). The male rate was twice as high as the female rate among 25–39 year olds (13.2 compared with 6.7 per 100,000), and 1.7 times as high among those aged 40 years or over (6.1 compared with 3.6 per 100,000). This male excess in the older age group is consistent with the findings of various other studies (including Gale & Gillespie 2001; Kyvik et al. 2004; Weets et al. 2002).

- Between 2000 and 2006, the age-standardised incidence of Type 1 diabetes among people aged 15–24 years remained fairly stable (Figure 3). However, there was a significant decrease in incidence rates among people aged 25 years or over, with the rate decreasing

from 11.8 to 9.1 per 100,000 for 25–39 year olds and from 7.6 to 3.8 per 100,000 for people aged 40 years or over. A similar pattern was observed for both males and females (Table A3b).

- The results presented in this report show that, from 2000 to 2006, the incidence of Type 1 diabetes increased significantly among 0–14 year olds and decreased significantly among people aged 25 or over. This is consistent with studies that show that the incidence of Type 1 diabetes is increasing among children but not among young adults (IDF 2006), and may indicate a shift to a younger age at onset.
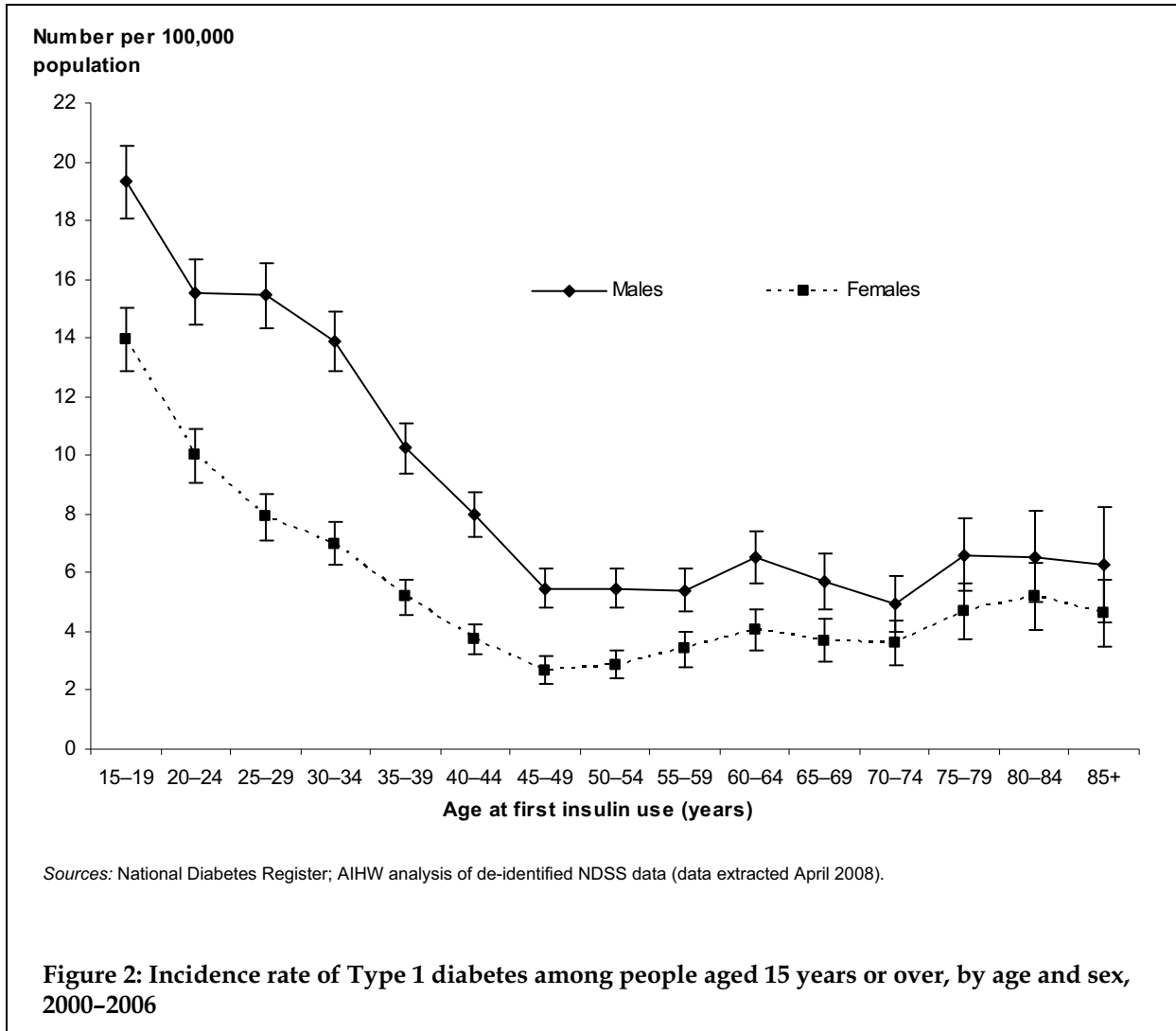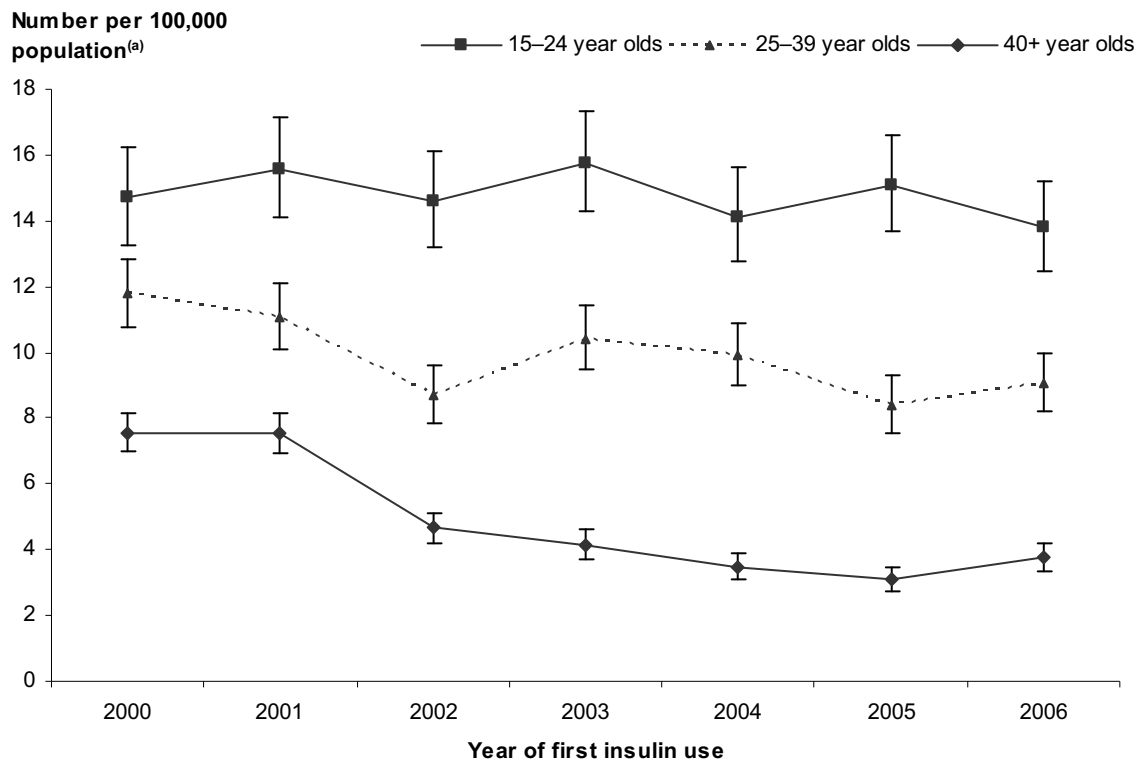
Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

**Figure 2: Incidence rate of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006**

(a)   Age-standardised to the 2001 Australian population—see the Methods section in the appendix.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Figure 3: Incidence rate of Type 1 diabetes among people aged 15 years or over, by year and age, 2000–2006

States and territories

Care should be taken when interpreting rates for the smaller states and territories because of the small numbers involved (Table A4).

- Between 2000 and 2006, the average annual rate of new cases of Type 1 diabetes among people aged 15–24 years ranged from 19.0 per 100,000 in the Australian Capital Territory to 11.1 in the Northern Territory (Table 3). Among 25–39 year olds, the incidence rate ranged from 12.6 per 100,000 in Tasmania to 7.1 in the Australian Capital Territory; and among people aged 40 years or over it ranged from 6.4 per 100,000 in Tasmania to 2.7 in the Australian Capital Territory.

- The age patterns in almost all states and territories were in line with the national trend. That is, the rate of new cases of Type 1 diabetes in those aged 15 years or over was highest in those aged 15–24 years and lowest among those aged 40 years or over.

Table 3: Incidence rate of Type 1 diabetes among people aged 15 years or over, by age and state or territory of usual residence, 2000–2006

Age at first insulin use (years)	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
	Number per 100,000 population[a]								
15–19	15.4	17.1	17.0	20.1	15.5	19.3	18.9	11.5	16.7
20–24	11.3	11.8	15.1	14.1	13.7	14.5	19.2	10.6	12.8
15–24 ASR[b] (95% CI)	**13.4** (12.5–14.3)	**14.5** (13.4–15.6)	**16.1** (14.8–17.4)	**17.2** (15.4–19.1)	**14.6** (12.7–16.7)	**17.0** (13.4–21.2)	**19.0** (14.8–24.1)	**11.1** (7.1–16.5)	**14.8** (14.3–15.4)
25–29	10.6	11.4	13.9	13.7	9.4	16.5	9.3	10.5	11.7
30–34	9.0	10.3	11.8	12.4	11.5	13.7	5.6	12.5	10.5
35–39	6.7	7.1	8.6	9.6	10.2	7.7	6.4	4.2	7.7
25–39 ASR[b] (95% CI)	**8.7** (8.2–9.3)	**9.5** (8.9–10.2)	**11.4** (10.5–12.3)	**11.9** (10.7–13.2)	**10.4** (9.1–11.8)	**12.6** (10.0–15.6)	**7.1** (5.0–9.7)	**9.0** (6.2–12.6)	**9.9** (9.6–10.3)
40–44	5.2	5.4	5.7	8.9	5.8	9.8	3.4	6.3	5.9
45–49	3.9	3.2	4.5	5.6	4.4	4.9	4.2	3.0	4.1
50–54	4.4	4.0	2.8	5.6	5.3	5.2	1.9	6.8	4.2
55–59	4.5	4.9	2.6	6.0	5.9	4.4	0.8	3.1	4.4
60–64	5.8	5.3	3.2	5.5	7.2	7.3	4.7	7.2	5.3
65–69	5.4	4.9	2.5	6.2	5.0	5.2	0.0	8.3	4.7
70–74	4.9	5.3	1.1	4.6	5.4	1.7	0.0	6.6	4.2
75–79	6.9	5.5	1.2	5.1	6.9	14.2	4.8	0.0	5.5
80–84	5.4	8.6	1.6	6.7	6.7	5.9	0.0	0.0	5.7
85+	5.1	7.4	1.5	2.4	7.9	5.7	10.3	0.0	5.1
40+ ASR[b] (95% CI)	**5.0** (4.7–5.3)	**4.9** (4.5–5.2)	**3.3** (2.9–3.6)	**6.1** (5.5–6.8)	**5.7** (5.1–6.4)	**6.4** (5.2–7.8)	**2.7** (1.8–4.1)	**4.9** (3.0–7.5)	**4.8** (4.6–5.0)

(a) The rate is the average annual rate for the 7 years.

(b) Age-standardised to the 2001 Australian population—see the Methods section in the appendix.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

4   Forthcoming publications

The publication planned to follow this report is a major statistical profile report covering NDR data up to 2007. This publication will provide a general profile of the NDR registrants by describing the demographic features of the NDR population. It will contain the latest information on the incidence of Type 1 diabetes up to 2007. It will also provide information on NDR registrants with other forms of diabetes (Type 2, gestational and other types).

For a full list of NDR publications see <www.aihw.gov.au/diabetes/publications.cfm>.

Appendix

Data sources

AIHW population database

Population data held by the Australian Institute of Health and Welfare (AIHW) are sourced from the Australian Bureau of Statistics' (ABS) Demography section and are updated as new or revised estimates become available. All population estimates currently produced by the ABS are based on a 'usual residence' concept, that is, where people usually reside, and are referred to as estimated resident populations.

De-identified National Diabetes Services Scheme (NDSS) data set

The de-identified NDSS data set held at the AIHW is provided by Diabetes Australia Ltd and contains de-identified information on all NDSS registrations since 1987. This report analyses de-identified data on registrants in the scope of the NDR, that is, the registrant uses insulin to treat their diabetes and their insulin use started on or after 1 January 1999.

National Diabetes Register (NDR)

The NDR, maintained at the AIHW, was established in 1999. The NDR is a prospective population-based register of people living in Australia with insulin-treated diabetes. It holds information on people with all forms of insulin-treated diabetes, including Type 1, Type 2, gestational and other types of diabetes, where insulin use began on or after 1 January 1999. The NDR has two sources of ascertainment: the NDSS database and the state and territory databases for 0–14 year olds of the Australasian Paediatric Endocrine Group (APEG).

National Diabetes Services Scheme (NDSS)

The NDSS is an initiative of the Australian Government that subsidises the supply of insulin syringes, insulin infusion pump consumables and diagnostic reagents (blood and urine testing strips) to registered persons with diabetes. The NDSS was established in 1987 and is administered by Diabetes Australia Ltd, which coordinates the supply of products in all states and territories. The NDSS aims to enhance the capacity of people with diabetes to understand and manage their life with diabetes and to ensure that they have timely, reliable and affordable access to the supplies and services they require to effectively self-manage their condition. (See Table A1 in AIHW: Catanzariti et al. 2007 for details of the data items that the NDSS contributes to the NDR.)

Australasian Paediatric Endocrine Group (APEG)

APEG is the professional body in Australia and New Zealand that represents those involved in management and research of children with disorders of the endocrine system including diabetes mellitus.

APEG's state-based databases collect diagnosis information on children and adolescents with Type 1 diabetes. Each state has established its database independently, and at varying times since 1985, but all collect the same minimum data set. (See Table A1 in AIHW: Catanzariti et al. 2007 for a list of the data items that APEG contributes to the NDR.)

Statistical tables

Table A1: Incidence of Type 1 diabetes among 0–14 year olds, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
				Number				
Males								
0–4	84	106	107	123	106	108	97	731
5–9	139	143	154	157	175	158	157	1,083
10–14	172	202	199	215	231	206	245	1,470
Total males 0–14	**395**	**451**	**460**	**495**	**512**	**472**	**499**	**3,284**
Total males 0–14 (per cent)	**51.9**	**53.2**	**51.0**	**50.8**	**52.6**	**52.1**	**54.5**	**52.3**
Females								
0–4	71	76	86	93	84	94	79	583
5–9	140	154	160	183	175	157	152	1,121
10–14	155	166	196	203	202	183	186	1,291
Total females 0–14	**366**	**396**	**442**	**479**	**461**	**434**	**417**	**2,995**
Total females 0–14 (per cent)	**48.1**	**46.8**	**49.0**	**49.2**	**47.4**	**47.9**	**45.5**	**47.7**
Persons								
0–4	155	182	193	216	190	202	176	1,314
5–9	279	297	314	340	350	315	309	2,204
10–14	327	368	395	418	433	389	431	2,761
Total persons 0–14	**761**	**847**	**902**	**974**	**973**	**906**	**916**	**6,279**
Total persons 0–14 (per cent)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a)   The number is the total for 2000–2006.

Source: National Diabetes Register (data extracted April 2008).

Table A2: Incidence of Type 1 diabetes among 0–14 year olds, by year and state or territory of usual residence, 2000–2006

Year of first insulin use	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
					Number				
2000	249	183	158	69	71	15	10	6	761
2001	270	212	176	85	61	24	15	4	847
2002	288	231	164	100	75	25	16	3	902
2003	277	254	204	102	90	31	11	5	974
2004	312	229	198	94	81	30	20	9	973
2005	269	238	193	82	61	40	20	3	906
2006	265	242	193	87	78	34	11	6	916
Total 2000–2006	**1,930**	**1,589**	**1,286**	**619**	**517**	**199**	**103**	**36**	**6,279**

Source: National Diabetes Register (data extracted April 2008).

Table A3a: Incidence of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000 – 2006[a]
				Number				
Males								
15–19	120	124	132	142	139	148	143	948
20–24	101	118	104	114	108	111	103	759
15–24	**221**	**242**	**236**	**256**	**247**	**259**	**246**	**1,707**
25–29	119	116	96	129	107	97	91	755
30–34	116	110	104	90	94	101	107	722
35–39	94	91	58	82	90	54	62	531
25–39	**329**	**317**	**258**	**301**	**291**	**252**	**260**	**2,008**
40–44	75	56	63	58	62	46	61	421
45–49	58	39	40	37	29	34	32	269
50–54	61	30	34	29	31	21	46	252
55–59	33	54	23	40	21	20	25	216
60–64	46	58	25	17	15	13	28	202
65–69	30	35	19	15	15	16	12	142
70–74	25	28	13	13	10	7	8	104
75–79	27	34	21	8	4	3	13	110
80–84	15	17	12	8	7	5	2	66
85+	10	8	2	11	4	2	2	39
40+	**380**	**359**	**252**	**236**	**198**	**167**	**229**	**1,821**
Total males 15+	**930**	**918**	**746**	**793**	**736**	**678**	**735**	**5,536**
Total males (per cent)	**61.2**	**60.1**	**63.6**	**63.4**	**64.8**	**63.0**	**64.3**	**62.7**

(continued)

Table A3a (continued): Incidence of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
					Number			
Females								
15–19	99	104	87	98	82	94	90	654
20–24	65	67	70	77	62	71	59	471
15–24	**164**	**171**	**157**	**175**	**144**	**165**	**149**	**1,125**
25–29	76	63	51	54	45	48	48	385
30–34	69	56	43	55	60	41	45	369
35–39	42	47	27	43	36	28	48	271
25–39	**187**	**166**	**121**	**152**	**141**	**117**	**141**	**1,025**
40–44	37	37	24	23	27	26	26	200
45–49	22	23	19	11	14	25	20	134
50–54	22	31	17	14	16	15	17	132
55–59	26	28	16	20	18	10	15	133
60–64	34	28	11	15	13	12	11	124
65–69	31	25	9	9	6	7	8	95
70–74	18	32	10	10	3	6	4	83
75–79	19	32	16	8	9	6	7	97
80–84	15	20	15	14	5	4	6	79
85+	14	17	12	7	4	5	4	63
40+	**238**	**273**	**149**	**131**	**115**	**116**	**118**	**1,140**
Total females 15+	**589**	**610**	**427**	**458**	**400**	**398**	**408**	**3,290**
Total females (per cent)	**38.8**	**39.9**	**36.4**	**36.6**	**35.2**	**37.0**	**35.7**	**37.3**
Persons								
15–19	219	228	219	240	221	242	233	1,602
20–24	166	185	174	191	170	182	162	1,230
15–24	**385**	**413**	**393**	**431**	**391**	**424**	**395**	**2,832**
25–29	195	179	147	183	152	145	139	1,140
30–34	185	166	147	145	154	142	152	1,091
35–39	136	138	85	125	126	82	110	802
25–39	**516**	**483**	**379**	**453**	**432**	**369**	**401**	**3,033**
40–44	112	93	87	81	89	72	87	621
45–49	80	62	59	48	43	59	52	403
50–54	83	61	51	43	47	36	63	384
55–59	59	82	39	60	39	30	40	349
60–64	80	86	36	32	28	25	39	326

(continued)

Table A3a (continued): Incidence of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
				Number				
65–69	61	60	28	24	21	23	20	237
70–74	43	60	23	23	13	13	12	187
75–79	46	66	37	16	13	9	20	207
80–84	30	37	27	22	12	9	8	145
85+	24	25	14	18	8	7	6	102
40+	**618**	**632**	**401**	**367**	**313**	**283**	**347**	**2,961**
Total persons 15+	**1,519**	**1,528**	**1,173**	**1,251**	**1,136**	**1,076**	**1,143**	**8,826**
Total persons (per cent)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a)   The number is the total for 2000–2006.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Table A3b: Incidence rate of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
				Number per 100,000 population				
Males								
15–19	17.7	18.0	19.0	20.3	19.7	20.8	19.7	19.3
20–24	15.4	17.9	15.4	16.4	15.1	15.2	13.8	15.5
15–24 ASR[b]	**16.6**	**17.9**	**17.2**	**18.4**	**17.5**	**18.0**	**16.8**	**17.5**
(95% CI)	(14.5–18.9)	(15.7–20.3)	(15.1–19.5)	(16.2–20.8)	(15.4–19.8)	(15.9–20.4)	(14.8–19.0)	(16.6–18.3)
25–29	16.5	16.5	13.9	18.8	15.6	14.0	12.8	15.4
30–34	16.4	15.1	14.0	11.9	12.4	13.4	14.4	13.9
35–39	12.6	12.3	7.9	11.3	12.3	7.3	8.2	10.2
25–39 ASR[b]	**15.1**	**14.6**	**11.9**	**13.9**	**13.4**	**11.5**	**11.8**	**13.2**
(95% CI)	(13.5–16.8)	(13.0–16.3)	(10.5–13.4)	(12.4–15.6)	(11.9–15.0)	(10.1–13.0)	(10.4–13.3)	(12.6–13.7)
40–44	10.4	7.6	8.4	7.6	8.1	6.0	8.0	8.0
45–49	8.7	5.8	5.8	5.3	4.1	4.7	4.3	5.5
50–54	9.6	4.6	5.2	4.4	4.7	3.1	6.8	5.5
55–59	6.7	10.5	4.2	6.9	3.5	3.2	3.9	5.4
60–64	11.5	14.0	5.9	3.9	3.3	2.7	5.6	6.5
65–69	9.0	10.4	5.5	4.2	4.1	4.3	3.1	5.7
70–74	8.3	9.2	4.3	4.3	3.3	2.3	2.6	4.9
75–79	12.3	15.0	9.0	3.3	1.6	1.2	5.2	6.6
80–84	12.6	13.3	8.8	5.5	4.6	3.1	1.2	6.6
85+	12.9	9.8	2.3	12.6	4.4	2.1	1.9	6.3
40+ ASR[b]	**9.7**	**8.9**	**6.1**	**5.6**	**4.6**	**3.7**	**5.1**	**6.1**
(95% CI)	(8.7–10.7)	(8.0–9.9)	(5.3–6.9)	(4.9–6.3)	(3.9–5.2)	(3.2–4.3)	(4.4–5.8)	(5.8–6.4)

(continued)

16

Table A3b (continued): Incidence rate of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
				Number per 100,000 population				
Females								
15–19	15.2	15.7	13.0	14.6	12.2	13.9	13.1	14.0
20–24	10.2	10.4	10.7	11.5	9.0	10.1	8.2	10.0
15–24 ASR[b]	**12.8**	**13.1**	**11.9**	**13.1**	**10.6**	**12.0**	**10.7**	**12.0**
(95% CI)	**(10.9–14.9)**	**(11.2–15.2)**	**(10.1–13.9)**	**(11.2–15.2)**	**(9.0–12.5)**	**(10.3–14.0)**	**(9.0–12.5)**	**(11.3–12.7)**
25–29	10.5	8.9	7.4	7.9	6.6	7.0	6.9	7.9
30–34	9.6	7.6	5.7	7.2	7.8	5.4	6.0	7.0
35–39	5.6	6.3	3.6	5.8	4.9	3.7	6.3	5.2
25–39 ASR[b]	**8.5**	**7.6**	**5.5**	**6.9**	**6.4**	**5.3**	**6.4**	**6.7**
(95% CI)	**(7.3–9.8)**	**(6.5–8.8)**	**(4.6–6.6)**	**(5.9–8.1)**	**(5.4–7.6)**	**(4.4–6.4)**	**(5.4–7.5)**	**(6.3–7.1)**
40–44	5.1	5.0	3.2	3.0	3.5	3.3	3.4	3.7
45–49	3.3	3.4	2.7	1.6	1.9	3.4	2.7	2.7
50–54	3.5	4.8	2.6	2.1	2.4	2.2	2.5	2.9
55–59	5.5	5.6	3.0	3.5	3.0	1.6	2.4	3.4
60–64	8.6	6.9	2.6	3.5	2.9	2.6	2.2	4.0
65–69	9.0	7.2	2.5	2.5	1.6	1.8	2.0	3.7
70–74	5.4	9.6	3.0	3.0	0.9	1.8	1.2	3.6
75–79	6.6	11.0	5.4	2.7	3.0	2.0	2.3	4.7
80–84	7.9	9.9	7.1	6.4	2.2	1.7	2.5	5.2
85+	8.0	9.3	6.3	3.6	2.0	2.4	1.8	4.6
40+ ASR[b]	**5.6**	**6.2**	**3.3**	**2.8**	**2.5**	**2.5**	**2.5**	**3.6**
(95% CI)	**(4.9–6.3)**	**(5.5–7.0)**	**(2.8–3.8)**	**(2.4–3.4)**	**(2.0–3.0)**	**(2.0–3.0)**	**(2.0–3.0)**	**(3.4–3.8)**
Persons								
15–19	16.5	16.9	16.1	17.5	16.0	17.4	16.5	16.7
20–24	12.9	14.2	13.1	14.0	12.1	12.7	11.0	12.8
15–24 ASR[b]	**14.7**	**15.6**	**14.6**	**15.8**	**14.1**	**15.1**	**13.8**	**14.8**
(95% CI)	**(13.3–16.3)**	**(14.1–17.1)**	**(13.2–16.1)**	**(14.3–17.3)**	**(12.8–15.6)**	**(13.7–16.6)**	**(12.5–15.2)**	**(14.3–15.3)**
25–29	13.5	12.7	10.7	13.4	11.1	10.5	9.9	11.7
30–34	13.0	11.3	9.8	9.5	10.1	9.3	10.2	10.4
35–39	9.0	9.2	5.8	8.5	8.6	5.5	7.2	7.7
25–39 ASR[b]	**11.8**	**11.1**	**8.7**	**10.4**	**9.9**	**8.4**	**9.1**	**9.9**
(95% CI)	**(10.8–12.8)**	**(10.1–12.1)**	**(7.8–9.6)**	**(9.5–11.4)**	**(9.0–10.9)**	**(7.6–9.3)**	**(8.2–10.0)**	**(9.5–10.3)**
40–44	7.7	6.3	5.8	5.3	5.8	4.7	5.7	5.9
45–49	6.0	4.6	4.3	3.4	3.0	4.0	3.5	4.1
50–54	6.6	4.7	3.9	3.3	3.6	2.7	4.6	4.2

(continued)

Table A3b (continued): Incidence rate of Type 1 diabetes among people aged 15 years or over, by age and sex, 2000–2006

Sex and age at first insulin use (years)	2000	2001	2002	2003	2004	2005	2006	2000–2006[a]
	Number per 100,000 population							
55–59	6.1	8.1	3.6	5.2	3.3	2.4	3.1	4.4
60–64	10.0	10.5	4.3	3.7	3.1	2.6	3.9	5.3
65–69	9.0	8.8	4.0	3.3	2.8	3.0	2.6	4.7
70–74	6.8	9.4	3.6	3.6	2.1	2.1	1.9	4.2
75–79	9.1	12.7	7.0	3.0	2.4	1.6	3.6	5.5
80–84	9.7	11.2	7.8	6.0	3.1	2.3	2.0	5.7
85+	9.5	9.4	5.1	6.4	2.8	2.3	1.9	5.1
40+ ASR[b]	**7.6**	**7.5**	**4.7**	**4.1**	**3.5**	**3.1**	**3.8**	**4.8**
(95% CI)	**(7.0–8.2)**	**(6.9–8.1)**	**(4.2–5.1)**	**(3.7–4.6)**	**(3.1–3.9)**	**(2.7–3.5)**	**(3.4–4.2)**	**(4.6–5.0)**

(a)   The rate is the average annual rate for the 7 years.

(b)   Age-standardised to the 2001 Australian population—see the Methods section in the appendix.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Table A4: Incidence of Type 1 diabetes among people aged 15 years or over, by age and state or territory of usual residence, 2000–2006

Age at first insulin use (years)	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
					Number				
15–19	483	395	321	200	112	46	32	12	1,602
20–24	354	283	282	136	96	30	37	12	1,230
15–24	**837**	**678**	**603**	**336**	**208**	**76**	**69**	**24**	**2,832**
25–29	349	278	257	130	64	32	17	13	1,140
30–34	317	272	233	127	86	30	10	16	1,091
35–39	233	186	170	100	79	18	11	5	802
25–39	**899**	**736**	**660**	**357**	**229**	**80**	**38**	**34**	**3,033**
40–44	185	140	116	95	47	25	6	7	621
45–49	129	77	84	57	34	12	7	3	403
50–54	133	89	50	52	39	12	3	6	384
55–59	119	94	40	46	38	9	1	2	349
60–64	121	80	38	32	36	12	4	3	326
65–69	93	62	23	29	21	7	0	2	237
70–74	76	60	9	18	21	2	0	1	187
75–79	90	53	8	16	24	14	2	0	207
80–84	48	56	7	14	16	4	0	0	145
85+	35	38	5	4	15	3	2	0	102
40+	**1,029**	**749**	**380**	**363**	**291**	**100**	**25**	**24**	**2,961**
Total persons 15+	**2,765**	**2,163**	**1,643**	**1,056**	**728**	**256**	**132**	**82**	**8,826**

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Methods

Coverage and incidence among 0–14 year olds

Based on NDR data, a total of 6,997 people aged 0–14 years with Type 1 diabetes began using insulin between 1999 and 2006. Using the capture–recapture method (LaPorte et al. 1993) with the two independent data sources, NDSS and APEG, coverage of 0–14 year olds with Type 1 diabetes on the NDR for the 8-year period was estimated to be 96.6% (Table A5). Based on this estimate, it is expected that 248 cases were missed by both sources over the 8 years. The coverage rate has generally improved over the period and was 98.2% in 2006. As the coverage was notably lower in the first year compared with the other years, 1999 was excluded from the analyses presented in this report. The overall coverage rate for 2000–2006 was 97.2%.

The data presented in Chapter 2 Incidence of Type 1 diabetes in children aged 0–14 years come directly from the NDR and are not adjusted for the estimated missing cases. This is because the coverage is high and has been relatively stable for the period 2000–2006.

Table A5: Coverage of Type 1 diabetes on the NDR among children aged 0–14 years at their first insulin use, by year of first insulin use, 2000–2006

Year of first insulin use	Males			Females			Persons		
	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)
1999	363	37	90.8	355	29	92.4	718	66	91.6
2000	395	16	96.2	366	9	97.5	761	25	96.8
2001	451	16	96.7	396	14	96.6	847	29	96.6
2002	460	17	96.4	442	10	97.9	902	27	97.1
2003	495	13	97.4	479	14	97.3	974	27	97.3
2004	512	12	97.6	461	11	97.8	973	23	97.7
2005	472	12	97.5	434	23	95.0	906	35	96.3
2006	499	15	97.1	417	2	99.5	916	17	98.2
Total	**3,647**	**138**	**96.4**	**3,350**	**111**	**96.8**	**6,997**	**248**	**96.6**

(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]) x 100.

Note: Columns and rows may not add to totals owing to rounding.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Coverage and incidence among people aged 15 years and above

The coverage rate for people aged 15 years and above with Type 1 diabetes on the NDR (the proportion of NDSS registrants consenting to be on the NDR) has steadily increased from 49% in 1999 to 95% in 2006 (Table A6). The recent increases are largely due to the 2003 NDSS registration form change. As the use of the new form continues to increase, the consent rate should approach 100%. More detail about the change to the registration form and the impact on the NDR's ascertainment from the NDSS can be found in the report *National Diabetes Register: impact of changed consent arrangements on ascertainment from the National Diabetes Services Scheme* (AIHW 2006).

The data presented in Chapter 3 Incidence of Type 1 diabetes in people aged 15 years or over are produced using results from the NDR that have been adjusted to account for missing cases using information from the de-identified NDSS data set. Adjusting the NDR results in this way ensures that more accurate incidence estimates are presented. For further details about these data sets please see the Data sources section at the beginning of the appendix.

It can be seen from Table A6 that only 54 cases were missed in 2006. It will soon be unnecessary to adjust the NDR results in this way and the AIHW will be able to present results directly from the NDR.

Table A6: Coverage of Type 1 diabetes on the NDR among people aged 15 years or over at their first insulin use, by year of first insulin use, 2000–2006

Year of first insulin use	Males			Females			Persons		
	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)	NDR regis-trants	Missing cases[a]	Coverage rate[b] (%)
1999	719	648	52.6	508	627	44.8	1,227	1,275	49.0
2000	733	197	78.8	436	153	74.0	1,169	350	77.0
2001	718	200	78.2	467	143	76.6	1,185	343	77.6
2002	590	156	79.1	324	103	75.9	914	259	77.9
2003	646	147	81.5	363	95	79.3	1,009	242	80.7
2004	682	54	92.7	376	24	94.0	1,058	78	93.1
2005	628	50	92.6	369	29	92.7	997	79	92.7
2006	708	27	96.3	381	27	93.4	1,089	54	95.3
Total	**5,424**	**1,479**	**78.6**	**3,224**	**1,201**	**72.9**	**8,648**	**2,680**	**76.3**

(a) Missing cases refers to NDR-eligible NDSS registrants who are not on the NDR.

(b) Coverage rate = (NDR registrants/[NDR registrants + Estimated missing cases]) x 100.

Sources: National Diabetes Register; AIHW analysis of de-identified NDSS data (data extracted April 2008).

Derived diabetes type—the NDR algorithm

There are several types of diabetes, with different causes and clinical histories, but the three main types are Type 1, Type 2 and gestational diabetes.

As described in *National Diabetes Register: statistical profile 1999–2005* (AIHW: Catanzariti et al. 2007), reported diabetes type may not be reliable, particularly with people reporting Type 1 diabetes when they actually have Type 2. Thus, in order to obtain a more accurate measure of type of diabetes, an algorithm (method of calculation, shown in Box 3) has been developed that assesses 'reported type of diabetes' based on age at diagnosis and the period of time between diagnosis and date of first insulin use to create a 'derived type of diabetes' (for more information on algorithms to derive diabetes type see AIHW: Catanzariti et al. 2007:56–58).

Table A7 shows data on the NDR registrants, diabetes type before (reported) and after (derived) the algorithm was applied. In all age groups, the number of registrants with Type 1 diabetes falls after the algorithm is applied. For example, in the age groups of 45–54 years the number of registrants with reported Type 1 diabetes is 1,563 but the derived type of diabetes shows only 792. That is, it is estimated that about 50% of people on the NDR aged 45–54 years at diagnosis with reported Type 1 diabetes probably have Type 2 diabetes.

In total, the algorithm reclassified 4,491 people who were originally reported as having Type 1 diabetes. Of these people, 3,058 were reclassified as having Type 2 diabetes. For the remaining 1,433 people, a type of diabetes could not be derived either because of missing information, such as age at diagnosis and/or date of first insulin use, or because they were aged under 15 years at diagnosis and the time between diagnosis and first insulin use was greater than 1 year. Note that no assumptions are made about diabetes type for the small group of registrants who are aged under 15 at diagnosis and have more than 1 year between their date of diagnosis and first insulin use. There are 141 of these registrants where a

diabetes type was unable to be derived, therefore these cases are excluded from this analysis. The vast majority of registrants for which a type of diabetes could not be derived were missing an age at diagnosis (1,299 of the 1,440).

Clearly, the algorithm helps to reduce the misrepresentation of the level of Type 1 diabetes on the NDR. For this reason, tables in this report involving type of diabetes are based on derived type of diabetes and not reported type of diabetes, unless otherwise stated. However, note that even with the algorithm some level of misclassification may remain.

Box 3: NDR 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:

- *and the reported diabetes type is Type 2 or 'Other', then the derived diabetes type equals the reported diabetes type.*
- *and the reported diabetes type is Type 1 and the age at diagnosis is missing, then the derived diabetes type is unable to be derived.*
- *and the reported diabetes type is Type 1 and the age at diagnosis is less than 15 years:*
  - *and the time between diagnosis and first insulin use is missing, then the derived diabetes type is unable to be derived*
  - *and the time between diagnosis and first insulin use is more than 1 year, then the derived diabetes type is unable to be derived*
  - *and 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.*
- *and the reported diabetes type is Type 1 and the age at diagnosis is greater than or equal to 15 years:*
  - *and the time between diagnosis and first insulin use is missing, then the derived diabetes type is unable to be derived*
  - *and the time between diagnosis and first insulin use is more than 1 year, then the derived diabetes type equals Type 2*
  - *and 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.*
- *and the reported diabetes type is gestational diabetes mellitus (GDM):*
  - *and the age at diagnosis is less than 50 years, then the derived diabetes type equals the reported diabetes type, that is, gestational diabetes mellitus*
  - *and the age at diagnosis is greater than or equal to 50 years, then the derived diabetes type equals Type 2*
  - *and the age at diagnosis is missing, then the derived diabetes type is unable to be derived.*

Table A7: NDR registrants: reported and derived diabetes type, by age, 1999–2006

Age at diag-nosis (years)	Reported diabetes type				Derived diabetes type					Total
	Type 1	Type 2	GDM	Other [a]	Type 1	Type 2	GDM	Other [a]	Not derived	
0–4	1,513	25	—	26	1,471	25	—	26	42	1,564
5–9	2,501	39	—	21	2,458	39	—	21	43	2,561
10–14	3,129	135	1	62	3,073	135	1	62	56	3,327
15–24	2,957	983	927	110	2,772	1,168	927	110	—	4,977
25–34	2,585	4,272	6,898	98	2,174	4,683	6,898	98	—	13,853
35–44	1,961	8,803	3,700	112	1,391	9,373	3,700	112	—	14,576
45–54	1,563	12,816	62	163	792	13,594	55	163	—	14,604
55–64	1,314	11,563	8	170	676	12,209	—	170	—	13,055
65–74	783	7,102	4	98	432	7,457	—	98	—	7,987
75 or over	538	3,304	7	47	406	3443	—	47	—	3,896
Not stated	1,292	12,351	7	79	—	12,351	—	79	1,299	13,729
Total (number)	**20,136**	**61,393**	**11,614**	**986**	**15,645**	**64,477**	**11,581**	**986**	**1,440**	**94,129**
Total (per cent)	**21.4**	**65.2**	**12.3**	**1.0**	**16.6**	**68.5**	**12.3**	**1.0**	**1.5**	**100.0**

(a)   See Glossary for 'Other types of diabetes'.

Source: National Diabetes Register (data extracted April 2008).

Age-specific rates

Age-specific rates were calculated by dividing the number of cases occurring in each specified age group by the mid-year estimated resident population for that age group, expressed as a number per 100,000 population.

Age-standardised rates

Age standardisation is a technique used to eliminate the effect of differences in population age structures when comparing rates for different periods of time, and/or different geographic areas and/or different population groups. Definitions are included in the *National health data dictionary* (HDSC 2006).

There are two methods of age standardisation, direct and indirect. The direct method was used for the incidence rates reported in this report.

Direct age standardisation

To control for any effects of varying age structures of population, direct age standardisation is used. The 2001 Australian population was used as the standard population in calculating age-standardised rates, using the following formula (HDSC 2006):

$$SR = \frac{\sum (r_i P_i)}{\sum P_i}$$

where SR =   the age-standardised rate for the population being studied
            r_i =   the age-group specific rate for age group i in the population being studied
            P_i =   the population of age group i in the Australian standard population (persons) as at 30 June 2001.

Confidence intervals

The 95% confidence intervals in this report indicate the variation that might be expected in incidence numbers purely by chance. The confidence intervals for the age-standardised incidence rates were calculated assuming a Poisson distribution of cases and using a method developed by Dobson et al. (1991). This method calculates approximate confidence intervals for a weighted sum of Poisson parameters. The confidence intervals for age-specific (that is, crude) rates per 100,000 populations have been calculated using the formula:

$$se(r_i) = \sqrt{\left(\frac{r_i}{n_i} \times 100000 \right)}$$

where r_i =   the age-group specific rate for age group i in the population being studied
            n_i =   the population of age group i.

The confidence intervals are used to provide an approximate indication of the differences between rates. Where the confidence intervals of two rates do not overlap, this indicates that the corresponding rates can be considered statistically significantly different from each other. However, when there is overlap between the confidence intervals of two rates, it cannot be assumed that there is no statistically significant difference between the rates and, in this case, an appropriate statistical test needs to be carried out to test for statistical significance (Washington State Department of Health 2002). As with all statistical comparisons, care should be exercised in interpreting the results of the comparison. If two rates are statistically significantly different from each other, this means that the difference is unlikely to have arisen by chance. Judgment should, however, be exercised in deciding whether the difference is of any practical significance.

Average annual rates of change

To indicate the extent of change in age-standardised rates over time, a linear line of best fit is calculated for the time frame in question. Average annual rates of change are then calculated using the geometric formula:

Average rate of change = $\left((P_n / P_o)^{1/N} - 1 \right) \times 100$

where P_n = rate at later year n

        P_o = rate at earlier year o

        N = $n - o$.

This process averages out variations in the actual annual changes that may have occurred between the two points in time.

Glossary

Derived diabetes type

Refers to how a classification of individuals on the NDR as Type 1, Type 2 and so on is derived from data in the NDR. The method of calculation (algorithm) is based on age of diagnosis and the period of time between the date of diagnosis and start of insulin use. For more information on this, see the Methods section in the appendix.

Glucose

A simple sugar that is the major source of energy for the body and the sole source of energy for the brain. It is supplied through food and is also produced and released by the liver. Its proper use requires the hormone insulin.

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.

Latent autoimmune diabetes in adults (LADA)

In adults, Type 1 diabetes sometimes occurs as a slowly progressive condition known as latent autoimmune diabetes in adults. At presentation, LADA appears to be similar to Type 2 diabetes, and can be treated with lifestyle changes or tablets, but in fact it is a slowly progressive form of autoimmune or Type 1 diabetes that ultimately requires insulin injections.

Other types of diabetes

Other types of diabetes include certain conditions or syndromes, such as:

- genetic defects of beta-cell function (formerly referred to as maturity-onset diabetes of the young (MODY))
- genetic defects in insulin action
- diseases of the exocrine pancreas (including cystic fibrosis and cancer of the pancreas)
- endocrinopathies (for example, acromegaly and Cushing's syndrome)
- drug- or chemical-induced diabetes (for example, steroid-induced diabetes)
- infections (for example, congenital rubella)
- uncommon but specific forms of immune-mediated diabetes mellitus
- other genetic syndromes sometimes associated with diabetes (WHO 1999).

These types of diabetes are relatively uncommon. Only persons being treated with insulin for these types of diabetes are included on the National Diabetes Register.

Pancreas

The organ that lies behind the lower part of the stomach and produces insulin.

Reported diabetes type

The type of diabetes recorded on the NDSS or APEG registration forms. Diabetes type is known to be misreported in many instances; for details see the Methods section in the appendix.

Type 1 diabetes

Mostly arises in children or young adults, although it can occur at any age. It is marked by severe insulin deficiency. People with Type 1 diabetes need insulin replacement for survival. Most cases are caused by autoimmune destruction of the cells of the pancreas that produce insulin (see Box 2 on page 2).

Type 2 diabetes

The most common form of diabetes, and occurs mostly in people aged 40 years or 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 require drugs as well, namely oral glucose-lowering drugs that work on the pancreas. Many others require insulin in addition to other treatments.

References

AIHW (Australian Institute of Health and Welfare) 2006. National Diabetes Register: impact of changed consent arrangements on ascertainment from the National Diabetes Services Scheme. Diabetes series no. 5. Cat. no. CVD 35. Canberra: AIHW.

AIHW: Catanzariti L, Faulks K & Waters A-M 2007. National Diabetes Register: statistical profile 1999–2005. Diabetes series no. 7. Cat. no. CVD 39. Canberra: AIHW.

Bruno G, Runzo C, Cavallo-Perin P et al. 2005. Incidence of Type 1 and Type 2 diabetes in adults aged 30–49 years. The population-based registry in the province of Turin, Italy. Diabetes Care 28(11):2613–19.

Daneman D 2006. Type 1 diabetes. The Lancet 367:847–58.

DIAMOND Project Group 2006. Incidence and trends of childhood Type 1 diabetes worldwide 1990–1999. Diabetic Medicine 10:857–66.

Dobson AJ, Kuulasmaa K, Eberle E & Scherer J 1991. Confidence intervals for weighted sums of Poisson parameters. Statistics in Medicine 10:457–62.

Gale E & Gillespie K 2001. Diabetes and gender. Diabetologia 44:3–15.

HDSC (Health Data Standards Committee) 2006. National health data dictionary. Version 13. Canberra: AIHW.

IDF (International Diabetes Federation) 2006. Diabetes atlas, 3rd edition. Belgium: IDF.

Kyvik KO, Nystrom L, Gorus F et al. 2004. The epidemiology of Type 1 diabetes mellitus is not the same in young adults as in children. Diabetologia 47:377–84.

Lammi N, Taskinen O, Moltchanova E et al. 2007. A high incidence of type 1 diabetes and an alarming increase in the incidence of type 2 diabetes among young adults in Finland between 1992 and 1996. Diabetologia 50:1393–1400.

LaPorte RE, McCarty D, Bruno G, Tajima N & Baba S 1993. Counting diabetes in the next millennium: application of capture–recapture technology. Diabetes Care 16(2):528–34.

Molbak A, Christau B, Marner B, Borch-Johnsen K, & Nerup J 1994. Incidence of insulin-dependent diabetes mellitus in age groups over 30 years in Denmark. Diabetic Medicine 11:650–55.

Washington State Department of Health 2002. Guidelines for using confidence intervals for public health assessment. Olympia, WA: Washington State Department of Health. Viewed 25 March 2008, <www.doh.wa.gov/Data/guidelines/WordDocs/CI_guidelines.pdf>.

Weets I, De Leeuw I, Du Caju M et al. 2002. The incidence of Type 1 diabetes in the age group 0–39 years has not increased in Antwerp (Belgium) between 1989 and 2000. Diabetes Care 25(5):840–6.

WHO (World Health Organization) 1999. Definition, diagnosis and classification of diabetes mellitus and its complications: report of a WHO consultation—Part 1: Diagnosis and classification of diabetes mellitus 1999. Geneva: WHO.

List of tables

List of figures