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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

AIHW	Australian Institute of Health and Welfare
APEG	Australasian Paediatric Endocrine Group
NDR	National Diabetes Register
NDSS	National Diabetes Services Scheme
OECD	Organisation for Economic Co-operation and Development

Summary

This report provides information on Type 1 diabetes among children from Australia's National Diabetes Register (NDR). The register holds information on Australians who began using insulin for diabetes since 1999.

The report focuses on children with Type 1 diabetes who were aged 0–14 years when they began using insulin. It includes information on the prevalence of the disease among children aged 0–14 years who were registered on the NDR as at 31 December 2008 by age, sex, and state or territory of current residence. It also provides projections of prevalence in 2013.

Main findings

- Over 5,700 Australian children aged 0–14 years had Type 1 diabetes in 2008. This equates to a prevalence of 138 cases per 100,000 population.
- There was no significant difference in the prevalence rate between boys and girls.
- The prevalence increased with age, from 29 cases per 100,000 in 0–4 year olds to 256 cases per 100,000 in 10–14 year olds.
- The prevalence of Type 1 diabetes in 0–14 year olds varied by state and territory. It was lowest in the Northern Territory (62 cases per 100,000 population). In the other jurisdictions, it ranged from 130 cases per 100,000 in New South Wales to 188 cases per 100,000 in Tasmania.
- Assuming new cases continue increasing at the current rate, it is estimated that the prevalence rate of Type 1 diabetes in children aged 0–14 years will increase by 10% between 2008 and 2013.

1 Introduction

Diabetes has a major impact on quality of life and life expectancy. The National Diabetes Register was set up as an important part of Australia's monitoring system for diabetes. This monitoring is essential to improve Australia's ability to plan preventive and treatment services, identify and focus on priority population groups, track the effects of environmental change and prevention and control strategies, and to decide the cost-effective allocation of resources (AIHW: Dixon & Webbie 2006).

The NDR now has 10 years of data on over 21,300 cases of people with Type 1 diabetes diagnosed over the period 1999–2008. Almost 9,000 of these are children, who were aged 0–14 years at first insulin use.

The main aim of this report is to present estimates of the prevalence of Type 1 diabetes in Australian children aged 0–14 years in 2008, based on data from the cohort of children of the same age who were registered on the NDR as at 31 December 2008. Specifically, it provides estimates of prevalence by age, sex, and state or territory of current residence. It also provides projections of prevalence to 2013.

Prevalence refers to the number or proportion of cases of an illness present in a population at a given time.

1.1 Structure of this report

General information about diabetes and its different types is provided in the next section. This is followed by a description of the NDR and summary data about the coverage and number of new cases of Type 1 diabetes in children aged 0–14 years registered on the NDR between 1999 and 2008. Chapter 2 provides estimates of the prevalence of Type 1 diabetes in children aged 0–14 years in 2008 in Australia, international comparisons and projections of prevalence in Australia to 2013. The Appendixes include information about the derivation of diabetes type on the NDR and statistical notes relevant to the analyses undertaken for this report. The 'Glossary' defines some of the technical terms used in this report.

For the most recent statistics on Australians of all ages with all types of insulin-treated diabetes, refer to our publication *Insulin-treated diabetes in Australia 2000–2007* : <http://www.aihw.gov.au/publication-detail/?id=6442468275&tab=2 >.

For a full list of NDR publications see our website: <http://www.aihw.gov.au/diabetes-related-publications/ >.

1.2 Diabetes

Diabetes mellitus (diabetes) is a serious illness causing substantial morbidity, premature death, disability and reduced quality of life. People with the condition need lifelong treatment and continual monitoring by health professionals.

Diabetes is a disease 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 cannot make enough insulin, or when the body does not respond adequately to insulin.

These abnormalities lead to a rise in the glucose level in the blood. Symptoms such as thirst, frequent urination, tiredness and lack of energy, blurred vision, infections and weight loss may be the first signs of diabetes. Diabetes can also cause many serious health complications, some of which may occur within months of diagnosis while others may develop over several years.

Some of the short-term complications of diabetes include: diabetic ketoacidosis (resulting from a severe lack of insulin—see page 3 and the 'Glossary' for more detail about ketoacidosis); increased susceptibility to infections, and reduced ability to heal. Longer term complications include diseases of the large blood vessels (macrovascular disease) such as coronary heart disease, stroke and peripheral vascular disease, as well as diseases of the small blood vessels (microvascular disease) such as retinopathy, kidney diseases and neuropathy (peripheral nerve disease).

As a result of these complications, together with the need for constant and long-term treatment, diabetes imposes a large burden on the health system and on the community. In 2003, diabetes accounted for more than 5.5% of the disease burden in Australia (Begg et al. 2007). This burden increases to 8.3% when the added risk of diabetes-related cardiovascular diseases is included, and the true burden would be even higher if other diabetes-related diseases were taken into account.

Types of diabetes

There are three main types of diabetes mellitus: Type 1, Type 2 and gestational diabetes. In addition, a number of conditions or syndromes that cause diabetes have been put into a fourth category: other types of diabetes. Each type has different causes and clinical histories (see Box 1). Type 1 diabetes, which is the focus of this report, is described in detail below.

Box 1: Types of diabetes

Type 1 diabetes mainly occurs 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 the destruction of the insulin-producing cells in the pancreas by the body's immune system.

Type 2 diabetes is the most common form of diabetes. It occurs mostly in people aged 50 years and over but, although still uncommon in childhood, is becoming increasingly recognised in that group. People with Type 2 diabetes produce insulin, but may not produce enough or cannot use it effectively. Type 2 diabetes may be managed with changes to diet and exercise, oral glucose-lowering drugs, insulin injections or a combination of these.

Gestational diabetes mellitus is a form of diabetes that develops during pregnancy in some females. It involves higher blood sugar levels appearing for the first time during pregnancy in females not previously diagnosed with other forms of diabetes. This type of diabetes is short term and, although it usually disappears after the baby is born, can recur in later pregnancies. Gestational diabetes is also a marker of increased risk of developing Type 2 diabetes later in life. Some cases of gestational diabetes are managed with changes to diet and exercise, and some require insulin treatment.

Other types of diabetes can occur as a result of other conditions or syndromes, such as:

- genetic defects of beta-cell function in the pancreas and insulin action (formerly referred to as maturity-onset diabetes of the young)
- other diseases of the pancreas (including cystic fibrosis and cancer of the pancreas)
- endocrine disorders (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 (ADA 2010).

These other types of diabetes are relatively uncommon.

Type 1 diabetes

In 2007–08, Type 1 diabetes was estimated to account for 10% of all diabetes in Australia (AIHW 2010a). It can occur at any age, although more than half of cases arise in childhood or adolescence (AIHW 2008). Type 1 diabetes is characterised by progressive destruction of the insulin-producing cells in the pancreas.

When most of the insulin-producing cells have been destroyed, the glucose levels in the blood rise rapidly, causing increased frequency of urination as the kidneys rid the body of excess glucose. The body also begins to break down fat as an alternative source of energy, causing ketones to accumulate in the blood, and resulting in rapid weight loss. The excess of ketones makes the blood acidic (ketoacidosis), and without urgent medical intervention this can lead to coma and death. While the process may develop gradually over months or years, patients with this type of diabetes usually present at a health service with symptoms that have rapidly worsened over several weeks, and when only small numbers of insulin-producing cells remain.

Type 1 diabetes can cause many serious health complications that affect the quality of life of both the person with the disease and their families. Some of these complications, including diabetic ketoacidosis, may occur within months of diagnosis while others, including kidney disease and coronary heart disease, may develop over several years (see page 2 for more detail about these health complications).

Type 1 diabetes is treated with insulin, given either by injection several times a day or continuously by an insulin pump, with frequent monitoring of blood glucose levels. This monitoring usually involves pricking the tip of the finger with a small needle and placing a drop of blood on a reagent strip, which gives a reading to guide the patient on the insulin dose the body needs. A well-balanced and healthy diet, and continued monitoring of the diabetes by a multidisciplinary health team are essential for maintaining good health and minimising complications (NHMRC 2005).

Researchers believe that Type 1 diabetes is caused by a combination of environmental factors and a genetic predisposition. Some of the possible environmental risk factors being investigated include viruses; diet, such as early consumption of cow's milk; and low levels of vitamin D (Greer et al. 2007; Littorin et al. 2006; Vaarala 2005; Yeung et al. 2011; Yoon et al. 1999).

1.3 National Diabetes Register

About the National Diabetes Register

The National Diabetes Register is a database established in 1999 to collect information about new cases of insulin-treated diabetes—that is, all new cases of Type 1 diabetes and all other new cases of individuals needing insulin treatment, whether Type 2, gestational or other types of diabetes. It was set up as a result of a recommendation of the National Diabetes Strategy and Implementation Plan (Colagiuri et al. 1998).

The register is operated by the Australian Institute of Health and Welfare, using data from the National Diabetes Services Scheme (NDSS) for people of all ages and the Australasian Paediatric Endocrine Group (APEG) state and territory databases for children aged 0–14 years (see Appendix A.2 for more information on the NDSS and APEG). The NDR is funded by the Australian Government Department of Health and Ageing.

The NDR holds diabetes-related information on all cases of diabetes in people in Australia for whom insulin treatment began on or after 1 January 1999 and who consented to be included on the register (if they registered between 1999 and July 2003) or who did not opt-off if they registered from August 2003 onwards.

The aim of the NDR is to record all new cases of people who use insulin to treat their diabetes. This means that it should cover all new cases of Type 1 diabetes because they all need insulin treatment. However, not all Type 2 and gestational diabetes cases require insulin treatment, so those that do not are excluded from the register. The register is based on insulin treatment rather than type of diabetes, because a person's type of diabetes is not as easily defined as a person's insulin-using status (AIHW 2001).

Since its inception in 1999, the NDR has been used to monitor the incidence of insulin-treated diabetes in Australia; that is, the number of new cases since 1999. However, as the register now has 10 years of data, it can also begin to be used to estimate the prevalence of insulin-treated diabetes in Australia.

New cases of insulin-treated diabetes in children (0–14 years) on the NDR

Just over 9,500 children aged 0–14 years at first insulin use were registered on the NDR between 1999 and 2008 (Table B1). Of these children, 94.5% (8,976) had Type 1 diabetes; 3.2% had other types of insulin-treated diabetes (that is, Type 2, gestational diabetes mellitus or 'other types' of diabetes); and it was not possible to accurately derive diabetes type for the remaining 2.3%.

Among the 8,976 children registered on the NDR with Type 1 diabetes, 52% (4,679) were males; 48% (4,297) were female; 21% (1,859) were aged 0–4 years; 35% (3,163) were aged 5–9 years; and 44% (3,954) were aged 10–14 years (tables 1 and B1).

Coverage of Type 1 diabetes in children (0–14 years) on the NDR

As the NDR receives information about new cases of insulin-treated diabetes from two independent data sources (that is, NDSS and APEG) for children aged 0–14 years, the capture–recapture method as described by LaPorte and colleagues (1993) can be applied to identify the number of new cases that may have been missed by both sources. Essentially, 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. See Appendix B.2 for more information on this method.

Of the 8,976 cases of Type 1 diabetes in children aged 0–14 years registered on the NDR between 1999 and 2008, 61% (5,447) were identified by both the NDSS and APEG; 33% (2,997) were identified by the NDSS only and the remaining 6% (532) were identified by APEG only.

Using the capture–recapture method, it is estimated that a total of 263 cases of Type 1 diabetes in children aged 0–14 years may not have been identified by either the NDSS or APEG over the 10-year period. Therefore, the coverage of children aged 0–14 years with Type 1 diabetes on the NDR over the period 1999–2008 is estimated to be 97.2% (Table 1). The coverage rate remained consistently high during this period but improved markedly from 2000 onwards. The increase in coverage rates between 1999 and 2000 mainly reflects the improvement in NDSS ascertainment rates for the NDR at this time, among children with Type 1 diabetes who were aged 0–14 years at first insulin use (AIHW 2006).

Table 1: Coverage of Type 1 diabetes on the National Diabetes Register among children aged 0–14 years at their first insulin use, by year of first insulin use, 1999 to 2008

	Males			Females			Persons		
Year of first insulin use	NDR registrants (number)	Missing cases[(a)] (number)	Coverage rate[(b)] (per cent)	NDR registrants (number)	Missing cases[(a)] (number)	Coverage rate[(b)] (per cent)	NDR registrants (number)	Missing cases[(a)] (number)	Coverage rate[(b)] (per cent)
1999	366	38	90.7	350	28	92.6	716	65	91.6
2000	394	13	96.7	363	7	98.1	757	20	97.4
2001	453	15	96.8	397	14	96.6	850	29	96.7
2002	461	14	97.0	441	9	97.9	902	24	97.4
2003	499	12	97.6	481	12	97.5	980	25	97.5
2004	513	11	97.9	466	10	97.9	979	21	97.9
2005	468	11	97.8	435	20	95.5	903	31	96.7
2006	496	12	97.6	424	3	99.3	920	15	98.4
2007	526	11	97.9	463	8	98.3	989	19	98.1
2008	503	9	98.3	477	4	99.1	980	13	98.7
Total 1999–2008	**4,679**	**146**	**97.0**	**4,297**	**117**	**97.4**	**8,976**	**263**	**97.2**

(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.

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

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

2 Prevalence of Type 1 diabetes in children (0–14 years) in 2008

In this report, the prevalence of Type 1 diabetes in Australian children aged 0–9 years in 2008 has been calculated directly from NDR data, while the prevalence for 10–14 year olds has been estimated using a combination of existing NDR data and statistical modelling. See Appendix B.4 for more information about the statistical modelling.

2.1 Methods

Number of children aged 0–14 years with Type 1 diabetes on the NDR as at 31 December 2008

Of the 8,976 children with Type 1 diabetes who registered on the NDR between 1999 and 2008, there were 5,390 children who were aged between 0 and 14 years as at 31 December 2008—2,137 children aged 0–9 years and 3,253 aged 10–14 years. The remaining 3,586 children who registered on the NDR between 1999 and 2008 were all aged 15 years or older at 31 December 2008.

Estimating prevalence among children aged 0–9 years

National Diabetes Register data for the period 1999–2008 were used to estimate the prevalence of Type 1 diabetes among the cohort of children aged 0–9 years at 31 December 2008. These data were linked to the AIHW's National Death Index (NDI) to identify and exclude any deaths that occurred between first insulin use and the end of 2007. It was not possible to identify deaths that occurred in 2008, as these data are not yet available on the NDI.

There were a very small number of deaths (≤ 2) of children with Type 1 diabetes on the NDR who were aged 0–9 years at 31 December 2008, and these were excluded from the cohort upon which the following prevalence estimates are based.

Estimating prevalence among children aged 10–14 years

The records for the children registered on the NDR who were aged 10–14 years at 31 December 2008 were also linked to the NDI, and the very small number of deaths (≤ 2) identified were excluded from the cohort before estimating prevalence. However, these 10–14 year olds do not make up the entire cohort of those with Type 1 diabetes at 31 December 2008, as they do not include children who were diagnosed between 1994 and 1998, at the ages of 0 to 4 years, who therefore would also have been 10–14 years old in December 2008. As the NDR does not include any data before 1999, it was necessary to estimate the number of new cases of Type 1 diabetes that occurred between 1994 and 1998 among children who were aged 0–4 years at that time. These data have been estimated using Poisson regression (see Appendix B.4) and the available data from the register for the period 1999–2008.

2.2 Prevalence

Age and sex

There were 5,388 children registered on the NDR who were aged 0–14 years at 31 December 2008 (2,761 boys and 2,627 girls). Based on Poisson regression modelling, it is estimated that 345 new cases of Type 1 diabetes would have occurred in children aged 0–4 years between 1994 and 1998 (189 boys and 156 girls).

Combining these data, it is estimated that among all Australian children aged 0–14 years at 31 December 2008 there were 5,733 children with Type 1 diabetes—2,950 boys and 2,783 girls (Table 2). The majority (63%) of these children were aged 10–14 years, 30% were aged 5–9 years and the remaining 7% were aged 0–4 years. This pattern of increasing prevalence with age reflects the fact that the incidence rate of Type 1 diabetes in children in Australia has increased with increasing age since 1999 (AIHW: Catanzariti et al. 2007; AIHW 2010b).

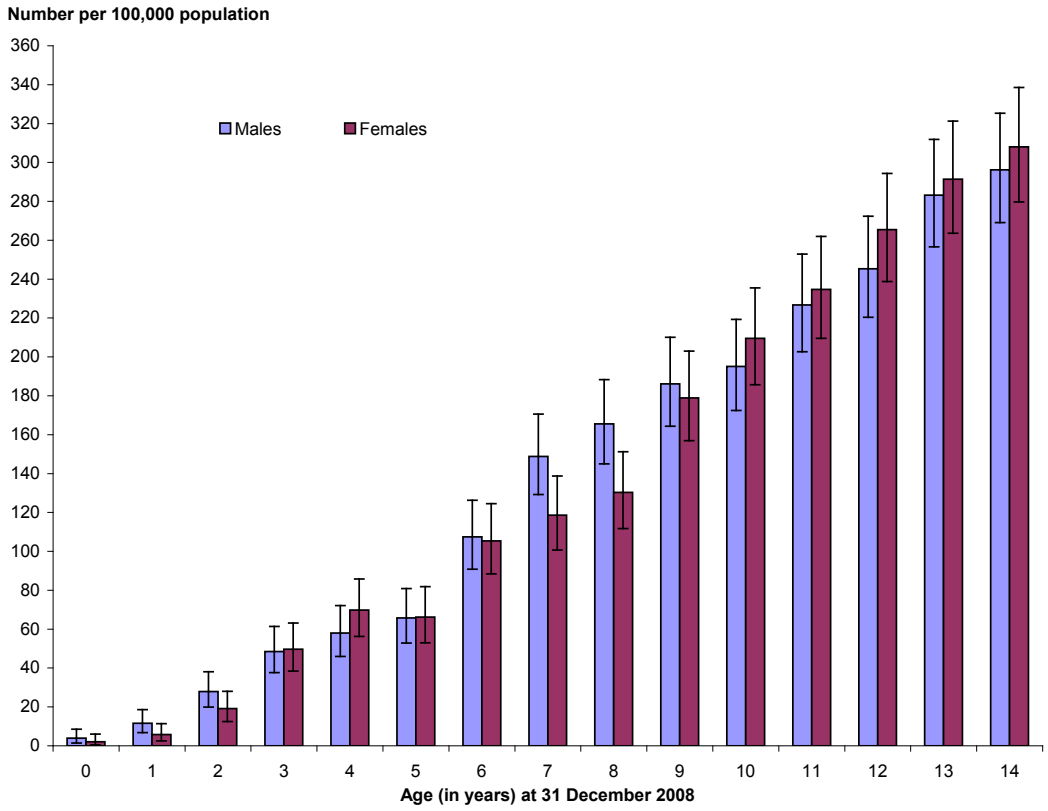
Overall, the age-standardised prevalence of Type 1 diabetes in 2008 was 139.6 per 100,000 population and there was no significant difference in this rate by sex (Table 2). The prevalence per 100,000 population in 2008 increased with age (Figure 1); and was statistically significantly higher in 10–14 year olds (256.3 per 100,000) than among 5–9 and 0–4 year olds (128.0 and 28.8 per 100,000 respectively) (Table 2).

Table 2: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2008 by sex and age, Australia

Age (in years) at 31 December 2008	Males	Females	Persons
		Number	
0–4	211	194	405
5–9	937	794	1,731
10–14	1,802	1,795	3,597
Total 0–14	**2,950**	**2,783**	**5,733**
	Number per 100,000 population (95% confidence interval)		
0–4	29.2 (25.3–33.2)	28.4 (24.4–32.4)	28.8 (26.0–31.6)
5–9	135.2 (126.6–143.9)	120.5 (112.1–128.8)	128.0 (122.0–134.1)
10–14	250.2 (238.7–261.8)	262.7 (250.5–274.8)	256.3 (247.9–264.7)
0–14	138.2 (133.2–143.2)	137.4 (132.3–142.5)	137.8 (134.2–141.4)
Total 0–14[(a)]	**140.1 (135.1–145.3)**	**139.1 (134.0–144.4)**	**139.6 (136.1–143.3)**

(a) Age-standardised to the 2001 Australian population (see Appendix B.2).

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).



Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

Figure 1: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2008, by sex and age

State/territory of current residence

Estimates of the prevalence of Type 1 diabetes by state and territory of current residence provide information about where children with Type 1 diabetes live. Service providers and policy decision makers can then use this information to make decisions and plan appropriate services.

In 2008, the prevalence of Type 1 diabetes in 0–14 year olds ranged from 62 per 100,000 population in the Northern Territory to 188 in Tasmania (Table 3). The prevalence rate in Tasmania was significantly higher than that in all jurisdictions except South Australia and the Australian Capital Territory, reflecting the higher incidence of Type 1 diabetes in children in Tasmania (AIHW 2010b). However it should be noted that due to the small number of cases, estimates for Tasmania, the Australian Capital Territory and the Northern Territory have very wide confidence intervals and should be interpreted with caution.

In line with the national picture, the prevalence of Type 1 diabetes increased with increasing age in each jurisdiction (Table 3).

Table 3: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2008 by state, sex and age

Age (in years) at 31 December 2008	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia
					Number per 100,000 population				
Males									
0–4	26.4	27.3	28.7	21.3	57.5	n.p.	n.p.	n.p.	29.2
5–9	125.0	130.0	138.0	145.8	153.5	238.4	n.p.	n.p.	135.2
10–14	230.1	261.3	250.8	250.5	270.5	334.4	352.3	140.3	249.9
Total males 0–14 ASR[(a)] (95% CI)	*128.8 (120.4–137.6)*	*141.6 (131.4–152.4)*	*141.3 (130.4–152.8)*	*141.3 (126.0–157.9)*	*162.1 (142.1–183.7)*	*202.2 (163.8–244.7)*	*194.7 (148.0–248.2)*	*66.3 (38.0–104.5)*	**140.1 (135.1–145.3)**
Females									
0–4	31.6	28.7	25.0	26.6	25.7	n.p.	n.p.	n.p.	28.4
5–9	117.5	122.0	115.0	119.3	147.0	158.5	n.p.	n.p.	120.3
10–14	240.0	295.8	243.0	286.4	280.8	337.0	240.8	123.0	262.4
Total females 0–14 ASR[(a)] (95% CI)	*131.5 (122.8–140.6)*	*150.9 (140.1–162.3)*	*129.6 (119.0–141.0)*	*146.4 (130.4–163.9)*	*153.0 (133.2–174.5)*	*173.4 (137.8–215.1)*	*146.9 (106.4–195.2)*	*56.7 (30.0–94.2)*	**139.1 (134.0–144.4)**
Persons									
0–4	28.9	28.0	26.9	23.9	41.9	n.p.	n.p.	n.p.	28.8
5–9	121.4	126.1	126.8	132.9	150.3	199.5	n.p.	n.p.	128.0
10–14	235.0	278.1	247.0	267.8	275.5	335.7	297.2	132.1	256.0
Total persons 0–14 ASR[(a)] (95% CI)	*130.1 (124.1–136.4)*	*146.1 (138.7–153.9)*	*135.6 (127.9–143.6)*	*143.7 (132.6–155.6)*	*157.6 (143.5–172.7)*	*188.3 (161.9–217.6)*	*171.2 (139.9–206.4)*	*61.7 (41.8–87.5)*	**139.6 (136.1–143.3)**

n.p. Not available for publication; data cannot be released due to being based on a small cell size, but they are included in totals.

ASR Age-standardised rate.

(a) Age-standardised to the 2001 Australian population (see Appendix B.2).

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

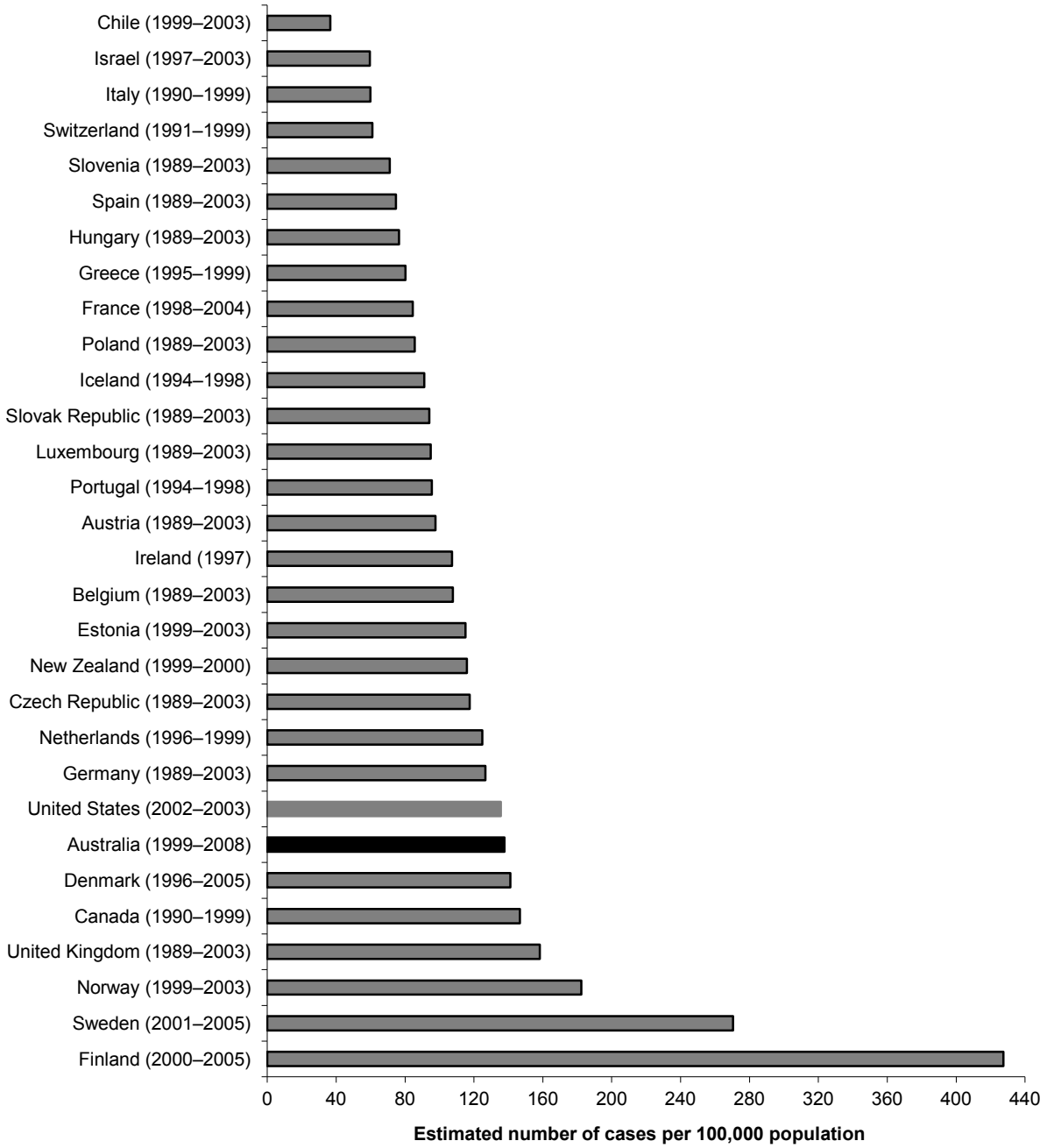
International comparisons

The International Diabetes Federation (IDF) Diabetes Atlas estimated that worldwide in 2010, 479,600 children aged 0–14 years would have Type 1 diabetes (IDF 2009).

This report estimates that the crude prevalence of Type 1 diabetes in Australia in children aged 0–14 years was 137.8 per 100,000 population in 2008 (Table 2). Figure 2 presents estimates of the crude prevalence of Type 1 diabetes in children aged 0–14 years in 2010 for Organisation for Economic Co-operation and Development (OECD) countries from the Diabetes Atlas (IDF 2009), together with the estimated Australian prevalence in 2008. The data periods for which prevalence in 2010 has been estimated for the other OECD countries shown range from 1989 to 2008.

Among the 34 countries that are currently members of the OECD, Australia had the seventh highest prevalence of Type 1 diabetes in children aged 0–14 years, at 137.8 per 100,000. The six OECD countries with a higher prevalence than Australia were: Finland (427.5), Sweden (270.5), Norway (182.4), the United Kingdom (158.3), Canada (146.7) and Denmark (141.2)

(Figure 2; Table C3). Note that the overseas data were compiled from multiple studies about diabetes in children and cover varying periods, and so should be considered as a general indicator only.



Notes:

1. For all countries other than Australia, the prevalence estimates are based on the estimated number of cases and population aged 0–14 years in 2010. For Australia, the prevalence is based on the estimated number of cases and population aged 0–14 years in 2008.
2. The data period on which prevalence has been estimated for each country is shown in brackets after the country name.

Sources: IDF 2009 for OECD countries other than Australia; AIHW analysis of National Diabetes Register (data extracted December 2010) for Australia.

Figure 2: Estimated prevalence of Type 1 diabetes in children aged 0–14 years: Australia (2008) compared with other OECD countries (2010)

2.3 Projections

The prevalence of Type 1 diabetes in Australian children is predicted to rise over the 5-year period 2008–2013.

The number of cases of Type 1 diabetes among Australian children aged 0–14 years at 31 December 2013 was estimated using available NDR data for the period 1999 to 2008 and predicting the number of new cases occurring in children aged: 0–10 years between 2009 and 2013; 11 years between 2010 and 2013; 12 years between 2011 and 2013; 13 years between 2012 and 2013; and 14 years in 2013.

The predicted numbers of new cases between 2009 and 2013 were estimated by applying the average annual increase in the age-standardised incidence rate for Type 1 diabetes among children aged 0–14 years between 2000 and 2008 to the number of new cases in 2008 by sex and single year of age.

The average annual increase in the incidence rate of Type 1 diabetes in children between 2000 and 2008 was estimated to be 1.7% (AIHW 2010b). Based on the assumption that incidence continues to increase at this rate, it is estimated that 6,427 children in Australia could have Type 1 diabetes by 31 December 2013—3,315 boys and 3,112 girls (Table 4). The age-standardised prevalence in 2013 is estimated to be 153.3 per 100,000 population, representing a 10% increase in the estimated age-standardised prevalence of 139.6 per 100,000 population in 2008.

Table 4: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2013 by sex and age, Australia

Age (in years) at 31 December 2013	Males	Females	Persons
		Number	
0–4	295	229	524
5–9	966	975	1,941
10–14	2,054	1,908	3,962
Total 0–14	**3,315**	**3,112**	**6,427**
		Number per 100,000 population (95% confidence interval)	
0–4	39.4 (34.9–43.9)	32.2 (28.1–36.4)	35.9 (32.9–39.0)
5–9	132.0 (123.7–140.4)	140.3 (131.5–149.1)	136.1 (130.0–142.1)
10–14	284.8 (272.5–297.1)	277.9 (265.4–290.4)	281.5 (272.7–290.2)
0–14	150.6 (145.4–155.7)	148.7 (143.5–153.9)	149.7 (146.0–153.3)
Total 0–14[(a)]	**154.2 (149.0–159.5)**	**152.4 (147.1–157.9)**	**153.3 (149.6–157.1)**

(a) Age-standardised to the 2001 Australian population (see Appendix B.2).

Source: AIHW projections based on National Diabetes Register (data extracted February 2011).

Appendixes

Appendix A Data sources

A.1 AIHW Population database

Population data held by the AIHW are sourced from the Australian Bureau of Statistics' demography section and are updated as revised or as new estimates become available. All population estimates currently produced by the Australian Bureau of Statistics are based on a 'current residence' concept (that is, where people usually reside) and are referred to as 'Estimated Resident Populations'.

A.2 National Diabetes Register

The NDR has two sources of ascertainment: the NDSS database for people of all ages; and the APEG state and territory databases for children aged 0–14 years.

National Diabetes Services Scheme

The NDSS is an Australian Government program that subsidises the supply of insulin syringes, insulin infusion pump consumables and diagnostic reagents (blood and urine testing strips) to registered people with diabetes. The scheme 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 help people with diabetes to understand the condition and manage their life with diabetes, and to ensure they have timely, reliable and affordable access to the supplies and services they need to effectively manage their condition.

Australasian Paediatric Endocrine Group

The Australasian Paediatric Endocrine Group (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 is actively involved in setting standards of care for children and adolescents with diabetes. One aspect of this care is APEG's state-based databases, which collect diagnosis information on children and adolescents with all forms of insulin-treated diabetes. Each state has established its database independently, and at varying times since 1985, but all collect the same minimum data set.

Appendix B Statistical methods

B.1 Derivation of diabetes type

Diabetes is classified into four types:

- Type 1 diabetes
- Type 2 diabetes
- gestational diabetes mellitus
- other specific types.

All of these types of diabetes may be treated with insulin. Once diagnosed, Type 1 diabetes is always treated with insulin (although individuals may have a brief and temporary remission phase after diagnosis during which insulin is not needed).

As described in *Insulin-treated diabetes in Australia 2000–2007* (AIHW 2009), reported diabetes type may not be reliable, particularly with people reporting Type 1 diabetes when they actually have Type 2. To obtain a more accurate measure of type of diabetes, an algorithm (method of calculation, see Box B.1) has been developed to better describe the distribution of registrants' diabetes type—this has been in place since before the first statistical profile report on the NDR. Because of the correlation between type of diabetes and age of diagnosis, the algorithm was originally based on age at diagnosis and the period between diagnosis and the start of insulin treatment. It was originally aimed at registrants believed to be incorrectly reported as Type 1 rather than Type 2.

The algorithm has been updated several times over the years, in consultation with, and agreement from, the National Diabetes Data Working Group. The current algorithm relevant for children aged 0–14 years is shown in Box B.1 (for the complete algorithm and more background information, see *Insulin-treated diabetes in Australia 2000–2007* (AIHW 2009)).

Box B.1: Algorithm used to derive diabetes type for children aged 0–14 years with reported Type 1 diabetes

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 time between diagnosis and first insulin use is missing, then the derived diabetes type cannot be derived
- if the time between diagnosis and first insulin use is more than 1 year, then the derived diabetes type cannot 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.

Table B1: Reported and derived diabetes type among NDR registrants, by age, 1999 to 2008

Age at first insulin use (years)	Reported diabetes type			Derived diabetes type			
	Type 1	Type 2, gestational or other diabetes	Total	Type 1	Type 2, gestational or other diabetes	Not derived	Total
0–4	1,893	44	1,937	1,859	44	34	1,937
5–9	3,237	56	3,293	3,163	56	74	3,293
10–14	4,066	206	4,272	3,954	206	112	4,272
Unknown	0	1	1	0	1	0	1
Total 0–14	**9,196**	**307**	**9,503**	**8,976**	**307**	**220**	**9,503**

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

There were 220 registrants aged 0–14 years at first insulin use who were unable to be reclassified using the algorithm, either because there was insufficient information or the time between diagnosis and first insulin use was more than 1 year.

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. But even with the algorithm, there will still be some misclassification.

Data collection

National Diabetes Services Scheme

Type of diabetes is reported on the NDSS registration form by either a medical practitioner or an accredited diabetes educator.

Australasian Paediatric Endocrine Group

In the APEG collection, diabetes type is nearly always certified by a medical specialist and, in most paediatric centres nationwide, tests are done to determine whether diabetes-associated autoantibodies are present. These serve to confirm the diagnosis of Type 1 diabetes. When a difference in diabetes type is found on NDR records sourced from both NDSS and APEG, the APEG-reported type is used.

B.2 Assessing coverage of the National Diabetes Register using the capture–recapture method

The capture–recapture method as described by LaPorte and colleagues (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 this method, the cases provided by both the NDSS and APEG (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.

In this report, the estimated NDR coverage rate was calculated as:

$$Coverage\ rate = \frac{(M + n - m)}{N} \times 100$$

where:

M = the number of new cases from the NDSS

n = the number of new cases from APEG

m = the number of new cases in common to both the NDSS and APEG

(M + n – m) = total number of new cases on the NDR

N = the estimated total number of new cases after adjusting for under-count (see LaPorte et al. 1993 for more information), that is:

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

B.3 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 and/or different geographic areas and/or different population groups. Definitions are included in the *National health data dictionary* (HDSC 2006).

Direct age standardisation

To control for any effects of varying age structures of population, direct age standardisation was used to calculate rates. 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.

B.4 Estimating the number of new cases of Type 1 diabetes in children aged 0–4 years between 1994 and 1998

The NDR does not include any data on new cases of insulin-treated diabetes before 1999. Therefore, to estimate the total prevalence of Type 1 diabetes among all children who were aged 10–14 years in 2008, it was necessary to also estimate the number of new cases that occurred between 1994 and 1998 among children aged 0–4 years during that 5-year period.

These data have been estimated using Poisson regression and the available NDR data for the cohort of 5,390 children aged 0–14 years as at 31 December 2008. Estimates were predicted for males and females separately at the national level using the following model:

$$\log_e(E_t) = \beta_0 + \beta_1 t + \beta_2 x + \beta_3 y + \log_e(N_t)$$

where:

t = year of first insulin use (1999–2008 treated as a continuous variable)

x = age at first insulin use (0–14 in single years; treated as a categorical variable)

y = age at 31 December 2008 (0–14 in single years; treated as a categorical variable)

N_t = the 31 December population in year t for age at first insulin use x

E_t = the estimated number of new cases of Type 1 diabetes in year t for age at first insulin use x and age at 31 December 2008 y

β_0, β_1, β_2 and β_3 are estimated in the model.

No interaction terms were included in the model as none were significant at the 0.05 level of significance.

Based on this Poisson model, it is estimated that 345 new cases of Type 1 diabetes occurred among 0–4 year olds between 1994 and 1998 (189 new cases among boys and 156 among girls).

The regression models at state/territory level were quite unstable, particularly for the smaller jurisdictions. Therefore, the numbers of new cases of Type 1 diabetes occurring between 1994 and 1998 for children aged 10–14 years at December 2008 were estimated at state and territory level as follows:

1. The number of cases of Type 1 diabetes in children aged 10–14 years as at 31 December 2008 for the 10-year period 1999–2008 was calculated from the available NDR data by sex and single year of age at the national level and by state and territory.
2. The data from (1) were used to calculate the proportional distribution of cases for each state and territory by sex and single year of age for 10–14 year olds as at 31 December 2008.
3. The proportional distribution by state and territory from (2) was then applied to the predicted national level estimates for children who began using insulin between 1994 and 1998, to estimate the predicted number of new cases during this 5-year period by sex and single year of age at the state and territory level.

B.5 Validation of the estimated number of new cases of Type 1 diabetes in children aged 0–4 years between 1994 and 1998

The estimated number of new cases of Type 1 diabetes in children aged 0–4 years was validated by comparing with:

1. estimates obtained from various other regression models; and
2. other available data on the number of new cases of Type 1 diabetes in children between 1994 and 1998, namely de-identified national NDSS data and data from the New South Wales APEG register.

Comparison with estimates from other models

A variety of other regression models were investigated. These included Poisson models in which 'age at first insulin use' and/or 'age at December 2008' were treated as continuous rather than categorical variables; and models in which 'age at December 2008' was replaced by a binary variable, with value 0 or 1, depending on whether a child who began using insulin in year t at age x was x or $(x+1)$ years old at the end of year t. A significance level of 0.05 was used to determine whether to include interactions in these models. Separate models by age at first insulin use and sex, rather than sex only, were also explored. Further, negative binomial models were also investigated where there was evidence of over-dispersion in the Poisson models.

Goodness of fit statistics and residuals were examined for each of these models to determine which was the most appropriate to use. However, there was very little difference in the results based on any of the models with reasonable fit. Therefore, the chosen model was based on goodness of fit as well as ease of interpretation.

Comparison with other available data

Data on the number of new cases of Type 1 diabetes in children between 1994 and 1998 were obtained from the 2008 October-December quarter cumulative de-identified national NDSS database and from the APEG database in New South Wales. Data on the number of new cases of Type 1 diabetes were also requested from APEG in Western Australia; however, these data could not be provided as Western Australia does not have hospital ethics or parental permission to provide data before 1999 to us.

The de-identified national NDSS and New South Wales APEG data were compared with the estimated number of cases of Type 1 diabetes in 0–4 year olds from 1994 to 1998 obtained from the Poisson regression models.

When compared with the number of cases of derived Type 1 diabetes from the 2008 October-December quarter cumulative de-identified NDSS database, the modelled estimates appear to be higher than expected (Table B2), particularly between 1994 and 1996. However, it appears that the number of registrations on the NDSS for new cases of Type 1 diabetes in children was very low between 1994 and 1996, suggesting that the NDSS data cannot be reliably used to validate the modelled estimates for these years (Figure B1).

Comparing against the New South Wales APEG data, the estimated number of cases for children in New South Wales was generally lower than the APEG count (Table B3). Overall, the estimated total number of cases in New South Wales among boys aged 10–14 years in 2008 who began using insulin between 1994 and 1998 was 16 cases fewer than the APEG total, while for girls it was 14 cases fewer. If this were also true in the other jurisdictions for which data are not available to validate against, then this would imply that the modelled estimates for new cases in 1994 to 1998 are underestimates and that the estimated prevalence for 10–14 year olds in 2008 might also be an underestimate.

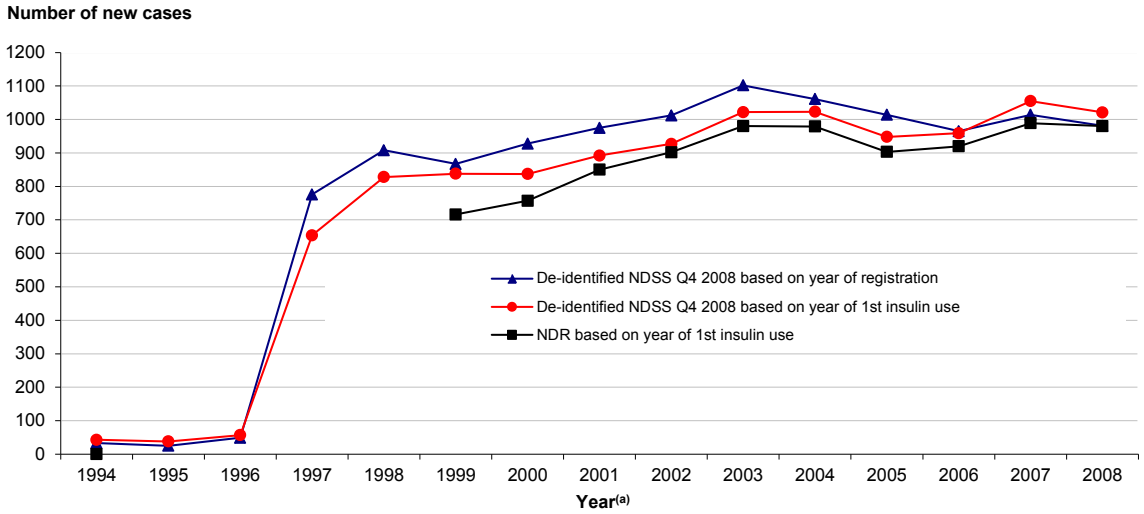
Table B2: Number of new cases of Type 1 diabetes in children aged 10–14 years at 31 December 2008 who began using insulin at age 0–4 years by sex and age; comparison of de-identified NDSS data with data estimated from Poisson models

Age (in years) at 31 December 2008	Males	Females	Persons	Males	Females	Persons
	De-identified NDSS numbers			Estimated numbers from Poisson models[(a)]		
10–11[(b)]	15	11	26	17	14	31
12	22	15	37	35	28	62
13	35	34	69	60	47	106
14	49	30	79	78	68	146
Total 10–14	**121**	**90**	**211**	**189**	**156**	**345**

(a) Components may not add to totals due to rounding.

(b) Numbers for 10- and 11-year olds have been combined due to the small numbers of cases.

Sources: AIHW analysis of National Diabetes Register (data extracted January 2010) and AIHW analysis of 2008 October-December quarter cumulative de-identified National Diabetes Services Scheme (NDSS) database.



(a) Year of first insulin use for NDR data; Year of registration or year of first insulin use for de-identified NDSS data.

Sources: AIHW analysis of National Diabetes Register (data extracted January 2010) and AIHW analysis of 2008 October-December quarter cumulative de-identified National Diabetes Services Scheme (NDSS) database.

Figure B1: Number of new cases of Type 1 diabetes in children aged 0–14 years at first insulin use, de-identified NDSS data (1994–2008) and NDR data (1999–2008), Australia

Table B3: Comparison of the number of new cases of Type 1 diabetes among children on the NSW APEG register, whose state of usual residence is NSW, with estimated numbers for NSW

Age (in years) at 31 December 2008	Males	Females	Persons	Males	Females	Persons
	NSW APEG numbers			Estimated numbers for NSW		
10–11[(a)]	8	6	14	5	5	10
12	9	4	13	12	9	21
13	20	27	47	19	14	33
14	38	25	63	23	20	43
Total 10–14	**75**	**62**	**137**	**59**	**48**	**107**

(a) Numbers for 10- and 11-year olds have been combined due to the small numbers of cases.

Sources: AIHW analysis of National Diabetes Register (data extracted February 2011) and NSW APEG data.

B.6 Projections

The predicted numbers of new cases of Type 1 diabetes occurring in children aged 0–14 years between 2009 and 2013 are summarised in Table B4.

Table B4: Predicted number of new cases of Type 1 diabetes in children aged 0–14 years by sex and age, Australia

	Year of first insulin use					
Sex and age at first insulin use (in years)	2008	2009	2010	2011	2012	2013
	Number of new cases	Predicted number of new cases				
Males						
0–4	100	102	103	105	107	109
5–9	177	180	183	186	189	193
10–14	226	230	234	238	242	246
Total 0–14	*503*	512	520	529	538	547
Females						
0–4	93	95	96	98	99	101
5–9	176	179	182	185	188	191
10–14	208	212	215	219	223	226
Total 0–14	*477*	485	493	502	510	519
Persons						
0–4	193	196	200	203	206	210
5–9	353	359	365	371	378	384
10–14	434	441	449	457	464	472
Total 0–14	**980**	**997**	**1,014**	**1,031**	**1,048**	**1,066**

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

B.7 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 and colleagues (1991). This method calculates approximate confidence intervals for a weighted sum of Poisson parameters. The confidence intervals are used to provide an approximate indication of the differences between rates. Where the confidence intervals of two direct age-standardised rates do not overlap, this indicates that the corresponding rates can be considered statistically significantly different from each other. 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.

Appendix C Additional tables

Table C1: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2008 by sex and age, Australia

Age (in years) at 31 December 2008	Males	Females	Persons
	Number per 100,000 population (95% confidence interval)		
0	3.9 (1.4–8.5)	2.1 (0.4–6.0)	3.0 (1.4–5.7)
1	11.6 (6.8–18.6)	5.8 (2.5–11.4)	8.8 (5.7–13.0)
2	27.9 (20.0–38.1)	19.1 (12.5–28.0)	23.7 (18.3–30.1)
3	48.5 (37.6–61.4)	49.6 (38.4–63.2)	49.0 (41.1–58.1)
4	58.0 (46.0–72.1)	69.8 (56.2–85.8)	63.7 (54.5–74.0)
Total 0–4	*29.2 (25.3–33.2)*	*28.4 (24.4–32.4)*	*28.8 (26.0–31.6)*
5	65.7 (52.9–80.8)	66.3 (53.0–81.8)	66.0 (56.6–76.5)
6	107.5 (90.8–126.3)	105.3 (88.4–124.5)	106.4 (94.4–119.6)
7	148.8 (129.2–170.6)	118.6 (100.7–138.7)	134.1 (120.6–148.6)
8	165.6 (144.9–188.3)	131.1 (112.4–152.0)	148.8 (134.6–163.9)
9	186.2 (164.3–210.1)	178.9 (156.9–203.0)	182.6 (167.0–199.3)
Total 5–9	*135.2 (126.6–143.9)*	*120.5 (112.1–128.8)*	*128.0 (122.0–134.1)*
10	195.1 (172.5–219.2)	209.6 (185.7–235.5)	202.1 (185.7–219.7)
11	226.8 (202.7–253.0)	234.7 (209.6–262.1)	230.7 (213.1–249.3)
12	245.6 (220.7–272.7)	265.7 (239.0–294.6)	255.4 (237.0–274.8)
13	283.8 (257.1–312.5)	291.9 (264.1–321.8)	287.7 (268.4–308.2)
14	296.9 (269.7–326.0)	308.6 (280.2–339.2)	302.6 (282.8–323.4)
Total 10–14	*250.2 (238.7–261.8)*	*262.7 (250.5–274.8)*	*256.3 (247.9–264.7)*
Total 0–14 Crude rate	**138.2 (133.2–143.2)**	**137.4 (132.3–142.5)**	**137.8 (134.2–141.4)**
Total 0–14 ASR[(a)]	**140.1 (135.1–145.3)**	**139.1 (134.0–144.4)**	**139.6 (136.1–143.3)**

ASR age-standardised rate

(a) Age-standardised to the 2001 Australian population (see Appendix B.2).

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

Table C2: Estimated prevalence of Type 1 diabetes in children aged 0–14 years at 31 December 2008 by state, sex and age

Age (in years) at 31 December 2008	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Australia[(a)]
					Number				
Males									
0–4	61	48	44	16	28	n.p.	n.p.	n.p.	**210**
5–9	282	216	201	105	74	38	n.p.	n.p.	**937**
10–14	531	452	379	191	140	58	38	12	**1,802**
Total Males 0–14	*874*	*716*	*624*	*312*	*242*	*101*	*62*	*17*	***2,949***
Females									
0–4	69	48	36	19	12	n.p.	n.p.	n.p.	**194**
5–9	252	193	159	81	68	24	n.p.	n.p.	**794**
10–14	530	483	351	203	138	55	25	10	**1,795**
Total Females 0–14	*851*	*724*	*546*	*303*	*218*	*82*	*45*	*14*	*2,783*
Persons									
0–4	130	96	80	35	40	n.p.	n.p.	n.p.	**404**
5–9	534	409	360	186	142	62	n.p.	n.p.	**1,731**
10–14	1,061	936	730	394	278	113	63	22	**3,597**
Total Persons 0–14	**1,725**	**1,441**	**1,170**	**615**	**460**	**183**	**107**	**31**	**5,732**

n.p. Not available for publication; data cannot be released due to small cell size but included in totals.

(a) Columns may not add to the Australian total as state of usual residence was missing for one registrant.

Source: AIHW analysis of National Diabetes Register (data extracted February 2011).

Table C3: Prevalence of Type 1 diabetes in children aged 0–14 years: Australia (2008) compared with other OECD countries (2010)

OECD countries (in descending order)	Period of data on which prevalence estimate is based	Estimated number of cases ('000)	Population aged 0 to 14 years ('000)	Estimated number of cases per 100,000 population
Finland	2000–2005	3.8	883	427.5
Sweden	2001–2005	4.1	1,507	270.5
Norway	1999–2003	1.6	889	182.4
United Kingdom	1989–2003	16.9	10,649	158.3
Canada	1990–1999	8.0	5,471	146.7
Denmark	1996–2005	1.4	980	141.2
Australia	**1999–2008**	**5.7**	**4,161**	**137.8**
United States	2002–2003	85.8	63,278	135.6
Germany	1989–2003	14.1	11,103	126.7
Netherlands	1996–1999	3.6	2,892	124.8
Czech Republic	1989–2003	1.6	1,386	117.5
New Zealand	1999–2000	1.0	865	115.9
Belgium	1989–2003	1.8	1,715	107.7
Ireland	1997	1.0	950	107.3
Austria	1989–2003	1.2	1,241	97.6
Portugal	1994–1998	1.6	1,666	95.5
Luxembourg	1989–2003	0.1	86	94.9
Slovak Republic	1989–2003	0.8	814	94.2
Iceland	1994–1998	0.1	64	91.1
Poland	1989–2003	4.8	5,551	85.7
France	1998–2004	9.6	11,397	84.5
Greece	1995–1999	1.3	1,563	80.2
Hungary	1989–2003	1.1	1,448	76.5
Spain	1989–2003	5.0	6,705	74.6
Switzerland	1991–1999	0.7	1,159	61.1
Italy	1990–1999	4.9	8,144	59.9
Turkey	1992–1996	4.0	20,371	19.8
Japan	1998–2001	2.7	17,071	15.7
Mexico	1990–1993	2.5	30,886	8.1
Korea	1990–1991	0.9	12,845	6.7

Note: For all countries other than Australia, the prevalence estimates are based on the estimated number of cases and population aged 0–14 years in 2010. For Australia, the prevalence is based on the estimated number of cases and population aged 0–14 years in 2008.

Sources: IDF 2009; AIHW analysis of National Diabetes Register (data extracted February 2011).

Glossary

Derived diabetes type

Refers to the classification of diabetes type that is derived for an individual on the NDR. The method of derivation (algorithm) is based on *reported diabetes type*, age at diagnosis and the period of time between the date of diagnosis and start of *insulin* use. For more information, see Appendix B.1.

Diabetes (diabetes mellitus)

A chronic condition in which the body cannot properly use its main energy source, the sugar *glucose*. This is due to either the pancreas not producing enough of the hormone *insulin*, or the body being unable to effectively use the *insulin* produced. *Insulin* helps *glucose* enter the body's cells from the bloodstream and then be processed by them. Diabetes is marked by an abnormal build-up of *glucose* in the blood, and can have serious short- and long-term effects on many of the body's systems, especially the blood vessels and nerves.

For the different types of diabetes, see (Box 1).

Diabetic ketoacidosis

Diabetic ketoacidosis is a complication of diabetes that occurs as a result of *insulin* deficiency. The body begins breaking down fat as an alternative source of energy and this causes an excess of ketones to accumulate in the blood, making the blood acidic (ketoacidosis).

Gestational diabetes mellitus

A type of diabetes (see Box 1).

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. Compare with *Prevalence.*

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*, which include 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

A category that includes less common conditions or syndromes that cause diabetes (see Box 1).

Pancreas

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

Prevalence

The number or proportion (of cases or instances) present in a population at a given time. Compare with *Incidence*.

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 more information see Appendix B.1.

Type 1 diabetes

A type of diabetes (see Box 1).

Type 2 diabetes

A type of diabetes (see Box 1).

References

ADA (American Diabetes Association) 2010. Diagnosis and classification of diabetes mellitus. Diabetes Care 33:S62–9.

AIHW (Australian Institute of Health and Welfare) 2001. National Diabetes Register statistical profile, December 2000. Diabetes series no. 2. Cat. no. CVD 18. Canberra: AIHW.

AIHW 2006. National Diabetes Register: impact of changed consent arrangements on ascertainment from the National Diabetes Services Scheme. Diabetes Series Number 5. Cat. no. CVD 35. Canberra: AIHW.

AIHW 2008. Diabetes: Australian facts 2008. Diabetes series no. 8. Cat. no. CVD 40. Canberra: AIHW.

AIHW 2009. Insulin-treated diabetes in Australia 2000–2007. Diabetes series no. 11. Cat. no. CVD 45. Canberra: AIHW.

AIHW 2010a. Australia's health 2010. Australia's health series no. 12. Cat. no. AUS 122. Canberra: AIHW.

AIHW 2010b. Incidence of Type 1 diabetes in Australian children 2000–2008. Diabetes series no. 13. Cat. no. CVD 51. Canberra: AIHW.

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

AIHW: Dixon T & Webbie K 2006. The National System for Monitoring Diabetes in Australia. Cat. no. CVD 32. Canberra: AIHW.

Begg S, Vos T, Barker B, Stevenson C, Stanley L & Lopez AD 2007. The burden of disease and injury in Australia 2003. AIHW cat. no. PHE 82. Canberra: AIHW.

Colagiuri S, Colagiuri R & Ward J 1998. National diabetes strategy and implementation plan. Canberra: Diabetes Australia.

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

Greer RM, Rogers MA, Bowling FG, Buntain HM, Harris M, Leong GM et al. 2007. Australian children and adolescents with type 1 diabetes have low vitamin D levels. Medical Journal of Australia 187(1):59–60.

HDSC (Health Data Standards Committee) 2006. National health data dictionary. Version 13. Canberra: Australian Institute of Health and Welfare.

IDF (International Diabetes Federation) 2009. IDF diabetes atlas. 4th edn. Brussels: IDF.

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.

Littorin B, Blom P, Scholin A, Arnqvist HJ, Blohme G, Bolinder J et al. 2006. Lower levels of plasma 25-hydroxyvitamin D among young adults at diagnosis of autoimmune type 1 diabetes compared with control subjects: results from the nationwide Diabetes Incidence Study in Sweden (DISS). Diabetologia 49:2847–52.

National Health and Medical Research Council (NHMRC) 2005. Clinical practice guidelines: Type 1 diabetes in children and adolescents. Canberra: Commonwealth of Australia.

Vaarala O 2005. Is type 1 diabetes a disease of the gut immune system triggered by cow's milk insulin? Advances in Experimental Medicines and Biology 569:151–6.

Yeung W-C G, Rawlinson WD & Craig ME 2011. Enterovirus infection and type 1 diabetes mellitus: systematic review and meta-analysis of observational molecular studies. British Medical Journal 342:d35.

Yoon J-W, Kim A & Jun H-S 1999. Role of viruses in Type 1 diabetes. In: Turtle J, Kaneko T & Osato S (eds). Diabetes in the new millennium. Sydney: Endocrinology and Diabetes Research Foundation, University of Sydney, 105–18.

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