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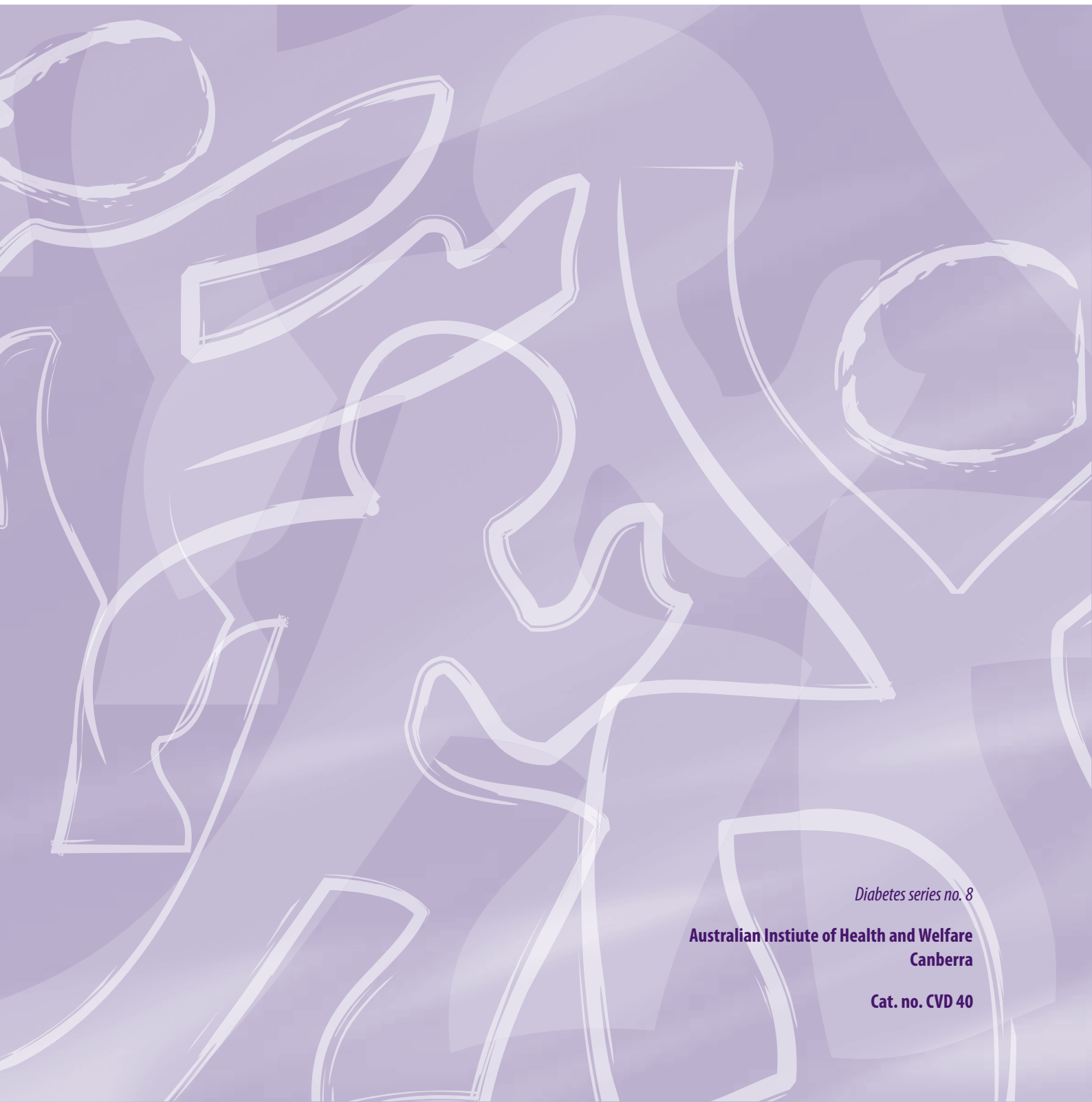
Diabetes

Australian facts 2008



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Contents

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ANDIAB	Australian National Diabetes Information Audit and Benchmarking
ANZDATA	Australia and New Zealand Dialysis and Transplant Registry
APEG	Australasian Paediatric Endocrine Group
AusDiab	Australian Diabetes, Obesity and Lifestyle study
BEACH	The Bettering the Evaluation and Care of Health study
BMI	body mass index
CHD	coronary heart disease
CVD	cardiovascular disease
DoHA	Australian Government Department of Health and Ageing
DDD	defined daily dose
ESKD	end-stage kidney disease
GDM	gestational diabetes mellitus
GP	General Practitioner
HbA1c	glycosylated haemoglobin
HDL	high-density lipoprotein
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification
IFG	impaired fasting glucose
LDL	low-density lipoprotein
NATSIHS	National Aboriginal and Torres Strait Islander Health Survey
NDR	National Diabetes Register
NDS	National Diabetes Strategy
NDSS	National Diabetes Services Scheme
NHS	National Health Survey
OGTT	oral glucose tolerance test
PVD	peripheral vascular disease
WHO	World Health Organization

Symbols

$	Australian dollars, unless otherwise specified	n.a.	not available
–	nil or rounded to zero	>	greater than
%	per cent	≥	greater than or equal to
g	gram	<	less than
kJ	kilojoule	≤	less than or equal to
mmHg	millimetres of mercury	n.r	not reported
mmol/L	millimoles per litre		

Summary and key findings

Diabetes: Australian facts 2008 is the second in the series of national reports providing an overview of diabetes, a serious chronic disease affecting many Australians. The report contains the most recent national data on prevalence, incidence, risk factors, and complications of diabetes. In this edition, a separate chapter on diabetes in specific population groups is also included.

Some of the main findings about the impact of diabetes on the Australian community are given below.

Its prevalence continues to rise. The most recent national data show that the prevalence of diagnosed diabetes more than doubled between 1989–90 and 2004–05. Diabetes and its complications were responsible for around 8% of the total burden of disease in Australia in 2003.

It can have severe complications. Notably a person with diabetes is at greater risk of developing cardiovascular, eye and kidney diseases. In 2004–05 people with diabetes were twice as likely as those without it to have had a heart attack and three times as likely to have had a stroke in 1999–2000. People with diabetes were twice as likely to have cataracts or glaucoma as those without diabetes and nearly a third of people starting treatment for end stage kidney disease did so because of diabetic nephropathy.

Type 2 diabetes is largely preventable. Control of modifiable risk factors, such as overweight and obesity and physical inactivity, are central to preventing Type 2 diabetes and can help reduce the complications associated with diabetes. However, prevalence of a key risk factor, overweight and obesity, is increasing.

Some population groups are at much higher risk. Aboriginal and Torres Strait Islander peoples are 3 times as likely as non-Indigenous people to have diabetes and have much greater hospitalisation and death rates than other Australians. Diabetes prevalence and death rates for the worst-off fifth of the population are nearly twice as high as for the best-off fifth of the population.

More detailed findings of the report are given in the next section 'Key findings'.

Key findings

Diabetes is one of the leading chronic diseases affecting Australians…

- An estimated 700,000 Australians (3.6% of the population) had diagnosed diabetes in 2004–05.
- In addition, there are many more cases of diabetes that have not been diagnosed. The most recent national data on this indicate one undiagnosed case for every one diagnosed case.
- In 2005, nearly 3% of deaths in Australia were directly due to diabetes and it contributed to another 6% of deaths—nearly 12,000 deaths in total.
- Diabetes was responsible for 5.5% of the total burden of disease in Australia in 2003; 92% of this burden was due to Type 2 diabetes, which is by far the most common type. When the contribution of diabetes to stroke and heart disease is also included, it accounted for 8.3% of the total disease burden.

Diabetes in Australia continues to rise…

- Between 1989–90 and 2004–05, the proportion of people with diagnosed diabetes more than doubled from 1.3% to 3.3%.
- The rise is largely driven by an increase in the prevalence of Type 2 diabetes; however, Type 1 diabetes and gestational diabetes are also on the rise.
- Between 2000–01 and 2004–05, the rates of diabetes hospitalisation increased by 35%, from 1,932 hospitalisations per 100,000 people to 2,608 per 100,000.

It is a serious disease….

- It was treated in over 500,000 hospitalisations in 2004–05.
- More than half (56%) of the people with diagnosed diabetes in 2003 also had a disability. A quarter considered diabetes as the main condition causing their disability.

… which reduces quality of life

- People with diabetes were more likely to rate their own health as fair or poor (48%) than those without diabetes (15%) in 2004–05.
- People with diabetes were more likely than those without diabetes to report high or very high levels of psychological distress (18% compared with 12% respectively).

… and has serious complications

- Heart disease rates are higher in people with diabetes. In 2004–05 people with diabetes were twice as likely as those without it to have had a heart attack (age-standardised rate of 3% and 1.5% respectively) and nearly 3 times as likely to have had a stroke (age-standardised rate of 5% and 2% in 1999–2000).
- People with diabetes are much more likely to suffer eye problems:
  - About 22% of people with previously diagnosed Type 2 diabetes and 6.2% of people with newly diagnosed Type 2 had retinopathy in 1999–2000.
  - Self-reported data for 2004–05 showed that 9% of people with diabetes had cataracts and 6% had glaucoma, twice the rates reported by people without diabetes.
  - Visual disturbances or loss of vision, or complete or partial blindness was reported by 7% of people with diabetes. About 2% of people with diabetes were completely or partially blind.
- In 2005, nearly a third of people starting treatment for end stage kidney disease (ESKD) did so because of diabetic nephropathy. This was an increase of 28% since 2001.
- Nerve damage is a common complication of diabetes and in extreme situations can lead to leg or foot amputations. In 1999–2000, over 10% of males and 9.4% of females with newly diagnosed diabetes had clinical signs of neuropathy.

- In 2004–05 there were 3,394 lower limb amputations among people with diabetes. More males than females had lower limb amputations in that period (70% of amputations were for males).
- In 1999–2000 about 30% of men with self-reported diabetes were suffering from impotence which is likely to be linked to their diabetes.

Diabetes and its complications incur substantial health system costs

- The direct health-care expenditure on diabetes in 2004–05 was $907 million, which accounted for nearly 2% of the allocatable recurrent health expenditure in that year.

Not all diabetes is the same…

- Type 1 affects 10%–15% of people with diabetes. It requires daily insulin therapy for survival.
- In 2005, nearly 1,700 persons under age 40 years were first diagnosed with Type 1 diabetes in that year. This equates to 23 new cases per 100,000 children aged 0–14 years and 11 new cases per 100,000 for people aged 15–39 years.
- About 83% of self-reported cases of diagnosed diabetes in 2004–05 were Type 2. Type 2 diabetes is more common among people aged 45 years or over and is marked by the inability of the body to use insulin properly (insulin resistance) and reduced levels of insulin.
- Around 1 in 20 pregnant women are affected by gestational diabetes mellitus (GDM)—a form of diabetes that develops during pregnancy in some women and is a strong marker for the later development of Type 2 diabetes.
- Of women giving birth in Australian hospitals in 2004–05, 4.2% (10,900 births) had GDM.

Control of modifiable risk factors is the key to prevention

- Overweight and physical inactivity are the main modifiable risk factors responsible for Type 2 diabetes.
- In 2004–05, an estimated 51% of Australians aged 15 years and over were overweight or obese (based on self-reported information).
- People with diabetes are more likely than those without diabetes to be overweight or obese (69% compared with 51%, respectively, in 2004–05). Being overweight or obese also increases their risk of diabetes complications such as coronary heart disease (CHD), stroke and peripheral vascular disease (PVD).
- An estimated 70% of Australians aged 15 years or over in 2004–05 did insufficient physical activity, as did two out of three people with diabetes.

Some population groups are more susceptible to diabetes than others

Aboriginal and Torres Strait Islander peoples

- In 2004–05, the prevalence of diabetes among Indigenous people was estimated to be over 3 times the rate of non-Indigenous people.
- In the same year, 62% of Indigenous people aged 15 years and over were estimated to be either overweight or obese, compared with 51% of non-Indigenous people.
- Diabetes hospitalisations for Indigenous people were nearly 11 times as high as for other Australians in 2004–05. Hospitalisations for kidney complications among Indigenous people were 29 times as high as for other Australian people.
- The death rate from diabetes among Indigenous people was almost 12 times that experienced by non-Indigenous Australians.

KEY FINDINGS CONTINUED OVERLEAF

- Death rates from renal complications among Indigenous people were 19 times that of non-Indigenous people and deaths from CHD, stroke, PVD and lower limb ulcers were approximately 7 times as high.

People from lower socioeconomic groups

- Diabetes prevalence rates among people in the fifth of the population with the lowest socioeconomic position are nearly twice as high as those in the fifth of the population with the highest socioeconomic position.
- Diabetes death rates increased with decreasing socioeconomic position. During 2003–2005, the diabetes death rate in the lowest socioeconomic group was nearly twice the rate in highest socioeconomic group.

People from different geographical areas

- In 2004–05, the respective hospitalisation rates for diabetes among people living in Remote and Very Remote areas were 2 and 3 times as high as the rate for people living in Major Cities.
- The death rate from diabetes among people living in Remote and Very Remote areas was 2 and 4 times that experienced by people in Major Cities.

People born overseas

- People born in some overseas countries have higher rates of diabetes than those born in Australia: diabetes prevalence was 7% among those born in North Africa and the Middle-East, 6% among those born in South-East Asia and 5% in each of the populations born in Southern and Eastern Europe and Oceanic countries (excludes Australia), while Australian-born people had a prevalence rate of 3%.
- Death rates from diabetes among people born overseas were higher than the rate among Australian-born people. The highest rates were recorded for those born in South-East Europe and North Africa and the Middle-East (60% and 50% as high as the rate for Australian-born).

1 Introduction

Background

Diabetes is one of the leading chronic diseases in many countries, and is now reaching epidemic levels. If left unchecked, 1 in 14 adults or an estimated 380 million people worldwide are predicted to have diabetes by 2025 (IDF 2006). Diabetes is associated with a range of complications including coronary artery and peripheral vascular disease, stroke, diabetic neuropathy, amputations, renal failure and blindness, and can cause much disability, poor quality of life and premature death, especially if left undiagnosed or poorly controlled (IDF 2006).

Diabetes imposes a large burden on the health system and on some communities and in 2003, diabetes accounted for over 5% of the disease burden in Australia (AIHW: Begg et al. 2007). Diabetes also carries with it an increased risk of ischaemic heart disease and stroke and the associated burden has not been included in the above figures. When this risk was accounted for, the burden attributable to diabetes increased to 8.3% of total disease burden.

Purpose and structure of the report

Diabetes: Australian facts 2008 provides an overview of diabetes and its impact on the Australian community. The report presents the latest available statistics on diabetes, including information on risk factors, complications, health service use, and the impact of the disease (including mortality) on Australians. The report includes both summary and trend data related to diabetes in Australia and information useful for health professionals, policy makers, academics and other interested readers. However, the report is not designed to be a source of personal medical advice.

This is the second national report on diabetes compiled by the National Centre for Monitoring Diabetes, at the Australian Institute of Health and Welfare (AIHW). As part of the National Health Priority Area program, the Australian Government Department of Health and Ageing (DoHA) allocated funding for the establishment of the National System for Monitoring Diabetes. Although Australia previously had national data sources relevant to the monitoring of diabetes, it lacked an integrated system to coordinate these resources and their analysis. The National Centre for Monitoring Diabetes, with advice from an expert advisory committee, fulfils this function by producing reports and other information on various aspects of diabetes.

The lack of good quality national data in many areas limits a full understanding of the true impact of diabetes on Australian society and has also influenced the structure and content of this report. For example, current information examining the psychosocial effect of the disease on people with diabetes and their carers are not available. Importantly, the most recent information on diabetes prevalence and risk factors from a national blood survey is now becoming quite dated, having been collected in 1999–2000.

More information on data gaps and deficiencies for monitoring diabetes can be found in the latest publication *National indicators for monitoring diabetes: Report of the Diabetes Indicators Review Subcommittee of the National Diabetes Data Working Group* (AIHW 2007).

What is diabetes?

Diabetes mellitus (diabetes) is a disease marked by high blood glucose levels resulting from defective insulin production, insulin action or both (WHO 1999). There are several types of diabetes, with different causes and clinical histories: Type 1, Type 2, gestational diabetes and other types (Box 1.1). Other types of diabetes are relatively uncommon therefore only the three main types of diabetes—Type 1, Type 2 and gestational diabetes—are discussed in this report.

Diabetes in the Australian population

Based on self-reported data from the most recent National Health Survey (NHS), an estimated 700,000 people (3.6% of Australians) had diagnosed diabetes in 2004–05. Of those people reporting long-term diabetes, 13% had Type 1

diabetes, 83% had Type 2 diabetes and 4% had an unknown type of diabetes. Type 2 diabetes occurs mainly among people aged 40 years or more (WHO 1999) but in recent times Type 2 diabetes has been increasingly seen in children and young people (Craig et al. 2007; McMahon et al. 2004).

There is evidence that the incidence of Type 1 diabetes is increasing among children (AIHW: 2007; Haynes et al. 2004; Taplin et al. 2005). Although only a small proportion of children are affected by diabetes, the impact of diabetes on their health is often severe, both during childhood and later in life.

Some population groups including Aboriginal and Torres Strait Islander, and people born in some other countries, are at an increased risk of Type 2 diabetes (AIHW: Dixon & Webbie 2005; Craig et al. 2007), which is due to a combination of genetic, biological, behavioural and environmental risk factors (AIHW: Thow & Waters 2005; Zimmet et al. 2001). In 2004–05, the age standardised-rate of diabetes among Aboriginal and Torres Strait Islander peoples was over 3 times the rate in non-Indigenous people (ABS 2006b). During the same period, the age-standardised prevalence of diabetes among people born in Southern and Central Asia was 8.7%, North Africa and the Middle East 6.6%, South East Asia 5.7% and Southern and Eastern Europe 4.9%. In contrast, the prevalence rate of diabetes among Australian-born people was 3.3% (ABS 2006a).

Untreated diabetes can lead to complications involving many parts of the body, particularly the heart, kidneys, eyes and feet. In Australia, diabetes is the most common reason for renal dialysis, and the most common cause of blindness in people under age 60 years, non-traumatic lower-limb amputation and cardiovascular disease (Barr et al. 2006).

The national strategy

In recognition of the impact that diabetes has on the Australian community, and the potential for improved health outcomes, Australian Health Ministers agreed in 1996 to make diabetes mellitus a National Health Priority Area. The aim of this initiative was to focus public attention on diseases that present a significant health burden, where there is a potential for health gain through prevention and treatment programs.

In 1999, the National Diabetes Strategy (NDS) was endorsed by all Australian Health Ministers. The NDS was developed to assist governments and service providers in identifying key areas for action aimed at improving the health of Australians with, or at risk of, diabetes. The NDS aims to achieve this by coordinating the wide range of activities undertaken across Australia

Box 1.1: Types of diabetes

Type 1 diabetes mostly arises in children or young adults, though it can occur at any age. It is marked by the inability to produce insulin. People with Type 1 diabetes need insulin replacement for survival. Type 1 diabetes accounts for approximately 10–15% of all diabetes cases.

Type 2 diabetes is the most common form of diabetes, which occurs mostly in people aged 50 years or over. Although uncommon in childhood, it 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 is a form of diabetes that develops during pregnancy in some women. It involves high blood sugar levels appearing for the first time during pregnancy among women who have not previously been diagnosed with other forms of diabetes. It usually disappears after the baby is born; however, it can recur in later pregnancies. It 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 alone and some may require insulin treatment.

to improve the prevention, early detection and management of diabetes.

Key initiatives under the National Diabetes Strategy (NDS) include:

- National Service Improvement Framework for Diabetes
- National Integrated Diabetes Program
- National Diabetes Services Scheme (NDSS)
- Diabetes Prevention Pilot Initiative
- Evidence-based guidelines for the management of diabetes
- The Australian Diabetes, Obesity and Lifestyle Study
- support for diabetes research
- National Centre for Monitoring Diabetes
- National Diabetes Register (NDR)
- National Diabetes Improvement Projects
- Australian National Diabetes Information Audit and Benchmarking (ANDIAB) project.

Information on these initiatives can be found at the DoHA website <www.health.gov.au>.

Structure of the report

This report presents information in eight thematic chapters. This introductory chapter provides some background information, describes what diabetes is and its different types, and summarises its overall level and impact. Chapter 2 provides information on the number of people with diabetes and Chapter 3 presents information on risk factors for diabetes and its complications. The major complications of diabetes are discussed in Chapter 4. Diabetes prevalence, complications and risk factors of diabetes for specific population groups are discussed in Chapter 5, and Chapter 6 presents available data on the use of health services in diabetes management. Chapter 7 covers the impact of diabetes, including information on quality of life, disability, disease burden and economic costs. Mortality from diabetes is presented as a separate chapter (Chapter 8) in this edition of the report.

Appendix 1 describes the methods and main data sources used in this report. Appendix 2 refers the reader to where information related to national indicators for monitoring diabetes can be found.

Some epidemiological concepts used in the report are described in the glossary.

What is new in this edition?

This second edition of this report on diabetes in Australia updates information presented in the 2002 edition, wherever possible. More extensive data and analysis have been able to be included in many areas of the report.

Considerable new information on the number of people with diabetes has been incorporated, and this information on the incidence and prevalence of diabetes is contained in Chapter 2. This chapter also includes several years of data from the NDR, which was only very new at the time of the first edition of this report. Thus trends in incidence of Type 1 diabetes can now be examined at the national level.

Another major change in this edition is the inclusion of a separate chapter on diabetes in specific population groups. The first edition contains this information throughout the report, but in this edition separate sections on diabetes in Indigenous people, people living in regional areas, people born overseas and people from different socioeconomic groups are included in Chapter 5.

Main data sources used in the report

A brief summary of the data sources is provided below. Further details are provided in Appendix 1.

The 2004–05 NHS data are used extensively throughout the report and provide self-reported information on diabetes, including prevalence, risk factors and some complications.

The National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) 2004–05 collected information relating to Indigenous peoples, including health status, health action taken and lifestyle factors that may influence health. This survey covered information similar to the NHS including health status, health risk factors, long-term conditions, health service use, social and emotional wellbeing and basic demographic information. Information from

this survey is mainly presented in Chapter 5 (Aboriginal and Torres Strait Islander peoples section).

The 1999–2000 Australian Diabetes and Lifestyle Study (AusDiab) collected actual physical measurements (such as blood pressure) and blood specimens in people aged 25 years and over and thus provided more accurate estimates of diabetes prevalence, its risk factors and complications for this age group. Although the AusDiab study is older than the 2004–05 NHS, it is the most recent national source providing measured data on various aspects of diabetes in Australia.

The NDR collects information about people who use insulin as part of their treatment of diabetes. It includes data for persons who began to use insulin from 1 January 1999. Data for the register are obtained from two main sources: the National Diabetes Services Scheme, which is administered by Diabetes Australia Ltd, and the Australasian Paediatric Endocrine Group (APEG) state-based registers. APEG registers collect information about children with diabetes aged less than 15 years.

The 2004 National Drug Strategy Household Survey (NDSHS) includes data on the drug use, perceptions and attitudes of almost 30,000 Australians aged 12 years and older. Data from the NDSHS are self-reported. In this report, the prevalence of tobacco smoking was obtained from this source.

The Australian National Diabetes Information Audit and Benchmarking (ANDIAB) data collection compiles information from audits of patients attending a selection of specialist diabetes centres and specialist endocrinologists in private practice. It reports data on over 5,000 persons with diabetes requiring specialist clinical management, in particular those who have had poor control of their diabetes.

The AIHW National Hospital Morbidity Database contains demographic, diagnostic, procedural and duration-of-stay information on episodes of care for patients admitted to hospital. In this report, disease data relate to the principal diagnosis unless otherwise specified.

The AIHW National Mortality Database contains information on the underlying and additional causes of death, along with demographic information about deceased persons based on information supplied by the medical practitioner certifying the death or by a coroner.

2 How many people have diabetes?

Introduction

Recent increases in the number of people with diabetes have led to a number of claims that we are in an 'epidemic' of diabetes (Colagiuri et al. 2005). There is much concern about the likely effect of this epidemic on individual and population health, and its wider social and economic impacts. Therefore our estimates on the magnitude of the problem are essential for monitoring the impact of the disease and prevention strategies, and for planning and providing services to people with diabetes.

Two measures of disease occurrence are included here: prevalence and incidence. Both of these measures described below are important in describing the occurrence of diabetes.

Prevalence is the number of people with diabetes at a point in time. In this report, the time point is a single day in the case of continuous data collections such as the National Diabetes Services Scheme, or the day the respondent was questioned in the case of the various surveys. Information is presented here both in terms of the absolute number of cases, and as a percentage of the population.

Incidence is the number of new cases of diabetes during a period of time. The period of time used in this report is calendar years. As well as the absolute number of new cases, this is also expressed as a rate: the number of new cases during the year divided by the population at risk (multiplied by 100,000).

This chapter has five sections. The first provides information on the prevalence of all diabetes—how many people have any type of diabetes. The second section contains available information on the incidence of all diabetes regardless of type. Then three sections that follow describe the prevalence and incidence of the main types of diabetes—Type 1, Type 2 and gestational diabetes.

Prevalence of diabetes

There are two main data sources of national diabetes prevalence in Australia. The first is the 1999–2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab study), in which diabetes prevalence was estimated on the basis of measured blood sugar levels. The second is the Australian Bureau of Statistics (ABS) series of National Health Surveys, in which prevalence estimates are based on self-reported information. Note that gestational diabetes is excluded from the NHS estimates in this chapter.

Measured data, such as those collected in the AusDiab study, provide more accurate estimates of the prevalence of diabetes than self-reported survey data. Diabetes prevalence derived from measured data can be estimated for both diagnosed and previously undiagnosed cases. The accuracy of self-reported data, such as those collected in the NHS, relies on respondents being aware of and accurately reporting their health status, and therefore will not include previously undiagnosed cases of diabetes. However, because the NHS is conducted regularly, it is able to provide recent information and produce trends on the prevalence of diagnosed diabetes over time.

Measurement data

The latest available national information on the prevalence of diabetes using data collected as part of a survey that included blood samples is the 1999–2000 AusDiab study. Based on data from that study, it has been estimated that nearly 880,000 Australian adults aged 25 or over had diabetes in 1999–2000, constituting 7.4% of the population (more than 1 in 14 people). The vast majority (96%) of diabetes cases in adults aged 25 years and over were Type 2.

The proportion of people with diabetes increased with age (Figure 2.1). Fewer than 3% of adults aged 35–44 years had diabetes. The rate then steadily increased to 23% for people aged 75 years and over.

The rates were higher for males than females in most age groups, particularly for the middle groups between 55 and 74 years of age.

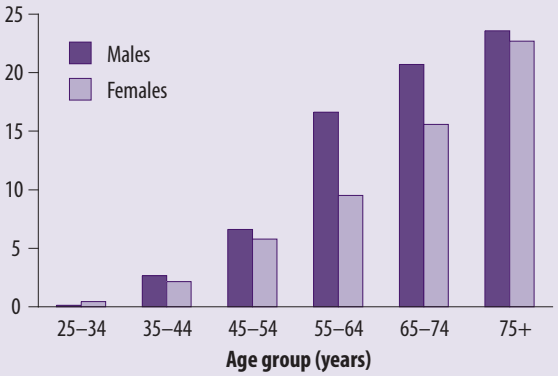
The AusDiab study found that a large proportion of total diabetes cases were undiagnosed—half of the cases detected in the survey had not previously been diagnosed. There was little variation in this pattern across age groups (Figure 2.2).

Another estimate of the proportion of undiagnosed diabetes cases was obtained in the Northwest Adelaide Health Study (NWAHS) conducted during

2000–2003. This study found fewer undiagnosed cases than the AusDiab study (see Box 2.1).

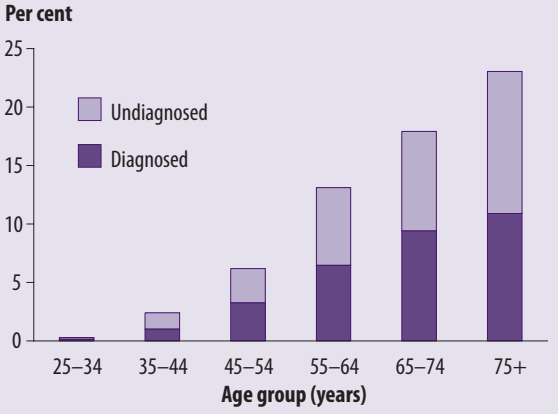
In 2000–2003, the NWAHS found that 6.6% of the population aged 18 years and over had diabetes. Blood measurements were taken; however, there are a number of reasons why this estimate cannot be directly compared with the AusDiab estimate. These include the use of different blood tests (outlined in Box 2.1) and different scopes (age range and geographical populations covered).

The NWAHS found similar age and sex patterns to the AusDiab study. The percentage of people in the population with diabetes was higher in males compared with females, and the percentage increased with age.



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 2.1: Age-specific prevalence of diabetes, by sex, 1999–2000



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 2.2: Age-specific prevalence of diagnosed and undiagnosed diabetes, 1999–2000

Little information is available on trends in diabetes based on measurement data. Comparisons can be made between the National Heart Foundation (NHF) Risk Factor Prevalence Survey conducted in 1983 and the 1999–2000 AusDiab survey. The valid comparison is for the overlapping population of 25–64 year olds living in capital cities. Diabetes cases are included if the fasting plasma sugar was 7.0 mmol/l or more. Using this comparison and adjusting for age, 1.2% of this population had diabetes in 1983. By 1999–2000, this had increased to 3.2%.

Box 2.1: Diagnosed versus undiagnosed diabetes?

The following two Australian studies have examined the ratio of diagnosed versus undiagnosed diabetes.

1999–2000 Australian Diabetes and Lifestyle Study (AusDiab) In the 1999–2000 AusDiab study, people with known (diagnosed) diabetes were defined as those receiving treatment in the form of tablets or insulin at the time of the study or who had been told by a doctor or nurse that they had diabetes and had a fasting blood sugar level of at least 7.0 mmol/L or a 2-hr post load sugar level of at least 11.1 mmol/L. People with undiagnosed diabetes were defined as those who had never been diagnosed with diabetes and were not receiving treatment and who had a fasting blood sugar level of at least 7.0 mmol/L or a 2-hr post load sugar level of at least 11.1 mmol/L. The study found a ratio of 1:1 for diagnosed versus undiagnosed diabetes; in other words, for every known case of diabetes there was one newly diagnosed case (Dunstan et al. 2002).

North West Adelaide Health Study (NWAHS) In the NWAHS, people with diagnosed diabetes were defined as those reporting that they had been told by a doctor that they had diabetes. People with previously undiagnosed diabetes were defined as having a fasting plasma sugar level of at least 7.0 mmol/L but did not report having been told by a doctor that they had diabetes. The study found a ratio of 1:5–6 for diagnosed versus undiagnosed diabetes; in other words, for approximately every five or six people with diagnosed diabetes, one person had undiagnosed diabetes (Grant 2005).

Self-reported data

Self-reported data are easier to collect than measurement data but have certain limitations: the data cannot identify undiagnosed cases, and they rely on the respondent accurately reporting that they have been diagnosed with diabetes.

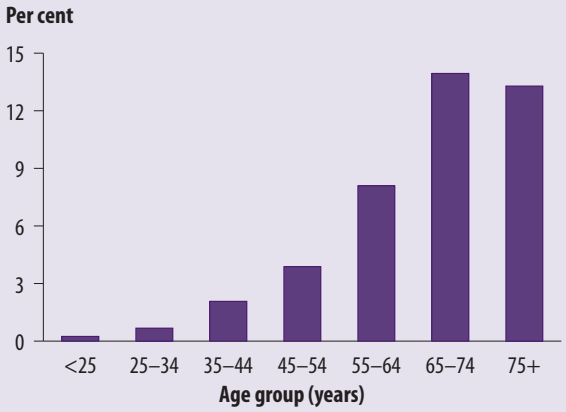
From self-reported data in the 2004–05 NHS, about 700,000 Australians (3.6% of the population) had been diagnosed with diabetes (ABS 2006b). The proportion of people with diabetes increased with age, and the highest prevalence rates were for those aged 65–74 years (Figure 2.3). Males had a higher prevalence than females (4.0% and 3.2%, respectively).

The NHS found that, among people with diabetes, 13% had Type 1 diabetes, while 83% had Type 2 and a further 4% did not know which type they had.

The number of people with diabetes has increased substantially in recent years. Results from the four National Health Surveys indicate that the number of people with diagnosed diabetes more than doubled between 1989–90 and 2004–05 from around 250,000 to 640,000 (age-standardised). The corresponding percentage of the population with diabetes increased from 1.3% to 3.3% (Figure 2.4). This is a substantial increase, believed to be related to more people developing diabetes, people living longer with the disease, and potentially better detection of the disease (Colaguiri et al. 2005).

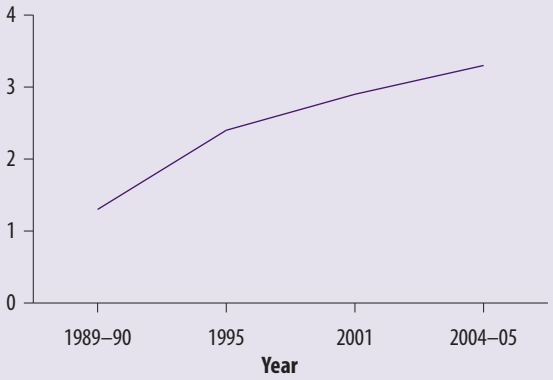
International comparisons

Comparisons of the percentage of people with diabetes in 20 other OECD countries show that Australia, with a prevalence rate of 5%, is towards the bottom of this group of countries (Figure 2.5). These estimates of the prevalence for people aged 20 to 79 years of age have been adjusted for differences in the age structure of the populations. The highest rate (>10%) was found in Mexico, while the lowest rate (around 3%) was in the United Kingdom.



Note: Based on self-reported data.
Source: AIHW analysis of the ABS 2004–05 National Health Survey data.

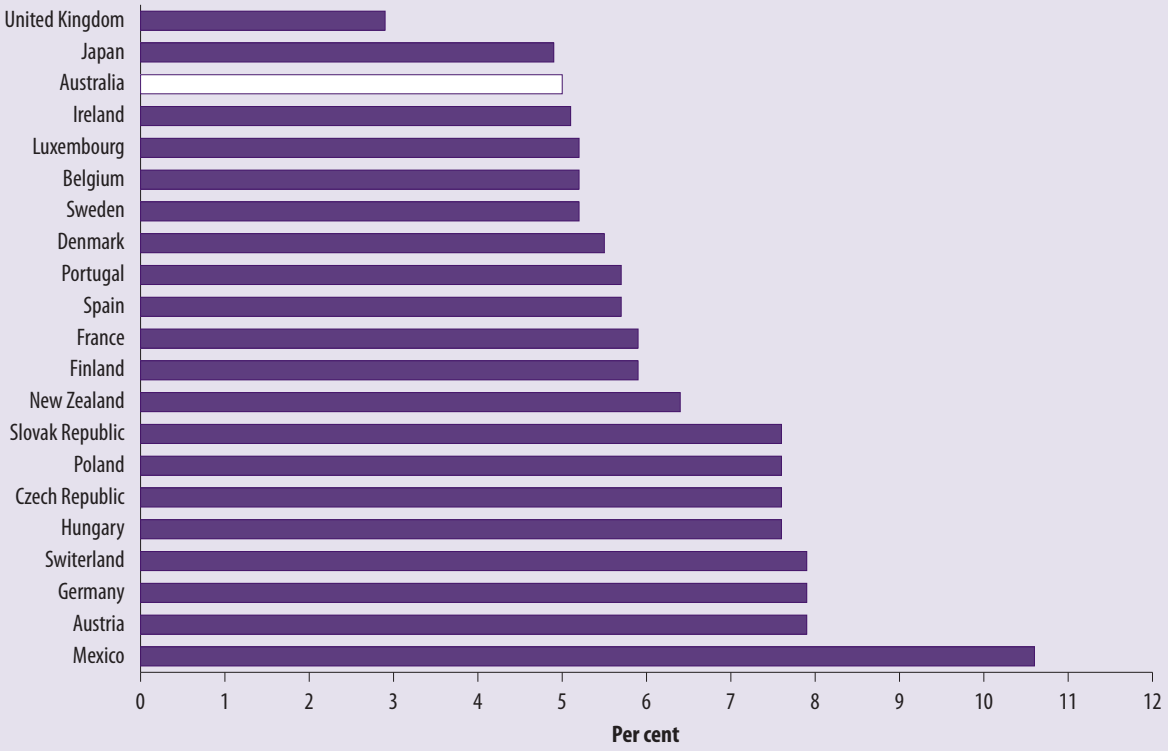
Figure 2.3: Age-specific prevalence of diagnosed diabetes, 2004–05



Notes
1. Directly age-standardised to the 2001 Australian population.
2. Based on self-reported data.

Sources: AIHW analysis of the 1989–90, 1995, 2001 and 2004–05 ABS National Health Survey data.

Figure 2.4: Trends in the prevalence of diagnosed diabetes, 1989–90 to 2004–05



Source: International Diabetes Federation 2006.

Figure 2.5: Estimated diabetes prevalence, 20–79 year olds, 2007

Incidence of diabetes

There is limited national information on the incidence of diabetes in Australia. The exception is Type 1 diabetes for which there are good incidence data from 1999 onwards from the NDR. In addition state-level incidence data has been published from Western Australia since the 1980s and New South Wales since 1990 (Haynes et al. 2004; Taplin 2005; Craig 2007).

This section presents available information on the incidence of all diabetes, while subsequent sections present more detail on different types of diabetes where available.

Disease register and administrative data

Recent evidence from disease registers and administrative data shows that there are at least 45,000 new cases—about 1 new case for every 450 people—of diagnosed diabetes (excluding gestational diabetes) each year (Table 2.1). This includes around 5,000 new cases of diabetes that are insulin-treated (new cases of Type 1 diabetes and new cases of Type 2 and 'other diabetes' starting insulin treatment within approximately a year of diagnosis). Registration data for the NDSS show that, by 30 September 2006, there were at least another 40,000 people newly diagnosed in 2003 who do not use insulin. There is also a sizeable proportion of NDSS registrations where diagnosis year is missing: 19% of people registered since 2003 do not have a diagnosis year recorded. At least some of these cases are likely to have been diagnosed in 2003. Distributing the registrations without diagnosis year according to the distribution of the cases that did have a diagnosis year leads to another 12,000 registrations that may have been diagnosed in 2003.

Using the latest available national hospital data, each year there are around 11,000 cases of diagnosed gestational diabetes. This estimate comes from counting the number of deliveries in hospital where gestational diabetes was recorded in the hospital record (see Gestational diabetes section for more information).

Table 2.1: New cases of diagnosed diabetes recorded in disease register and administrative data by year of diagnosis, 2003–2005

	New insulin-treated diabetes per year	National Diabetes Services Scheme registrants[a]	Deliveries in hospital with gestational diabetes per year	
Type of diabetes[b]	National Diabetes Register, 2003–2005	NDSS database, diagnosed 2003	AIHW National Hospital Morbidity Database, 2003–04 to 2004–05[c]	Estimate of total new cases[c]
Type 1	2,000	(refer to NDR data)	–	2,000
Type 2	3,100	43,100	–	43,100
Gestational	1,700	6,700	10,800	10,800
Other	100	300	–	300
Total excl gestational	*5,200*	*45,400*	–	*45,400*
Total	*6,900*	*52,100*	*10,800*	*56,200*

(a) As at 30 September 2006. Excluding NDSS registrations with missing diagnosis year information (19% of registrations occurring since 1 January 2003). Only cases diagnosed in 2003 have been used in this estimate due to the known time delay between diagnosis and registration for a proportion of people with Type 2 diabetes.

(b) Data from the National Diabetes Register and the National Diabetes Services Scheme data are grouped using 'derived type of diabetes' (AIHW: Catanzariti et al. 2007). Gestational diabetes cases in the hospital data are identified using ICD-10-AM code O24.4, and have only been counted when present at the time of delivery.

(c) Estimate of the number of new cases as recorded in these databases.

Note: Numbers rounded to nearest 100.

Sources: National Diabetes Register, AIHW analysis of National Diabetes Services Scheme database, AIHW analysis of AIHW National Hospital Morbidity Database.

Cohort study

The AusDiab 5-year follow-up study determined that 0.8% of Australian adults aged 25 years and over developed diabetes (excluding gestational diabetes) each year between 2000 and 2005. This corresponds to an estimated 275 people developing the disease each day, or around 100,000 per year. Overall, there were more new cases of diabetes per year for males than for females; for males the incidence of diabetes peaked between the ages of 55 and 74 years while for females the incidence was highest for those aged 65 years and over (Barr et al. 2006). Note that only around 75% of these cases identified using only one blood sample (the standard practice in these types of surveys) would be expected to be true clinical cases (WHO 2006). Therefore this number should be seen as an upper limit of the number of cases developing.

It is unlikely that 100,000 people will be diagnosed with diabetes in a year. However, for a number of reasons it is difficult to compare this estimate of newly developed cases of diabetes with the ones presented above on new cases of diagnosed diabetes. First, a proportion of the estimated new cases found in a survey would not be true cases (as explained above). Second, a proportion would also remain undiagnosed, though for an unknown period of time. It is also not known whether the proportion of undiagnosed cases is changing over time. Third, there are complex flows of people moving from not having diabetes to having it, then from being undiagnosed to being diagnosed. People are not necessarily diagnosed in the year they develop diabetes, and the gap between developing diabetes and being diagnosed is likely to vary between individuals.

Type 1 diabetes

Type 1 diabetes usually arises in childhood or youth (though it can occur at any age) and is characterised by the inability to produce insulin. People with Type 1 diabetes need insulin replacement for survival.

Risk factors

No modifiable risk factors have been clearly identified for Type 1 diabetes. It is currently thought that a combination of genetic and environmental factors are involved in the

development of the disease (Daneman 2006; Devendra et al. 2004), though research continues into the exact nature of these risk factors.

Some environmental risk factors being researched include: viruses, nutrition including early consumption of cow's milk and vitamin D exposure (Yoon et al. 1999; Vaarala 2005; Greer et al. 2007; Littorin et al. 2006).

How many Australians have Type 1 diabetes?

Prevalence

There is limited information available that can be used to accurately determine the number of people in Australia with Type 1 diabetes. An indication of Type 1 diabetes prevalence can be obtained from four sources—the NHS, the NDSS, the NDR, and the Australian Diabetes, Obesity and Lifestyle Study (AusDiab). However each of these has limitations, as indicated below. Due to the nature of Type 1 diabetes, undiagnosed cases will not complicate the assessment of prevalence.

Based on self-reported data from the NHS, Type 1 diabetes accounted for 13% of all diabetes cases reported in 2004–05. This corresponds to an estimated 91,900 (0.4%) Australians affected by the disease in 2004–05. However, the type of diabetes is not accurately reported by participants in population surveys. Validation of the 1995 NHS using other information collected in the survey indicated that only around half of the people reporting Type 1 diabetes were estimated to have Type 1 diabetes.

Another indication of prevalence can be obtained using the NDSS data. As at 30 September 2006, there was an estimated maximum of 122,300 people registered with Type 1 diabetes on the NDSS (AIHW analysis of the NDSS data). However, it is likely that a proportion of these people have Type 2 diabetes rather than Type 1. The proportion falling into this category cannot be estimated from the database due to missing diagnosis information.

Further information on the number of people with Type 1 diabetes in particular subgroups can be obtained from the NDR (people diagnosed since 1999) and AusDiab (people aged 25 years and over).

There were 12,700 registrants on the NDR with derived Type 1 diabetes who were still alive at the end of 2005. This represents the total number of people diagnosed with Type 1 diabetes in the 7 years between 1999 and 2005 who did not die during that period.

Based on data from the 1999–2000 AusDiab study, Type 1 diabetes accounted for around 8.1% of all diagnosed diabetes in people aged 25 years and over—affecting approximately 35,500 Australians in this age group.

Incidence

The NDR collects information on new cases of insulin-treated diabetes. NDR records for 0–14 year olds are received from the NDSS and the Australasian Paediatric Endocrine Group (APEG) state and territory databases. As a result, coverage of new cases of insulin-treated diabetes under 15 years of age is considered to be high thus producing reliable estimates of Type 1 diabetes incidence (AIHW: Catanzariti et al. 2007). For 15–39 year olds, the incidence estimates are adjusted to account for NDSS registrants not consenting to be on the NDR.

According the NDR, there were 1,689 new cases of Type 1 diabetes diagnosed in 2005 among people aged less than 40 years (Table 2.2). The annual incidence of Type 1 diabetes for 0–14 year olds was 22.6 cases per 100,000 population and 10.9 cases per 100,000 population for people aged 15–39. There is substantial variation within these broad age ranges. For children, the highest rates were for the 10–14 year age group (28.0 per 100,000). For young adults, the highest rate occurred in the 15–19 year age group (17.5 per 100,000). Males accounted for 58% of cases, and incidence rates were higher for males than females across nearly all age groups.

Trends

There was a significant increase in the incidence of Type 1 diabetes between 1999 and 2005; over the seven years, the age-adjusted rate of new cases among those aged 0–14 increased from 18.1 per 100,000 population in 1999, to 22.6 in 2005 (AIHW: Catanzariti et al. 2007). The incidence remained relatively stable for people aged 15–39 years (around 15 per 100,000 for males and 10 per 100,000 for females).

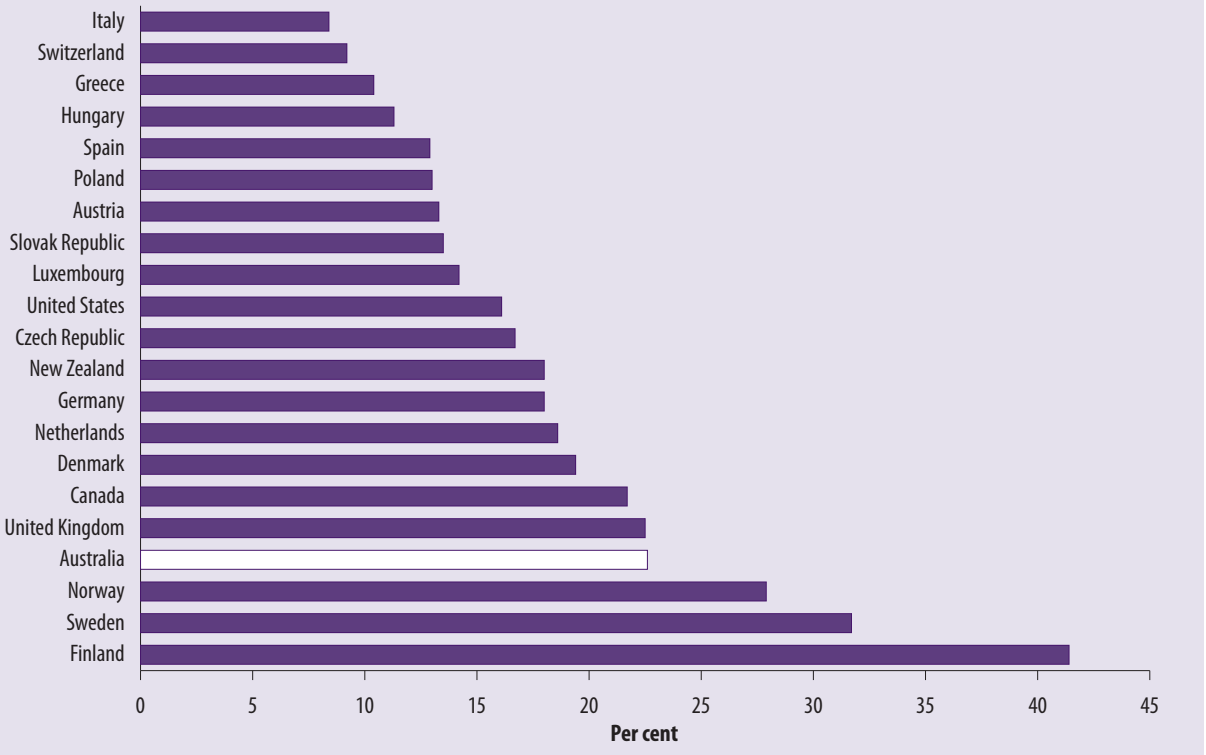
International comparisons

Australia's incidence rate for Type 1 diabetes in the late 1990s to early 2000s was at the upper end of the range of estimates for OECD countries (Figure 2.6). Three of the Nordic countries had the highest rates (up to 41 per 100,000), followed by Australia, the United Kingdom and Canada with rates around 22–23 per 100,000. The lowest rate was 8.4 per 100,000 in Italy.

Table 2.2: Incidence of Type 1 diabetes among those aged 0–39 years at their first insulin use, by age and sex, 2005

	Males		Females		Persons	
	Number	Rate	Number	Rate	Number	Rate
0–4 years	109	16.8	92	14.9	201	15.9
5–9 years	156	23.0	154	23.9	310	23.5
10–14 years	207	29.0	183	27.0	390	28.0
Total 0–14[(a)]	*472*	*23.0*	*429*	*22.1*	*901*	*22.6*
15–19 years	150	21.1	93	13.7	243	17.5
20–24 years	112	15.3	70	10.0	182	12.7
25–29 years	96	13.9	48	7.1	144	10.6
30–34 years	101	13.5	38	5.0	139	9.2
35–39 years	54	7.4	26	3.5	80	5.4
Total 15–39[(a)]	*513*	*14.1*	*275*	*7.7*	*788*	*10.9*
Total 0–39	**985**		**704**		**1,689**	

(a) Directly age-standardised to the 2001 Austalian population.
Source: AIHW: Catanzariti et al. 2007.



Sources: International Diabetes Federation 2006, National Diabetes Register.

Figure 2.6: Incidence of Type 1 diabetes in OECD countries, 0–14 year olds, late 1990s to early 2000s

Type 2 diabetes

Type 2 is the most common form of diabetes. It occurs mostly in people aged 40 years and over and is marked by reduced or less effective insulin. Although uncommon in childhood, it is becoming increasingly recognised in that group.

Risk factors

A number of risk factors are implicated in the development of Type 2 diabetes. These may act alone, but often act together in complex interplay. Consideration of combinations of risk factors is important as it may explain why some population subgroups have higher rates of diabetes than others. Table 2.3 outlines the risk factors for Type 2 diabetes.

How many Australians have Type 2 diabetes?

Prevalence

From the 1999–2000 AusDiab study, it has been estimated that nearly 840,000 Australian adults aged 25 years or above had Type 2 diabetes in 1999–2000, which constitutes 7.1% of the population. These cases represent the vast majority (96%) of cases identified in the survey.

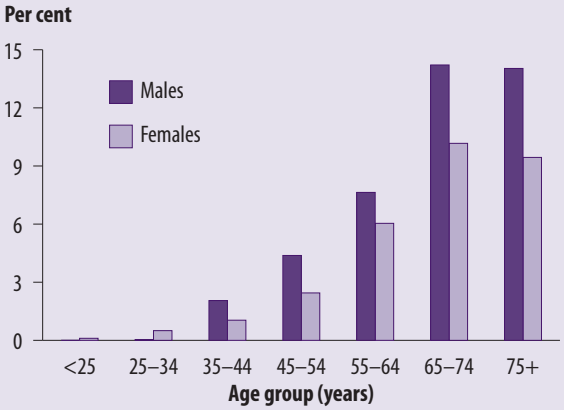
Based on self-reported data from the NHS, Type 2 diabetes accounted for 83% of all diabetes in 2004–05. This corresponds to an estimated 582,800 (3%) Australians.

Prevalence estimates based on measured data are much higher than those based on self-reports because they include people with undiagnosed diabetes. In addition, the figures from the NHS apply to the whole population, while AusDiab only covers adults aged 25 years and over.

Sex and age

As the vast majority of diabetes cases detected in AusDiab were Type 2, the age and sex patterns shown in the overall prevalence results earlier in this chapter also hold for Type 2 diabetes. There was a higher prevalence of Type 2 diabetes in males than females (age-standardised rate of 7.6% compared with 6.5%). Type 2 diabetes increased with age: being highest in the age group 75 years and over (22%).

Based on 2004–05 NHS data, the age-standardised prevalence of self-reported Type 2 diabetes in the general population was 1% higher for males than for females: 3% and 2%, respectively. The proportion of people reporting Type 2 diabetes increased with age, and the highest prevalence rates appeared for those aged 65 years and over (Figure 2.7).



Note: Based on self-reported data.
Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 2.7: Age-specific prevalence of diagnosed Type 2 diabetes 2004–05

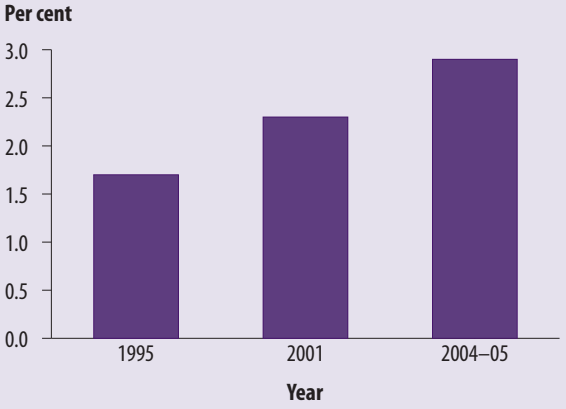
Trends

The prevalence of diagnosed Type 2 diabetes has increased substantially in recent years. From the National Health Surveys, it has increased from

Table 2.3: Risk factors for Type 2 diabetes

Demographic	Genetic	Lifestyle and behavioural	Biomedical/metabolic
Age	Ethnicity	Diet	Intra-uterine growth retardation
Urbanisation	Family history	Obesity (especially abdominal)	Previous gestational diabetes
	Specific genes have been identified	Physical inactivity Foetal nutrition	Impaired sugar regulation (i.e. impaired fasting sugar, impaired sugar tolerance)

1.7% of the Australian population in 1995 to 2.9% in 2004–05 (Figure 2.8). This increase in the age-standardised rate reflects a likely increase in the incidence of Type 2 diabetes, better survival for people with Type 2 diabetes, and also potentially an increase in the detection of the disease (Colagiuri et al. 2005).



Note: Based on self-reported data.

Sources: AIHW analysis of ABS 1995, 2001 and 2004–05 National Health Survey data.

Figure 2.8: Trends in the prevalence of diagnosed Type 2 diabetes, 1995 to 2004–05

Less information is available on trends in the prevalence of Type 2 diabetes including the undiagnosed cases. As the majority of diabetes cases are Type 2, it is likely that much of the increase in overall diabetes between 1983 and 1999–2000 described in the prevalence section earlier in this chapter (from 1.1 to 2.9% for people aged 25–64 years living in capital cities) was in the Type 2 subgroup.

Incidence

The NDR provides information on the incidence of the subset of Type 2 diabetes that is insulin-treated. In 2005, around 11,400 with Type 2 diabetes used insulin to treat their condition for the first time. Just over 2,700 of these were also newly diagnosed Type 2 cases in that year.

The 5-year follow-up AusDiab study provides an estimate of diabetes incidence (Barr et al. 2006). Results for Type 1 and Type 2 diabetes were not reported separately as the vast majority of cases were for Type 2 diabetes. Thus the results outlined in the prevalence of diabetes section earlier in this chapter are largely about Type 2 diabetes.

Gestational diabetes

Gestational diabetes is diabetes first diagnosed during pregnancy (gestation). It may disappear after pregnancy, but signals a high risk of diabetes occurring later in life.

Risk factors

Pregnant women who are at higher risk of developing gestational diabetes include:

- older mothers (risk increases with age)
- those with a history of sugar intolerance or gestational diabetes
- those from certain high-risk ethnic groups, such as Indigenous Australians, and people from the Indian subcontinent, the Pacific Islands, Asia or the Middle East
- women with a family history of diabetes
- women with a history of 'large for gestational age' babies
- women who are overweight or obese before their pregnancy.

Gestational diabetes may occur in women who have no identifiable risk factors, which is why the Australasian Diabetes in Pregnancy Society (ADIPS) recommends screening for all women.

How many Australian women are affected by gestational diabetes?

The Australasian Diabetes in Pregnancy Society estimates that about 5% of pregnant women are affected by gestational diabetes (ADIPS 2007).

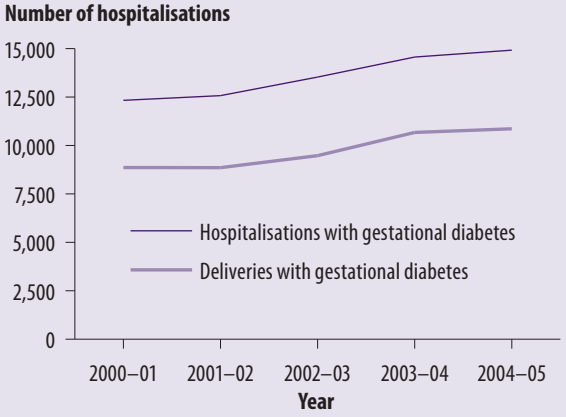
Based on self-reported data from the NHS, gestational diabetes accounted for approximately 3% of all diabetes identified in 2004–05 NHS; this corresponds to an estimated 7,930 Australian women affected by the disease at the time of the survey.

Another assessment of the number of women diagnosed with gestational diabetes can be obtained using the AIHW National Hospital Morbidity Database. During 2004–05, around 10,900 women giving birth in hospital also had diagnosed gestational diabetes, which is 4.2% of hospital births in that year. A third (32.7%) of these gestational diabetes cases were

in women over the age of 35 years, while only one-fifth (19.9%) of the deliveries occurred in this age group. As not all pregnant women are screened for gestational diabetes, it is likely that a proportion of cases remains undiagnosed, and therefore would not be included in these figures.

Trends

Trends in hospitalisations indicate that gestational diabetes as any diagnosis has increased over the last 5 years, from 12,300 in 2000–01 to 14,900 in 2004–05 (Figure 2.9). Similarly, the number of deliveries in hospital where gestational diabetes was diagnosed has increased over the same period. In 2000–01, 8,900 women delivering babies in hospital had diagnosed gestational diabetes (3.6% of these births). By 2004–05, this had increased to almost 10,900 (4.2% of births in hospital). Some of this increase is likely to be due to the increasing average age of mothers (Laws et al. 2006).



Note: Gestational diabetes is classified according to ICD-10-AM code O244, for principal or additional diagnosis. Deliveries are classified according to ICD-10-AM code Z37.
Source: AIHW National Hospital Morbidity Database.

Figure 2.9: Trends in hospitalisations with gestational diabetes, 2000–01 to 2004–05

3 Risk factors for diabetes and its complications

Introduction

A risk factor is the term given to a range of health-related behaviours and biomedical conditions that can impact on the health of an individual in a negative way. Risk factors include both modifiable and non-modifiable factors and for diabetes and its complications, they include genetic, behavioural and biomedical factors (Centers for Disease Control and Prevention 2005; WHO 1999). The determinants of health, however, go beyond these to the underlying social, economic, psychological and cultural factors that can contribute to disease (AIHW 2006a).

Assessing the prevalence of risk factors in the population is useful in understanding trends in disease prevalence, incidence and deaths, as well as predicting future trends, and can help explain why some groups have better or worse health than others. Monitoring prevalence can also provide insight into the success of health-related campaigns or the need to initiate health-promotion interventions.

What are the risk factors for diabetes and its complications?

Many factors contribute to the onset and development of diabetes. Type 1 diabetes is believed to be caused by particular biological interactions and exposure to environment agents among people genetically predisposed to diabetes (Atkinson & Eisenbarth 2001; Daneman 2006).

Several behavioural and modifiable risk factors play a role in the onset of Type 2 diabetes, including obesity, physical inactivity and unhealthy diet, as does genetic predisposition such as family history, ethnic background and age (Shaw & Chisholm 2003). In 2003, high body mass and physical inactivity together explained 60% of the disease burden (in terms of Disability Adjusted Life Years) from Type 2 diabetes (See Chapter 7 for more information). High body mass was the largest contributor (55%) to Type 2 diabetes while the contribution of physical inactivity was 24% (AIHW: Begg et al. 2007).

There is some evidence that depression can increase the risk of developing Type 2 diabetes and diabetes complications (Arroyo et al. 2004; Brown et al. 2005b; Carnethon et al. 2003; Golden et al. 2004). The increased risk for Type 2 diabetes may be due to elevated stress levels and weight gain (Diabetes Australia 2006b).

Poor foetal nutrition leading to low birth-weight for gestational age is another factor that may predispose some individuals to Type 2 diabetes. If these individuals are exposed to other risk factors (such as obesity and physical inactivity) the likelihood of developing Type 2 diabetes becomes greater (Forsen et al. 2000; WHO 1999; Barker 1999; Hales & Barker 2001).

The risk factors for gestational diabetes are similar to those for Type 2 diabetes: women are at higher risk if they are of relatively advanced age or obese when pregnant (Virjee et al. 2001).

There are also a number of additional risk factors for diabetes complications (see Chapter 4), including high blood pressure, high blood cholesterol and tobacco smoking (WHO 1999). Recent studies have suggested that tobacco smoking may also be a risk factor for developing insulin-resistant Type 2 diabetes (Meisinger et al. 2006), although the evidence for this is far more limited compared with other recognised risk factors.

The metabolic syndrome—the clustering of a number of risk factors including abdominal obesity, impaired fasting blood glucose, raised blood pressure, raised blood triglycerides and reduced blood HDL-cholesterol—substantially increases the risk of Type 2 diabetes. The prevalence of the metabolic syndrome among Australians aged 25 years and over was 29% in the AusDiab stucy, conducted in 1999–2000. The 2004–05 AusDiab follow-up study showed an annual incidence rate for the metabolic syndrome of 3% (3.8% in males and 2.4% in females) (Barr et al. 2006).

Risk factors such as physical inactivity, poor diet and tobacco smoking can influence biomedical risk factors, including impaired glucose regulation, overweight, high blood pressure and high cholesterol. Behavioural and biomedical risk factors have the potential to be modified.

The risk factors presented in this chapter are:

- impaired glucose regulation
- physical inactivity

- unhealthy diet
- overweight
- tobacco smoking
- high blood pressure
- high blood cholesterol and triglycerides.

Impaired glucose regulation

Impaired glucose regulation is the metabolic state between normal glucose regulation and diabetes (WHO 1999). There are two categories of impaired glucose regulation: impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). IFG and IGT are not considered to be clinical entities in their own right but rather risk factors for the future development of diabetes and cardiovascular disease (Twigg et al. 2007; NHMRC 2001).

Early treatment and improved management of impaired glucose regulation could reduce the incidence of Type 2 diabetes (Bennett 1999; Shaw & Chisholm 2003). In a review of six studies exploring IFG and IGT as predictors of future diabetes, it was found that in the majority of the populations studied, 60% of people who developed diabetes had either IGT or IFG five years before they were diagnosed with diabetes (Unwin et al. 2002).

There is some evidence that lifestyle changes incorporating increased physical activity and healthy eating could reduce or stop the progression of IFG and IGT to diabetes. For example, results from a longitudinal study by Tuomilehto et al. (2001) showed that lifestyle intervention such as counselling aimed at reducing weight and total fat intake and increasing fibre intake and physical activity among obese adults with IGT reduced the rate of progression to diabetes by 40–60% over a 3 to 6 year period.

How is impaired glucose regulation defined?

IFG and IGT are measured using an Oral Glucose Tolerance Test (OGTT)—the same test used to measure diabetes. In the OGTT a blood glucose measurement is taken after a period of approximately 8 hours of fasting. Another measurement is taken 2 hours after consuming 75 g of glucose. IFG represents abnormalities of glucose regulation immediately after an overnight fast while IGT represents abnormalities of glucose regulation 2 hours after consuming 75 g of glucose, often in the form of a high sugar drink.

IFG is diagnosed when the OGTT results show that the fasting blood glucose level (that is the measurement taken immediately after fasting) is more than 6.1 mmol/L but less than 7.0 mmol/L, and the blood glucose level 2 hours after consuming the glucose is less than 7.8 mmol/L. This means that the fasting blood glucose level is higher than normal but does not rise abnormally after taking 75 g of glucose (Diabetes Australia 2003).

IGT is diagnosed when OGTT results show that the fasting blood glucose level is less than 7.0 mmol/L and the blood glucose level 2 hours after consuming the glucose is more than 7.8 mmol/L, but less than or equal to 11.0 mmol/L.

Diabetes is detected when the fasting blood glucose level is greater than or equal to 7.0 mmol/L and the 2 hour 75 g OGTT blood glucose level is greater than or equal to 11.1 mmol/L.

Who is affected by impaired glucose regulation?

As with Type 2 diabetes, impaired glucose regulation is most common in people who are overweight or obese, physically inactive, have high levels of triglycerides, low high density lipoprotein (HDL) cholesterol, high total cholesterol and high blood pressure. The prevention of risk factors for impaired glucose regulation can reduce the progression to Type 2 diabetes.

How many Australians have impaired glucose regulation?

Prevalence

Based on measured data from the 1999–2000 AusDiab study, it was estimated that approximately one in six Australians aged 25 years or over had impaired glucose regulation, with IGT more prevalent than IFG (10.6% and 5.8%, respectively) (Table 3.1).

Table 3.1: Prevalence of impaired glucose regulation among adults aged 25 years and over, 1999–2000

	Males	Females	Persons
		Per cent	
Impaired glucose regulation	17.4	15.4	16.4
Impaired glucose tolerance	9.2	11.9	10.6
Impaired fasting glucose	8.1	3.4	5.8

Source: AIHW analysis of the 1999–2000 AusDiab study.

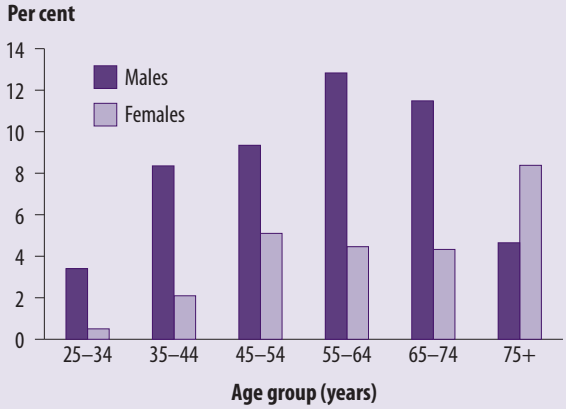
A comparison of results from the 1981 Busselton Study and 1999–2000 AusDiab study suggests a substantial increase for both males (3% to 10%) and females (3% to 12%) in the age-standardised prevalence of IGT (Dunstan et al. 2001).

Age and sex

The prevalence of impaired glucose regulation varies with sex and age as well as the category of glucose regulation. For example, the 1999–2000 AusDiab study found that the overall prevalence of IFG was significantly higher in males than females (8.1% compared with 3.4%) (Table 3.1). This pattern is consistent with results of other studies which report IFG in males being 1.5 to 3 times as high as in females (DECODE Study Group 2003; DECODA Study Group 2003).

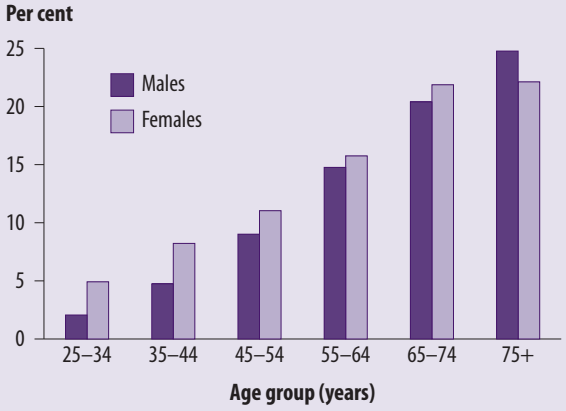
The age distribution of IFG indicates that the prevalence of IFG peaks in females aged 75 years and over and in males aged 55–64 years (Figure 3.1). The prevalence of IFG declines for males from age 65 years. There is a rapid increase in IFG in females aged 75 years and over, at which point the female prevalence of IFG exceeds that of males.

In contrast, the prevalence of IGT was higher in females than males for ages 25 to 74 years. However, from age 75 years the prevalence of IGT was higher for males than for females. Unlike the distribution of IFG by age, the prevalence of IGT increased steadily with age for both sexes (Figure 3.2).



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.1: Age-specific prevalence of impaired fasting glucose (IFG) in adults, 1999–2000



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.2: Age-specific prevalence of impaired glucose tolerance (IGT) in adults, 1999–2000

Physical inactivity

Physical activity is important for maintaining good health. Regular participation in moderate- to vigorous-intensity physical activity is protective against a range of diseases and conditions, including diabetes, heart disease and some forms of cancer (AIHW 2006a).

Participation in regular physical activity is one of the major recommendations of the evidence-based guidelines for the primary prevention of Type 2 diabetes. Exercise was found to reduce the risk of developing Type 2 diabetes, slow the progression from impaired glucose regulation to Type 2 diabetes, and reduce diabetes-related mortality (NHMRC 2001).

Exercise has been shown to significantly improve blood sugar control in people with Type 2 diabetes (Thomas et al. 2006). Also, resistance exercise, such as lifting weights, has been shown to be beneficial for the health of older people with diabetes through improving control of blood sugar levels (Castaneda et al. 2002; Dunstan et al. 2002a).

Participation in sufficient physical activity can modify, or reduce the impact of, other risk factors for diabetes and its complications such as obesity and high blood cholesterol. Furthermore, insufficient physical activity is itself a risk factor for cardiovascular disease, one of the major complications of diabetes (AIHW 2006a). People with diabetes—particularly those taking insulin or oral blood glucose–lowering medicines—need to monitor their response to exercise and may need to adjust their diet or medication (Harris et al. 2006; Williams & Pickup 1999).

What is physical activity?

Physical activity includes moderate or vigorous exercise, resistance exercise and flexibility training. Recommended physical activity levels for both adults and children have been outlined in the National Physical Activity Guidelines for Australians (see Box 3.1).

The recommendations for children and adolescents also state that no more than 2 hours a day should be spent using electronic media for entertainment (such as computer games, the internet and television), particularly during daylight hours. Studies have found an association between increased time watching television and the risk of abnormal glucose metabolism or diabetes in adults (Dunstan et al. 2004; Hu et al. 2003).

For this report, sufficient physical activity is defined as 30 minutes of moderate physical activity on at least five days of the week, or 150 minutes spread out over five sessions in a week.

Box 3.1: What is sufficient physical activity for health?

The National Physical Activity Guidelines for Australians (AIHW 2003a; DHAC 1999; DoHA 2004a, 2004b) recommend at least 30 minutes of moderate-intensity activity on most, preferably all, days of the week to obtain health benefits. This is generally interpreted as 30 minutes on at least five days of the week — a total of 150 minutes of moderate activity per week. The guidelines for children and adolescents recommend at least 60 minutes of moderate to vigorous physical activity every day.

Examples of moderate-intensity activity are brisk walking, swimming, doubles tennis and medium-paced cycling. More vigorous physical activity includes jogging and active sports such as football and basketball.

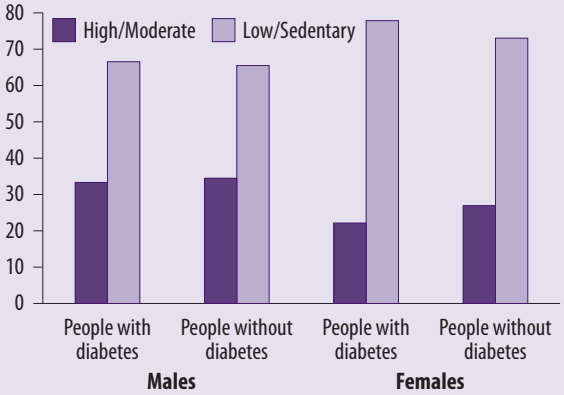
There are two ways of calculating 'sufficient' activity for health benefits in the Australian Guidelines. These are: 'sufficient time'—at least 150 minutes of moderate-intensity physical activity per week, and 'sufficient time and sessions'—at least 150 minutes of moderate-intensity physical activity accrued over at least five sessions per week, with vigorous activity counted double. For population-monitoring purposes, sufficient time and sessions is the preferred measure of activity for health as it takes into account the frequency, as well as duration of physical activity. Research suggests that even shorter sessions (down to 10 minutes) can be beneficial as well, provided they add up to the required total over the week.

How many Australians are physically inactive?

Prevalence

The most recent source of national data for physical activity levels is the 2004–05 NHS. According to this survey, the majority (about 70%) of Australians aged 15 years and over undertook insufficient (sedentary or low) levels of physical activity. Overall physical activity levels were slightly lower in people with diabetes: nearly three out of every four people with diabetes were classified as being sedentary (36%) or having low exercise levels (39%) compared with just over two-thirds (32% sedentary and 37% low) of people without diabetes.

In 2004–05, a similar proportion of males with diabetes had insufficient exercise levels as males without diabetes (67% and 66%, respectively). The main differences were found among females, where the prevalence of insufficient exercise was higher among those with diabetes (78%) than those without diabetes (73%) (Figure 3.3).



Notes
1. See appendix 1 for a definition of excercise level.
2. Based on self-reported data.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.3: Prevalence of physical activity among people aged 15 years and over, 2004–05

Trends

Published trend information indicates that the proportion of people in the low/sedentary group remained fairly constant, at about 70%, over the period 1995 to 2004–05 (ABS 2006c).

Unhealthy diet

Diet plays an important role in the prevention and development of chronic diseases such as diabetes (WHO 2003). The promotion of good health and prevention of chronic diseases through dietary behaviour may be achieved, in the first instance, by following dietary guidelines such as those developed by the National Health and Medical Research Council (NHMRC). According to these guidelines, Australian adults and children should consume a wide variety of nutritious foods including a high intake of plant foods and limit salt, saturated fat and alcohol intake (NHMRC 2003a) (see Box 3.2).

Nutrition plays an important part in the management of diabetes (ADA 2004). Poor nutrition is a risk factor for Type 2 and gestational diabetes largely through its influence on body weight, particularly obesity (NHMRC 2001; WHO 2003). Reducing total fat intake has been found to reduce the risk of developing diabetes independent of weight loss (Franz et al. 2002) however, evidence supporting claims that individual dietary factors can have an effect on diabetes, independent of obesity, is inconclusive (WHO 2003).

Dietary risk factors for diabetes and its complications

Both fat and fibre intake are associated with diabetes (WHO 2003). Dietary fat has received particular attention in relation to diabetes because of its strong association with overweight and obesity— a major risk factor for the development of diabetes (Howard 1999).

Dietary fat intake

It is recommended that people consume a diet with less than 30% energy as fat and less than 10% energy as saturated fat (NHMRC 2003a). This is especially important for those at risk of Type 2 and gestational diabetes. Reducing saturated fat intake can decrease the risk of developing diabetes by increasing the body's ability to use insulin properly, promoting weight loss (in people who are overweight or obese), and reducing low-density lipoprotein (LDL) cholesterol (the 'bad' cholesterol) (NHMRC 2001).

It can also help reduce the risk of cardiovascular disease — a major complication of both Type 1 and Type 2 diabetes (Howard 1999). Replacing saturated fats with monounsaturated fats can also lead to improved blood glucose control if total fat intake is less than 37% of total energy intake (WHO 2003).

Dairy products contribute significantly to saturated fat intake, therefore, the proportion of people consuming skim or reduced fat milk compared with whole cow's milk can be used as an indicator of lower total and saturated fat intake (AIHW 2006b).

Box 3.2: Dietary guidelines for Australian adults

Enjoy a wide variety of nutritious foods

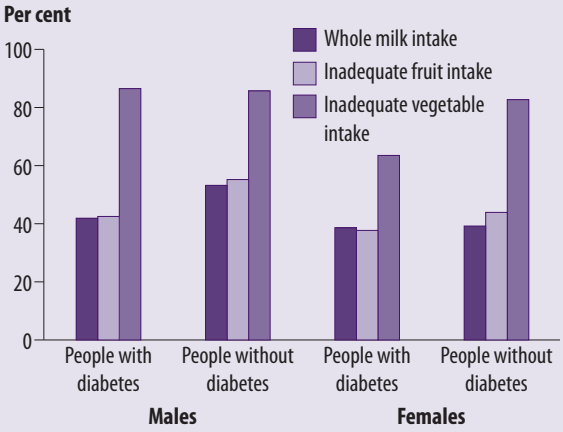
- eat plenty of vegetables, legumes and fruit
- eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
- include lean meat, fish, poultry and/or alternatives
- include milks, yoghurts, cheeses and/or alternatives: reduced fat varieties should be chosen where possible
- drink plenty of water

and take care to:

- limit saturated fat and moderate total fat intake
- choose foods low in salt
- limit your alcohol intake if you choose to drink
- consume only moderate amounts of sugars and foods containing added sugars
- prevent weight gain: be physically active and eat according to your energy needs
- care for your food: prepare and store it safely
- encourage and support breastfeeding.

Source: NHMRC 2003a.

In 2004–05, 45% of the Australian population drank whole milk, 49% drank other types of milk (including soy) and 5.1% did not drink milk. A smaller proportion of people with diabetes (40%) drank whole milk compared with people without diabetes (46%). A higher proportion of males consumed whole milk than females, although these sex differences were greater among people without diabetes (Figure 3.4).



Notes

1. Inadequate fruit intake is defined as less than two serves of fruit per day for adults and less than three serves a day for children and adolescents aged 12–18 years.
2. Inadequate vegetable intake is defined as less than five serves of vegetables per day for adults and less than four serves a day for children and adolescents aged 12–18 years.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.4: Prevalence of whole milk consumption, and inadequate fruit and vegetable intake among people aged 12 years and over, 2004–05

Dietary fibre intake

A high fibre diet is recommended to reduce the risk of developing Type 2 diabetes and complications commonly associated with both Type 1 and Type 2 diabetes (ADA 2002; Mann et al. 2004; NHMRC 2001; WHO 2003). The increased consumption of foods rich in dietary fibre (such as cereals, fruits, vegetables and legumes) has been found to reduce the incidence of cardiovascular disease in people with and without diabetes (Mann et al. 2004). It is also associated with lower body mass index in people with Type 1 diabetes and higher insulin-sensitivity in people without diabetes (Mann et al. 2004). The protective effect of dietary

fibre against diabetes has been shown to be independent of age, body mass index, smoking and physical activity (WHO 2003). Fruit and vegetable intake can be used as an indicator of dietary fibre intake.

In 2004–05, 49% of Australians did not eat the recommended serves of fruit and 84% of Australians did not eat the recommended serves of vegetables each day.

More males and females with diabetes met the daily requirement for fruit intake compared with males and females without diabetes. In 2004–05, 41% of people with diabetes and 50% of people without diabetes were consuming less than the recommended daily serves of fruit. Overall, a greater proportion of males with diabetes (43%) and males without diabetes (55%) had inadequate fruit intake compared with their female counterparts (38% and 44% respectively) (Figure 3.4).

In 2004–05, the majority of people with diabetes (73%) and without diabetes (84%) were not meeting the recommended daily intake of vegetables (Figure 3.4). Overall, only about 1 out of 10 males with and without diabetes consumed the recommended daily serves of vegetables. A higher proportion of females with diabetes met the recommenced daily serves of vegetables (36%) than females without diabetes (17%).

Other dietary factors

The glycaemic index

Foods with a particular glycaemic index (GI)—a ranking of carbohydrate foods based on their overall effect on blood glucose levels—may also be associated with Type 2 diabetes. Some studies indicate that high GI diets may contribute to the risk of Type 2 diabetes, while low GI diets may play a protective role. Other studies have found no relationship at all (Sheard et al. 2004). Low GI foods are considered good carbohydrate-rich sources as long as other attributes of the food (such as saturated fat, salt and sugar content) are appropriate (Mann et al. 2004; Sheard et al. 2004).

Alcohol consumption

High alcohol consumption is associated with an increased risk of diabetes complications such as heart, stroke and vascular disease (Mann et al. 2004). Moderate alcohol consumption has been found to reduce the risk of hypoglycaemia (low blood glucose levels); however, there is currently insufficient evidence to confirm or refute suggestions that alcohol might protect against the development of Type 2 diabetes (Mann et al. 2004; WHO 2003). Furthermore, drinking too much alcohol can cause hypoglycaemia in people who are taking insulin or certain diabetes tablets (Diabetes Australia 2006a).

Overweight

Overweight, and in particular obesity, are key risk factors for the development of diabetes, with the escalating prevalence of obesity believed to be a significant contributing factor to the rapid rise of Type 2 diabetes (Dunstan et al. 2001; Eckel et al. 2006). There is evidence that the risk of Type 2 diabetes increases with increasing excess weight (Chan et al. 1994; Colditz et al. 1995; Golay & Ybarra 2005).

Overweight also increases the risk of developing cardiovascular diseases in people with and without diabetes. Because diabetes is a risk factor for cardiovascular diseases, people who are both overweight and have diabetes are at an even greater risk than those who are just overweight or just have diabetes (Eckel et al. 2006).

Increased body weight can lead to increased insulin resistance and defects in insulin secretion. Type 2 diabetes occurs when insulin resistance declines to a level at which it cannot compensate for insulin secretion (Golay & Ybarra 2005; Sharma 2006). Weight loss reduces the risk of diabetes in people who are overweight by improving insulin sensitivity and glycaemic control. People at risk of or who already have Type 2 diabetes can achieve weight reduction through diet and physical activity (Sharma 2006) (for further information see sections on physical activity and dietary behaviour).

What is overweight?

Overweight is a condition of excess weight that normally results from a sustained energy imbalance. Energy imbalance occurs when dietary energy intake exceeds energy expenditure over a period of time. Obesity is a severe form of overweight.

A combination of body mass index (BMI) and waist circumference is recommended for the clinical measurement of overweight and obesity (see Box 3.3) (NHMRC 2003b; 2003c). BMI is an acceptable approximation of total body fat at the population level and can be used to estimate the risk of disease in most people; however, because BMI does not distinguish between weight attributable to fat and weight attributable to muscle, it should be interpreted with caution when assessing an individual's body weight (NHMRC 2003b).

People tend to overestimate their height and underestimate their weight, leading to an underestimate of BMI. As a result, self-reported data is likely to underestimate the true prevalence of overweight and obesity based on BMI and therefore should not be directly compared with prevalence estimates based on measured data.

Although measured data provide more accurate estimates of the prevalence of excess body weight among people with diabetes, the self-reported information on BMI from the 2004–05 NHS is also reported here as it is the most recent source of national prevalence information.

Waist circumference is an indicator of excess abdominal weight, which is a risk factor for Type 2 diabetes and cardiovascular disease. Waist circumference is a valid measure of abdominal fat and disease risk in people with a BMI of less than 35 (NHMRC 2003b).

Box 3.3: Monitoring body weight

There are two main methods used for monitoring body weight in settings such as population health surveys: body mass index (BMI) and waist circumference. Both provide an acceptable alternative to more accurate measurement of total body fat, which is only feasible for specialised clinical or other settings.

Body mass index

The most common measure of body weight is the BMI, which is calculated by dividing weight in kilograms by the square of height in metres (kg/m2). The standard recommended by the WHO (WHO 2000) and included in the *National Health Data Dictionary* for adults aged 18 years and over is:

- underweight (BMI <18.5)
- healthy weight (BMI ≥18.5 and BMI <25)
- overweight (BMI ≥25; includes obese)
- overweight but not obese (BMI ≥25 and BMI <30)
- obese (BMI ≥30).

For children and adolescents aged 2–17 years, Cole et al. (2000) have developed a separate classification of overweight and obesity based on age and sex.

Waist circumference

For monitoring overweight, waist circumference is a useful addition to BMI because abdominal fat mass can vary greatly within a narrow range of total body fat or BMI. The *National Health Data Dictionary* defines waist circumference cut-offs for increased and substantially increased risk of ill-health. Waist circumferences of 94 cm or more in men and 80 cm or more in women indicate increased risk (referred to here as abdominal overweight). Waist circumferences of 102 cm or more in men and 88 cm or more in women indicate substantially increased risk (referred to here as abdominal obesity) (NHDC 2003). This classification is not suitable for use in people aged less than 18 years and the cut-off points may not be suitable for all ethnic groups.

Self-reported versus measured data

Height and weight data may be collected in surveys as measured or self-reported data. People tend to overestimate their height and underestimate their weight, leading to an underestimate of BMI. Thus, rates of overweight and obesity based on self-reported data are likely to be underestimates of the true rates, and should not be directly compared with rates based on measured data (Flood et al. 2000; Niedhammer et al. 2000).

How many Australians are overweight?

Body mass index

Prevalence

Estimates from the 1999–2000 AusDiab study suggest that about 60% of Australians aged 25 years and over were overweight, as measured by the BMI. Approximately one third of them were obese. Being overweight or obese increases the risk of developing diabetes in individuals without diabetes and it increases the risk of developing diabetes-related complications in persons with diabetes.

People with diabetes are on average more likely than those without diabetes to be overweight. In 1999–2000, based on measured data, 80% of people with diabetes were overweight (BMI of 25 or more) compared with 59% of people without diabetes. The prevalence of obesity among people with diabetes was 3 times that of those without diabetes (Table 3.2).

In 1999–2000, the prevalence of obesity was similar among males (58%) and females (59%) with diabetes. A slightly higher proportion of females (20%) without diabetes were obese compared with males without diabetes (17%). A greater proportion of males than females were overweight regardless of diabetes status (Table 3.2).

Based on self-reported information, 51% of Australians aged 15 years and over were overweight or obese (BMI of 25 or more) in 2004–05. A higher proportion of males than females were overweight; 61% and 42% respectively, with a higher prevalence of obesity in males and females with diabetes compared with people who do not have the disease (Figure 3.5).

Trends

Published data, based on self-reported information, indicate that the prevalence of overweight and obesity in adults increased from 41% in 1995 to 49% in 2004–05. The age-standardised prevalence of overweight (but not obese) among Australian adults aged 18 years and over in 1995, 2001 and 2004–05 was 30%, 31% and 33%, respectively and obesity was 11%, 15% and 16% respectively (ABS 2006c).

Waist circumference

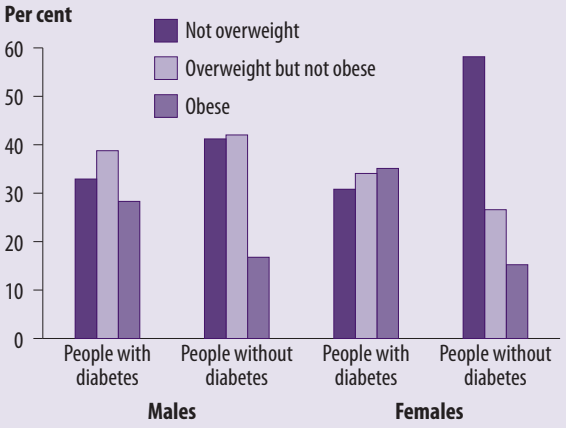
The only source of national data for overweight based on waist circumference is the 1999–2000 AusDiab study. In this study, 23% of Australians aged 25 years and over had an increased risk of health problems and 30% had a substantially increased risk of health problems, based on their waist circumference. A higher proportion of males (81%) and females (83%) aged 25 years and over with measured diabetes were abdominally overweight compared with males and females without diabetes (53%) (Figure 3.6).

Table 3.2: Prevalence of overweight (measured) based on body mass index[(a)], people aged 25 years and over, 1999–2000 (per cent)

	People with diabetes			People without diabetes		
	Males	Females	Persons	Males	Females	Persons
Not overweight	15.7	21.0	19.9	33.0	49.6	41.4
Overweight but not obese	26.4	19.6	23.4	49.7	30.5	39.9
Obese	58.0	59.4	56.7	17.3	20.0	18.7
Overweight[(b)]	**84.4**	**79.0**	**80.1**	**66.9**	**50.4**	**58.6**

(a) See Box 3.3 for classification of body mass index.
(b) Includes both overweight and obese, classified as BMI >25.0.
Notes
1. Based on measured data.
2. Directly age-standardised to the 2001 Australian population.
3. Column totals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.
Source: AIHW analysis of the 1999–2000 AusDiab study.

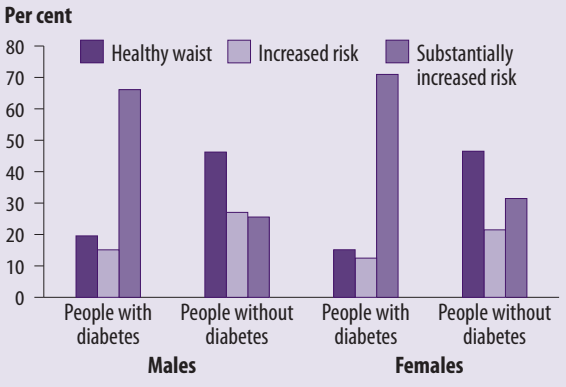
Results from the 1999–2000 AusDiab study indicated that more people with diabetes were on the upper spectrum of the abdominal overweight scale (substantially increased risk of health problems) compared with those without diabetes (Figure 3.6).



Notes
1. See Box 3.3 for classification of body mass index.
2. Directly age-standardised to the 2001 Australian population.
3. Missing values were excluded from the numerator and the denominator

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.5: Prevalence of overweight (self-reported) based on body mass index, people aged 15 years and over, 2004–05



Notes
1. See Box 3.3 for classification of body mass index.
2. Directly age-standardised to the 2001 Australian population.
3. Subtotals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab Study.

Figure 3.6: Prevalence of overweight (measured) based on waist circumference among people aged 25 years and over, 1999–2000

Tobacco smoking

Tobacco smoking increases the risk of developing diabetes-related complications such as coronary heart disease, stroke, peripheral vascular disease and kidney disease (AIHW 2005a; ACDS 2004; Eliasson 2003). Exposure to environmental smoke, or passive smoking, has also been found to increase the risk of coronary heart disease in non-smokers (National Drug Strategy 2002; USDHHS 2006).

Research from a range of prospective studies has shown that quitting tobacco smoking can reduce the risk of developing Type 2 diabetes (Foy et al. 2005; Patja et al. 2005; Carlsson et al. 2004; Eliasson 2003; Wannamethee et al. 2001).

People who stop smoking may reduce their risk of developing Type 2 diabetes to that of people who have never smoked (Foy et al. 2005). In their analysis of the British Regional Health Study, Wannamethee et al. (2001) found that the risk of developing diabetes decreased with time since quitting smoking tobacco, and the benefits were apparent within about 5 years.

What is tobacco smoking?

Tobacco smoking includes the smoking of tobacco products such as packet cigarettes, roll-your-own cigarettes, pipes and cigars.

People who smoke inhale a range of chemicals. The addictive substance in cigarettes is nicotine, but a range of other noxious substances, such as carbon monoxide and cadmium are also inhaled (Foy et al. 2005).

How many Australians smoke?

Prevalence

According to the 2004 National Drug Strategy Household Survey (NDSHS), just over one in six Australians aged 14 years and over (17.4%, 2.9 million) smoked on a daily basis (AIHW 2005e). More than half had never smoked (52.9%).

Trends

Smoking rates have been declining since the 1950s (AIHW 2006a). Between 1995 and 2004,

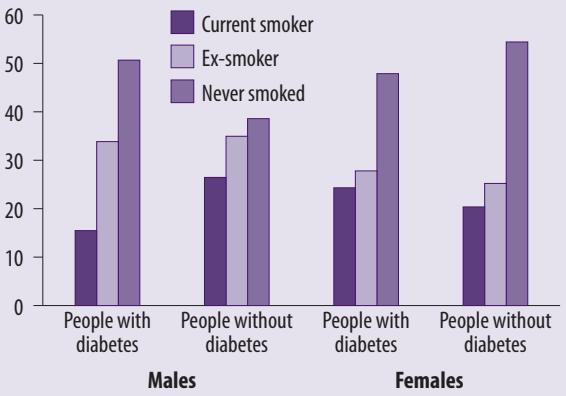
the prevalence of smoking for males and females declined by 7.3 and 5.5 percentage points, respectively (AIHW 2005e).

Smoking and people with diabetes

The 2004–05 NHS also provides information on the prevalence of smoking among people aged 18 years and over and, unlike the NDSHS, the 2004–05 NHS can be used to compare the prevalence of smoking among people with and without diabetes.

In 2004–05, among people with diagnosed diabetes more females currently smoked (24%) than males (16%). This is in contrast to people without diabetes where more males (27%) currently smoked than females (20%) (Figure 3.7).

In 2004–05, 34% of males and 28% of females with diabetes were ex-smokers compared with 35% of males and 25% of females without diabetes. A further 51% of males and 48% of females with diabetes had never smoked, compared with 39% and 54% of males and females without diabetes (Figure 3.7).



Notes

1. Current smoker includes people who reported smoking daily, at least once a week or less than weekly.
2. Based on self-reported data.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.7: Prevalence of smoking among people aged 18 years and over, 2004–05

High blood pressure

High blood pressure (also known as hypertension) is a major risk factor known to contribute to, or lead to, the development of diabetes complications including cardiovascular disease, kidney disease and diabetic eye disease. The risk of cardiovascular disease increases as the level of blood pressure increases. When high blood pressure is controlled, the risk of cardiovascular disease and overall mortality is reduced, but not necessarily to the levels of unaffected people (WHO–ISH 1999).

High blood pressure is more likely to occur in people who are obese, physically inactive and consume high levels of dietary salt and/or alcohol (NHMRC 2004). Psychological stress is likely to have an indirect effect by influencing harmful health behaviours associated with high blood pressure (WHO 2002). Lifestyle modification plays an important role in preventing and managing high blood pressure.

What is blood pressure?

Blood pressure is the force of blood on the artery walls as the heart pumps it around the body. It is expressed as a ratio, for example 120/80 mmHg, stated as '120 over 80'. The first number is the systolic blood pressure, which represents the maximum pressure in the arteries when the heart contracts to pump blood. The second number is the diastolic blood pressure, which represents the minimum pressure in the arteries when the heart relaxes.

The WHO (1999) defines high blood pressure as:

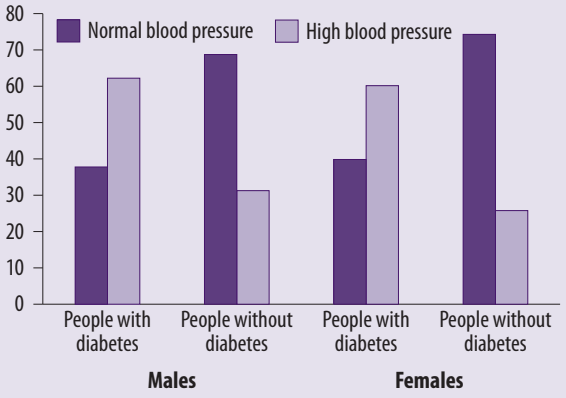
- systolic blood pressure of 140 mm Hg or more or
- diastolic blood pressure of 90 mm Hg or more or
- receiving medication for high blood pressure.

There is evidence that people with diabetes are at greater risk of cardiovascular disease at equivalent blood pressure levels than people without diabetes; as such, the NHMRC recommends that high blood pressure in people with Type 2 diabetes be defined as more than 130/80 mmHg (NHMRC 2004).

How many Australians have high blood pressure?

Prevalence

Based on measured data from the 1999–2000 AusDiab study, 30% of Australians had high blood pressure. People with diabetes (60%) had much higher rates of high blood pressure compared with people without diabetes (28%). Overall, males with and without diabetes (62% and 31%, respectively) had slightly higher rates of high blood pressure than their female counterparts (60% and 26%, respectively) (Figure 3.8).



Notes
1. Based on measured data.
2. Directly age-standardised to the 2001 Australian population.
3. Subtotals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.8: Prevalence of high blood pressure among people aged 25 years and over, 1999–2000

Another source of information for the prevalence of measured high blood pressure is the North West Adelaide Health Study. In this study, 27% of study participants had high blood pressure and the prevalence of high blood pressure was significantly higher among people with diabetes than people without diabetes (Grant et al. 2005).

Trends

Between 1995 and 1999–2000, the prevalence of high blood pressure among people aged 25 years or over remained about the same—31% in 1995 and 30% in 1999–2000 (AIHW 2006a).

Longer-term trends are available only for the urban population. They indicate that the prevalence of high blood pressure more than halved for males aged 25 to 64 years (from 47% in 1980 to 21% in 1999–2000) and halved for females of the same ages (from 32% in 1980 to 16% in 1999–2000) (AIHW 2006a).

High cholesterol and high triglycerides

People with diabetes, particularly those with Type 2 diabetes, often have high levels of LDL cholesterol ('bad' cholesterol) and triglycerides. Both of these conditions are risk factors for diabetes-related complications, coronary heart disease and stroke (Rewers and Hamman 1995). For most people, saturated animal fat in the diet is the main cause of raised cholesterol levels, although genetic factors may also play a role (NHFA 1999). Maintaining a healthy lifestyle through moderate physical activity and balanced nutrition plays an important role in reducing the risks associated with high LDL-cholesterol and triglycerides (NHFA & CSANZ 2001).

What are cholesterol and triglycerides?

Cholesterol is a fatty substance produced by the liver and carried by the blood to the rest of the body. Its natural function is to provide material for cell walls and for steroid hormones. If levels in the blood are too high, this can lead to the artery-clogging process known as atherosclerosis that can trigger heart attacks, angina or stroke. This process may be intensified by diabetes. The risk of heart disease increases steadily from a low base with increasing blood cholesterol levels. A total cholesterol level of 5.5 mmol/L or more is considered 'high'.

Total cholesterol has several parts:

- LDL cholesterol, often known as 'bad' cholesterol. Excess levels of LDL cholesterol are the main way that cholesterol contributes to atherosclerosis.
- High-density lipoprotein (HDL) cholesterol, often known as 'good' cholesterol. High levels

of HDL have a protective effect against heart disease by helping reduce atherosclerosis.

Triglyceride is another form of fat that is made by the body. Its levels can fluctuate according to dietary fat intake and under some conditions excess levels may contribute to atherosclerosis.

How many Australians have high cholesterol and triglycerides?

Prevalence

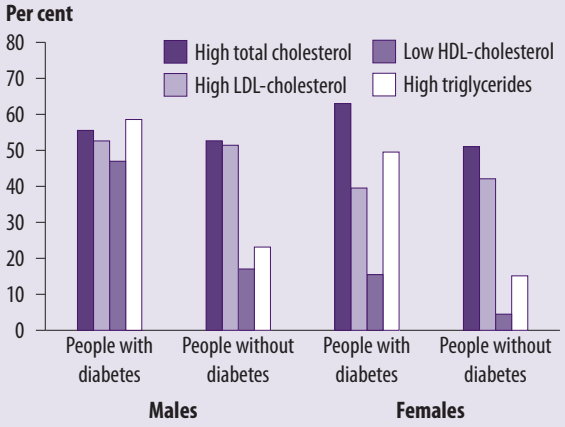
According the the AusDiab study, among Australians aged 25 years and over, 51% had high total cholesterol, 11.5% had low levels of HDL-cholesterol, 46% had high levels of LDL-cholesterol and 21% had high triglyceride levels in 1999–2000.

Using the same data source, total cholesterol levels were higher in people with diabetes: 56% of males and 63% of females with diabetes had high total cholesterol compared with 53% of males and 51% of females without diabetes. Even larger differences were found for HDL-cholesterol and triglycerides. The prevalence of low levels of HDL-cholesterol was 47% in males and 15% in females with diabetes compared with 17% and 4% respectively in people without diabetes. High triglyceride levels were observed among 59% of males and 50% of females with diabetes compared with 23% of males and 15% of females without diabetes (Figure 3.9).

The North West Adelaide Health Study also found that the prevalence of high blood cholesterol was significantly higher among people with diabetes than people without diabetes (Grant et al. 2005).

Trends

Trends in the prevalence of high blood cholesterol are only available to the year 2000 for people aged 25–64 years living in capital cities and show that there has been no apparent change in the prevalence of high blood cholesterol since 1980 (AIHW 2006a).



Notes
1. See Appendix 1 for definitions of blood lipid risk factors.
2. Based on measured data.
3. Directly age-standardised to the 2001 Australian population.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.9: Prevalence of blood lipid risk factors among adults, 1999–2000

4 Complications of diabetes

Introduction

Diabetes can result in a range of short- and long-term complications which are the major causes of associated morbidity and mortality in people with diabetes. These complications are responsible for loss of working ability, invalidism, shortened life expectancy and reduced quality of life among people with diabetes. The presence of complications also greatly increases the cost of managing diabetes.

Short-term complications include diabetic ketoacidosis which results from a severe lack of insulin and hypoglycaemia (low blood sugar) —a complication of insulin or sulphonylurea treatment. Other short-term complications include increased susceptibility to infections and poor wound healing when diabetes is poorly controlled (Flack & Colagiuri 2005).

Long-term complications include disease of the large blood vessels (macrovascular disease) such as coronary heart disease (CHD), stroke and peripheral vascular disease (PVD) as well as diseases of the small blood vessels (microvascular disease) such as retinopathy, kidney diseases and neuropathy (peripheral nerve disease) (Bate & Jerums 2003). Other complications of or conditions associated with diabetes include digestive diseases (ulcers, coeliac disease, cancer of the pancreas, constipation, diarrhoea, liver disease and gallstones), infections, oral diseases, mental problems (depression and anxiety) and problems in pregnancy (ADA 2007b, 2007c; AIHW 2002).

Complications arising from the treatment for diabetes can also occur. These include: hypoglycaemia from insulin or oral hypoglycaemic agents and side effects of hypoglycaemic agents (gastro-intestinal, liver toxicity, lactic acidosis and allergic skin reactions) (Hussein et al. 2004).

The underlying causes of diabetes complications remain controversial, although persistent high blood sugar is strongly implicated. The Diabetes Control and Complications Trial, involving participants with Type 1 diabetes, showed that keeping blood sugar levels as close to normal as possible slows the onset and progression of eye, kidney and nerve diseases (DCCT Research Group 1993). The United Kingdom Prospective Diabetes Study of people with Type 2 diabetes found that tight blood sugar control reduces the risk of major diabetic eye disorder by a quarter and early kidney damage by a third. Moreover, tight blood pressure control in people with high blood pressure reduces the risk of strokes, serious deterioration of vision and death from long term complications in diabetes, all by at least a third (UKPDS 1998).

Improving the management and care of diabetes, particularly the early identification and reduction of risk factors, can delay the onset or slow the progression of complications.

This chapter presents information on diabetes complications from many different data sources: self-reported and measured surveys and administrative collections. Data on a number of diabetes-related complications, including kidney, eye, nervous system and peripheral circulatory complications are available in hospital and deaths databases. However, other conditions such as CHD, stroke, PVD and ESKD are not available specifically identified as being related to diabetes. For these conditions, it was necessary to derive information assuming that the presence of diabetes may have contributed to them. The method of deriving such data is described in Box 4.1.

Cardiovascular disease

Cardiovascular disease (CVD) is a major complication of, and leading cause of death in, diabetes (Ali & Maron 2006). People with diabetes have twice the risk of CVD, including stroke and myocardial infarction (heart attack) compared with the general population. People with diabetes have higher mortality as a result of their first cardiovascular event (such as stroke or heart attack), and poorer outcomes in the months and years following such an event, compared with the general population (Buse et al. 2007). In people with diabetes, CVD has an earlier onset and is more resistant to treatment and therapies compared wutg those without diabetes (Weisfeldt & Zieman 2007).

This section focuses on coronary heart disease, stroke and peripheral vascular disease, as they are the most common cardiovascular complications associated with diabetes.

Box 4.1 Identifying diabetes complications in hospitalisations and deaths data

The method described below is used to identify diabetes hospitalisations and deaths that occurred with CVD, stroke, PVD, kidney complications of diabetes (including ESKD), oral, neurological and ophthalmic complications of diabetes and lower limb ulcers.

The first step in analysing the hospitalisations data was to identify people with diabetes: that is, hospitalisations where diabetes was mentioned as either the principal or an additional diagnosis (ICD 10 codes: E10-E14 and O24).

The next step was to identify which of these diabetes hospitalisations also had the selected complication listed as the principal or an additional diagnosis.

Similarly, mortality analysis for diabetes complications for these conditions include any death where diabetes was mentioned along with the selected complication, either as the underlying or the additional cause of death.

It is possible for a single person with diabetes to have multiple complication types and consequently, there may be multiple complication types listed among the diagnoses for a single hospitalisation event or as a cause of death for an individual.

Coronary heart disease

Coronary heart disease (CHD) is the most common cause of sudden death in Australia. It consists mainly of acute myocardial infarction (heart attack) and angina. A heart attack occurs when a blood vessel supplying the heart itself is suddenly blocked completely, threatening to disrupt the heart and its functions, whereas angina is a temporary chest pain or discomfort caused by a reduced blood supply to the heart muscle.

Stroke

Cerebrovascular disease comprises disorders in which there is a disturbance of blood supply to the brain. Stroke is the most important manifestation of cerebrovascular disease. A stroke occurs when an artery supplying blood to a part of the brain suddenly becomes blocked (ischaemic stroke) or bleeds (haemorrhagic stroke), which account for about 85% and 15% of cases respectively. One in five people having a first-ever stroke die as a result within 1 month of its occurrence and one in three die within 12 months of their stroke (Thrift et al. 2000). Stroke also causes a large degree of disability and nearly all patients are disabled immediately following a stroke event. There may be permanent paralysis of one side of the body, speech or swallowing difficulties, problems with memory, personality changes or a range of other difficulties. Depression, anxiety and cognitive impairment are also common after stroke (Srikanth et al. 2004).

Peripheral vascular disease

Peripheral vascular disease (PVD) occurs due to a reduced arterial blood supply to the legs. It ranges from asymptomatic disease, through pain on walking, to pain at rest. It can also result in reduced blood supply that may lead to amputation if severe enough. While this is a significant cause of disability among people with PVD, the major cause of death in people with PVD is coronary heart disease.

How does diabetes increase the risk of developing cardiovascular disease?

The reasons why diabetes increases the risk of CVD are only partially understood. The prevailing explanation is that diabetes increases atherosclerosis (thickening of the walls of a blood vessel with deposits of plaque). Studies have shown that people with diabetes have a high prevalence of sub-clinical coronary heart disease (disease without symptoms) and it can be assumed that a person with diabetes would have some level of coronary pathology (Ali & Maron, 2006; Buse et al. 2007). Other factors possibly

contributing to the excess risk of cardiovascular disease in people with diabetes include high blood pressure and dyslipidaemia (low levels of HDL-cholesterol and high levels of LDL-cholesterol and triglycerides). Both are risk factors for cardiovascular disease and their prevalence is higher among people with diabetes (Wu et al. 1999).

Many aspects of the development of macrovascular complications such as cardiovascular disease in people with diabetes are not yet fully understood. It is not clear, for example, whether the development of the disease is the same in Type 1 and Type 2 diabetes, although both types are associated with an increased risk.

Risk factors

The risk of developing CVD increases when diabetes is present with other risk factors such as tobacco smoking, physical inactivity, high blood pressure, high blood cholesterol, and overweight and obesity.

Prevention and treatment of macrovascular complications in people with diabetes is not as well defined or as straight forward as microvascular disease (eye disease and kidney disease). A 'broad-based' regime involving weight reduction, increased physical activity, blood pressure control, blood lipid reduction, cessation of tobacco use and aspirin therapy have been shown to be effective primary preventative and treatment measures. Blood sugar control has also been shown to be effective in preventing microvascular disease, but there is no strong evidence suggesting that it lowers the risk of CVD in people with diabetes (Buse et al. 2007).

How many Australians with diabetes also have cardiovascular disease?

Coronary heart disease

The 1999–2000 AusDiab study showed that nearly 10% of Australians aged 25 years and over with diabetes had coronary heart disease compared with 6% of people without diabetes. In the same survey, 5% of people with diabetes had had a heart attack and 8% had angina while the corresponding rates for people without diabetes were 3% and 5%.

According to the 2004–05 NHS self-reports, an estimated 11% of people with diabetes had had a heart attack and 12% had angina. These proportions were greater among people with diabetes than among those without diabetes.

The age-standardised rate of heart attack among people with diabetes was more than twice as high as that among people without diabetes (3.1% and 1.5% respectively). The respective age-standardised rates of angina were 4.1% and 1.6% for people with and without diabetes.

A greater proportion of males with diabetes had suffered a heart attack (4%) than females (2.1%). The reverse was true for angina: 3.6% of males and 4.8% of females with diabetes had experienced the condition.

Stroke

Based on information from the 2003 Survey of Disability, Ageing and Carers, people aged over 50 had higher rates of stroke than younger people. In the 50 years and over age group, about 23,400 (7.2%) of males and 31,300 (10%) of females with diabetes had had a stroke. When the different age-structures of the male and female populations were taken into account, females with diabetes (10.2%) still had a higher rate of stroke than males with diabetes (7.7%). People with diabetes over 50 had a higher rate of stroke (7.8%) than people without diabetes (5.2%). Based on 1999–2000 AusDiab survey data, an estimated 5% of people aged 25 years and over with diabetes had had a stroke compared with 2% of people without diabetes.

Peripheral vascular disease

There are limited national data on the number of Australians who have diabetes and PVD. Data collected through the Australian National Diabetes Information Audit and Benchmarking (ANDIAB) in 2004 revealed that 12.4% of adults attending specialist diabetes services also had peripheral vascular disease (NADC 2005).

Hospitalisations

In 2004–05, there were over 81,000 hospitalisations where both diabetes and CHD were present and this accounted for 15.3% of all diabetes hospitalisations. Diabetes hospitalisations with stroke in 2004–05 amounted to 11,750 or 2.2% of all diabetes hospitalisations and PVD was present in more than 31,000 (5.9% of all diabetes hospitalisations. A greater proportion of males than females with diabetes also had CHD, PVD and stroke (Table 4.1).

The rate of diabetes hospitalisations with CHD, stroke and PVD increased progressively with age for both sexes, although more males than females across all age groups were hospitalised with diabetes and these complications. Diabetes hospitalisations with CHD started to accelerate for males at ages 45–49 years onwards, while for females the acceleration occurred from ages 60 to 64 years. For both males and females, diabetes hospitalisations with stroke did not start to increase until ages 70–74 years. Diabetes hospitalisations with PVD increased for males from ages 60–64 years of age and for females aged 65–69 years.

Deaths

In 2005, diabetes was mentioned as an underlying or an associated cause of death in nearly 11,900 deaths (9% of all deaths in that year). Almost half of these deaths also involved CHD (48%), while stroke was mentioned in 16%, and PVD in 6%of diabetes deaths (Table 4.2). Males had higher age-adjusted rates of mortality from diabetes with CHD, stroke and PVD compared with females.

During 1999–05, CVD was the underlying cause in approximately 3 in 10 (29%) deaths of people on the NDR. Of all CVD deaths, 68% were due

Table 4.1: Hospitalisations with diabetes and CHD, stroke or PVD, 2004–05

	Males		Females		Persons[(a)]	
	Number	Per cent	Number	Per cent	Number	Per cent
Coronary heart disease	49,802	17.3	31,551	13.0	81,360	15.3
Stroke	6,697	2.3	5,052	2.1	11,750	2.2
Peripheral vascular disease	20,684	7.2	10,755	4.4	31,439	5.9
Total diabetes hospitalisations	**288,444**		**242,614**		**531,069**	

(a) Includes sex not stated.

Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Hospitalisations include diabetes as a principal or additional diagnosis.

Source: AIHW National Hospital Morbidity Database.

Table 4.2: Diabetes deaths also involving CHD, stroke or PVD, 2005

	Males		Females		Persons	
	Number	Per cent	Number	Per cent	Number	Per cent
Coronary heart disease	3,216	50.8	2,499	45.1	5,715	48.2
Stroke	931	14.7	971	17.5	1,902	16.0
Peripheral vascular disease	352	5.6	326	5.9	678	5.7
Total diabetes deaths	**6,325**		**5,539**		**11,864**	

Notes

1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Diabetes deaths include diabetes as an underlying or associated cause of death where CHD, stroke and PVD are also mentioned as an underlying or additional cause of death.

Source: AIHW National Mortality Database.

to coronary heart disease and 14% were from cerebrovascular diseases. Diabetes itself was the underlying cause in 14% of deaths of NDR registrants. The NDR contains information on people who started using insulin to treat their diabetes after 1 January 1999 (AIHW: Catanzariti et al. 2007).

Trends

Over the period 1997 to 2005, the contribution of CHD and PVD to diabetes deaths has declined while the contribution of stroke has remained steady. The proportion of diabetes deaths where CHD was also present declined by 5% and for PVD by 27% between 1997 and 2005. Over this period the proportion of diabetes deaths with CHD was consistently higher among males than females whereas diabetes deaths with PVD or stroke were higher among females.

Eye disease

People with diabetes are at an increased risk of developing diabetic retinopathy (retinal disease), cataract and glaucoma—leading to a loss of vision or blindness—than people without diabetes (Williams et al. 2004). Diabetic retinopathy is the leading cause of blindness in adults aged 20–74 years (Aylward 2005; Fong et al. 2004). Cataracts and glaucoma are also major causes of vision impairment and blindness among adults.

Diabetic retinopathy

Diabetic retinopathy is a microvascular complication of diabetes caused by damage to the capillaries of the retina (the light-sensitive tissues at the back of the eye). In the early stages, the retinal capillaries swell and leak fluid. At this stage there is usually no visual impairment. As the disease progresses, abnormal new capillaries grow on the surface of the retina. Without treatment, these capillaries can bleed causing cloudy vision or blindness. Abnormal fibrous tissue can also develop, leading to retinal detachment with severe vision loss.

Diabetic retinopathy is symptomless in its early phases, and can be treated successfully by laser surgery if identified early. Although it cannot be cured completely, it is estimated that early detection and timely treatment can prevent nearly 100% of severe vision loss and blindness due to diabetic retinopathy (Lee et al. 2001). Despite this, the disease is estimated to account for 17% of all blindness and vision impairment in Australia (Resnikoff et al. 2004).

Cataracts and glaucoma

Cataracts and glaucoma, along with diabetic retinopathy, are the leading causes of blindness and visual impairment in people with diabetes (Williams et al. 2004).

A cataract is a clouding of the normally clear lens of the eye leading to vision loss. A cloudy lens prevents light from entering the eye. Cataracts are more common and progress more rapidly in people with diabetes (Klein & Klein 1995).

Glaucoma is a condition where pressure builds up in the eye, pinching the capillaries that carry blood to the retina and optic nerve. Over time, the retina and optic nerve become damaged and vision is lost. People with diabetes are significantly more likely to develop glaucoma than people without diabetes (Klein & Klein 1995).

Timely identification and treatment can prevent serious vision loss due to cataracts and glaucoma.

Risk factors

Age at onset and duration of diabetes are key factors influencing the development of diabetic retinopathy. In young people with diabetes (aged <30 years at diagnosis), the prevalence is as high as 25% during the first 5 years after diagnosis, increasing to 50% after 15 years since diagnosis. In older people (aged 30 years or more at diabetes diagnosis), up to 20% may have signs of retinopathy, rising to 60% after 15 years with diabetes (Mensah & Kohner 2002).

In addition to duration of diabetes, the risk of developing eye complications and visual impairment increases with coexisting medical problems or complications (such as high blood pressure and nephropathy), poor blood sugar

control, pregnancy, elevated blood lipids and smoking (Cohen et al. 1998; NHMRC 1997). Consequently, good glycaemic control, blood pressure control, management of kidney impairment, blood lipid reduction and increased screening before conception and during pregnancy are key preventative measures and treatment options for reducing the prevalence and serious consequences of diabetic retinopathy (Fong et al. 2004; Williams et al. 2004).

How many Australians with diabetes also have eye disease?

Diabetic retinopathy

In the 1999–2000 AusDiab study, 22% of people with known diabetes and 6.2% of people with new diabetes had retinopathy (Tapp et al. 2003b).

The National Divisions Diabetes Program (NDDP) Data Collation Project found that approximately 11% of patients examined in 2000, 10% in 2001 and 9% in 2002 had retinopathy detected in at least one eye.

Data on the prevalence of diabetic retinopathy among patients attending diabetes clinics are also available from the ANDIAB data. According to ANDIAB, of those patients who had a retinal assessment in 2004, approximately 30% had a diabetes-related abnormality at least one eye (NADC 2005). ANDIAB data report on people with diabetes requiring specialist clinical management, in particular those who have had poor control of their diabetes, so ANDIAB figures are likely to be higher than the rate of this condition among all people with diabetes.

Cataracts and glaucoma

From self-reports in the 2004–05 NHS, about 12% of people with diabetes had sight problems due to diabetes. Overall, 9% of people with diabetes (7% males and 11% females) had cataracts as a long-term condition while 6% (4% males and 7% females) had glaucoma.

The age-standardised rates showed that compared with people without diabetes, those with diabetes were over twice as likely to have glaucoma and nearly two times as likely to have cataracts.

The prevalence of cataracts and glaucoma were high in older ages: over 80% and 52% of people with diabetes aged 65 years and above were estimated to have cataracts and glaucoma, respectively, in 2004–05.

Blindness and visual problems

In 2004–05, 7% of people (7% males and 8% females) with diabetes had visual disturbances or loss of vision, or complete or partial blindness in one or both eyes, based on self-reported data. Of these, 2% had complete or partial blindness and 5% had visual disturbances or loss of vision.

People with diabetes were 1.3 times as likely to be blind or have visual disturbances as people without diabetes according to age-standardised rates.

In 2004–05, among people with diabetes, blindness or visual disturbance was most prevalent among those aged 65 years and over: over 60% of blindness occurred in this age group. A greater proportion of females than males aged 65 years and above was blind or had visual disturbances.

Based on ANDIAB data for 2006, the incidence rate for blindness was 0.7% of all people with clinically diagnosed diabetes (NADC 2007).

Hospitalisations

In 2004–05, there were around 38,700 hospitalisations for diabetes-related eye complications (including retinopathy, glaucoma and cataract) which accounted for approximately 7% of all hospitalisations with diabetes.

Hospitalisations for diabetes-related eye complications were higher for females than for males (8.2% and 7%, respectively). These hospitalisations increased with age: people with diabetes aged 65 years and over accounted for 78% of diabetes hospitalisations with eye complications (Figure 4.1).

Note: Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.

Source: AIHW National Hospital Morbidity Database.

Figure 4.1: Number of hospitalisations for diabetes with ophthalmic complications, 2004–05

Kidney disease

Diabetes can affect the kidneys in a variety of ways, leading to serious and even life-threatening conditions. This section focuses on diabetic nephropathy and chronic kidney failure including ESKD, as these are the most common kidney complications associated with diabetes.

Diabetic nephropathy

Diabetic nephropathy results from high blood sugar levels damaging the blood-filtering capillaries in the kidneys. As a result the filtering efficiency of these capillaries declines and blood proteins such as albumin leak into the urine (albuminuria).

In the early stages of diabetic nephropathy, small quantities of albumin leak into the urine (this is known as microalbuminuria). As diabetic nephropathy progresses, the kidneys leak larger amounts of albumin — this is known as macroalbuminuria or proteinuria. Microalbuminuria is a strong predictor of developing proteinuria, ESKD, high blood pressure and cardiovascular disease. Proteinuria is usually associated with kidney damage (Chadban et al. 2003). Diabetic nephropathy is often asymptomatic until late in the disease when therapeutic interventions are less effective. If detected early, intervention may slow or halt its progression.

Chronic kidney failure (end-stage kidney disease)

In severe cases of diabetic nephropathy, kidney function may deteriorate to the extent that it is no longer sufficient to sustain life and if left untreated is fatal within weeks. This terminal condition is called end-stage kidney disease (ESKD) —a type of chronic kidney failure. Diabetic nephropathy is the most common cause of ESKD in Australia (McDonald et al. 2006).

Risk factors

Factors that may determine whether diabetic nephropathy develops and progresses to ESKD include long duration of diabetes, poor blood sugar control, high blood pressure, anaemia, genetic susceptibility to diabetic kidney disease and smoking (Rossing et al. 2004).

How many Australians with diabetes also have kidney disease?

The most recent available data on the prevalence of kidney disease among people with diabetes is from the 1999–2000 AusDiab study. According to self-reported data from this study, approximately 6.3% of Australians aged 45 or over with diabetes were treated for, or suffering, from kidney disease. Significantly more women with diabetes reported being treated for, or suffering from, kidney disease than men (11% compared with 3%).

Diabetic nephropathy

Examining the prevalence of diabetic nephropathy is problematic due to different methodologies. In this report we have used albuminuria and proteinuria (protein in the urine) as a proxy measures for diabetic nephropathy. These are indicators of kidney damage, which may be caused by high blood sugar in people with diabetes.

Data on the prevalence of diabetic nephropathy based on urinary albumin measurements is available from the 1999–2000 AusDiab study. The prevalence of proteinuria in those with diabetes was over 4 times as high as in those without diabetes (8.7% versus 1.9% respectively) (Chadban et al. 2003).

Data on the prevalence of albuminuria among patients attending diabetes clinics is available from the ANDIAB data. Two thirds of these patients had a urinary albumin assessment in 2006. Of them, 58.9% had normal albumin levels, 31.1% had microalbuminuria and 10.0% had macroalbuminuria (NADC 2007).

Similar data are also available from the National Divisions Diabetes Program (NDDP) Data Collation Project. In 2002, 3,548 of the 13,325 registered NDDP patients had albuminuria assessed. Of those, 76.9% had normal albumin levels, 19.9% had microalbuminuria and 3.1% had macroalbuminuria.

End-stage kidney disease (ESKD)

Evidence of the burden of ESKD caused by diabetes is available from the Australia and New Zealand Dialysis and Transplant (ANZDATA) Registry — a registry of people receiving kidney dialysis or a kidney transplant. New cases of ESKD with diabetic nephropathy as the primary cause have increased dramatically over the past decade. This increase has been most evident among patients with Type 2 diabetes.

In Australia during 2006, diabetic nephropathy was the most common cause of primary kidney disease among ANZDATA patients, which accounted for one third (32%) of new patients (McDonald et al. 2007). This represents an increase in the proportion of new ESKD cases with diabetes—from 25%, in 2001. The burden of ESKD from diabetes, particularly Type 2 diabetes, is likely to increase further as both the age of the population and prevalence of diabetes are projected to rise.

Hospitalisations

Kidney complications

In 2004–05, there were nearly 112,100 diabetes hospitalisations with kidney complications (excludes hospitalisations for dialysis) which accounted for 21% of all diabetes hospitalisations. Nearly 58% of those hospitalisations were for males. Hospitalisations for diabetes with kidney complications increased with age for both men and women (Figure 4.2).

Note: Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.

Source: AIHW National Hospital Morbidity Database.

Figure 4.2: Number of hospitalisations for diabetes with kidney complications, 2004–05

Hospitalisation rates for diabetes with kidney complications increased 3-fold over the period 2000–01 to 2004–05 from about 37,400 to 112,100. Part of this increase may be the result of changes made to the way complications are coded in hospitalisations data (see Appendix 1).

The average length of stay in hospital for diabetes with a principal diagnosis of kidney complication was 11 days for both males and females (this excludes day stay for regular dialysis). The average length of stay was 5 days for males and females for hospitalisations involving any diagnosis of kidney complications.

Chronic kidney failure

In 2004–05 there were over 102,000 hospitalisations with diabetes and chronic kidney failure (this excludes day admissions for dialysis, but includes admissions for ESKD) and 57% of these were for males. These represented 19% of all diabetes hospitalisations in that year.

Between 2000–01 and 2004–05, there has been a 4-fold increase in the number of diabetes hospitalisations with chronic kidney failure (about 23,600 and 102,000, respectively). The proportion of male hospitalisations with diabetes and a diagnosis of chronic kidney failure has always been higher than that of females.

The average length of stay in hospital for people with chronic kidney failure as the principal and diabetes as an additional diagnosis was 9 days. Length of stay in hospital was generally higher for females than for males (11 days compared with 7 days).

Deaths

In 2005, chronic kidney diseases were responsible for 13% (1,557 deaths) of all diabetes deaths and ESKD was mentioned in the majority (90%) of these deaths.

The rate of kidney-related diabetes mortality was higher for males compared with females in 2005 (10 and 6 deaths per 100,000, respectively).

Between 1997 and 2005, the kidney-related diabetes death rate increased by nearly 70% from 5 to 8 per 100,000 people. Males experienced a slightly higher increase than females between the two periods (71% and 62%, respectively).

Nerve damage

Nerve damage (neuropathy) is a frequent complication of diabetes (Boulton et al. 2005). It is not certain how nerve damage occurs. However, there is some evidence suggesting that diabetic neuropathy may be the result of chronically high blood sugar levels, which affect the metabolism of nerves, causing reduced blood flow to the nerve. This, in turn, causes the accumulation of toxins which damage nerve structure and function.

Diabetic neuropathy affects both peripheral (peripheral neuropathy) and autonomic (autonomic neuropathy) nervous systems and is associated with reduced quality of life and increased mortality (Boulton et al. 2005; Vinik et al. 2003).

Peripheral neuropathy

Peripheral neuropathy is 'the presence of symptoms and/or signs of peripheral nerve dysfunction in people with diabetes after the exclusion of other causes' (Boulton et al. 2005). The condition commonly causes damage to the nerves in the toes, feet and legs; however, damage can also occur in the hands and arms. Peripheral neuropathy can cause a diverse range of symptoms, depending on the nerve(s) affected, although some people will experience no obvious symptoms.

There are two broad types of peripheral neuropathy:

- Sensory neuropathy—affects the nerves that carry information to the brain about sensations from various parts of the body. Symptoms may include pain, tingling in the limbs, extreme sensitivity to touch, or absence of feeling in the feet (which predisposes people with diabetes to foot trauma).
- Motor neuropathy—affects the nerves that carry signals to muscles to allow the muscles to move and is characterised by loss of strength and inability to control movement. Motor neuropathy can lead to muscle weakness, particularly in the feet, which may become deformed as a result.

Autonomic neuropathy

Autonomic neuropathy is manifested by dysfunction of one or more organ systems, and

affects the nerves controlling the heart and blood vessels, digestive system, urinary tract, sex organs, sweat glands and eyes (Boulton et al. 2005; Vinik et al. 2003). Symptoms may include dizziness and fainting, nausea, vomiting and diarrhoea, constipation, loss of bladder control, sexual dysfunction in women and erectile dysfunction in men (see Box 4.2).

Risk factors

The risk of developing neuropathy increases with duration of diabetes, poor blood sugar control, and age. Strict glycaemic control has been shown to reduce or prevent the development of neuropathy, and may alleviate neuropathic symptoms. Early identification is essential, especially in people with no obvious symptoms, to prevent the late sequelae of neuropathy. A combination of clinical observations and complex nerve function tests are often required to confirm the presence of diabetic neuropathy.

How many Australians with diabetes also have neuropathy?

According to the 1999–2000 AusDiab study, 10.3% of males and 8.6% of females with diabetes had clinical signs of neuropathy.

Box 4.2: Erectile dysfunction

What is erectile dysfunction?

Erectile dysfunction is the inability to achieve and/or sustain an erection sufficient for sexual intercourse. Research indicates that the prevalence of erectile dysfunction is significantly higher among men with diabetes than men without diabetes, with prevalence estimates ranging from 35–75% and age of onset occurring 10–15 years earlier in men with diabetes.

Risk factors for erectile dysfunction

Neuropathy is a major risk factor for developing erectile dysfunction among men with diabetes. Other risk factors include poor glycaemic control, vascular disease, nutrition, psychogenic factors and anti-diabetes medication.

Sources: Chu & Edelmanl 2001; Vinik et al. 2003; Brown et al. 2005a.

In the 2004 ANDIAB study, approximately one quarter (25.5%) of adults attending specialist diabetes clinics were recorded as having peripheral neuropathy following clinical assessment (NADC 2005). However, it should be noted that ANDIAB data are obtained from specialist diabetes clinics that are likely to see more patients with complications.

In the 1999–2000 AusDiab study, 30.2% of men with diabetes suffered from or received treatment for impotence (difficulty getting or sustaining an erection). This is probably due to neuropathy, but could be due to other factors (see Box 4.2). According to the ANDIAB Study, 2.2% of all males attending specialist diabetes clinics in 2006 had erectile dysfunction in the previous 12 months and 26.7% had erectile dysfunction before the previous 12 months (NADC 2007).

Hospitalisations

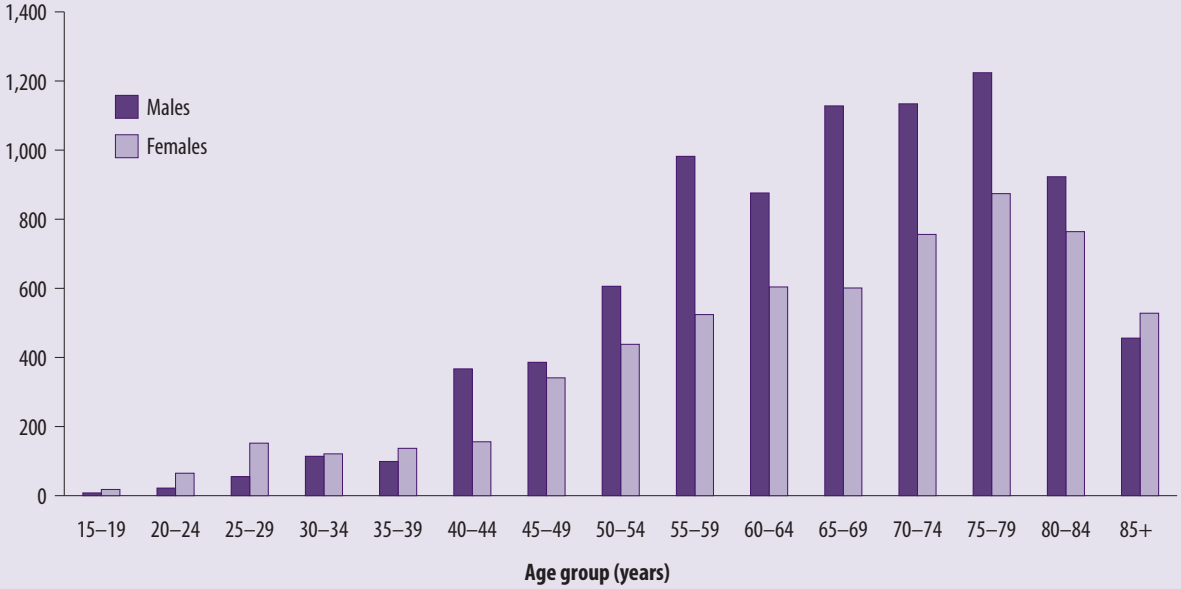
In 2004–05, there were around 14,500 diabetes hospitalisations where nervous system complications were also mentioned. These complications accounted for nearly 3% of all diabetes hospitalisations.

More males than females with diabetes had nervous system complications (58% of these hospitalisations were for males). For both males and females, diabetes hospitalisations with nervous system complications increased with age until 75–79 years and declined thereafter (Figure 4.3).

During 2004–05 the average length of stay in hospital for people with diabetes and a principal diagnosis of nervous system complication was 5 days. When nervous system complication was considered as a principal or additional diagnosis the average length of stay was 9 days for males and females.

Deaths

In 2005, nervous system complications were mentioned in 26 deaths where diabetes was an underlying or an associated cause of death.



Note: Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.

Source: AIHW National Hospital Morbidity Database.

Figure 4.3: Number of hospitalisations for diabetes with neurological complications, 2004–05

Foot complications

Diabetes is associated with nerve damage (peripheral neuropathy) and poor circulation (peripheral vascular disease) in the lower limbs. These factors increase the risk of developing foot ulcers and infections. Progression of these conditions in people with diabetes often leads to lower extremity amputations. Amputations are associated with increased morbidity and mortality and high treatment costs. Diabetes is estimated to account for approximately half of all non-traumatic amputations (ADA 2007a).

Foot ulcer

Over time, diabetes can damage the nerves in the feet, resulting in a loss of sensation. Reduced sensation of pain and discomfort from foreign bodies, injury or even tightly fitting shoes can predispose people to foot trauma and ulceration (ADA 2007a). Damage to nerves also causes wasting of the foot muscles, reduced joint mobility and foot deformities such as claw or hammer toes that are vulnerable to ulceration.

High blood sugar can also damage blood vessels in the lower limbs. Without a healthy supply of oxygen and nutrients, feet are predisposed to ulceration and infection.

Foot ulceration is a common reason for hospital admission for people with diabetes and is estimated to precede more than half of all diabetes-related amputations.

Lower extremity amputation

The combination of diabetic neuropathy, peripheral vascular disease (PVD) and foot deformity increases the risk of lower limb ulcers. Non-healing ulcers can result in gangrene (chronic infection resulting in tissue death). Amputation of the affected area may be necessary as a limb-saving procedure if medical treatment is unsuccessful.

Amputation is estimated to be 15 times more common in people with diabetes compared with other people. Nearly half of the amputations in people with diabetes are minor (involving toes, feet and ankles); the other half are major (below

knee or above knee) (Campbell et al. 2000). Major amputations are associated with greater loss of limb function and greater rehabilitation following amputation (Oyibo et al. 2002).

Many diabetic patients who undergo amputation will have a subsequent amputation on the other side within a few years. The remaining limb becomes more vulnerable to ulceration and infection because it has to bear extra pressure.

Risk factors

The risk of lower limb ulcers and amputations is higher in people who have had diabetes for 10 years or more, are male, have poor blood sugar control, have cardiovascular, visual, or kidney complications or smoke. Certain foot-related conditions are associated with an increased risk of foot ulcer and amputation: peripheral neuropathy (particularly loss of protective sensation), peripheral vascular disease (PVD), foot deformity, and prior history of foot ulcers or amputation (Lavery et al. 2006).

How many Australians with diabetes also have foot complications?

Foot ulcer

The 1999–2000 AusDiab study found that, among people with diabetes, 2.1% had had aprevious foot ulceration and 19.6% were found to be at risk of foot ulcer (defined by the presence of any one of neuropathy, PVD or history of foot ulceration). The greatest risk was evident in those with a diabetes duration of 20 years or more where more than half (53%) were at risk (Tapp et al. 2003a).

Based on the ANDIAB data for 2004, the prevalence of current foot ulcers among adult patients attending diabetes clinics was 1.9%. In addition, 5.3% of patients had a past history of foot ulcers. The vast majority (77.2%) of patients with a current foot ulcer had a past history of foot ulceration (NADC 2005). Also indicative of potential foot problems, peripheral neuropathy, PVD and foot deformity were recorded for a total of 25.5%, 12.7% and 4.4% of adult patients, respectively.

Among patients registered in the NDDP Data Collation Project during 2002, 20.8% were identified with foot risk (indicated by a history of foot problems, and/or presence of peripheral neuropathy, PVD or foot deformity on examination).

Lower limb amputation

In 2004, the incidence of lower limb amputation among adult ANDIAB patients was estimated to be 0.6%. Further analysis revealed that 76.5% of patients undergoing a lower limb amputation in the previous 12 months had a past history of foot ulceration (NADC 2005).

Hospitalisations

The majority of foot ulcers are treated in outpatient settings, which limits effective surveillance of the problem due to lack of available data relating to these visits (DHAC & AIHW 1999). However, some information on the extent of lower limb ulcer and amputation is available from hospital data that cover admitted patient episodes.

Lower limb ulcer

In 2004–05 there were approximately 9,900 diabetes hospitalisations in which patients were treated for lower limb ulcers and this represented 2% of all diabetes hospitalisations in that year. Over 56% of these hospitalisations were for males. Diabetes hospitalisations with lower limb ulcers increased with age, with over two-thirds of such cases being among people aged 65 and over in 2004–05.

People hospitalised with lower limb ulcer and diabetes required long hospitalisations: the average length of stay was 12 days for males and 13 days for females.

Lower limb amputation

In 2004–05, there were close to 3,400 lower limb amputations, which accounted for 0.6% of all diabetes hospitalisations. Overall, hospitalisations for lower limb amputations among people with diabetes were more common among males than females (70% of the amputations were for males); this pattern

occurred across all age groups. The number of diabetes-related amputations in hospital increased with age, with people aged 65 years and over accounting for 61% of all such hospitalisations (Figure 4.4).

People with diabetes hospitalised for lower limb amputation tended to stay considerably longer than those hospitalised for other diabetes-related conditions. The average length of stay in hospital for lower limb amputation among people with diabetes was 26 days.

Deaths

In 2005, there were 1,001 diabetes deaths where lower limb ulcers were recorded as a cause of death, which accounted for 8% of all diabetes deaths. Males had a death rate of 6 per 100,000 people and females half that at 3 per 100,000 people. Between 1997 and 2005, diabetes death rates where lower limb ulcers were also implicated decreased by 12%, from 5.2 to 4.6 deaths per 100,000 people.

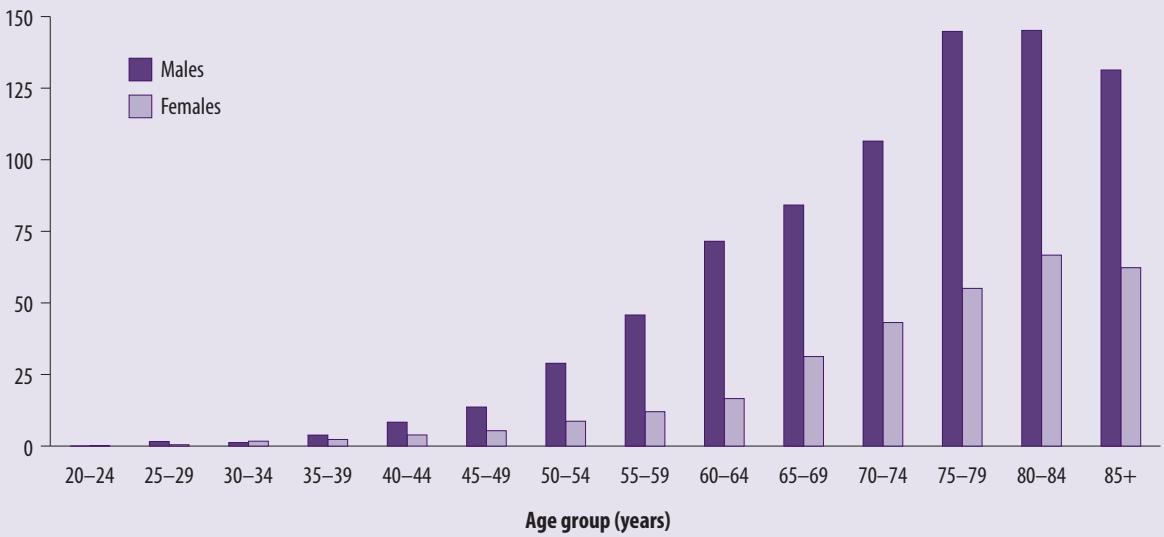
Oral complications

Diabetes can lead to oral complications. Diabetes may manifest initially with oral symptoms other than thirst. For instance, burning tongue, gum bleeding and excessive salivation have been found in people with undiagnosed diabetes and resolved on treatment to improve glycaemic control. This is very uncommon in Westernised societies but is more common in underdeveloped countries or in lower socioeconomic groups, especially where there is poor hygiene and delayed diagnosis of diabetes.

Periodontal disease

There is growing acceptance that diabetes is associated with increased occurrence, extent and severity of periodontitis (inflammation of the tissues supporting the teeth). The risk is independent of whether the diabetes is Type 1 or Type 2 (Lalla et al. 2006; Southerland et al. 2005). Some researchers point to a two-way connection between diabetes and periodontal disease, proposing that not only are diabetic patients more prone to periodontal disease, but the presence of periodontal disease affects control of blood sugar.

International studies have shown that people with Type 2 diabetes are at increased risk of more severe periodontal disease compared with those without diabetes (Campus et al. 2005). Diabetes can affect the tissues supporting the teeth (periodontium) and the treatment of periodontal diseases. Patients with long-term poor control



Note: Diabetes and related complications are classified according to ICD-10-AM codes. See appendix 1.
Source: AIHW National Hospital Morbidity Database.

Figure 4.4: Number of diabetes hospitalisations where a lower limb amputation was performed, 2004–05

of diabetes have increased extent and severity of periodontal disease, whereas those who maintain good metabolic control have minimal periodontal problems. Integrated medical and dental management of these conditions is essential for the general health and quality of life of patients. Treatment of periodontal infections with systemic antibiotics can contribute to the control of diabetes.

Other oral problems

Caries (tooth decay) in the crowns of teeth appear to be more frequent in adults with poor control of insulin-dependent diabetes. Oral infections other than dental caries and periodontal disease are often more severe in people with diabetes. Examples of these are life-threatening deep neck infections and fatal ulcers of the palate.

Risk factors

Risk factors for oral complications in people with diabetes include poor oral hygiene, poor control of blood sugar levels, smoking and inadequate nutrition.

How many Australians with diabetes also have oral complications?

Currently there are no national data on the dental visits of people with diabetes or the prevalence of oral complications among people with diabetes. Hospitalisations data are presented in this report as they give some indication of the number of people using the hospital system to deal with such problems.

In 2004–05, there were 98 hospitalisations for periodontal complications where diabetes was the principal diagnosis and 202 hospitalisations for periodontal complications where diabetes was the principal or additional diagnosis (Table 4.3).

The average length of stay for diabetes with periodontal complications was 3 days when diabetes was a principal diagnosis and 7 days as any diagnosis.

Table 4.3: Number of diabetes hospitalisations with periodontal complications, 2004–05

	Diabetes as	
	Principal diagnosis	Any diagnosis[(a)]
Males	50	106
Females	48	96
Persons	98	202

(a) Includes principal and additional diagnosis.
Note: Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
Source: AIHW National Hospital Morbidity Database.

Complications in pregnancy

Pregnancy complicated by diabetes can be divided into 2 main groups: pre-gestational diabetes and gestational diabetes. Pre-gestational diabetes is defined as pre-existing diabetes in pregnancy among women who had Type 1 or Type 2 diabetes before conception. Pre-gestational diabetes represents about 10% of cases of pregnancy complicated by diabetes. Gestational diabetes is the more common type of diabetes complicating pregnancy. Gestational diabetes is defined as diabetes first diagnosed during pregnancy, and is a transient condition that usually develops late in the second trimester and resolves shortly after the birth (Barbour & Friedman 2003).

What is diabetes in pregnancy?

In all pregnant women, pregnancy hormones induce insulin resistance, which means there is a higher insulin requirement in order to keep the blood sugar levels in the 'normal range'. In women without diabetes there is on average a 3-fold increase in insulin production by late pregnancy. Gestational diabetes occurs when the pancreas is not able to adequately increase insulin production to overcome the effects of insulin resistance. Pre-gestational Type 1 diabetes leads to an average 50% increase in insulin requirements by late pregnancy. Women with pre-gestational Type 2 diabetes are likely to require insulin therapy during pregnancy (Barbour & Friedman 2003).

Effect of diabetes in pregnancy

Diabetes in pregnancy has potential effects on the mother's health as well as on the foetus and newborn baby. Women with well-controlled diabetes lower the risk of complications for themselves and their babies.

Maternal risks

Some diabetes complications may be exacerbated by pregnancy. Retinopathy may worsen during pregnancy and the risk is particularly increased with longer duration of diabetes and with the degree of blood sugar control. Laser therapy may be needed during pregnancy (Van Impe 2005). Pregnancy can lead to a reduction in kidney function in about one-third of women with pre-existing kidney disease (Willams 2007).

Common pregnancy complications are more common in women with diabetes. Pregnancy-induced hypertension is more common in women with pre-existing diabetes than in women without diabetes (Leguizamon et al. 2006) and caesarean delivery is more frequent in pregnancies complicated by diabetes (Gonzalez-Quintero et al. 2007).

Women with gestational diabetes are at significantly increased risk of developing Type 2 diabetes and at an increased risk of developing cardiovascular disease later in life (Lee et al. 2007).

Foetal risks

Babies of women with gestational diabetes may have a greater risk of perinatal death, and newborn problems including: hypoglycaemia in the newborn, low birthweight, jaundice, respiratory distress and birth trauma due to very high birthweight (Gonzalez-Quintero et al. 2007). Pre-gestational diabetes is also associated with an increased rate of major congenital malformations in the foetus and a higher rate of spontaneous abortions (Barbour & Friedman 2003).

How many Australian women are affected by maternal diabetes?

Nearly 11,000 Australian women giving birth in hospital in 2004–05 had gestational diabetes, which is 4.2% of all deliveries. For more details refer to Chapter 2 of this report. Another 1,200 women giving birth in hospital in that year had pre-existing diabetes and a further 800 women had diabetes at the time of delivery, though it was not specified whether it was pre-existing or gestational diabetes.

Table 4.4: Pre-existing and gestational diabetes, 2004–05

	Number	Per cent[d]
Pre-existing diabetes in pregnancy[a]	1,257	0.5
Gestational diabetes[b]	10,861	4.2
Diabetes of unknown onset in pregnancy[c]	826	0.3

(a) Pre-existing diabetes in pregnancy defined by ICD-10-AM codes 0240–0243.
(b) Gestational diabetes defined by ICD-10-AM code 0244.
(c) Diabetes of unknown onset in pregnancy defined by ICD-10-AM code 0249.
(d) Percentage of all births in hospital, defined by ICD-10-AM code Z37.
Source: AIHW National Hospital Morbidity Database.

Information is also available from state and territory midwives data collections. These data are not yet available as national estimates; however, the development of a nationally consistent scope, collection methods and classifications of gestational diabetes and pre-existing diabetes in pregnancy is progressing (NPSU 2006). The available state and territory data (excluding Tasmania) show that in most jurisdictions pre-existing diabetes was present in less than 1% of women giving birth in 2004. Gestational diabetes was reported in 4.0 to 6.3% of women across these states and territories.

5 Population groups

Aboriginal and Torres Strait Islander people

Aboriginal and Torres Strait Islander peoples suffer a greater burden of chronic disease than the rest of the Australian population and the current diabetes epidemic has had a disproportionate impact on the Australian Indigenous population compared with the total Australian population (Daniel et al. 1999). The greater burden of diabetes in the Australian Indigenous population is largely due to higher rates of modifiable risk factors, such as obesity, which are related to the social disadvantage experienced by Aboriginal and Torres Strait Islander peoples. Reduced or limited availability and accessibility of health-care services for diagnosis and treatment may also adversely influence health outcomes for Indigenous people with diabetes and related complications.

Aboriginal and Torres Strait Islander people do not use health services with the same frequency as other Australians, and many communities and individuals may not have ready access to services. Difficulties with spoken and written English, lack of available transport, financial difficulties and the proximity of culturally appropriate health-care services present barriers to Aboriginal and Torres Strait Islander people accessing health care, and feelings of marginalisation also present barriers to the efficacy of diabetes prevention strategies and treatment (ABS & AIHW 2005).

Box 5.1: Age standardisation

In this chapter survey data are directly standardised. Hospitals and mortality data are indirectly age standardised, except for reporting of trends and comparisons between socioeconomic groups. For a detailed discussion on age-standardisation methods and reference populations, see Appendix 1.

Incidence

A recent population-based study among 180,481 Indigenous and nearly 5 million non-Indigenous adolescents, aged 10–18 years, in New South Wales has shown that Indigenous adolescents are diagnosed with Type 2 diabetes at 6 times the rate of non-Indigenous adolescents. The incidence of Type 1 diabetes was not different between the two populations (incidence rate ratio=0.7) (Craig et al. 2007).

Prevalence

According to self-reported data from the 2004–05 NATSIHS, neary 30,000 Indigenous people (6.3% of the total Indigenous population) had diabetes: 57% of whom were male.

When the different age structures of the populations were taken into account, the rate of diabetes among Indigenous people was just over 3 times that of non-Indigenous people. The age-adjusted rate of diabetes among Indigenous males was 3 times the rate of non-Indigenous males and the rate among Indigenous females was 4 times that of non-Indigenous females (Figure 5.1).

Notes
1. Based on self-reported data.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 NATSIHS data.

Figure 5.1: Prevalence of diabetes by Indigenous status and sex, 2004–05

Risk factors

National data on diabetes risk factors for Aboriginal and Torres Strait Islander people are available for body weight and diet. Data on tobacco smoking—which is a risk factor for some diabetes complications—are also presented.

According to data from the 2004–05 NATSIHS, 57% of Aboriginal and Torres Strait Islander people aged 15 years and over were overweight

or obese. Of all Indigenous people aged 12 years and over, 5% did not eat vegetables on a daily basis and 14% did not eat fruit on a daily basis. In 2004–05, 50% of Indigenous people aged 18 years or over were current daily smokers.

The age-standardised rates indicate that a higher proportion of Indigenous people aged 15 years and over were overweight or obese compared with non-Indigenous people (62% compared with 51%). Indigenous people aged 12 years and over ate fewer fruit and vegetables each day compared with non-Indigenous people: Indigenous people were 7 times as likely as non-Indigenous people not to eat vegetables and twice as likely not to eat fruit. The rate of current daily smoking among Indigenous adults was more than twice that of non-Indigenous adults.

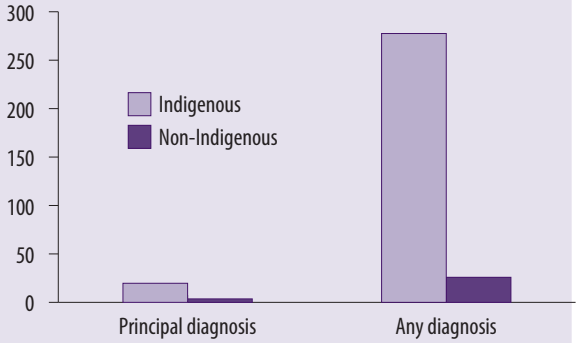
Self-reported data from the Well Person's Health Check study, which was undertaken in Queensland between 1998 and 2000, showed that 30% of Indigenous males and 33% of Indigenous females with diabetes consumed inadequate serves of fruit (fewer than 2 serves per day) (McCulloch et al. 2003). Also, 55% of Indigenous males and 60% of Indigenous females with diabetes did not do adequate exercise in the week before the survey (less than 3 days with 30 minutes of activity per day). The same survey indicated that 48% of Indigenous males and 36% of Indigenous females with diabetes smoked tobacco.

For more national information on specific risk factors, refer to Chapter 3.

Hospitalisations

In 2004–05, in Qld, WA, SA and the NT, there were approximately 2,900 hospitalisations of Aboriginal and Torres Strait Islander people where diabetes was a principal diagnosis. This accounted for 1.5% of all hospitalisations among Indigenous people. Diabetes was an additional diagnosis in a further 27,182 Indigenous hospitalisations, inceasing the total diabetes hospitalisations to 30,055 or 16% of all Indigenous hospitalisations. Indigenous people were hospitalised with diabetes as a principal diagnosis at 6 times the rate and with diabetes as any diagnosis at 11 times the rate of other Australian persons in 2004–05 (Figure 5.2).

Hospitalisation rates among Indigenous people were higher that among other Australians for all types of diabetes: twice as high for a diagnosis of Type 1 diabetes, 15 times as high for a diagnosis of Type 2 diabetes and 6 times as high for a diagnosis of other/unspecified diabetes. Indigenous women were hospitalised for gestational diabetes at more than 5 times the rate of other Australian women.



Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004–05 non-Indigenous population.
3. Data are from Queensland, Western Australia, South Australia and public hospitals in the Northern Territory only.

Source: AIHW National Hospital Morbidity Database.

Figure 5.2: Diabetes hospitalisations by Indigenous status, 2004–05

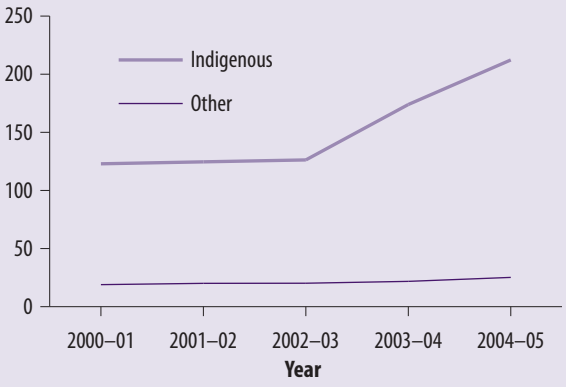
Trends

In 2000–01 the rate of hospitalisation with any diagnosis of diabetes among Indigenous Australians was 8 times that for other Australians. In 2004–05 this increased to 11 times the rate of hospitalisation for other Australians (Figure 5.3).

Deaths

Among Aboriginal and Torres Strait Islander people, diabetes was the underlying cause of 346 deaths, and an associated cause of a further 492 deaths in Queensland, Western Australia, South Australia and the Northern Territory, for the years 2003–2005. Diabetes deaths among Indigenous persons accounted for 9% of total diabetes deaths and nearly 8% of all Indigenous deaths in the four jurisdictions during this period. Indigenous

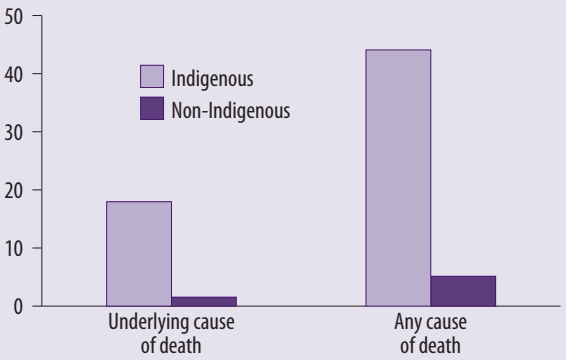
Australians died from diabetes as an underlying cause of death at 12 times, and from diabetes as any cause of death at 9 times the rate of non-Indigenous Australians (Figure 5.4).



Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.
3. Data are from Queensland, Western Australia, South Australia and public hospitals in the Northern Territory only.

Source: AIHW National Hospital Morbidity Database.

Figure 5.3: Diabetes hospitalisations by Indigenous status, 2000–01 to 2004–05



Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 non-Indigenous population.
3. Data are based on year of registration of death in Queensland, Western Australia, South Australia and the Northern Territory.
4. Data with missing/not stated Indigenous status were excluded from this analysis.

Source: AIHW National Mortality Database.

Figure 5.4: Diabetes deaths by Indigenous status, 2003–2005

Trends

Between 2000 and 2005 there was no consistent pattern in diabetes deaths among Indigenous people.

Complications

Common complications of diabetes include cardiovascular disease and kidney disease, and the prevalence rates of these diseases in the Australian community are presented in Chapter 4.

Prevalence

According to the self-reported 2004–05 NATSIHS, approximately 53% of Aboriginal and Torres Strait Islander people with diagnosed diabetes also had heart and circulatory disease and 10% also had kidney disease.

The age-standardised rate of heart and circulatory disease in the Indigenous population was 1.3 times that of the non-Indigenous population. For kidney disease, the prevalence was 10 times that of their non-Indigenous counterparts.

Hospitalisations

Of the approximately 30,100 diabetes hospitalisations among Aboriginal and Torres Strait Islander Australians in 2004–05, just over 18,300 (61%) also involved kidney complications of diabetes (including chronic kidney failure), and nearly 2,300 (8%) also had coronary heart disease (CHD). When the different age-structures of the two populations were accounted for, hospitalisation rates for kidney complications among Indigenous people were nearly 30 times as high and CHD hospitalisation rates were 8 times as high as those among other Australians (Table 5.1). One of the highest disparities in hospitalisation rates was for oral complications of diabetes, for which hospitalisations among Indigenous people were 17 times that among other Australians.

Deaths

Diabetes deaths where complications were mentioned were much higher among Indigenous persons than among non-Indigenous Australians (Table 5.2).

During the period 2003–2005, Indigenous people had a diabetes death rate with kidney complications 19 times that of the non-Indigenous Australians. Diabetes deaths with CHD, stroke, PVD and lower limb ulcers among Indigenous people were about 7 times as high as that of non-Indigenous people.

Table 5.1: Hospitalisations for diabetes complications among Indigenous Australians, 2004–05

Complication	Observed	Expected	Standardised hospitalisation ratio
CHD	2,289	278	8.1[(a)]
Stroke	314	34	9.1[(a)]
PVD	604	129	4.7[(a)]
Kidney	18,319	620	29.5[(a)]
Eye	758	138	5.5[(a)]
Nervous system	359	76	4.7[(a)]
Oral	26	1	17.4[(a)]
Limb ulcer	424	41	10.3[(a)]

(a) Denotes that the rate of hospitalisations for any diagnosis of diabetes complications is significantly higher among Indigenous Australians than among Other Australians.

Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004–05 Other Australian population.
3. Data are based on hospitalisations in Queensland, South Australia, Western Australia and public hospitals in the Northern Territory only.
4. Diabetes hospitalisations include those for which diabetes is a principal or additional diagnosis.
5. A single diabetes hospitalisation may include multiple complication types among the diagnoses.

Source: AIHW National Hospital Morbidity Database.

Table 5.2: Deaths from diabetes complications among Indigenous Australians, 2003–2005

Type of complication	Observed	Expected	Standardised mortality ratio
CHD	347	47	7.3[(a)]
Stroke	97	14	7.0[(a)]
PVD	37	5	6.7[(a)]
Kidney	216	11	19.3[(a)]
Limb ulcer	55	8	7.3[(a)]

(a) Denotes that the rate of deaths with any mention of diabetes complications are significantly higher among Indigenous Australians than among other Australians.

Notes

1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to 2003–2005 non-Indigenous Australian population.
3. Data are based on year of registration of death in Queensland, South Australia, Western Australia and the Northern Territory.
4. A total of 141 deaths in 2003–2005 where diabetes was mentioned as any cause of death had a missing/not stated Indigenous status and were excluded from the analysis.
5. A single person may have multiple complication types listed as a cause of death.

Source: AIHW National Mortality Database.

Socioeconomic position

Socioeconomic position is a complex concept, and it is well established that it has a strong influence on health. It is often conceptualised around three main features: education, employment status and income. Disadvantage in any of these areas has the potential to have an impact on the prevalence of diabetes and diabetes risk factors, as well as diabetes morbidity and mortality.

The measure of socioeconomic disadvantage—the ABS Socioeconomic Index for Areas (SEIFA)—used in this section is a measure constructed at the level of geographic area of residence. Although it does not necessarily represent the socioeconomic position of all households or individuals living within that area, it is a valid measure of socioeconomic position (Dutton et al. 2005). For the analysis presented here, the population was divided into five equal-sized groups based on the area-measure of socioeconomic position. That is, the group with the lowest socioeconomic position is the fifth of the population living in the least-well-off areas. And similarly, the highest socioeconomic group is the fifth of the population living in the most-well-off areas.

Prevalence

In 2004–05, the NHS showed a pattern of increasing diabetes prevalence with decreasing socioeconomic position. The age-adjusted prevalence rate of diabetes was 2.3% for people from the highest socioeconomic group. The prevalence of diabetes in the lowest socioeconomic group was nearly twice this rate. Across all socioeconomic groups males had higher rates of diabetes compared with females.

Risk factors

The prevalence of diabetes risk factors such as overweight and obesity and physical inactivity is higher in groups with lower socioeconomic position compared with groups with higher socioeconomic position. Based on data from the 2004–05 NHS, a higher proportion of people in the lowest socioeconomic groups were overweight or obese (53%) and physically inactive (76%), compared with people in the highest socioeconomic group (47% and 62%, respectively) (Table 5.3).

The pattern was mixed in relation to diet. While the proportions not eating sufficient amounts of vegetables were similar across all socioeconomic groups, a higher proportion of people in the least well-off group (54%) ate insufficient amounts of fruit compared with people in the most well-off group (44%).

People with diabetes were 20–50% as likely to be overweight or obese compared with those without diabetes across all socioeconomic groups. Except for those from the highest socioeconomic group, a higher proportion of people with diabetes than those without diabetes in all other socioeconomic groups were estimated to be physically inactive.

For more information on specific risk factors, refer to Chapter 3.

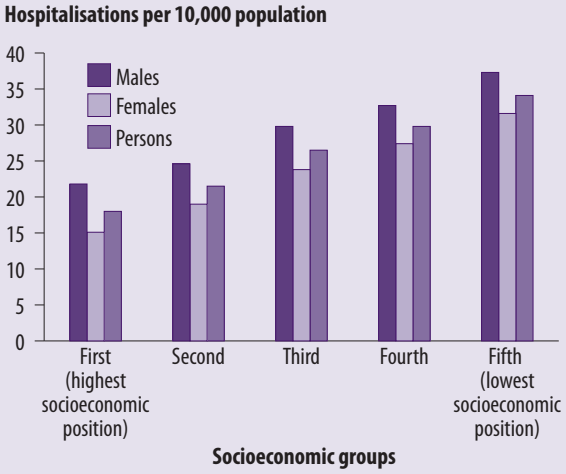
Table 5.3: Prevalence of diabetes risk factors by socioeconomic position, 2004–05 (per cent)

	Socioeconomic groups				
	First (highest socioeconomic position)	Second	Third	Fourth	Fifth (lowest socioeconomic position)
Overweight/obese	46.7	50.8	52.2	54.1	53.0
Physical inactivity[(a)]	62.3	68.0	71.0	72.3	75.9
Insufficient fruit[(b)]	43.7	47.3	50.2	52.6	54.0
Insufficient vegetable[(c)]	84.9	84.1	83.4	83.1	85.5

(a) Sedentary or low exercise level.
(b) Insufficient fruit is fewer than 3 serves per day for children aged 12–18 years, and fewer than 2 serves per day for adults aged 19 years and over.
(c) Insufficient vegetable is fewer than 4 serves per day for children aged 12–18 years, and fewer than 5 serves per day for adults aged 19 years and over.
Note: Directly age-standardised to the 2001 Australian population.
Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Hospitalisations

In 2004–05, diabetes hospitalisations increased with decreasing socioeconomic position (Figure 5.5). When diabetes was considered as any diagnosis, the rate of diabetes hospitalisation among people from the lowest socioeconomic group (341 per 10,000) was nearly twice as high as that among people from the highest socioeconomic group (180 per 10,000). When diabetes was the principal diagnosis, the rates ranged from 25 per 10,000 people among the most well-off to 47 per 10,000 for the least well-off.



Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

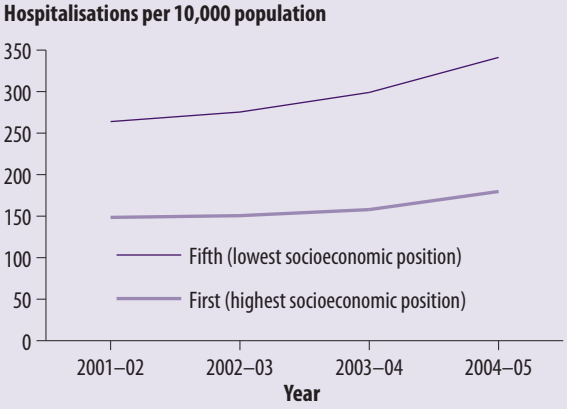
Source: AIHW National Hospital Morbidity Database.

Figure 5.5: Diabetes hospitalisations by socioeconomic position and sex, 2004–05

In 2004–05, hospitalisation rates for Type 2 diabetes among people from the lowest and the highest socioeconomic groups were 152 and 291 per 10,000 people, respectively. Females from the lowest socioeconomic group had hospitalisation rates for gestational diabetes that were twice that of females from the highest socioeconomic group (22 and 11 per 10,000 females, respectively).

Trends

Across the period 2001–02 to 2004–05, the diabetes hospitalisation rate increased for all socioeconomic groups (Figure 5.6). People from the highest socioeconomic group were hospitalised at a rate of 149 per 10,000 in 2001–02. This rate increased by 21% to 180 per 10,000 in 2004–05. In 2000–01, people from the lowest socioeconomic group were hospitalised with diabetes at a rate of 264 per 10,000, and this increased by 29% to a rate of 341 per 10,000 in 2004–05.



Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

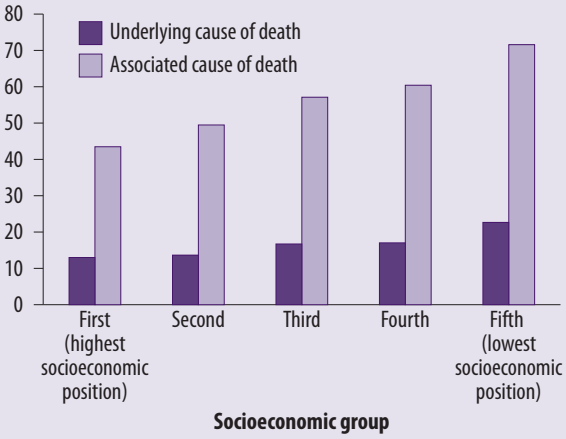
Source: AIHW National Hospital Morbidity Database.

Figure 5.6: Diabetes hospitalisations by socioeconomic position, 2000–01 to 2004–05

Deaths

In the period 2003–2005, lower socioeconomic position correlated with higher diabetes mortality. When diabetes was the underlying cause of death, there were 1,589 deaths among people in the highest socioeconomic group (13 deaths per 100,000) and 2,623 deaths among people in the lowest socioeconomic group (23 deaths per 100,000). There were 5,305 deaths from diabetes as an underlying or associated cause among people in the highest socioeconomic group—a rate of 40 deaths per 100,000. In the lowest socioeconomic group 8,298 deaths were recorded in 2003–2005—a rate of 72 per 100,000 (Figure 5.7).

During the period 2003–2005, people in the lowest socioeconomic group died from Type 1 diabetes at 1.4 times the rate, and Type 2 and other/unspecified diabetes at 1.7 times the rate of people in the highest socioeconomic group.



Notes

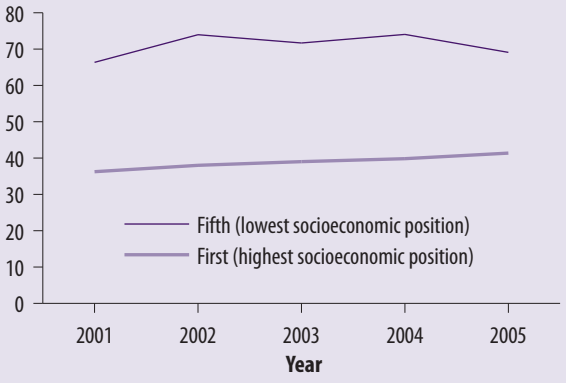
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Mortality Database.

Figure 5.7: Diabetes deaths by socioeconomic position, 2003–2005

Trends

The diabetes death rate increased for all socioeconomic groups, by between 4% and 16%, across the period from 2001 to 2005 (Figure 5.8).



Notes

1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Mortality Database.

Figure 5.8: Diabetes deaths by socioeconomic position, 2001 to 2005

Complications

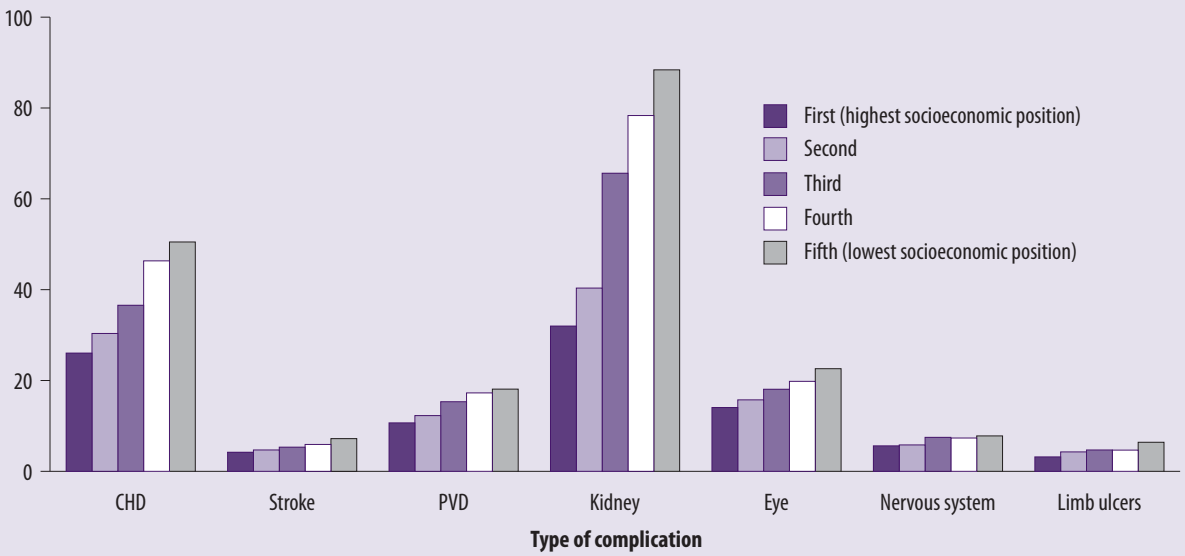
Hospitalisations

There was a consistent pattern of higher hospitalisation rates in lower socioeconomic groups for all complication types (Figure 5.9). Of the 75,741 hospitalisations for diabetes among people in the lowest socioeconomic group, 29% were also treated for coronary heart disease (CHD) and 46% were treated for kidney complications (including chronic kidney failure). These were twice and 3 times the corresponding rates among people in the highest socioeconomic group.

Deaths

Over the period 2003 to 2005, there was a consistent pattern of higher diabetes-related death rates in lower socioeconomic groups compared with higher socioeconomic groups for all complication types (Figure 5.10). The difference was greater for some complications than for others. For example, the diabetes death rate with kidney complications was twice as high among people in the lowest socioeconomic group as among those in the highest group. Similarly, the rate of diabetes deaths with CHD was also higher in the lowest socioeconomic group compared with the highest group (35 and 19 deaths per 100,000, respectively).

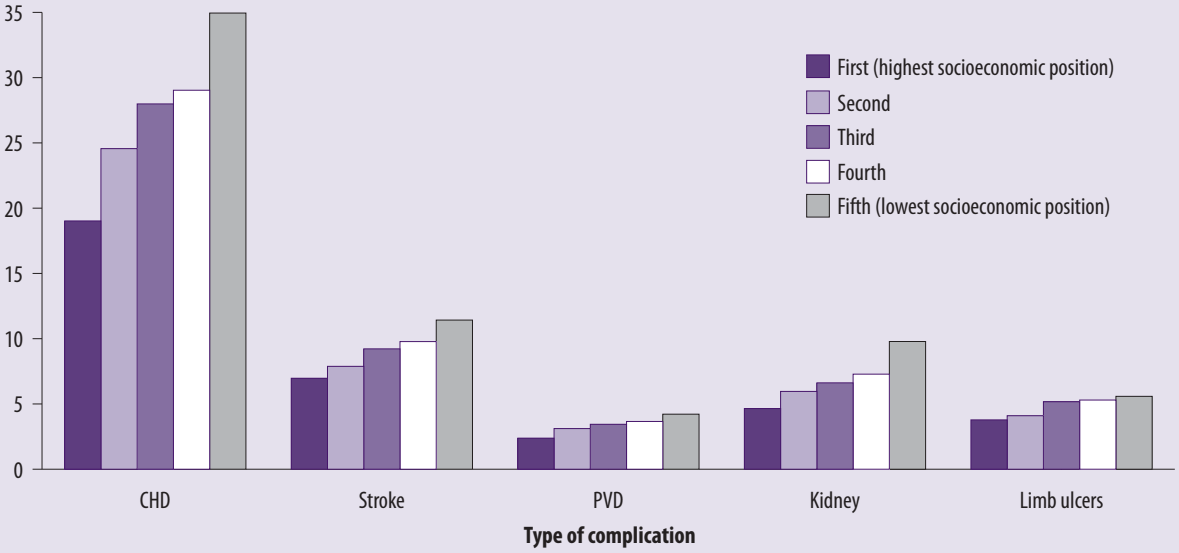
For more information on specific complications of diabetes, see Chapter 4.



Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.
3. These data include hospitalisations for any diagnosis of diabetes, and related complications as either principal or additional diagnosis.

Source: AIHW National Hospital Morbidity Database.

Figure 5.9: Hospitalisations for diabetes complications by socioeconomic position, 2004–05



Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.
3. These data include deaths with diabetes as any cause, and related complications as either underlying or additional cause of death.

Source: AIHW National Mortality Database.

Figure 5.10: Deaths from diabetes complications by socioeconomic position, 2003–2005

Geographical location

Persons living in rural and remote regions of Australia generally have worse health, in terms of mortality, hospitalisation rates and risk factors compared with those living in metropolitan regions (Wilkinson & Blue 2002). This difference may be related to fewer educational and employment opportunities, poorer access to health services and the availability of necessities such as sewerage, clean water and a safe food supply (AIHW 2006a).

The relatively large proportion of Indigenous people living in Remote and Very Remote areas (12% and 45%, respectively) compared with Major Cities, together with their poorer overall health, is reflected in high rates of death in Remote areas (AIHW 2006a; Draper et al. 2004; Coory 2003). In 2005, 57% of diabetes deaths registered in Remote areas were for persons of Aboriginal and Torres Strait Islander origin, compared with only 3% of diabetes deaths registered in Major Cities or regional areas. Similarly, 78% of diabetes hospitalisations in 2004–05 among people from Remote areas were for Aboriginal and Torres Strait Islander persons, compared with only 9% of diabetes hospitalisations among people from Major Cities or regional areas.

Prevalence

According to self-reported data from the 2004–05 NHS, there were small differences in diabetes prevalence between regions: the age-adjusted rate was 3.4% in Major Cities, 3.5% in Inner Regional Australia and 3.6% in all other regions (Outer Regional, Remote and Very Remote combined). The prevalence of Type 2 diabetes was 2.9% for all regions.

As data for persons living in Remote and Very Remote Australia needed to be combined in the analysis, the influence of remoteness on diabetes prevalence could not be determined.

Risk factors

Based on the estimates from the 2004–05 NHS, a number of differences in diabetes risk factors were seen among people from different geographical regions. Over 50% of people living in Major Cities, Inner Regional and other areas were overweight or obese, thus being at increased risk of diabetes. Approximately a third of the Major Cities and Inner Regional population—and four out of ten people in other areas—were estimated to be sedentary or exercising at a low level. Just under one half of people in Major Cities, half of people in Inner Regional areas and 54% of people in other areas consumed insufficient fruit in 2004–05. The amount of vegetables consumed by those living in all geographical areas were much less than the level recommended by Australian dietary guidelines. Over three-quarters of the populations in these areas consumed insufficient amounts of vegetables, with people living in Major Cities having the highest rate of 87%.

When the risk factors for diabetes in populations with and without diabetes in different geographical regions were compared, the proportion that was overweight or obese was consistently higher among people in all areas with diabetes than among those without diabetes (Table 5.4). For people with diabetes, higher rates of overweight were seen in the Major Cities, but for people without diabetes the situation was reversed.

While people with diabetes in Major Cities and Inner Regional areas had higher rates of physical inactivity than their counterparts without diabetes, there was no difference between the two groups in other areas (Table 5.4).

People with diabetes living in other areas were less likely to eat insufficient fruit and vegetables each day, compared with their counterparts without diabetes. People with diabetes in Major Cities and Inner Regional areas had higher rates of insufficient vegetable consumption compared with their counterparts without diabetes; however people without diabetes in these areas had higher rates of insufficient fruit consumption. (Table 5.4).

For more information on specific risk factors, refer to Chapter 3.

Hospitalisations

Hospitalisation rates for diabetes rose with increasing remoteness. In 2004–05, hospitalisation rates for diabetes as a principal diagnosis in Very Remote areas were 3 times as

Table 5.4: Risk factors by diabetes status and geographical location, 2004–05 (per cent)

	General population			With diabetes			Without diabetes		
	Major Cities	Inner Regional	Other areas[a]	Major Cities	Inner Regional	Other areas[a]	Major Cities	Inner Regional	Other areas[a]
Overweight/obese	50.6	51.9	54.4	75.0	63.4	65.2	49.6	51.5	53.9
Physical inactivity[b]	32.0	35.0	39.7	39.9	36.2	38.6	31.7	34.6	39.8
Insufficient fruit[c]	48.6	49.9	53.9	42.5	31.6	45.3	48.6	50.1	53.7
Insufficient vegetables[d]	86.8	79.3	78.4	86.8	79.5	78.1	75.1	59.7	86.5

(a) Other areas include Outer Regional, Remote and Very Remote Australia.
(b) Sedentary or low exercise level.
(c) Insufficient fruit is fewer than 3 serves per day for children aged 12–18 years, and fewer than 2 serves per day for adults aged 19 years and over.
(d) Insufficient vegetable is fewer than 4 serves per day for children aged 12–18 years, and fewer than 5 serves per day for adults aged 19 years and over.
Note: Directly age-standardised to the 2001 Australian population.
Source: AIHW analysis of ABS 2004–05 National Health Survey data.

high as in Major Cities (Table 5.5). Hospitalisation rates for any diagnosis of diabetes in Remote areas were nearly twice the rate in Major Cities and in Very Remote areas they were 3 times as high as in Major Cities. This may partly be a reflection of the high proportion of Indigenous people living in Remote and Very Remote areas, which contributes to but does not completely account for, the poorer health of people living in remote areas. As shown in the previous section of this chapter, the prevalence of diabetes is high among Indigenous people compared with the non-Indigenous population across all geographic areas.

In 2004–05 in Remote and Very Remote areas, females were hospitalised for diabetes at higher rates than males, either as the principal diagnosis or as any diagnosis (Table 5.5).

The majority of diabetes hospitalisations in all regions were for Type 2 diabetes. People living in Very Remote areas had hospitalisation rates for Type 2 diabetes over 3 times that of people living in Major Cities. There was a 4-fold difference for gestational diabetes. Hospitalisations for Type 1 diabetes among people living in Very Remote areas is significantly lower than among people living in Major Cities. (Table 5.6).

Trends

There was a significant increase in the diabetes hospitalisation rate in all regions of Australia between 2000–01 and 2004–05 (Figure 5.11). Major cities, Remote and Very Remote Australia had a 38% increase and regional Australia had a 36% increase over the period. Remote and Very Remote areas had higher hospitalisation rates than Major Cities and the difference between these areas has lessened in recent years.

Table 5.5: Diabetes hospitalisations by sex and geographical location, 2004–05 (per 10,000)

	Males	Females	Persons
	Principal diagnosis		
Major Cities	32.8	35.3	34.1
Inner Regional	36.9	33.0	34.8
Outer Regional	45.6	18.7	43.6
Remote	46.9	50.3	48.5
Very Remote	76.8	139.0	105.8
	Any diagnosis		
Major Cities	268.8	240.2	254.3
Inner Regional	292.5	211.0	249.3
Outer Regional	319.4	126.0	301.1
Remote	419.4	534.6	474.5
Very Remote	582.6	899.1	729.2

Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004–05 Major Cities population.

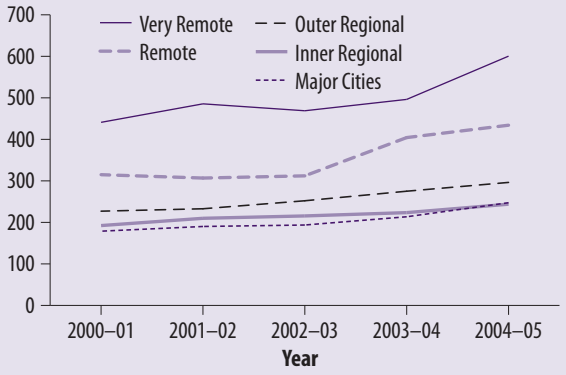
Source: AIHW National Hospital Morbidity Database.

Table 5.6: Diabetes hospitalisations by geographical location and type of diabetes, 2004–05

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
			Number		
Type 1	33,695	13,771	7,314	747	296
Type 2	290,895	99,797	55,758	11,778	7,797
Gestational[(a)]	10,767	2,263	1,290	228	308
Other/unspecified	5,147	1,966	1,068	235	159
			Standardised hospitalisation ratio		
Type 1	1.0	1.2[(b)]	1.4[(b)]	1.0	0.8[(b)]
Type 2	1.0	1.0	1.2[(b)]	2.0[(b)]	3.3[(b)]
Gestational[(a)]	1.0	1.6[(b)]	0.9	1.8[(b)]	4.2[(b)]
Other/unspecified	1.0	1.1[(b)]	1.3[(b)]	2.1[(b)]	3.0[(b)]

(a) Females only.
(b) Significantly different to Major Cities.
Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004–05 Major Cities population.

Source: AIHW National Hospital Morbidity Database.



Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 5.11: Diabetes hospitalisations by geographical location, 2000–01 to 2004–05

Deaths

In the period 2003–2005, the death rate from diabetes as the underlying cause of death for people living in Major Cities was 16 per 100,000 people. The rate increased with increasing remoteness, with people in Remote areas experiencing deaths rates nearly twice that of people in Major Cities while people in Very Remote areas had rates over 4 times the rate in Major Cities (Table 5.7).

Deaths where diabetes was the underlying or an additional cause of death were also high in more remote areas than in Major Cities or regional areas. During 2003–2005, the diabetes death rate in Very Remote areas was 3 times the rate in Major Cities (Table 5.7).

Again, the disparity in death rates by region could be a reflection of the higher proportion of Indigenous Australians in Remote and Very Remote areas compared with urban and regional centres. In 2001, 13% of people living in Remote areas and 44% of people living in Very Remote areas of Australia were of Indigenous origin. As discussed earlier in this chapter, the higher proportion of Indigenous Australians in remote areas does not completely account for the generally poorer health of people living in remote areas.

In 2003–2005, death rates from Type 2 and Other/Unspecified types of diabetes were significantly higher in Remote and Very Remote areas compared with Major Cities (Table 5.8). There is also evidence of some rates being higher in regional areas than in Major Cities.

Trends

There was no major change in diabetes death rates for any region across the six year period 2000 to 2005 (Figure 5.12). There were small reductions for regional and Very Remote areas and a 15% increase in remote areas.

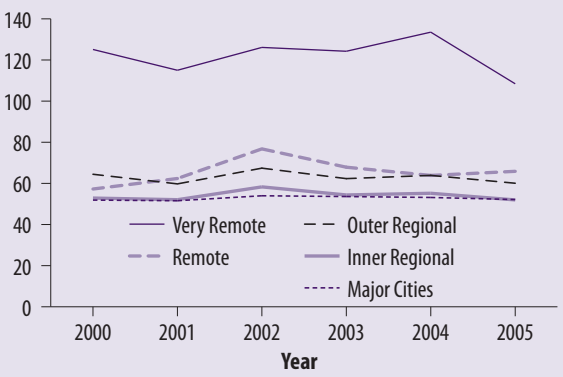
Across the same period, there was no significant change in the relative difference in diabetes death rates for people living in regional areas compared with people in Major Cities. However, there was a significant increase (18%) in the difference between Remote areas and Major Cities and a 13% decrease for Very Remote Australia compared with Major Cities.

Table 5.7: Diabetes deaths by sex and geographical location, 2003–2005 (per 100,000)

	Males	Females	Persons
Underlying cause of death			
Major Cities	16.4	15.0	15.7
Inner Regional	20.6	14.9	17.3
Outer Regional	26.1	18.1	21.6
Remote	36.9	28.7	32.6
Very Remote	68.9	61.7	65.3
Any cause of death			
Major Cities	57.7	50.7	54.2
Inner Regional	70.6	45.8	56.4
Outer Regional	83.6	52.9	66.5
Remote	97.4	71.7	84.1
Very Remote	159.4	165.9	162.6

Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Major Cities population.

Source: AIHW National Mortality Database.



Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Mortality Database.

Figure 5.12: Diabetes death rates by geographical location 2000 to 2005

Table 5.8: Diabetes deaths as any cause of death, by geographical location and type of diabetes, 2003–05

	Major Cities	Inner Regional	Outer Regional	Remote	Very Remote
			Number		
Type 1	1,695	717	336	41	16
Type 2	10,114	3,800	2,048	283	242
Other/unspecified	9,830	3,472	1,802	266	170
			Standardised mortality ratio		
Type 1	1.0	1.2[(a)]	1.2[(a)]	1.3	1.3
Type 2	1.0	1.1	1.3[(a)]	1.6[(a)]	3.7[(a)]
Other/unspecified	1.0	1.0	1.2[(a)]	1.5[(a)]	2.6[(a)]

(a) Significantly different to Major Cities.

Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Major Cities population.

Source: AIHW National Mortality Database.

Complications

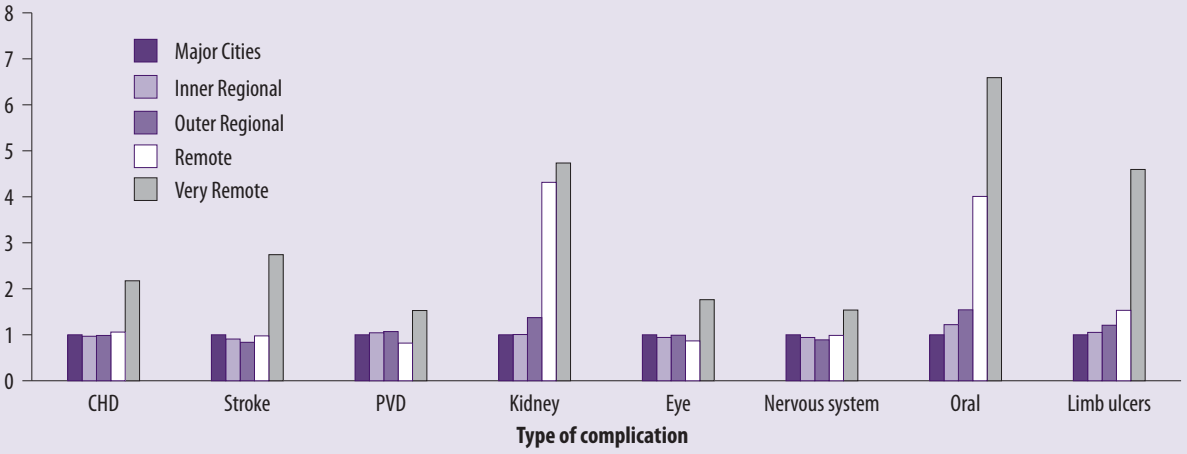
Hospitalisations

In 2004–05, hospitalisation rates for various diabetes complications in most regions were similar. The notable difference was in Very Remote areas where rates for nearly all diabetes complications were substantially higher than in other areas. The exception is for kidney complications where the rates for both Remote and Very Remote areas were higher than in other regions (Figure 5.13).

Deaths

There is inequality in death rates from diabetes complications across regions, particularly between people in Very Remote areas compared with other regions. Compared with people living in Major Cities, people living in Very Remote Australia were 7 times as likely to die with both diabetes and kidney complications as causes of death and 3 times as likely to die with diabetes and any of CHD, stroke and lower limb ulcers in 2003–2005 (Figure 5.14).

For more information on specific complications of diabetes, see Chapter 4.

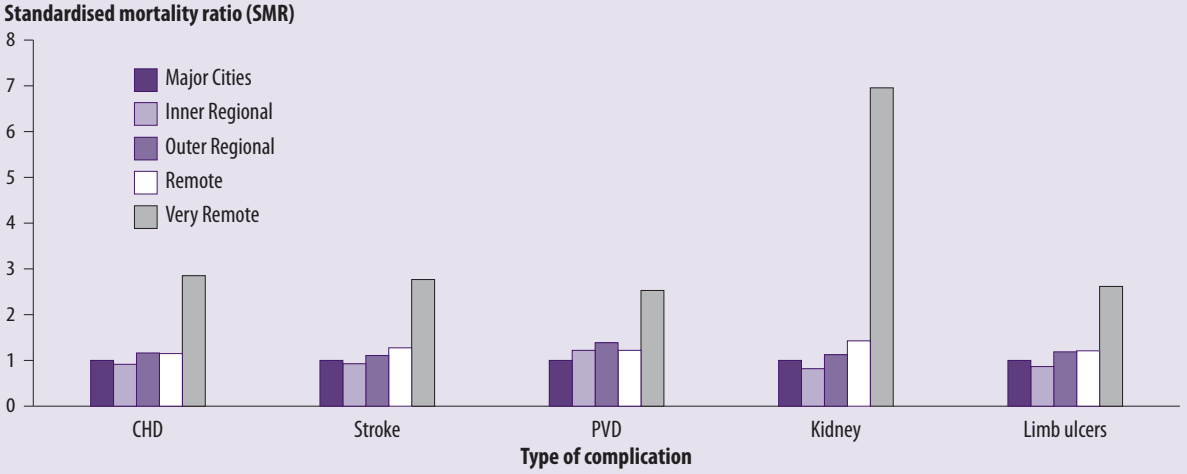


Notes

1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. 2004–05 Major Cities males, females and persons used as the standard population in the calculation of the rates.

Source: AIHW National Hospital Morbidity Database.

Figure 5.13: Hospitalisations for diabetes complications by geographic location, 2004–05



Notes

1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Major Cities population.

Source: AIHW National Mortality Database.

Figure 5.14: Deaths from diabetes complications by geographic location, 2003–2005

Overseas-born

Australia is a multicultural nation, with 28% of its population having been born overseas. However, previous analysis has shown that proportionally more overseas-born people than Australian-born people have diabetes. Rates of diabetes, hospitalisations and/or mortality are more common among people born in the South Pacific Islands, Southern Europe, Middle East, North Africa and Southern Asia (AIHW 2003a).

Data on ethnicity are not commonly collected in Australian health statistics, and so country of birth is used as a proxy for ethnicity in this section.

Prevalence

In 2004–05, according to NHS self-reported data, the age-adjusted prevalence of diabetes was 3% for people born in Australia and 4% for those born overseas. However, people born in specific country groups (regions) had much higher rates of diabetes than those born in Australia. For example, the prevalence among people born in North Africa and the Middle East was about 7%. For those born in South-East Asia it was close to 6% and for people born in both Oceania (excluding Australia) and Southern and Eastern Europe the prevalence of diabetes was around 5%.

Risk factors

According to the 2004–05 NHS data, the age-adjusted prevalence of overweight and obesity among people born in Australia was estimated to be 63%. In the same survey, 58% of those born in the United Kingdom, 62% born in other Oceania and 67% born in Southern and Eastern Europe were estimated to be overweight or obese (Table 5.9).

Over two-thirds of people born in Australia (69%), other Oceania (68%),the United Kingdom (66%) and over three-quarters of those born in Southern and Eastern Europe (79%) were estimated to be physically inactive.

Other risk factors for diabetes, such as poor dietary habits, as measured by low intake of fruit and vegetables, also appeared to be of concern among these populations. In 2004–05, just over half the Australian-born population consumed less than the daily requirement of fruit and 83% consumed fewer vegetables than their daily requirement. Of those born overseas, fewer than half the population from each region consumed insufficient amounts of fruit each day; however, over 80% consumed insufficient amounts of vegetables (Table 5.9).

For more information on specific risk factors, refer to Chapter 3.

Hospitalisations

In 2004–05, there were almost 42,100 hospitalisations among people born in Australia where diabetes was the principal diagnosis—a rate of 27 hospitalisations per 10,000. Hospitalisation rates for diabetes among people born in South-East Europe and in Africa and the Middle East were 20% higher than that among Australian-born people. People born in North-Western Europe and the Americas had lower rates of diabetes hospitalisations than Australian-born people.

Table 5.9: Prevalence of diabetes risk factors by region of birth, 2004–05 (per cent)

	Overweight/ obesity	Physical inactivity[a]	Insufficient fruit[b]	Insufficient vegetables[c]
Australia	62.9	68.7	50.5	82.6
Oceania (excluding Australia)	61.8	67.5	46.9	88.5
United Kingdom	58.1	66.3	49.1	86.8
Southern and Eastern Europe	67.2	78.9	36.0	88.6

(a) Sedentary or low exercise level.
(b) Insufficient fruit is fewer than 3 serves per day for children aged 12–18 years, and fewer than 2 serves per day for adults aged 19 years and over.
(c) Insufficient vegetable is fewer than 4 serves per day for children aged 12–18 years, and fewer than 5 serves per day for adults aged 19 years and over.
Note: Directly age-standardised to the 2001 Australian population.
Source: AIHW analysis of ABS 2004–05 National Health Survey data.

People born in Oceania (excluding Australia) and Asia had similar hospitalisation rates compared with people born in Australia. This pattern was similar for hospitalisations where any diagnosis of diabetes was considered (Figure 5.15).

In 2004–05, hospitalisations for Type 1 diabetes among people born overseas were only half those of Australian-born people. Hospitalisations for Type 2 diabetes among overseas-born people were 10% higher than those among people born in Australia. However, women born overseas had hospitalisation rates for gestational diabetes 3 times that of women born in Australia (Table 5.10).

Trends

Between 2000–01 and 2004–05, the rate of diabetes hospitalisations increased for both Australian and overseas-born people, by around 40% (Figure 5.16).

Deaths

In the period 2003–2005, there were 6,693 deaths from diabetes as the underlying cause of death among people born in Australia: a rate of 15 deaths per 100,000. In contrast, people born overseas had a slightly higher diabetes death rate of 18 deaths per 100,000.

Table 5.10: Hospitalisations by type of diabetes, Australian and overseas-born populations, 2004–05

Type of diabetes	Number		Standardised hospitalisation ratio (Overseas-born/ Australian-born)
	Australian-born	Overseas-born	
Principal diagnosis			
Type 1	12,050	2,321	0.6[(b)]
Type 2	25,645	13,883	1.1[(b)]
Gestational[(a)]	3,485	1,865	3.3[(b)]
Other/ unspecified	901	372	1.0
Any diagnosis			
Type 1	44,538	11,431	0.6[(b)]
Type 2	300,223	166,878	1.1[(b)]
Gestational[(a)]	9,522	5,341	3.4[(b)]
Other/ unspecified	6,033	2,568	1.0[(b)]

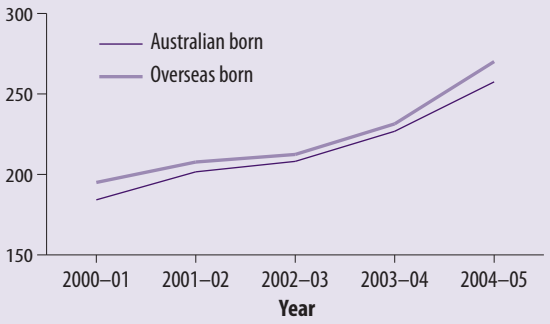
(a) Females only.
(b) Significantly different compared with Australian-born rates.
Notes
1. Diabetes is classified according to ICD-10-AM codes: E10–E14 and O24.
2. Indirectly age-standardised to the 2004 Australian-born population.
Source: AIHW National Hospital Morbidity Database.

Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004 Australian-born population.
Source: AIHW National Hospital Morbidity Database.

Figure 5.15: Diabetes hospitalisations by region of birth, 2004–05

Diabetes was the underlying or an associated cause of death in 22,259 deaths (48 per 100,000 people) among people born in Australia. (Figure 5.17). There were 12,741 deaths (58 per 100,000) among overseas-born people with diabetes as a cause of death. Specifically, people born in South-East Europe or Africa and the Middle East had the highest rates of death from diabetes (76 and 74 deaths per 100,000, respectively).

In 2003–2005, Australian-born and overseas-born people had similar rates of death from Type 1 diabetes. Death rates from Type 2 and other/unspecified diabetes among people born overseas were 20% higher than those among Australian-born people (Table 5.11).



Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Hospital Morbidity Database.

Figure 5.16: Diabetes hospitalisations, Australian-born and overseas-born people, 2000–01 to 2004–05

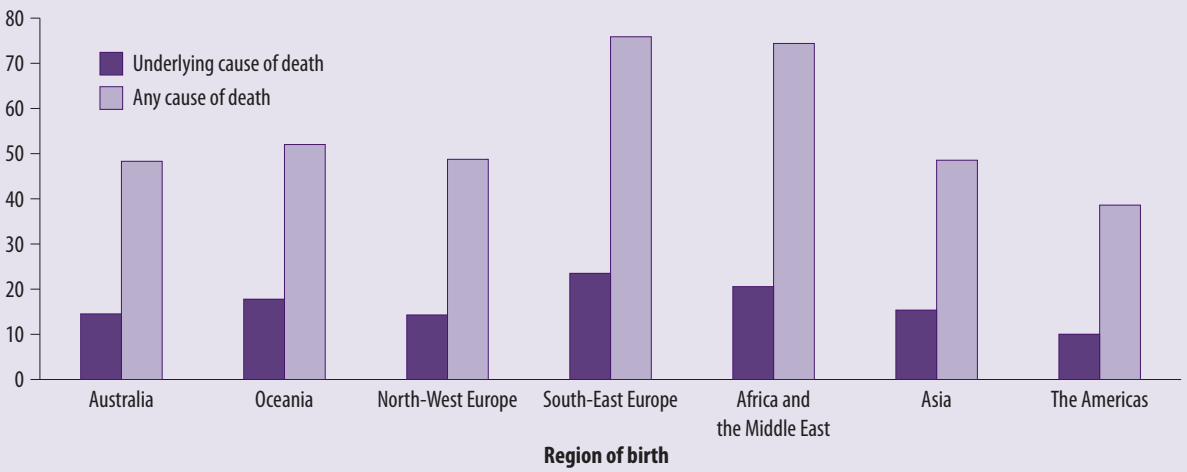
Table 5.11: Diabetes deaths for overseas-born and Australian-born people by type of diabetes, 2003–2005

	Number		Standardised Mortality Ratio (Overseas-born/ Australian-born
	Australian-born	Overseas-born	
Underlying cause of death			
Type 1	704	350	1.0
Type 2	2,642	1,516	1.2[(a)]
Other/ unspecified	3,347	1,950	1.2[(a)]
Any cause of death			
Type 1	1,887	927	1.0
Type 2	10,452	6,114	1.2[(a)]
Other/ unspecified	9,930	5,699	1.2[(a)]

(a) Significantly different compared with Australian-born rates.

Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Australian-born population.

Source: AIHW National Hospital Morbidity Database.



Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Australian-born population.

Source: AIHW National Mortality Database.

Figure 5.17: Diabetes deaths by region of birth, 2003–2005

Trends

Diabetes death rates among Australian and overseas-born populations remained largely unchanged over the period 2000–2005. However, overseas-born people experienced higher rates of deaths from diabetes than did people born in Australia, across all years (Figure 5.18). A large part of the disparity in deaths between the two populations can be attributed to the high rates of diabetes mortality experienced by people born in Africa and the Middle East.

Notes

1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW National Mortality Database.

Figure 5.18: Diabetes deaths as any cause of death, selected regions of birth, 2000 to 2005

Complications

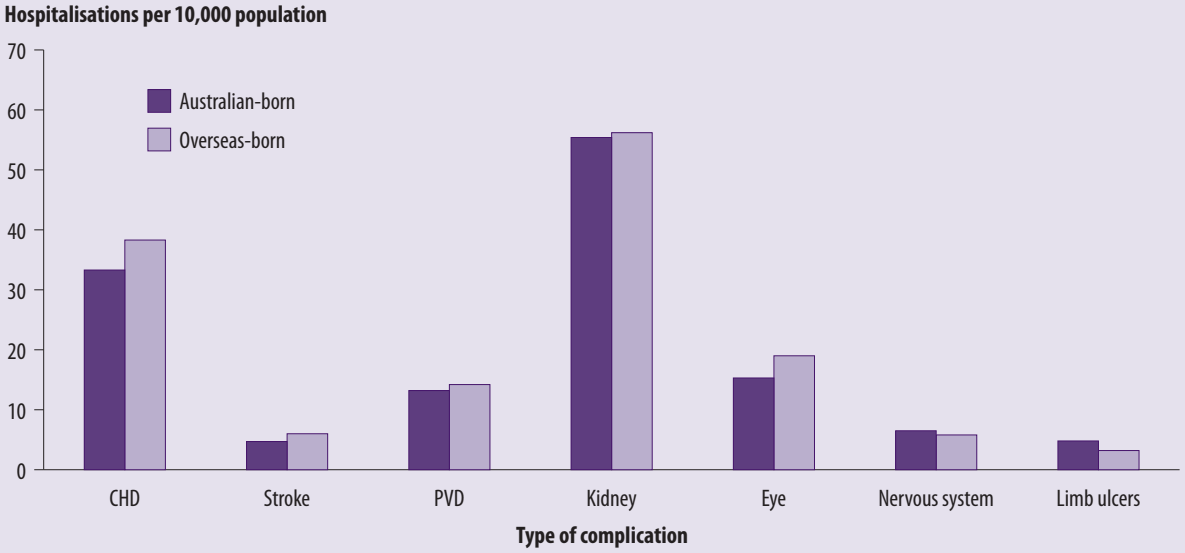
Hospitalisations

Of the 360,348 diabetes hospitalisations among Australian-born people in 2004–05, almost one quarter (24%) also had a diagnosis of kidney complications (including chronic kidney failure) and 14% had a coronary heart disease (CHD) diagnosis. There is very little difference in the hospitalisation rates between the Australian-born and overseas-born populations when the different age-structure of the two populations are accounted for (Figure 5.19).

Deaths

In the period 2003–2005, death rates from certain diabetes complications were significantly higher among people born overseas compared with that among people born in Australia; including CHD, stroke, kidney complications and lower limb ulcers (Figure 5.20). The highest mortality rates were for diabetes deaths with CHD: a rate of 24 deaths per 100,000 persons born among Australian-born people, and a rate of 28 deaths per 100,000 for people born overseas.

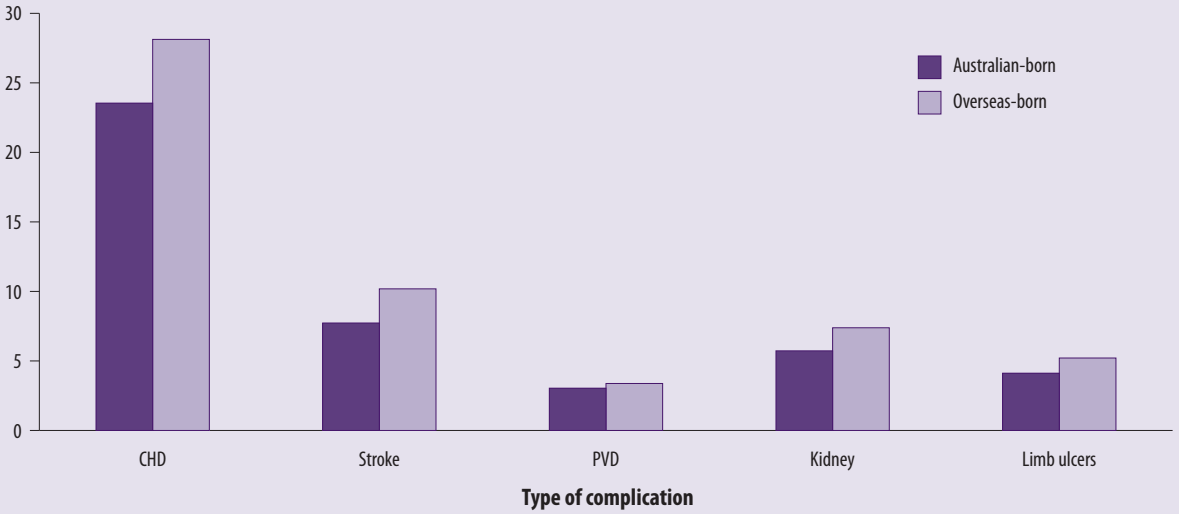
For more information on specific complications of diabetes, see Chapter 4.



Notes
1. Diabetes and related complications are classified according to ICD-10-AM codes. See Appendix 1.
2. Indirectly age-standardised to the 2004 Australian-born population.
3. Hospitalisations with diabetes as any diagnosis, and related complications as either principal or additional diagnosis.

Source: AIHW National Hospital Morbidity Database.

Figure 5.19: Diabetes hospitalisations among Australian-born and overseas-born people, by type of diabetes-related complication, 2004–05



Notes
1. Diabetes and related complications are classified according to ICD-10 codes. See Appendix 1.
2. Indirectly age-standardised to the 2003–2005 Australian-born population.
3. Deaths with diabetes as any cause, and related complications as either underlying or additional cause of death.

Source: AIHW National Mortality Database.

Figure 5.20: Diabetes deaths among Australian-born and overseas-born persons, by type of diabetes-related complication, 2003–2005

6 Use of health services

Introduction

Living with diabetes is challenging because it affects every aspect of a person's life. Support from family, multidisciplinary health-care teams, peers and various organisations, such as Diabetes Australia, can help individuals make the necessary adjustments towards improving a patient's health and quality of life.

Diabetes is a chronic condition requiring the use of a variety of health services for its control and for the early diagnosis and treatment of associated complications. People with diabetes use a range of health services to control blood sugar, blood pressure and blood lipid levels to reduce symptoms and the risk of complications, and to enhance their quality of life. Having complications as well as diabetes greatly increases the use of health services. People without diabetes who have a number of diabetes risk factors are also likely to use more health resources (Burke et al. 2007).

How is diabetes managed?

Diabetes management involves a combination of medical and non-medical approaches. The overall goal is for the patient to have a life that is as healthy, and as normal, as possible. This can be a demanding task because the condition requires careful attention and monitoring by the patient, their doctor and other health professionals.

The medical aims of diabetes management are:

- to remove the symptoms and short-term risks of high blood glucose
- to prevent longer term complications
- to detect and treat any complications early if they do arise.

Symptom control and longer term prevention can be achieved by maintaining normal blood glucose levels and by attention to lifestyle and its associated risk factors (such as diet and physical activity). Research studies have shown the benefits of improved blood glucose control in reducing the risk of complications in people with diabetes (UKPDS Group 1998; Stratton et al. 2000).

For both Type 1 and Type 2 diabetes, together with medication, a degree of blood glucose control can be brought about through lifestyle approaches, such as a healthy diet, regular exercise and resulting weight control. Avoiding smoking and maintaining good control of blood pressure and blood cholesterol levels as well as the lifestyle approaches help reduce the risk of complications such as heart attack and stroke.

Diabetes management guidelines

The annual cycle of care for diabetes describes the minimum level of care for people with diabetes. This is aimed at monitoring blood glucose control, and preventing or delaying the onset of complications. Care will often be managed by a general practitioner (GP); however, is also likely to involve nurses, specialists and allied health professionals as well as the patients themselves.

More information on diabetes management guidelines based on *Diabetes Management in General Practice* (13th edition 2007/8) (Diabetes Australia 2007b) and Medicare Service Incentive Payment items (DoHA 2007) for patients with diabetes mellitus are given in Table 6.1.

In Australia available research has identified the need for improved quality of diabetes care (Georgiou et al. 2004; Kemp et al. 2005). For example, in 1999 in divisions of general practice providing data for the National Divisions Diabetes Program (NDDP) fewer than 60% of patients were receiving care consistent with best-practice guidelines (Carter et al. 2000).

Medical and allied health services

GPs are usually the initial point of contact for people with diabetes and play a key role in coordinating the services that are needed because the condition and its complications affect several parts of the body. Patients and their carers also need information and support. Thus, a range of other health professionals may also be involved. GPs and other primary health-care professionals often manage diabetes in collaborative arrangements with specialised services. The Bettering the Evaluation and Care of Health (BEACH) report (Britt et al. 2007) established that diabetes was one of the main chronic conditions managed by GPs.

Table 6.1: Elements of the annual cycle of care for managing diabetes

Elements	Diabetes Management in General Practice	Medicare Service Incentive Payment
Measure HbA1c	Measure HbA1c at least six monthly.	Assess diabetes control by measuring HbA1c at least once every year.
Review smoking status, physical activity and nutrition	Minimal interventions in general practice settings can improve cessation rate of smoking. Encourage people with diabetes at least 30 minute walking (or equivalent) for 5 or more days a week. Nutrition management involves optimising weight and the introduction of a healthy eating plan.	Check smoking status; if applicable encourage cessation of smoking. Review levels of physical activity; reinforce information about appropriate levels of physical activity. Review diet; reinforce information about appropriate dietary choices.
Measure body mass index (BMI)	Maintain a BMI ≤ 25kg/m2 where practicable.	Measure weight and height and calculate BMI at least once every six months.
Measure blood pressure and lipids	Check blood pressure every three to four months; ensure that blood pressure is maintained at a target level of <130/80 mm Hg. Blood fats (cholesterol and triglycerides) tested every 12 months; targets are LDL cholesterol < 2.5 mmol/L, total cholesterol 4.0 mmol/L, HDL cholesterol > 1.0 mmol/L and triglycerides < 1.5 mmol/L.	Measure blood pressure at least once every six months. Measure total cholesterol, triglycerides and HDL cholesterol at least once every year.
Review medication	n.a.	Medication can be reviewed at least once every year.
Eye examination	Second yearly referral to an ophthalmologist/ optometrist if the patient has no retinopathy, more frequently if abnormal.	Ensure that comprehensive eye examination is carried out at least once every two years.
Foot examination	Check for ulcers, infections or abnormalities at least once every six months.	Examine feet, at least once every six months.
Tests for microalbuminuria	Test for microalbuminuria at least once every year.	Test for microalbuminuria at least once every year.

Note: The Diabetes Management in General Practice applies to the management of Type 2 diabetes only.
Sources: DoHA 2007; Diabetes Australia 2007b.

Doctors use a blood test, called HbA_{1c} or glycated haemoglobin, to assess how well blood glucose has been controlled over recent months; and sometimes a fructosamine test is used to assess the preceding three weeks. Doctors also advise and monitor their patients on lifestyle measures and other risk factor control, check regularly for any early damage to the kidneys and feet, periodically refer them for expert check-ups of their eyes and periodically review any medicines they are prescribing and how their patients are using them.

General practitioner visits

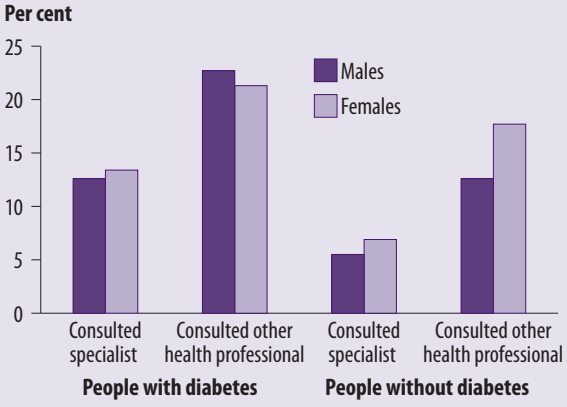
In 2005–06 GPs managed diabetes (excluding gestational diabetes) at a rate of 3.5 per 100 encounters, representing 2.4% of all problems managed. Diabetes was the third most frequently managed chronic problem accounting for 6.9% of all chronic problems managed (Britt et al. 2007).

GPs provided clinical treatment (advice and counselling) for 23.3% of consultations for diabetes problems. Diabetes was the problem most frequently referred to specialists in 2005–06, with 6.9% of diabetes encounters generating a referral to specialists by GPs. During the same period, 4.9% of all diabetes encounters with GPs resulted in referral to allied health professionals, including dieticians, diabetes educators, diabetes clinics, and podiatrists (Britt et al. 2007).

Visits to medical specialists and allied health professionals

Diabetes complications may affect a number of the body's organs, necessitating treatment by specialists in areas such as endocrinology, cardiology, nephrology, obstetrics and ophthalmology.

Information from the 2004–05 NHS indicates that people with diabetes were over 2.5 times as likely as people without diabetes to have visited a specialist. In the two weeks before the survey, 13% of people with diabetes had visited a specialist, compared with 6% of those without diabetes (Figure 6.1).



Notes
1. Based on self-reported information.
2. Data are for all persons.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 6.1: Consultations with a specialist or other health professional (excluding GPs), by diabetes status, 2004–05

In addition to the care provided by medical specialists, people with diabetes may also seek the advice of diabetes educators, nutritionists and podiatrists. The services of other allied health professionals and natural therapists may also be used.

Results from the 2004–05 NHS indicate that more people with diabetes (20.1%) sought advice from other health professionals than people without diabetes (15.1%).

Hospitalisations

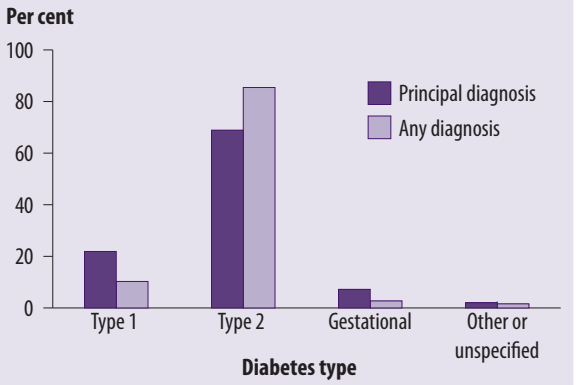
Hospital services are required to treat the advanced stages of diabetes complications, which include heart disease, stroke, kidney disease, and foot, eye and nerve problems. People with diabetes may also be hospitalised when blood glucose is particularly unstable. Thus, hospitalisation data provide a picture of the more severe aspects of the disease. Australian hospitals data are a valuable source of information about health service provision. In terms of diabetes, this gives an indication of the impact of diabetes and can help provide some background information on people with diabetes who are accessing services.

It is important to note that it is the condition responsible for the hospitalisation that is recorded as the principal diagnosis. Thus diabetes may not be the principal diagnosis even when the hospitalisation is for a complication of diabetes. Diabetes is more frequently recorded as an additional diagnosis, particularly when it is associated with coronary heart disease, stroke or kidney disease.

In 2004–05 there were a total of 74,490 hospitalisations with diabetes as a principal diagnosis and 531,069 with diabetes as any (principal or additional) diagnosis, accounting for 1% and 8% respectively of all hospitalisations for that year.

Type of diabetes

There are a greater number of hospitalisations for Type 2 diabetes than for Type 1. In 2004–05 Type 1 diabetes accounted for just over one-fifth (22%) of hospitalisations with a principal diagnosis of diabetes and 10% of those with any diagnosis of diabetes. Type 2 diabetes accounted for just over two-thirds (69%) of hospitalisations with a principal diagnosis of diabetes and 85% of those with any diagnosis of diabetes (Figure 6.2).



Note: Hospitalisations with any diagnosis of diabetes include those with a principal diagnosis of diabetes, classified according to ICD-10-AM codes. See Appendix 1.

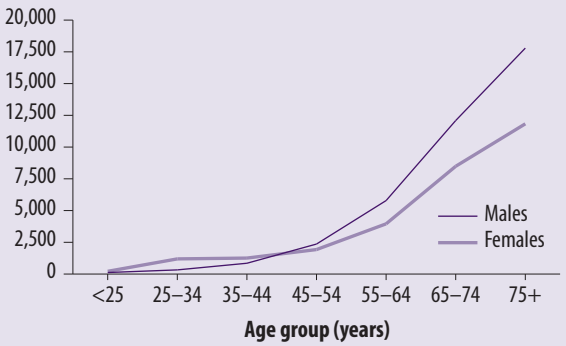
Source: AIHW National Hospital Morbidity Database.

Figure 6.2: Proportion of diabetes hospitalisations by type of diabetes, 2004–05

Age and sex

Hospitalisations with any diagnosis of diabetes increase with age for both males and females (Figure 6.3). Among females in 2004–05, a small peak was seen for those aged 25 to 44 years, mainly due to gestational diabetes, however, males had higher rates of hospitalisations at ages between 45 to 74 years. A similar pattern occurred for hospitalisations with a principal diagnosis of diabetes.

As mentioned above, the peak in diabetes hospitalisations among females aged 25 to 44 years in 2004–05 was due to gestational diabetes (see Figure 6.4), with the greatest proportion of hospitalisations for gestational diabetes occurring among women aged 25–34 years. The increase in diabetes hospitalisations among men and women aged 55 years and over was attributed to Type 2 diabetes. Hospitalisation rates for Type 1 diabetes remained relatively constant across all age groups for both males and females.



Note: Includes principal and additional diagnosis of diabetes, classified according to ICD-10-AM codes. See Appendix 1.
Source: AIHW National Hospital Morbidity Database.

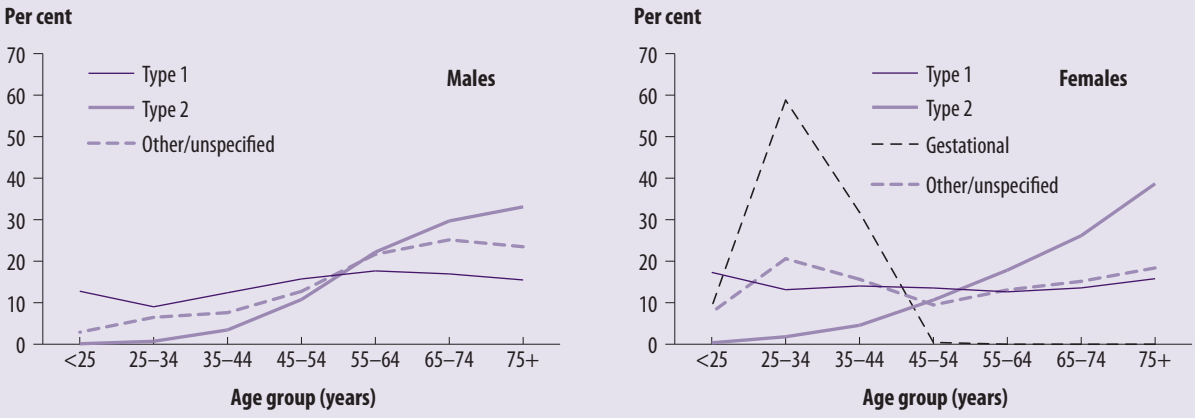
Figure 6.3: Diabetes hospitalisations by age group and sex, 2004–05

Length of stay in hospital

In 2004–05, the average length of stay in hospital for hospitalisations with any diagnosis of diabetes was 5.6 days, and this was slightly longer than for those with a principal diagnosis of diabetes (4.8 days). In contrast, the average length of stay for all hospitalisations was 3.4 days. Males had a longer average length of stay for hospitalisations with a principal diagnosis of diabetes (5.3 days compared with 4.4 days for females). The average length of stay for hospitalisations with any diagnosis of diabetes was similar for males and females.

Trends

Over the period 2000–01 to 2004–05, both the number of diabetes hospitalisations and the rate steadily increased. Between 2000–01 and 2004–05, the rates of hospitalisation for any diagnosis of diabetes increased by 35%, from 1,932 hospitalisations per 100,000 people to 2,608 per 100,000. Between the same two years, a 32% increase was observed in the rate of hospitalisations where diabetes was the principal diagnosis (272 hospitalisations per 100,000 people in 2000–01 compared with 358 hospitalisations in 2004–05 (Figure 6.5). Part of this increase may be the result of changes

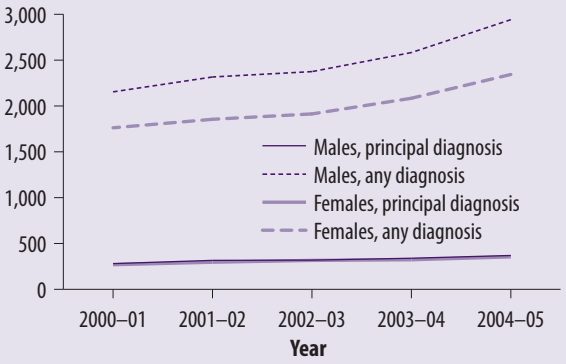


Note: Includes principal and additional diagnoses of diabetes, classified according to ICD-10-AM codes. See Appendix 1.
Source: AIHW National Hospital Morbidity Database.

Figure 6.4: Proportion of diabetes hospitalisations, by type of diabetes, age group and sex, 2004–05

made to the way complications are coded in hospitalisations data (see Appendix 1).

Males had higher hospitalisation rates than females over the five-year period.



Notes

1. Directly age-standardised to the 2001 Australian population.
2. Hospitalisations with any diagnosis of diabetes include those with a principal diagnosis of diabetes, classified according to ICD-10-AM codes. See Appendix 1.

Source: AIHW National Hospital Morbidity Database.

Figure 6.5: Trends in diabetes hospitalisations, 2000–01 to 2004–05

Medicines use

People with diabetes often require medication regimes to control high blood glucose levels. Further, people with the condition frequently have associated health problems such as high blood pressure and high blood lipids (cholesterol and related substances) that may necessitate taking multiple medicines. Clinical trials have shown that good control of blood glucose, blood lipids and blood pressure in patients with diabetes delays the onset and slows the progression of complications (DCCT Research Group 1993; HPS Collaborative Group 2003; UKPDS Group 1998b).

Medicines for diabetes

Self-reported data on medicine use from the 2004–05 NHS indicates that one-fifth (21%) of people with diabetes were using insulin, 68% were using other pharmaceutical medicines and only 4% were using vitamin or mineral supplement or herbal or natural medicines (ABS 2006a).

Oral medicines used by people with diabetes include: 40% were using metformin, 20% were using gliclazide and 6% were using other oral blood glucose lowering agents. Over 90% of these medicines were reported to be for the treatment of Type 2 diabetes. Metformin and gliclazide were also the most common medicines prescribed for diabetes in general practice (28.3 and 14.7 per 100 problems managed respectively) in the 2003–04 BEACH study (Britt et al. 2004).

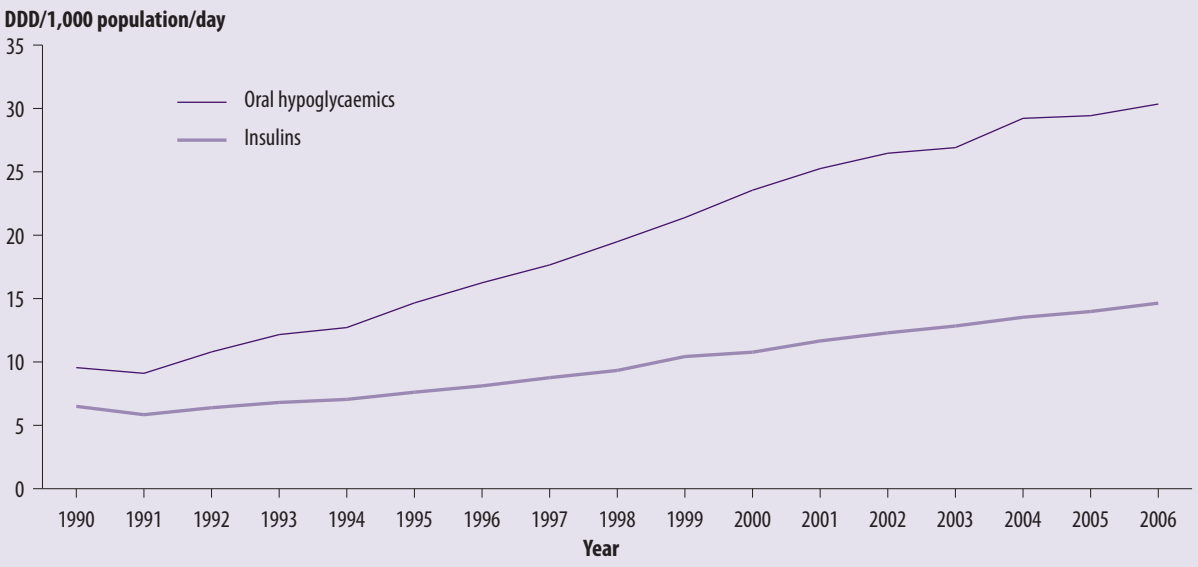
During the 1990s the use of insulins and oral glucose-lowering medicines in Australia increased and the trend has continued over the past few years (Figure 6.6) reflecting the increase in the number of people being diagnosed with diabetes and changing treatment practices. These results refer to the use of prescription medicines in the community (excluding public hospitals). Medicines use is expressed in the World Health Organization standard measurement unit—defined daily doses (DDDs) per 1,000 population per day (DDD/1,000/day). This is based on the assumed average dose per day of a medicine used for its main indication in adults. The DDD enables valid comparisons between medicines independent of differences in price, formulation and quantity per prescription.

In 2006, 15 DDD/1,000/day of insulin were dispensed while oral hypoglycaemics were dispensed at a rate of 30 DDD/1,000/day (Figure 6.6).

Insulins

All people with Type 1 diabetes and some people with Type 2 diabetes need insulin to control their blood glucose levels. Insulin helps the body use or store the glucose it gets from food. People whose pancreas does not make insulin (Type 1 diabetes) need insulin injections to survive. Some people with Type 2 diabetes also require insulin injections to improve diabetes control. Giving suitable doses of insulin to people with diabetes temporarily restores their ability to process carbohydrates, fats and proteins, to store glycogen in the liver, and to convert glucose to fat.

There are several types of insulin that differ in how soon the insulin starts working (onset), when it works most (peak time) and how long it lasts in the body (duration). Fast-acting insulin



Note: Data relate to products dispensed through community pharmacies only; medicines provided in public hospitals and highly specialised medicines available to outpatients through public hospital pharmacies are not included.
Source: DoHA Drug Utilisation Sub-Committee Database.

Figure 6.6: Community use of insulins and oral blood glucose-lowering medicines, 1990–2005

reaches the blood within 15 minutes of injection, peaks 30–90 minutes later and may last for up to 5 hours. In 2006, fast-acting human insulin was dispensed at a rate of 3.2 DDD/1,000/day.

Human intermediate-acting insulin reaches the blood 2–6 hours after injection, peaks 4–14 hours later and stays in the blood for about 14–20 hours. This type was dispensed at a rate of 3.4 DDD/1,000/day in 2006.

Long-acting insulin takes 6–14 hours to start working. It has no peak or a very small peak 10–16 hours after injection and stays in the blood between 20 and 24 hours. Long-acting insulin was dispensed less frequently and no recent data are available on the daily dispense rate of this type.

Some types of insulin come mixed together to make it easier to inject two kinds of insulin at the same time. Human intermediate-acting combined with fast acting insulin is the most common insulin of this kind and was the most common insulin dispensed overall in 2006 (5.8 DDD/1,000/day).

Oral blood glucose–lowering medicines

Biguanides lower blood glucose by suppressing glucose production in the liver and also promote the action of insulin by increasing the uptake of glucose in the tissues (especially muscle). Metformin belongs to this class of medicines. It's use has increased since the 1990s and in 2006 it was the most frequently dispensed oral hypoglycaemic medicine overall (15.3 DDD/1,000/day) (Figure 6.7).

Metformin is among the top 20 most commonly prescribed medicines in general practice; in 2003–04 it accounted for 1.2% of all prescriptions issued by general practitioners (Britt et al. 2004).

Sulfonylurea medicines stimulate the beta cells in the pancreas to release more insulin. Chlorpropamide, glipizide, glibenclamide, gliclazide and tolbutamide are members of this class. Gliclazide was the most commonly dispensed sulfonylurea in 2004 (7.0 DDD/1,000/day), followed by glimepiride (3.5 DDD/1,000/day) (Figure 6.7). While the use of metformin has continued to increase since 1990, gliclazide use peaked in 2000 and has since decreased slightly. This coincided with the inclusion of glimepiride in the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme during 2000.

Alpha glucosidase inhibitors help the body lower blood glucose by blocking the gut enzymes that

break down starches (such as bread, potatoes and pasta) and certain sugars into glucose. Their action slows the rise in blood glucose levels after a meal. Acarbose is a member of this class and was dispensed at a rate of 0.2 DDD/1,000/day in 2006 (Figure 6.7).

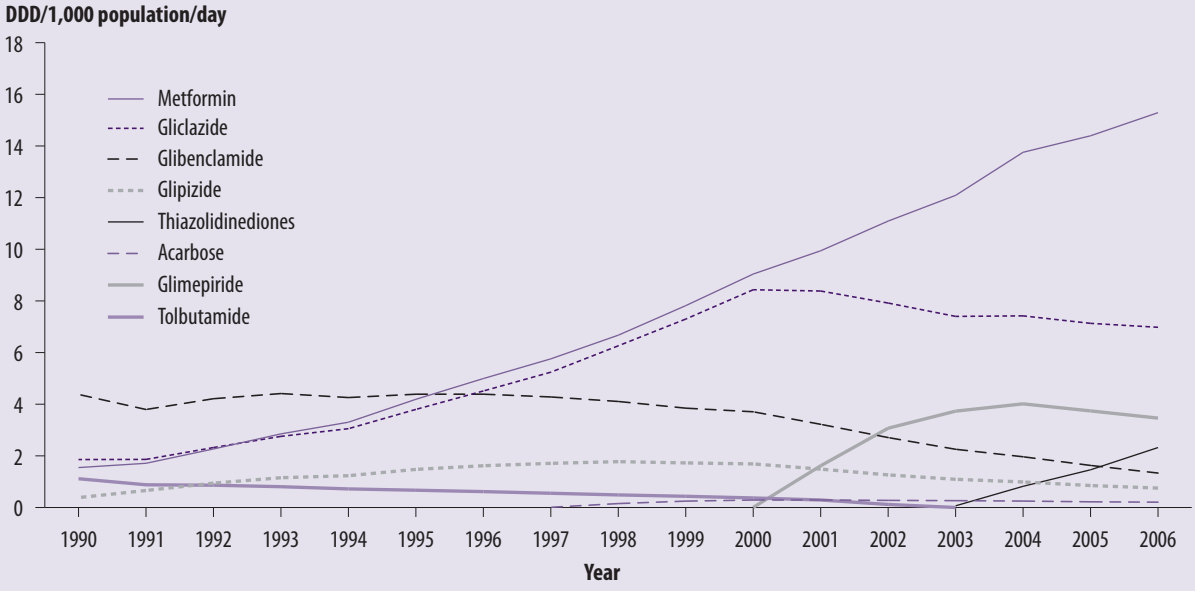
Thiazolidinedione agents (including glitazones such as rosiglitazone and pioglitazone) have been listed on the PBS only since 2003. In general, thiazolidinediones are recommended when either metformin or a sulfonylurea is contra-indicated or not tolerated, when combination therapy with metformin and a sulfonylurea fails, or when insulin (with or without oral medicines) no longer maintains blood glucose control (NPS 2004). In 2006 thiazolidinediones were dispensed at a rate of 2.3 DDD/1,000/day (Figure 6.7).

Medicines for associated conditions

The 2004–05 NHS showed that people with diabetes used medicines for cardiovascular conditions or its risk factors such as high blood pressure or high blood cholesterol at higher rates than those without diabetes. Blood pressure lowering medicines were used as follows: agents acting on renin-angiotensin system —includes ACE inhibitors and angiotensin II receptor antagonists (36%), beta-blocking agents (11%) and other antihypertensive medicines (7%). Cardiac therapy medicines were used by 6% of people with diabetes and 27% used serum lipid reducing agents.

In the 1999–2000 AusDiab study 35% of people with diabetes took blood pressure–lowering medicines, almost three times the proportion of people without diabetes (13%). More than twice the proportion of people with diabetes took blood cholesterol–lowering medicines than those without diabetes (15% and 7% respectively).

According to 2006 ANDIAB results, 55% of people with diabetes who were attending specialist diabetes services were on blood-pressure lowering treatments and 89% were on cholesterol lowering medicines (NADC 2007).



Note: Data relate to products dispensed through community pharmacies only; medicines provided in public hospitals, and highly specialised medicines available to outpatients through public hospital pharmacies are not included.

Source: DoHA Drug Utilisation Sub-Committee Database.

Figure 6.7: Community use of oral blood glucose-lowering medicines, 1990 to 2006

Pathology and other tests

There are a variety of pathology tests used in the diagnosis and management of diabetes. The more common tests include:

- oral glucose tolerance test (OGTT) which is a diagnostic test to assess absorption of glucose after a dose is given
- glycosylated haemoglobin (HbA1c) and fructosamine, which monitor glucose control
- microalbuminuria, which tests for amounts of protein (albumin) in the urine
- blood lipids tests, which include total cholesterol, triglycerides and HDL cholesterol.

Pathology tests processed by Medicare

Pathology tests billed to Medicare are subject to 'coning', that is, pathology companies charge Medicare for the three most expensive tests undertaken even where more tests were undertaken. Where a patient with diabetes is likely to receive multiple tests for monitoring the disease and its complications, the less expensive test may not be recorded in the Medicare data, i.e. it may 'drop' off the billing process due to coning (Britt et al. 2003).

According to Medicare items processed in 2006, 943,532 were for glycosylated haemoglobin (HbA1c). Over 99% of these were for persons with established diabetes (Medicare Online Health Statistics 2007).

Pathology tests ordered by GPs

A survey of general practice activity (BEACH) found that in 2005–06, GPs ordered pathology tests for diabetes problems relatively frequently: 30% of diabetes contacts resulted in pathology orders, with 263 tests ordered per 100 diabetes contacts where at least one pathology test was ordered. The specific pathology tests requested by GPs in the management of diabetes have not been published. However, pathology tests for electrolytes/urea/creatinine were requested at a rate of 2.8 per 100 GP encounters. Tests for glycosylated haemoglobin (HbA1c) which are mainly for people with diabetes were requested at a rate of 1.0 per 100 encounters. Note that the BEACH data do not capture whether the patients sent for pathology test ordered by the GP actually presents for the test, and therefore whether the test is performed (Britt et al. 2007).

Pathology tests at diabetes clinics

According to the ANDIAB data collection conducted in 2006, 93% of patients visiting specialist diabetes clinics had an HbA1c measurement in that year. Nearly 70% of patients attending specialist diabetes clinics had a microalbumin (or urinary protein level) recorded, and 79% had a cholesterol level recorded (66% had an HDL cholesterol level recorded, 76% had a triglyceride level recorded and 54% had an LDL cholesterol level recorded) (NADC 2007).

Programs and services

There are a number of programs and services available to people with diabetes providing information and support to help people in the self-management of their diabetes. Some programs also provide diabetes-related products at a subsidised cost, while others provide clinical consultations, counselling services, information and support services.

Organisations in Australia that provide services and support to people with diabetes and coordinating diabetes management include consumer, professional, research and education organisations. A number of agencies or programs central to the provision of services for diabetes management are described below. In addition to these organisations there are numerous others that are crucial to the provision of support and care for people with diabetes in Australia.

National Diabetes Services Scheme

The National Diabetes Services Scheme (NDSS) provides important support for many people with diabetes. The NDSS is an Australian Government program that provides products for the self-management of diabetes, such as blood and urine testing strips, syringes and needles for special injection systems, at subsidised prices. It also provides a range of information and education

services to people with diabetes and a variety of electronic and interpersonal communication strategies are used to deliver programs to communities and individuals throughout Australia. Diabetes Australia has administered the NDSS since it was introduced in 1987. As at 30 June 2006, 788,214 people with diabetes were registered for NDSS benefits and 228,774 (29%) of these were people requiring insulin. The NDSS distributed more than 3.2 million packets of blood glucose test strips during 2005–06 and 616,336 boxes of syringes and pen needles (Diabetes Australia 2007a).

Diabetes centres and educators

Diabetes centres, often referred to as Diabetes Ambulatory Care Centres, provide services such as diabetes education, nutrition advice and complications assessment to adults and children. As well as clinical management of the disease, centres generally aim to improve personal management of diabetes to minimise the effect of diabetes on daily living. Most patients attending diabetes centres are referred by GPs to receive specialist assessment and treatment, generally these are people whose diabetes is not managed as well as in other patients.

Staff of diabetes centres include an endocrinologist, diabetes nurse educators, dieticians and podiatrists. Many centres also provide training in diabetes care to other health professionals, and may conduct research into medical or social aspects of diabetes.

There were over 60 diabetes centres that were members of the National Association of Diabetes Centres (NADC) in 2006 (NADC 2007). The NADC promotes effective health care practice for people with diabetes. Over the past few years a number of the centres in the collective have participated in data collection through the ANDIAB project, enabling assessment and review of diabetes management. Some of these data have been reported in other sections of this report.

National Divisions Diabetes Program

The National Divisions Diabetes Program (NDDP) is a coordinated national approach to diabetes care in Australian General Practice.

As part of the NDDP Data Collation Project, 38 Divisions of General Practice reported having a diabetes program in 1999–00. At least 27% of GPs nationally participated in some aspect of a diabetes program.

In the 2004–05 annual survey of divisions, 98% of divisions conducted diabetes programs or activity (Hordacre et al. 2006). Approaches used to conduct these programs included: practice education (92%); GP education (89%); recall systems (80%); collaboration with other agencies (82%); community awareness (61%); and patient services (46%). Divisions also reported on services in their area, program highlights and barriers, advice to other divisions and future plans.

7 Impact

Introduction

Diabetes is associated with substantial morbidity and mortality and has a significant impact on affected individuals and their families. In particular, the onset of macrovascular and microvascular complications reduces quality of life through increased burden of illness and the costs of managing the complications of diabetes over time.

A number of studies have shown that the long-term complications of diabetes may lower the quality of life of people with diabetes (Bates & Jerums 2003; Maddigan et al. 2006; Mehta et al. 1999; Redekop et al. 2002). People with diabetes and peripheral neuropathy experience chronic, painful symptoms that diminish their quality of life and disrupt sleep, which can lead to depression (Argoff et al. 2006). They also experience social isolation due to impaired mobility and consequent physical and emotional ill health (Nabuurs-Franssen et al. 2005). There is evidence suggesting that depression is often diagnosed in people with diabetes because of its association with poor metabolic control, poor diet, adherence to the medication regimen and decreased quality of life (Egede et al. 2002; Hanninen et al. 1999). Depression is found to be highly prevalent among people with Type 2 diabetes and chronic comorbidities than among those with Type 2 diabetes only (Pouwer et al. 2003). People with diabetes complications are also likely to experience physical disability which will limit their ability to perform daily activities (Clarke et al. 2006; Egede 2004).

Diabetes is associated with substantial costs to the health system and to affected individuals and their families. These costs can be direct, indirect or intangible (Milton et al. 2006; Parsons et al. 2000).

Intangible costs are usually quantified using health 'gap' measures that indicate the difference between a population's actual health status and some 'ideal' or reference status. The most widely known example of such a measure is the disability-adjusted life year (DALY). Another measure commonly used in economic evaluations, but not in health status assessments, is the Quality Adjusted Life Year (QALY) (AIHW: Begg et al. 2007).

Quality of life

Measurement of the quality of life of people with diabetes assists in understanding the effect diabetes has on the individual. In addition, an individual's view of their quality of life is important for evaluating and understanding treatment effects from the person's perspective and for improving future care (Higginson & Carr 2001).

In the 2003 DiabCost Australia study, people with Type 2 diabetes in the 36–65 year age group reported poor quality of life compared with other Australians of the same age. Most frequently reported problems affecting quality of life for people with diabetes were pain/discomfort, impeded mobility and anxiety/depression. Having complications decreased quality of life compared with people without complications, but there was little variation in quality of life between different types of complications. When compared by treatment type, people whose diabetes was controlled by diet alone reported the highest quality of life, whereas those on insulin reported the lowest (Colagiuri et al. 2003).

Little information is available on the quality of life of people with Type 1 diabetes in Australia. A study of children and young people with Type 1 diabetes in Melbourne found that their general health and quality of life were poorer than those of children and young people in the general population. Lower quality of life was found to be related to poor blood glucose control in children (5–11 years), but not in 12–18 year-olds, while the presence of diabetes-related symptoms and concerns was associated with poorer psychosocial functioning for both age groups (Wake et al. 2000). Children with diabetes living in regional areas of Victoria have also been found to have lower quality of life than those from urban areas, despite similar diabetes knowledge and similar levels of glycosylated haemoglobin (HbA1c) (Cameron et al. 2002).

Self-assessed health

The ABS NHS collects information on 'self-assessed health status', which is the respondent's perception of their general health measured against a five-point scale: excellent, very good, good, fair and poor.

According to 2004–05 NHS self-reports, an age-standardised rate of 20% of people with diabetes assessed their health as very good or excellent, compared with 58% of those without diabetes. People with diabetes in all age groups (48%) were 3 times as likely to rate their own health as fair or poor than people without diabetes (15%) (Figure 7.1).

Notes
1. People aged 15 years and over are included.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 7.1: Self-assessed health status of people with and without diabetes, 2004–05

More females than males (51% and 45%, respectively) with diabetes rated their health as fair or poor (Table 7.1). The corresponding figures for those without diabetes were 14% for females and 15% for males.

Table 7.1: Self-assessed health status of people with and without diabetes, by sex, 2004–05 (per cent)

Self-assessed health status	People with diabetes		People without diabetes	
	Males	Females	Males	Females
Excellent	4.9	4.6	21.3	22.0
Very Good	15.0	15.2	35.4	37.1
Good	34.9	29.6	28.3	26.9
Fair	26.3	33.6	11.0	10.2
Poor	19.0	17.0	3.9	3.8

Notes
1. People aged 15 years and over are included.
2. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

People with diabetes and other long-term health conditions were more than twice as likely as people with other long-term health conditions to rate their own health to be fair or poor. The 2004–05 NHS results showed that 60% of people with diabetes and other long-term heath conditions rated their health as fair or poor compared with 27% of people with other long-term conditions.

Mental health

Depression and depressive symptoms have been shown to be highly prevalent in people with diabetes compared with those without diabetes (Anderson et al. 2001) and there is emerging evidence suggesting that depression itself is a risk factor for Type 2 diabetes (Arroyo et al. 2004; Brown et al. 2005b; Golden et al. 2004). A Canadian population-based study conducted from 1992 to 2000, showed that people with a history of depression were at a greater risk of developing diabetes (Brown et al. 2005b). Possible reasons for this relationship are that people with depression are less likely to be engaged in physical activities, and more likely to experience changes in body weight, which increases the risk of developing diabetes. In addition, some medications used to treat depression are known to cause weight gain and sedation, which, again, could contribute to the development of diabetes (Brown et al. 2005b). In the Fremantle Diabetes Study (1993–1996), 32% of people with Type 2 diabetes self-reported depression and it was associated with a greater prevalence of diabetic complications (Bruce et al. 2005). Having a number of comorbidities places an additional burden on people with diabetes as these conditions are associated with an increased number of functional limitations. Subsequently, functional limitations can reduce the patients' quality of life and thus contribute to the development of depression (Pouwer et al. 2003).

According to the 2004–05 NHS, 18% of people with diabetes had high or very high levels of psychological distress compared with 12% of people without diabetes, as measured by the Kesslar-10 scale (see Box 7.1). More females (22%) than males (15%) with diabetes had high or very high levels of psychological distress (Table 7.2).

Table 7.2: Level of psychological distress experienced by people with or without diabetes

Level of psychological distress (K-10 scale[a])	People with diabetes		People without diabetes	
	Males	Females	Males	Females
Low (0–15)	62.5	53.7	68.9	61.7
Moderate (16–21)	22.6	23.9	21.1	24.3
High (22–29)	9.9	13.2	6.9	10.1
Very high (30–50)	5.0	9.2	3.1	3.9

(a) Based on the Kessler-10 scale of psychological distress.
Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Disability and activity limitation

Diabetes has been shown to be associated with an increased risk of disability in adults (Gregg et al. 2002; Ryerson et al. 2003). This is mainly because diabetes is related to numerous vascular and neuropathic complications that could affect functional status. A study by Gregg et al. (2002) found that after controlling for a number of comorbidities (including coronary heart disease (CHD), stroke, depression, cognitive and visual impairment and arthritis) diabetes was still related to a 42% increased risk of disability.

In a nationally representative sample of U.S. adults, 66% with diabetes had difficulty doing at least one of the physical tasks that were assessed. The tasks involving mobility or lower extremity function, such as stooping, standing, walking, pushing, and climbing, tended to be the most problematic for people with diabetes and had the highest prevalence of any limitation (Ryerson et al. 2003).

Based on 2003 Survey of Disability Ageing and Carers (SDAC) self-reports, there were approximately 634,600 people with diabetes and, of them, 56% had a disability. Disability among people with diabetes was higher at older ages: 46% of people with diabetes aged less than 65 years compared with 67% of people with diabetes aged 65 years and over had a disability. This pattern was similar for both males and females (Figure 7.2).

Of the people with diabetes and a disability, 42% had a profound or severe core activity limitation, indicating that they were unable to do, or always/sometimes needed help with, a core activity task such as self-care, mobility and communication. Again, the proportion reporting profound or severe core activity limitation among people with diabetes and a disability increased with age. Among people with diabetes and a disability, 31% aged less than 65 years and 49% aged 65 years

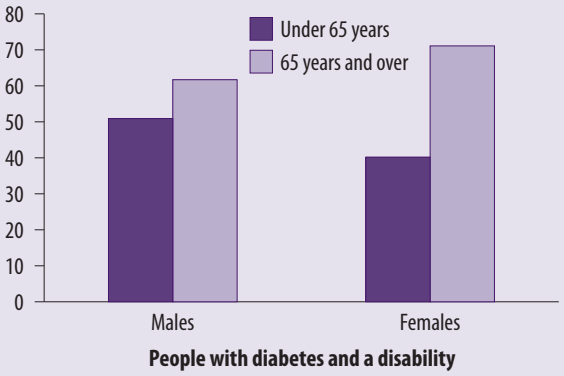
Box 7.1: Psychological distress according to Kessler-10 scale

Psychological distress refers to an individual's overall level of psychological strain or pain, evidenced by psychological states such as depression, anxiety and anger. Psychological distress may be fairly transient—for example, experiencing high anxiety over an upcoming event, or sadness because of the break-up of a relationship—but may also be a continuing problem, particularly among those experiencing mental health problems and clinical disorders.

Psychological distress can be measured using the Kessler-10 (K-10) distress scale, which is a 10-item questionnaire asking about feelings such as nervousness, hopelessness, restlessness, depression and worthlessness. For each item, the respondents are asked how often they experienced these feelings in the past 4 weeks, with responses ranging from 'none of the time' to 'all of the time' (scoring 1 to 5). The maximum score is 50 (indicating severe distress) and the minimum score is 10 (no distress). Andrews & Slade (2001) showed a strong association between the K-10 scale and current diagnoses of anxiety and affective disorders. They also showed a lesser, but significant, association with other mental disorder categories.

and over had a profound or severe core activity limitation.

Twenty-four per cent of people with diabetes and a disability considered diabetes as the main condition causing their disability in 2003.



Source: AIHW analysis of ABS 2003 Survey of Disability, Ageing and Carers data.

Figure 7.2: Disability among people with diabetes, 2003

Burden of disease

The impact of diabetes on the health of the population can be shown using a number of summary measures of health that combine information on mortality and non-fatal health outcomes into a single number. The disability-adjusted life year or DALY is one such measure that summarises the burden of disease and injury in a population. The DALY combines information on the impact of premature death as well as non-fatal health outcomes. Premature death is measured by the years of life lost (YLL) due to disease or injury and non-fatal health outcomes are measured by years of 'healthy' life lost (YLD) due to disease, disability or injury. To combine these two health measures into a summary health measure, the DALY uses time as a common 'currency'. It is a measure of the years of healthy life lost due to illness or injury—one DALY is one lost year of 'healthy' life (AIHW: Begg et al. 2007).

Diabetes was the eighth leading cause of burden of disease and injury in 2003 and it was responsible for 5.5% of the total burden (Table 7.3), with Type 2 diabetes accounting for 92% of this burden (AIHW: Begg et al. 2007).

Table 7.3: Diabetes burden of disease by specific cause, 2003

Cause	YLD	Per cent of total	YLL	Per cent of total	DALYs	Per cent of total
Diabetes per se	89,252	6.6	32,295	2.5	121,547	4.6
Neuropathy	6,500	0.5	—	0.0	6,500	0.2
Peripheral vascular disease	5,917	0.4	—	0.0	5,917	0.2
Diabetic foot	3,672	0.3	—	0.0	3,672	0.1
Amputation	2,455	0.2	—	0.0	2,455	0.1
Retinopathy	1,258	0.1	—	0.0	1,258	0.0
Other[(a)]	2,483	0.2	—	0.0	2,483	0.1
Total diabetes burden	**111,536**	**8.2**	**32,295**	**2.5**	**143,831**	**5.5**
Ischaemic heart disease attributable to diabetes	8,494	0.6	45,948	3.6	54,442	2.1
Stroke attributable to diabetes	3,985	0.3	16,260	1.3	20,245	0.8
Total burden attributable to diabetes	**124,015**	**9.2**	**94,503**	**7.4**	**218,518**	**8.3**

(a) Includes renal failure.

Notes

1. YLD = Healthy years lost due to disability.
2. YLL = Years of life lost due to premature mortality.
3. DALY = Disability adjusted life years.

Source: AIHW: Begg et al. 2007.

Eighty-five per cent of the total diabetes burden was due to diabetes per se (that is, the experience of having diabetes regardless of complications), with the remainder being due to complications such as neuropathy (5%), peripheral vascular disease (PVD) (4%), and diabetic foot (3%). The majority (78%) of the diabetes burden was due to years of health life lost, and the remainder was due to premature death.

Diabetes was responsible for a loss of just over 111,500 years or 8% of 'healthy' life due to disability in 2003. More males—9% compared with 7% females—with diabetes experienced loss of healthy life due to disability (AIHW: Begg et al. 2007).

Diabetes also carries with it an increased risk of ischaemic heart disease and stroke and the associated burden has not been included in the above figures. When this risk was accounted for, the burden attributable to diabetes increased to 8.3% of total burden (Table 7.3).

The burden from diabetes in both sexes increased linearly until age 80 then declined. The contribution from diabetes per se dominated at all ages.

Type 2 diabetes was ranked sixth among the 20 leading specific causes of burden (DALY) for both males and females in 1993. By 2003, it was ranked second for males and fourth for females. Type 2 diabetes is projected to be the leading specific cause for males and second for females by 2023 (AIHW: Begg et al. 2007).

Costs

Diabetes places a large burden on health-care systems in terms of expenditure on hospitalisations, aged c8 are, medications, diagnostic services, and other out-of-hospital medical care, including general practice and community health services. Non-health care and indirect costs borne by governments, private health insurers, and people with diabetes can also be substantial (AIHW: Dixon 2005). People with diabetes, particularly those with complications, are more likely to use health services than people without diabetes, and to use them more often and for longer periods of time (Ramsey et al. 2002).

Disease-related costs fall into four broad categories:

- direct health-care costs, which include hospital treatment, medications, GP visits, allied health and specialist care, use of diagnostic services and medical research (see Appendix 1 for a description of these categories)
- direct non-health-care costs, including transport to and from medical services, child care, and home care
- indirect costs, such as lost productivity, lost income, disability, and lost years of life
- intangible costs, such as impact on quality of life (Colagiuri et al. 1998; Parsons et al. 2000).

This section mainly focuses on direct health-care expenditure for diabetes—that is, money spent by governments, private health insurers, companies, households and individuals to prevent, diagnose and treat diabetes. Very little information is available in Australia on the other types of costs associated with diabetes.

Two sources of data on direct health expenditure for diabetes are used: the AIHW Disease Expenditure Database and the National Diabetes Services Scheme.

Direct health expenditure

Data on allocatable recurrent health expenditure from the AIHW Disease Expenditure Database showed that direct health-care expenditure on diabetes in 2004–05 was $989 million. Diabetes accounted for 1.9% of the year's total allocatable recurrent health expenditure (see Appendix 1 for discussion of exclusions). It is estimated that expenditure on Type 1 diabetes accounted for 14% of the diabetes expenditure, at $139 million, and expenditure on Type 2 diabetes accounted for 84% at $828 million. The remaining $22 million related to diabetes prevention services.

Much of the expenditure on diabetes was on hospital services, $371 million (37.5%) followed by out-of-hospital medical services, $288 million (29.1%), diabetes-related pharmaceuticals, $275 million (27.8%), and research, $55 million (5.6%) (Figure 7.3).

The National Diabetes Services Scheme (NDSS)

The NDSS provides access to products and services—such as syringes, insulin infusion pump consumables and blood and urine glucose testing reagents—that are needed for self-management of diabetes at prices subsidised by the Australian Government. It is administered by Diabetes Australia on behalf of the DoHA. The state and territory governments contribute co-payments for needles and syringes, which effectively makes them effectively free to NDSS registrants.

Australian Government expenditure on the NDSS is presented here, but no information on the total value of patient contributions to NDSS-subsidised products is available.

In 2006–07, there were 844,062 people registered with the NDSS (Diabetes Australia 2008) and the Australian government expenditure on the NDSS in that financial year was nearly $114 million (Personal communication with Special Access Programs Section, DoHA). This expenditure is in addition to the direct health expenditure shown in Figure 7.3, as expenditure on the NDSS, which is grouped under 'health aids and appliances', has not been allocated by disease group and therefore not included in the AIHW Disease Expenditure Database.

Direct non-health care costs

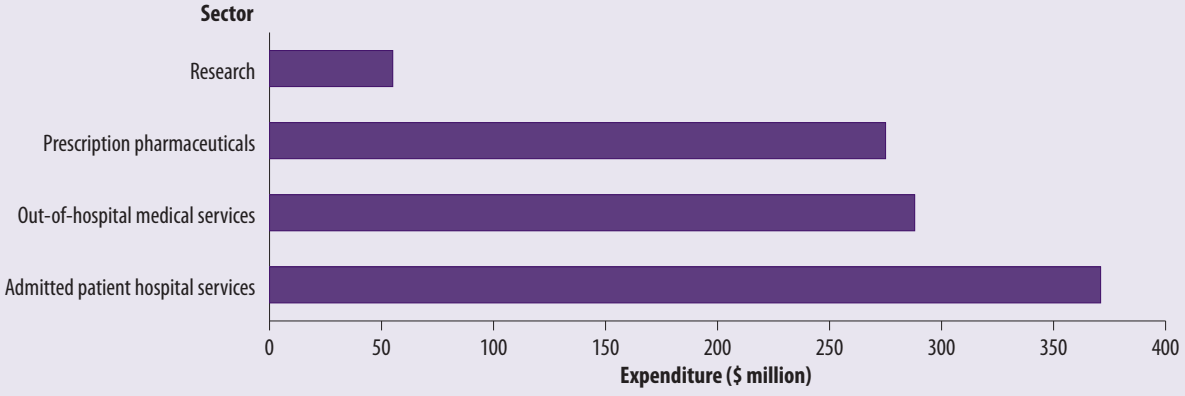
Results from the DiabCost study estimated that average annual direct non-health-care costs for people with Type 2 diabetes were $1,065 per person (Colagiuri et al. 2003). Home support and special foods accounted for around two-thirds of these costs (40% and 28%, respectively), with transport accounting for a further 12%. There is no information available on the direct non-health-care costs for people with Type 1 diabetes in Australia.

Indirect costs

The estimated average income lost by patients and carers unable to attend work was low in the DiabCost study: an average of only $35 per person per year, but the study sample had a mean age of 65 years and therefore few participants were employed (Colagiuri et al. 2003). The average income lost per person, particularly for carers, increased if complications were present. The impact of diabetes in terms of lost income is likely to be higher if people with Type 1 diabetes are included, because this type of diabetes generally develops at a much younger age and therefore affects parents of children with the disease as well as employed people who themselves have Type 1 diabetes. There are currently no Australian data available on the indirect costs associated with Type 1 diabetes.

Intangible costs

The impact of diabetes on quality of life was discussed earlier in this chapter. However, intangible costs of diabetes are difficult to quantify and there is no information currently available.



Source: AIHW Disease Expenditure Database.

Figure 7.3: Direct health expenditure on diabetes by sector, 2004–05

8 Mortality

Mortality rates are a vital measure of population health that can be used to assess the nature and progress of diseases such as diabetes (AIHW 2005d). In Australia, more than one cause of death can be listed on the death certificate. This means that for each death, both underlying and associated causes of death can be listed and have been available for analysis of deaths data since 1997. The underlying cause of death is the disease or injury initiating the sequence of events leading to death.

Diabetes is recognised as having a substantial impact on mortality in Australia; however, it may not be diabetes itself which directly leads to death, but one of its many complications. As a result, it is commonly the complication that is listed as the underlying cause of death on the death certificate. A more complete picture of the mortality burden of diabetes can be obtained by examining both diabetes as the underlying cause, which is the primary disease or injury causing the deaths, and diabetes as an associated cause of death (diseases or injuries that are considered to have contributed to the death).

The method of examining deaths where diabetes is listed as the underlying or associated cause of death may overestimate the true contribution of diabetes to mortality in Australia as it often includes deaths for a wide range of conditions, some of which are unlikely to be complications of diabetes (AIHW: Dixon & Webbie 2005). This may be overcome, at least to some extent, by examining diabetes-related deaths—that is, deaths where diabetes was listed as the underlying cause of death, or where diabetes was listed as the associated cause of death and the underlying cause of death was one of a specific list (see Box 8.1) commonly associated with diabetes complications.

Diabetes as the underlying cause of death

Diabetes is among the top ten leading causes of death among Australians. In 2005, diabetes was the underlying cause of death in 3,529 deaths registered (2.7% of all deaths). Of these, about 10% were due to Type 1 diabetes, 42% were due to Type 2 diabetes and the remaining deaths were due to unknown or unspecified type of diabetes.

Sex and age

More males than females die from diabetes. In 2005, Australian males were nearly one and a half times as likely to die from diabetes as Australian females (a death rate of 19 per 100,000 compared with 13 per 100,000, respectively). Diabetes mortality increases dramatically with age, with over 86% of deaths occurring in those aged 65 years and over in 2005 (Figure 8.1).

Box 8.1: Diabetes-related deaths

For the purposes of this report, diabetes-related deaths refer to deaths where:

- diabetes was listed as the underlying cause of death

  OR

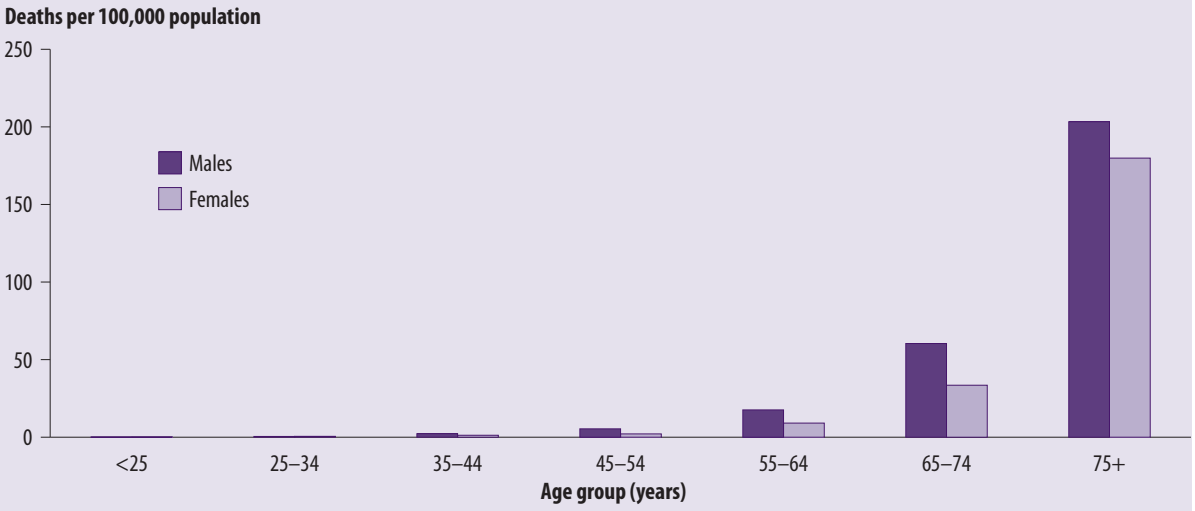
- diabetes was listed as an associated cause of death, where the underlying cause of death was one of:
  - myocardial infarction (heart attack)
  - ischaemic heart disease*
  - stroke or sequelae of stroke*
  - heart failure*
  - sudden death (cardiac arrest)
  - peripheral vascular disease
  - kidney disease
  - hyperglycaemia
  - hypoglycaemia.

Note: 'Diabetes-related deaths' is based on the definition of 'deaths related to diabetes' used in the United Kingdom Prospective Diabetes Study (UKPDS 1998). The UKPDS definition has been modified by diabetes specialists on the National Diabetes Data Working Group to include ischaemic heart disease, sequelae of stroke and heart failure, and other commonly recognised complications of diabetes.

*Not included in the UKPDS definition of deaths related to diabetes.

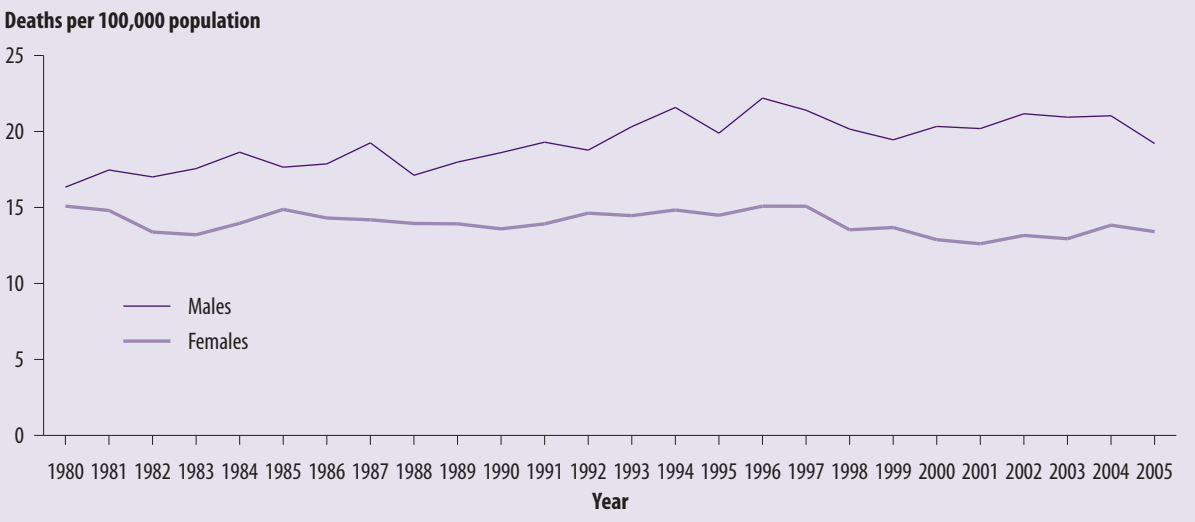
Trends

Over the 26-year period between 1980 and 2005, there were a total of 65,221 deaths (an average of 2,508 deaths per year) registered where diabetes was recorded as the underlying cause; this represents 2% of all deaths registered over that time. Trend analysis indicates that the death rate for diabetes as an underlying cause of death increased for males over the last 25 years, with an average annual increase of 0.7% between 1980 and 2005. However, for females the death rate for diabetes decreased over the same period, by 0.5% per year on average (Figure 8.2).



Note: Deaths classified according to the ICD-10 codes. See appendix 1.
Source: AIHW National Mortality Database.

Figure 8.1: Deaths with diabetes as the underlying cause of death, by age and sex, 2005



Notes
1. Directly age-standardised to the Australian population as at 30 June 2001.
2. For 1980 to 1996 the disease grouping is classified according to the ICD-9 code: 250 for diabetes.
3. For 1997 to 2005 the disease grouping is classified according to the ICD-10 codes: E10–E14 for diabetes.
Source: AIHW National Mortality Database.

Figure 8.2: Deaths with diabetes as the underlying cause of death, 1980 to 2005

Diabetes as an underlying or associated cause of death

Diabetes is more often listed as an associated cause of death than as the underlying cause. In 2005, the total number of deaths for diabetes increased from 3,529 when diabetes was the underlying cause to 11,864 when diabetes was also listed as an associated cause of death—this represents 9% of all deaths recorded in 2005.

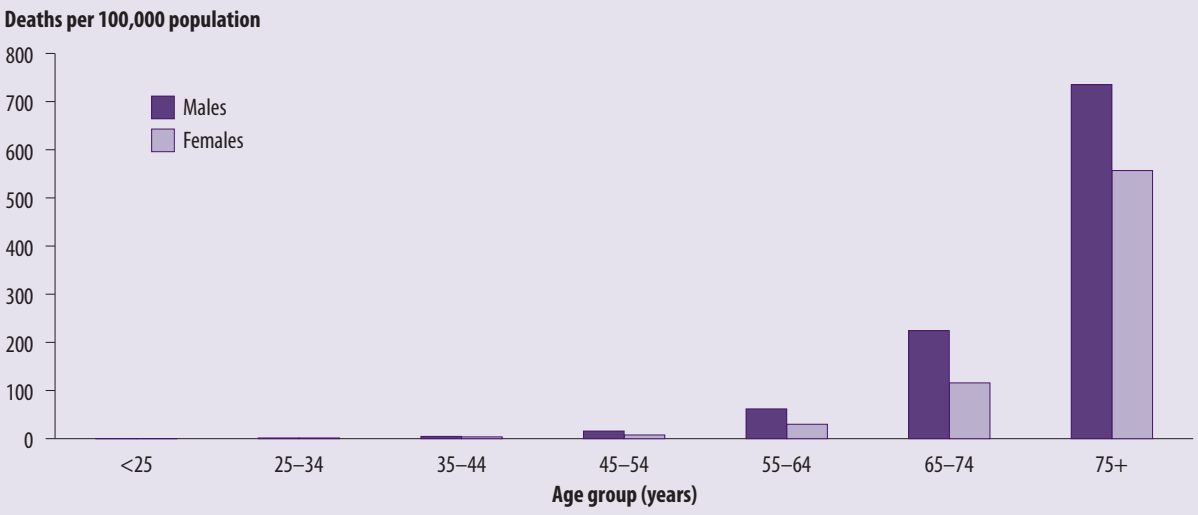
Sex and age

The sex and age distribution of deaths with diabetes as the underlying or associated cause is similar to that of deaths with diabetes listed as just an underlying cause. In 2005, the total number of deaths was higher for men than for women (6,325 deaths compared with 5,540 deaths, respectively). The majority of deaths, with diabetes as the underlying or associated cause (87%), occurred in those aged 65 years and over (Figure 8.3).

Trends

As previously noted, data for associated causes of death first became available in 1997. Therefore, trends for deaths with diabetes as an underlying or associated cause are presented for the years 1997 to 2005.

Over the 9-year period, there were a total of 95,478 deaths registered where diabetes was listed as an underlying or associated cause of death (an average of 10,609 deaths per year); this represents 8% of all deaths registered in that period. The death rates for both men and women remained fairly stable between 1997 and 2005, however, males experienced higher death rates than females across all years (Figure 8.4).



Note: Includes deaths where diabetes was the underlying or an associated cause of death.
Source: AIHW National Mortality Database.

Figure 8.3: Death with diabetes as the underlying or associated cause of death, by sex and age, 2005

Diabetes-related deaths

Diabetes-related death are deaths where diabetes was listed as the underlying cause of death, or where diabetes was listed as the associated cause of death and the underlying cause of death was one of a specific list (see Box 8.1) commonly associated with diabetes complications.

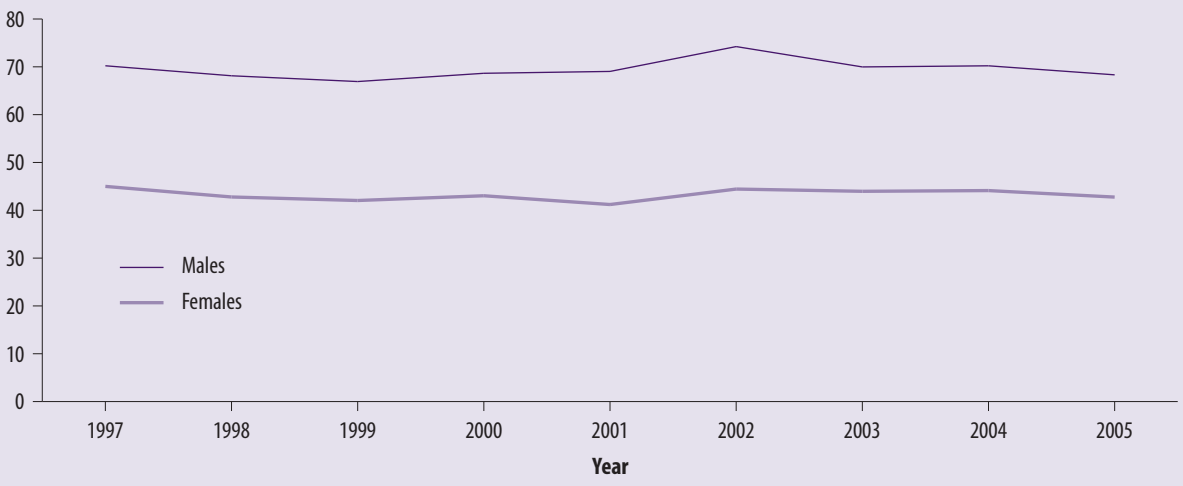
In 2005, there were 7,012 diabetes-related deaths, which constituted 5% of all deaths recorded. More males died from diabetes-related deaths than females (3,629 deaths compared with 3,383 deaths, respectively). The majority of diabetes-related deaths occurred in those aged 65 years and over.

Over the 9-year period 1997 to 2005, there were a total of 61,255 deaths registered where diabetes was a related cause of death. This represents an average of 6,780 deaths each year. The trend for the underlying or associated cause of death was similar—the death rates for diabetes-related deaths remained relatively stable for both males and females, but males had higher rates than females in all years.

Causes of death commonly listed with diabetes

As noted above, diabetes is rarely listed as the only cause of death on death certificates. In 2005, diabetes was recorded as the only cause of death in 31 (0.9%) deaths where diabetes was the underlying cause of death. Where diabetes was listed as the underlying cause of death, conditions most commonly listed as associated causes of death included coronary heart disease (in 67% of deaths), kidney-related diseases (30%), and stroke and heart failure (20%).

Of the deaths in 2005 where diabetes was listed as an associated cause of death, coronary heart disease was recorded as the underlying cause of death in 28% of deaths. Cancer (25%) and stroke (8%) were the other main underlying causes listed with diabetes deaths.



Notes

1. Directly age-standardised to the Australian population as at 30 June 2001.
2. For 1997 to 2005 the disease grouping is classified according to the ICD-10 codes: E10–E14 for diabetes.
3. Note that there have only been two cases in which gestational diabetes mellitus has been recorded as a cause of death; these deaths occurred in the years 2000 and 2005.
4. In 2005, two deaths with missing age or sex have been included in the total.

Source: AIHW National Mortality Database

Figure 8.4: Deaths with diabetes as the underlying or associated cause of death, 1997 to 2005

Deaths of people on the National Diabetes Register

There were over 7,500 deaths of NDR registrants during the period 1999–2005. Diabetes was the underlying cause of death in just over 14% of deaths. At broad disease group level, neoplasms were the most common underlying cause of death, accounting for just over a third (36%) of all deaths of NDR registrants, followed by diseases of the circulatory system, which accounted for 29% of deaths.

Coronary heart disease (CHD) was the most common specific underlying cause of death of NDR registrants—accounting for 19% of deaths. Cerebrovascular diseases accounted for nearly 5% of total deaths.

Diabetes is often under-reported on death certificates (Whittall et al. 1990) mainly because diabetes indirectly causes death being a strong risk factor for common cause of death such as heart and other circulatory diseases (AIHW: Dixon & Webbie 2005). Furthermore, many people have other chronic disease in addition to diabetes and selecting a single underlying cause of death in these people may be difficult (AIHW: Mathur et al. 2000).

Of all deaths to NDR registrants—people known to have diabetes—in 1999–2005 just under 50% had diabetes listed as a cause on their death certificates.

Appendixes

Appendix 1: Methods, definitions and main data sources

Methods and definitions

Also see Glossary for definitions used in this report.

Prevalence

Prevalence refers to the number or proportion (of cases, instances, and so on) present in a population at a given time.

Prevalence rate in this report is calculated by dividing the number of people with the disease by the average population in the same reference period. The resulting number is expressed as a percentage, or as x cases per a given population base (for example, 1,000, 10,000 or 100,000).

Incidence

Incidence refers to the number of new cases (of a disease, condition or event) occurring during a given period.

Incidence rate is calculated by dividing the number of new cases in a given period by the population at risk in the same period, expressed as x cases per a given population base (for example, 10,000 or 100,000). Although the individuals who have already developed the condition under study should be excluded from the denominator, it is often not possible to determine the individuals with the disease in the general population. Therefore, the denominator population used in calculating incidence rates is the average population—often the mid-year population, in the reference period.

Crude rates

A crude rate is defined as the number of events over a specified period (for example, a year) divided by the total mid-year population (30 June of the reference year for mortality and 31 December for hospital separations).

Age-specific rates

An age-specific rate is defined as the number of events for a specified age group over a specified period (for example, a year) divided by the total population at risk of the event in that age group. Age-specific rates in this report were calculated by dividing, for example, the number of hospitalisations or deaths in each specified age group by the mid-year population in the same age group.

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 in all chapters except in Chapter 5 where the indirect method was used.

Direct age-standardisation

Direct age-standardisation applies the age-specific rates to a 'standard population' in order to determine the rate that would have occurred in the standard population. This allows direct comparison of different rates applied to the same standard population. The 2001 Australian population was used as the standard population in calculating age-standardised rates, as described below:

The method used for the calculation of age-standardised rates consists of three steps:

Step 1: Calculate the age-specific rate for each age group.

Step 2: Calculate the expected number of cases in each age group by multiplying the age-specific proportion by the corresponding standard population to get the expected number of cases.

Step 3: Sum the expected number of cases in each age group, divide by the total of the standard population and multiply by 100,000. This gives the age-standardised rate.

Indirect age-standardisation

The indirect method is recommended for use when calculating rates for small populations where fluctuations in age-specific rates can affect the reliability of rates calculated using the direct method (HDSC 2006).

Standardised mortality or hospitalisation ratios

Comparisons between mortality or hospitalisations rates for specific population groups were made with the other Australian population or another standard population using standardised mortality or hospitalisation ratios, which use indirect standardisation to account for any differences in the age structure between the two populations.

These rates were calculated using the following steps:

1. The 'observed' number (that is, the actual number) of events for the population of interest (that is, the Indigenous population) was derived by age and sex.
2. Calculate age-specific proportions for the standard population of choice.
4. Multiply the observed cases in each age and sex group by the corresponding age-specific proportions in the standard population to get expected numbers in each age and sex group.
5. The total expected number was calculated by summing the age-specific expected numbers for each sex (from Step 4).
7. The standardised mortality or hospitalisation ratio was then calculated by dividing the total observed deaths by the total expected deaths (from Step 5). A ratio of 1.0 indicates that there is no difference between the rate of death or hospitalisations experienced by the study population and the standard population.
8. The confidence intervals were calculated using the method outlined below.

Significance testing

The observed value of a rate may vary due to chance even where there is no variation in the underlying value of the rate. Therefore, where indicators include a comparison between time periods, geographical locations, socioeconomic groups or Indigenous and non-Indigenous status, a 95% confidence interval has been calculated for administrative data (including data from the AIHW National Hospital Morbidity Database and the AIHW National Mortality Database).

The 95% confidence intervals for this report were calculated using a method for obtaining approximate confidence intervals for a weighted sum of Poisson parameters developed by Dobson et al. (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 rates do not overlap, the corresponding rates are statistically significantly different from each other; that is, there is at least 95% confidence that the change in a rate is greater than that which could be explained by chance.

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. Judgement should, however, be exercised in deciding whether or not the difference is of any practical significance.

In this report, differences have been reported based on 95% confidence intervals. These confidence intervals are available on request.

For survey data, significance testing was undertaken where possible, using information about sampling variability.

Classifications

Cause of death and hospital diagnosis

Table A1.1: ICD-10-AM codes used to define diagnosis groups for diabetes hospitalisations

Diagnosis	ICD-10-AM
Diabetes	
Type 1 diabetes	E10
Type 2 diabetes	E11
Gestational diabetes	O24.4
Other/Unspecified diabetes	E12–E14
Complications	
CHD	I20–I25
Stroke	I60–I64
PVD	I70–I79
Kidney	
Kidney complications of diabetes	E102, E112, E122,E132, E142
Chronic kidney failure	N18
Eye complications of diabetes	E103, E113, E123, E133, E143
Nervous system complications of diabetes	E104, E114, E124, E134, E144
Oral complications of diabetes	E1063, E1163, E1263, E1363, E1463
Lower limb ulcers	L97

Table A1.2 ICD-10 codes used to define cause of death groups for diabetes mortality

Cause of Death	ICD-10
Diabetes	
Type 1 diabetes	E10
Type 2 diabetes	E11
Other/Unspecified diabetes	E12–E14
Complications	
CHD	I20–I25
Stroke	I60–I64
PVD	I70–I79
Kidney	
Kidney complications of diabetes	E102, E112, E122, E132, E142
Chronic kidney failure	N18
Eye complications of diabetes	E103, E113, E123,E133, E143
Nervous system complications of diabetes	E104, E114, E124, E134, E144
Lower limb ulcers	E105, E115, E125, E135, E145

Defining exercise levels

High exercise level is defined as more than 3,200 mins and 2 hours or more of vigorous exercise, over a two-week period.

Moderate exercise level is defined as 1,600–3,200 mins or more than 3,200 mins but less than 2 hours of vigorous exercise, over a two-week period.

Low exercise level is defined as 100 mins to less than 1,600 mins of exercise over a two-week period.

Sedentary exercise level is defined as less than 100 mins (includes no exercise) over a two-week period.

Defining lipid levels

High blood pressure is defined as systolic blood pressure of 140mmHg or more; or diastolic blood pressure of 90mmHg or more; or receiving medication for high blood pressure.

High total cholesterol is defined as total cholesterol greater than or equal to 5.5mmol/L.

High LDL-cholesterol is defined as LDL greater than or equal to 3.5mmol/L.

Low HDL-cholesterol is defined as HDL less than 1.0mmol/L.

High triglyceride is defined as greater than or equal to 2.0mmol/L.

Methods used in the analyses specific to population groups

Aboriginal and Torres Strait Islander peoples

Hospitalisations

Analysis of hospitalisations for Aboriginal and Torres Strait Islander peoples was restricted to hospitals in Queensland, Western Australia, South Australia and public hospitals in the Northern Territory only, due to data quality issues related to Indigenous identification. Hospitalisations where Indigenous status was missing or unknown were amalgamated with those for non-Indigenous Australians as 'other' Australians (AIHW 2005c).

Deaths

Analysis of deaths among Aboriginal and Torres Strait Islander peoples was restricted to deaths registered in Queensland, Western Australia, South Australia and the Northern Territory. Death records with a missing/not stated Indigenous status were excluded (ABS 1997).

Care should be exercised when interpreting both hospitalisation and deaths statistics by Indigenous status, as these data may not be representative of other states and territories or for Australia as a whole.

Prevalence

Self-reported diabetes and risk factor prevalence data was sourced from the 2004–05 NATSIHS. This survey presented findings on the number of Aboriginal and Torres Strait Islander people in the community who reported having ever been told by a doctor or nurse that they had diabetes. The type of diabetes a person had was not asked. These data may underestimate the true prevalence of diabetes as those undetected cases of diabetes (that is, where the individual does not know they have diabetes) are not identified by the survey. The survey design similarly affects the self-reported prevalence of heart conditions and kidney disease as well as risk behaviours.

Socioeconomic status

Hospitalisations

Analysis of diabetes hospitalisations by socioeconomic status are based on the Index of Disadvantage from the Socioeconomic Index for Areas (SEIFA 2001) (ABS 2001), and were grouped into quintiles: the first representing the most disadvantaged areas, with the fifth representing the least disadvantaged areas. Hospitalisations for which no SEIFA is available have not been included in the analysis.

Deaths

Analyses of diabetes deaths by socioeconomic status are based on the Index of Disadvantage from the Socio-economic Index for Areas (SEIFA 2001) (ABS 2001), and were grouped into quintiles: the first representing the most disadvantaged areas, with the fifth representing the least disadvantaged areas. Death records

for which no SEIFA is available have not been included in the analysis.

Due to small numbers of deaths from diabetes each year, data from the years 2002–2004 have been combined (2003 to 2005 for complications), and year of registration of death has been used for all years. Trend data is only available from 2001.

Prevalence

Self-reported diabetes and risk factor prevalence data was sourced from the 2004–05 NHS conducted by the ABS. This survey presented findings on the number of Australians in the most disadvantaged and the least disadvantaged socioeconomic quintiles who reported having ever been told by a doctor or nurse that they had diabetes. These data may underestimate the true prevalence of diabetes in the Australian community, as those undetected cases of diabetes (that is, where the individual does not know they have diabetes) are not identified in the survey.

Geographic region

Hospitalisations

Analysis of diabetes hospitalisations by geographical location was based on the Australian Standard Geographical Classification Remoteness Structure (ASGC), categorised as 'Major Cities', 'Inner Regional', 'Outer Regional', 'Remote' and 'Very Remote'. Hospitalisations for which geographical area was not stated, classed as migratory or offshore, have not been included in the analyses.

Deaths

Analysis of diabetes deaths by geographical location was based on the Australian Standard Geographical Classification Remoteness Structure (ASGC), categorised as 'Major Cities', 'Inner Regional', 'Outer Regional', 'Remote' and 'Very Remote'. Deaths for which region is not stated, migratory or offshore have not been included in the analyses. Due to small numbers of diabetes deaths each year, data for the years 2003–2005 have been combined, and year of registration of death used throughout.

Prevalence

Self-reported diabetes and risk factor prevalence data was sourced from the 2004–05 NHS conducted by the ABS. This survey presented findings on the number of Australians in non-remote areas who reported having ever been told by a doctor or nurse that they had diabetes. These data may underestimate the true prevalence of diabetes in the Australian community, as those undetected cases of diabetes (that is, where the individual does not know they have diabetes) are not identified in the survey.

Overseas-born population

Hospitalisations

Analyses of diabetes hospitalisations by country of birth are based on the Standard Australian Classification of Countries (SACC) (ABS 1998), and were grouped by seven major regions: Australia, Oceania, North-West Europe, South-East Europe, Africa and the Middle East, Asia and The Americas. Due to small numbers, for some analyses only two groups are used: Australian-born and overseas-born. Hospitalisations for which country of birth is unknown have not been included in the analysis.

Deaths

Analysis of diabetes deaths by country of birth are based on the SACC (ABS 1998), and were grouped by seven major regions: Australia, Oceania, North-West Europe, South-East Europe, Africa and the Middle East, Asia and The Americas. Due to small numbers, for some analyses only two groups are used: Australian-born and overseas-born. Deaths for which country of birth is unknown have not been included in the analysis. Due to small numbers of deaths from diabetes each year, data from the years 2003–2005 have been combined, and year of registration of death has been used for all years.

Prevalence

Self-reported diabetes and risk factor prevalence data was sources from the 2004–05 NHS conducted by the ABS. This survey presented findings on the number of Australians born Australia, Other Oceania, UK, Other North-West Europe, Southern and Eastern Europe, North Africa and the Middle East, South-East Asia, and All other Countries, who reported having ever been told by a doctor or nurse that they had diabetes. These data may underestimate the

true prevalence of diabetes in the Australian community, as those undetected cases of diabetes (that is, where the individual does not know they have diabetes) are not identified in the survey.

Main data sources

AIHW disease expenditure database is a comprehensive database that allows expenditure estimates to be produced by source of funds (that is, Commonwealth, state or private) for each area of expenditure. Utilisation measures such as bed days, separations, number of medical encounters and services and pharmaceutical scripts can also be estimated (AIHW 2005c). There are some key exclusions in the 2004–05 health expenditure data, compared with that presented in previous reports. High level residential aged care expenditure (which was $5,807 million in 2004–05) has now been reclassified out of health expenditure to welfare expenditure. Also note that expenditure by disease for non-admitted hospital services, other health practitioner services (excluding optometry) and over-the-counter pharmaceuticals was unable to be allocated in 2004–05. This means that these data are not comparable with data reported in *Costs of Diabetes in Australia, 2000–01* and *Health system expenditure on disease and injury in Australia, 2000–01*.

This report provides direct health expenditure on diabetes under four categories:

Admitted patient hospital services covering the expenditure on services provided to an admitted patient including expenditure on medical services delivered to private admitted patients in hospitals

Prescription pharmaceuticals including prescriptions subsidised under government schemes (e.g. Pharmaceutical Benefits Scheme) and private prescriptions

Out of hospital medical services comprising medical services funded under the Medical Benefits Scheme, such as primary health visits, pathology and specialist services. Practice Incentive Payments are also included in this category

Research including health socioeconomic research funded by tertiary institutions, private non-profit organisations and government. Commercial research funded by private business is not included.

AIHW National Hospital Morbidity Database contains demographic, diagnostic, procedural and duration-of-stay information on episodes of care for patients admitted to hospital. The data collection is maintained by the AIHW using data supplied by state and territory health authorities. The database is episode-based and it is not possible to count patients individually. In this report, disease data relate to the principal diagnosis reported for hospitalisations unless otherwise specified. Data presented in this report are for the period July 2004 to June 2005, except in the case of trends. It is important to note that new coding standards introduced in 2000 changed the meaning of diabetes complication codes in hospital data from one of causality to the complication appearing with the diabetes. This change may have had an effect on trends (AIHW: Phillips 2003).

AIHW National Mortality Database contains information on the cause of death supplied by the medical practitioner certifying the death or by a coroner. Registration of deaths is the responsibility of the state and territory registrars of Births, Deaths and Marriages. Registrars provide the information to the ABS for coding of cause of death and then provided to AIHW. In this report, unless otherwise specified, death data relate only to the underlying cause of death. Data presented in this report are for the period January to December 2005, as year of death/year of registration.

Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) collects information to monitor dialysis and transplant treatments from all renal units in Australia and New Zealand on all patients receiving kidney replacement therapy where the intention to treat is long term. Cases of acute kidney failure are excluded. The Registry is coordinated within the Queen Elizabeth Hospital in Adelaide.

The Australian Diabetes, Obesity and Lifestyle Study (AusDiab) (1999–2000) conducted by the International Diabetes Institute, was designed to provide national estimates of the prevalence of diagnosed and undiagnosed diabetes. It also provided national measurements of blood pressure, blood lipids, blood glucose, body fat, height and weight, and waist and hip circumference, as well as self-

reported information on cardiovascular disease, anti-hypertensive and lipid lowering medication use, diet, smoking, alcohol consumption, physical activity, and general health and wellbeing. The study collected information in urban and non-urban areas in all states and the Northern Territory for more than 11,000 people aged 25 years and over who underwent a physical examination. This represents a response rate of 37% (Dunstan et al. 2002b).

Analysis of this data by the AIHW included only those people for whom all relevant data were available.

In this report, measured prevalence data on high blood pressure, high blood cholesterol and overweight was obtained from this source.

Australian National Diabetes Information Audit and Benchmarking (ANDIAB), a collection by the National Association of Diabetes Centres (NADC) based on an audit of patients attending a selection of specialist diabetes centres and specialist endocrinologists in private practice. In 2004, ANDIAB reported on 3,108 persons with diabetes requiring specialist clinical management, in particular those who have had poor control of their diabetes. The ANDIAB surveys have been conducted over one month periods since 1998. A limitation of the sample is that it does not accurately reflect the conditions prevailing in the general diabetes population, as people attending diabetes centres are likely to be more severe cases.

Bettering the Evaluation and Care of Health (BEACH) Survey of General Practice—an ongoing national survey looking at aspects of general practice in Australia, is conducted by the General Practice Statistics and Classification Unit (an AIHW collaborating unit within the Family Medicine Research Centre, University of Sydney). BEACH began in April 1998 and involves a random sample of approximately 1,000 GPs per year, each of whom records details regarding 100 consecutive patient encounters.

Drug Utilisation Sub-Committee Database (DUSC)—held at the DoHA, monitors the community (that is, non-public hospital) use of prescription medicines in Australia. This database combines information on prescriptions subsidised by the PBS and the RPBS and an estimate from the Pharmacy Guild Survey of those prescriptions that are not subsided (that is, private prescriptions and PBS prescriptions priced under the general patient co-payment). The Pharmacy Guild Survey collects dispensing information each month from a random sample of about 150 pharmacies throughout Australia. Information on drugs prescribed in public hospitals and on highly specialised drugs available to outpatients through public hospital pharmacies under section 100 of the National Health Act 1953 is not included in the DUSC database.

National Aboriginal and Torres Strait Islander Health Survey 2004–05, collected information relating to Indigenous health—including health status, health action taken, and lifestyle factors—that may influence health. Information was collected from 10,439 Indigenous persons living in both remote and non-remote areas of Australia. This survey covered information similar to the NHS, including health status, health risk factors, long-term conditions, health service use, social and emotional wellbeing and basic demographic information.

Information from this survey is mainly presented in the chapter on population groups (Aboriginal and Torres Strait Islander peoples section).

National Diabetes Register (NDR) is a database that collects information about people who use insulin as part of their treatment of diabetes. It includes data for persons who began to use insulin from 1 January 1999. Data for the register are obtained from two main sources: the National Diabetes Services Scheme, administered by Diabetes Australia, and the APEG state-based registers. APEG registers collect information about children with diabetes aged less than 15 years.

National Drug Strategy Household Survey (2004) includes data on 29,445 Australians aged 12 years and older. This was the eighth survey in a series that began in 1985. The survey is conducted by the AIHW. Respondents were asked about their use of licit and illicit drugs, their attitudes towards drugs and drug taking and their perception of drugs and related behaviours. In this report, self-reported prevalence of tobacco smoking was obtained from this source.

National Health Survey 2004–05, a series of surveys conducted by the ABS, were designed to obtain national information on the health status of Australians, their use of health services and facilities, and health-related aspects of their lifestyle. The 2004–05 survey included 25,906 persons and the 2001 survey collected information from a sample of 26,900 people from February to November 2001. The 1995 survey was considerably larger and collected information from a sample of 57,600 people over a 12-month period from January 1995 to January 1996.

Northwest Adelaide Health Study (NWAHS) conducted during 2000–2003 has been designed to segment a large representative population sample according to stage of disease in order to identify each segment's characteristics and determine how they change over time.

Appendix 2: Diabetes indicator data reference table

Indicator	Chapter	Reference
1. Prevalence of Type 2 modifiable diabetes risk factors over time.		
1.1 Prevalence of overweight and obesity over time 1.1.1 Prevalence of overweight, but not obese 1.1.2 Prevalence of overweight 1.1.3 Prevalence of obesity.	3. Risk factors for diabetes and its complications—Overweight.	How many Australians are overweight? Body Mass index—Prevalence/Trend: 1999–2000 AusDiab (Table 3.2); 1995, 2001, 2004–05 NHS (Fig 3.5). Waist circumference: 1999–2000 AusDiab (Fig 3.6).
1.2 Proportion of people not following guidelines for physical activity over time.	3. Risk factors for diabetes and its complications—Physical inactivity	How many Australians are physically inactive? Prevalence/Trends: 1995, 2004–05 NHS (Fig 3.3).
1.3 Proportion of people not following Australian dietary recommendations over time.	3. Risk factors for diabetes and its complications—Unhealthy diet	Dietary risk factors for diabetes and its complications— Dietary fat intake (whole milk): 2004–05 NHS (Fig 3.4). Dietary fibre intake (fruit and vegetables): 2004–05 NHS (Fig 3.4).
7. The proportion of people with diabetes mellitus (Type 1, Type 2 and gestational) who have had an annual cycle of care).	6. Health service use	Pathology tests at diabetes clinics: 2004, 2006 ANDIAB (HbA1c; lipids-total cholesterol, HDL, LDL, triglycerides; eye examination; microalbumin).
9. The diabetes-related death rate (includes Type 1, Type 2 and gestational) among: The general population	8. Mortality	Diabetes-related deaths: 1997 to 2005 NMD (Fig 8.4, trend).
Aboriginal and Torres Strait Islander peoples People of different socioeconomic status People from different geographic areas People of culturally and linguistically diverse backgrounds	5. Population Groups	Aboriginal and Torres Strait Islander peoples—Diabetes mortality: 2003–2005 NMD (Fig 5.4). Socioeconomic disadvantage—Diabetes mortality: 2003–2005 NMD (Fig 5.7), 2001 to 2005 NMD (Fig 5.8, trend). Geographical location—Diabetes mortality: 2003–2005 NMD (Table 5.7, 5.8); 2000 to 2005 NMD (Fig 5.12, trend). Overseas-born—Diabetes mortality: 2003–2005 NMD (Fig 5.17, Table 5.11), 2000 to 2005 NMD (Fig 5.18, trend).

(continued)

Indicator	Chapter	Reference
11. Prevalence and incidence of diabetes (Type 1, Type 2 and gestational), its complications and comorbidities among: The general population Aboriginal and Torres Strait Islander peoples People of culturally and linguistically diverse backgrounds People of different socioeconomic status People from different geographic areas.		
11.1 Prevalence of diabetes (Type 1, Type 2 and gestational) over time.	2: Diabetes incidence and prevalence	Prevalence of diabetes: Measurement data: 1999–2000 AusDiab (Fig 2.1, 2.2); 2000–2003 NWAHS Self-reported data: 2004–05 NHS (Fig 2.3, 2.4 (trend)) International comparison: IDF 2006 (Fig. 2.5). Type 1 diabetes—Prevalence: 2004–05 NHS; 2006 NDSS; 2005 NDR; 1999–2000 AusDiab. Type 2 diabetes—Prevalence: 1995, 2004–05 NHS (Fig 2.7, 2.8 (trend)); 1999–2000 AusDiab. Gestational diabetes mellitus: 2004–05 NHS.
	5: Population groups	Aboriginal and Torres Strait Islander peoples—Self-reported prevalence: 2004–05 NATSIHS (Fig 5.1). Overseas-born—Self-reported prevalence: 2004–05 NHS. Socioeconomic disadvantage—Self-reported prevalence: 2004–05 NHS. Geographical location—Self-reported prevalence: 2004–05 NHS.
11.2 Incidence of diabetes (Type 1, Type 2 and gestational) over time	2: Diabetes incidence and prevalence	Incidence of diabetes: Estimates from disease register and administrative data: 2003–2005 NDR; 2003 NDSS; 2003–04 to 2004–05 NHMD (Table 2.1) Estimates from cohort study: 2005 AusDiab. Type 1 diabetes—Incidence: 2005 NDR (Table 2.2); IDF 2006 (Fig 2.6). Type 2 diabetes—Incidence: 2005 NDR; 2005 AusDiab. Gestational diabetes mellitus: 2000–01 to 2004–05 NHMD (Fig 2.9).
	5: Population groups	Aboriginal and Torres Strait Islander people—Incidence: population-based study.

(continued)

Indicator	Chapter	Reference
11.3 Prevalence of cardiovascular disease among people with diabetes over time.	4: Complications of diabetes—Cardiovascular disease	How many Australians with diabetes also have cardiovascular disease? Coronary heart disease: 2004–05 NHS; 1999–2000 AusDiab Stroke: 2003 SDAC; 1999–2000 AusDiab Peripheral vascular disease: 2004 ANDIAB.
	5: Population groups	Aboriginal and Torres Strait Islander peoples—Complications, self-reported prevalence: 2004–05 NATSIHS (heart & circulatory problems or disease).
11.4 Incidence of cardiovascular disease among people with diabetes over time.		
11.5 Prevalence of visual loss among people with diabetes over time.	4: Complications of diabetes—Eye disease	How many Australians with diabetes also have eye disease? Diabetic retinopathy: 1999–2000 AusDiab; 2000, 2001, 2002 NDDP; 2004 ANDIAB. Cataracts and Glaucoma: 2004–05 NHS. Blindness: 2004–05 NHS; 2006 ANDIAB.
11.6 Incidence of visual loss among people with diabetes over time.		
11.7 Prevalence of end-stage renal disease among people with diabetes over time.		
11.8 Incidence of end-stage renal disease among people with diabetes over time.	4: Complications of diabetes—Kidney disease	How many Australians with diabetes also have kidney disease? ESRD: 2004 ANZDATA.
	5: Population groups	Aboriginal and Torres Strait Islander peoples—Complications, self-reported prevalence: 2004–05 NATSIHS (kidney disease).
11.9 Prevalence of non-traumatic amputation among people with diabetes over time.		
11.10 Incidence of non-traumatic amputation among people with diabetes over time.	4: Complications of diabetes—Foot complications	How many Australians with diabetes also have foot complications? Lower limb amputation: 2004 ANDIAB.

Glossary

additional diagnosis: A diagnosis established after study to be a contributing factor to or impacting on the patient's episode of care in hospital (or attendance at the health-care facility). Compare with p*rincipal diagnosis*.

albuminuria: More than normal amounts of a protein called albumin in the urine.

angina: Temporary chest pain or discomfort when the heart's own blood supply is inadequate to meet extra needs, as in exercise.

associated cause(s) of death: Any conditions, diseases and injuries—other than the underlying cause of death—considered to contribute to the death. Compare with *underlying cause of death*. See also c*ause of death*.

atherosclerosis: A process in which fatty and fibre-like deposits build up on the inner walls of the arteries, often forming plaques that can then cause blockages. It is the main underlying condition in heart attack, angina, stroke and peripheral vascular disease.

Australian Standard Geographical Classification (ASGC): the ASGC uses the Accessibility/Remoteness Index of Australia (ARIA), which is based on how distant a place is by road from urban centres of different sizes, and therefore provides a relative indication of how difficult it might be for residents to access certain services such as health care and education. Five categories are used in this publication: 'Major cities of Australia', 'Inner regional Australia', 'Outer regional Australia', 'Remote Australia' and 'Very remote Australia'.

blood cholesterol: Fatty substance produced by the liver and carried by the blood to supply the rest of the body. Its natural function is to supply material for cell walls and for steroid hormones, but if levels in the blood are too high it can lead to atherosclerosis and heart disease.

blood pressure: It is the force exerted by blood against the walls of the arteries. The force is created by the pumping action of the heart, at contraction (systolic) and at relaxation (diastolic).

body mass index (BMI): The most commonly used method of assessing whether a person is healthy weight, underweight, overweight or obese. It is calculated by dividing the person's weight (in kilograms) by their height (in metres) squared, that is, kg/m^2. For both men and women, underweight is a BMI of less than 18.5, healthy weight is from 18.5 to less than 25, overweight is 25 or more (includes obese), and obese is 30 or more.

cardiovascular disease: Any disease of the heart or blood vessels, including heart attack, angina, stroke and peripheral vascular disease.

cataract: A cloudy or opaque area in the lens of the eye.

cause of death: The disease or factor contributing to the death. When used technically, this term is usually applied to the 'underlying cause' listed on the medical certificate issued at death according to rules and conventions of the 10th revision of the International classification of diseases. The underlying cause of death is defined as the main disease that initiated the train of events leading directly to death, distinct from associated causes of death which are conditions, diseases or injuries that contributed to the death, directly or indirectly. See also *underlying cause of death* and *associated cause(s) of death*.

cerebrovascular: Of or relating to blood vessels and the supply of blood to the brain. See also *stroke*.

chronic disease: A disease persisting for a long period (at least 3 to 6 months).

complications: Secondary conditions and illness resulting directly or indirectly from another disease or condition.

coronary heart disease (CHD): Heart attack and angina (chest pain). Also known as ischaemic heart disease.

creatinine: A chemical found in the blood and passed in the urine. A test of the amount of creatinine in blood or in blood and urine indicates functioning of the kidneys.

dental caries: Tooth decay.

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 it can have serious short-term and long-term effects on many of the body's systems, especially the blood vessels and nerves. For the different types of diabetes, see *Type 1 diabetes*, *Type 2 diabetes*, *gestational diabetes mellitus (GDM)* and *other types of diabetes*.

dialysis: A method of removing excess waste substances from the blood when the kidneys are unable to work effectively.

disability: When used technically, disability refers to the presence of one or more of a defined set of limitations, restrictions or impairments.

disability-adjusted life year (DALY): A summary statistic to describe years of healthy life lost through disability and/or premature mortality.

encounter (general practitioner): Any professional interchange between a patient and a general practitioner.

endocrinologist: A doctor who treats people who have problems with their endocrine glands. Diabetes is an endocrine disorder.

gestational diabetes mellitus (GDM): A form of diabetes that is defined as glucose intolerance in pregnant women not previously diagnosed with diabetes. GDM is a temporary form of diabetes that usually disappears after the baby is born. Women who have had GDM are at increased risk of developing Type 2 diabetes and GDM increases the risk of perinatal morbidity and mortality. Compare with *Type 1 diabetes*, *Type 2 diabetes* and *other types of diabetes*.

glaucoma: An eye disease associated with increased pressure within the eye.

glomeruli: The primary filtration units of the kidney.

glucose: The main sugar that the body uses for energy. Glucose is a simple sugar that comes from the breakdown of carbohydrates in the diet as well as from the breakdown of glycogen (the storage form of glucose) in the liver. The body requires the hormone insulin to use glucose properly.

HDL cholesterol: Cholesterol packaged in high-density lipoprotein particles. The HDLs are good acceptors of membrane-free cholesterol and transport it back from tissues to the liver.

heart attack: Life threatening emergency that occurs when a vessel supplying blood to the heart muscle is suddenly blocked completely. The event may lead to the death of a part of the heart muscle. The medical term commonly used for a heart attack is myocardial infarction.

heart failure: When the heart cannot pump strongly enough to keep the blood circulating around the body at an adequate rate.

hospital separation: The formal process by which a hospital records the completion of treatment and/or care for an admitted patient. The episode of care may be completed by an admitted patient's discharge, death, transfer to another hospital, or change in the type of care.

hyperglycaemia: High blood glucose levels.

hypertensive: High blood pressure.

hypertriglyceridemia: High levels of triglycerides; a marker of lipid abnormalities.

hypoglycaemia: A low blood glucose level.

impaired glucose tolerance: Slower metabolism of glucose due to insulin deficiency or resistance. Classified as fasting plasma glucose less than 7.0 mmol/L and 2-hour plasma glucose 7.8–11.0 mmol/L after oral glucose tolerance testing (OGTT).

incidence: The number of new cases (of a disease, condition or event) occurring during a given period. Compare with *prevalence*.

insulin: A hormone produced in the pancreas that helps glucose to enter body cells for energy metabolism.

insulin resistance: A condition in which insulin works inefficiently and the body compensates by producing an excess supply.

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

International Classification of Diseases (ICD): The World Health Organization's internationally accepted statistical classification of disease and injury.

ischaemic heart disease: See *coronary heart disease*.

LDL cholesterol: Cholesterol packaged in low-density lipoprotein particles. LDLs carry cholesterol to the various tissues for use.

metabolic syndrome: Also called Syndrome X, is a symptom cluster associated with a high risk of coronary heart disease and stroke. Central to metabolic syndrome is insulin resistance. Other common signs include: impaired glucose tolerance, excessively high blood insulin levels, high blood pressure and abnormal blood cholesterol levels (specifically high levels of *triglycerides* and low levels of *HDL cholesterol*).

morbidity: Refers to ill health in an individual and to levels of ill health in a population or group.

myocardial infarction: See *heart attack*.

nephropathy: A disease of the kidneys.

neuropathy: A disease of the system that results in damage to nerves.

obesity: Increased adiposity or fat mass, associated with several chronic diseases and their risk factors. Technically defined as body mass index ≥ 30, or waist circumference ≥ 102 cm for males or ≥ 88 cm for females.

ophthalmologist: A doctor who sees and treats people with eye problems or diseases.

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. Compare with *Type 1 diabetes*, *Type 2 diabetes* and *gestational diabetes mellitus (GDM)*.

pancreas: An organ that is located behind the lower part of the stomach and produces digestive substances and hormones, including insulin.

periodontal: Refers to the supporting structures of the teeth; including the gums, connective tissue and bone.

peripheral vascular disease: Pain in the legs due to an inadequate blood supply to them.

prevalence: The number or proportion (of cases, instances, and so on) present in a population at a given time. Compare with incidence.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning the patient's episode of care in hospital (or attendance at the health-care facility).

retinopathy: A disease of the small blood vessels in the retina of the eye.

risk factor: Any factor that represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so. Along with their opposites, protective factors, risk factors are known as determinants.

saturated fats: Fats that are solid and are found in the diet mostly from animal sources. In excess, they tend to raise blood cholesterol.

separation: See hospital separation.

Socioeconomic Index for Areas (SEIFA): An area-based measure of socioeconomic disadvantage derived from the social and economic characteristics of a statistical local area (SLA) including income, education and employment. In this report, quintiles of socioeconomic disadvantage are presented: the first quintile represents the most disadvantaged areas; the fifth quintile represents the least disadvantaged areas.

stroke: When an artery supplying blood to the brain suddenly becomes blocked or bleeds. Often causes paralysis of parts of the body normally controlled by that area of the brain, or speech problems and other symptoms.

triglycerides: The more common form in which fats exist in the body in which three lipid (fat) molecules are packaged with proteins and cholesterol and are found in both the blood plasma and adipose (fatty) tissue.

Type 1 diabetes: A form of diabetes marked by a complete lack of insulin and needing insulin replacement for survival. This form of diabetes mostly arises in childhood or in young adults, though it can occur at any age. Adults may develop a slowly progressive form of Type 1 diabetes called Latent Autoimmune Diabetes in Adults (LADA), which can be treated initially without insulin injections. See also *Type 2 diabetes*, *gestational diabetes mellitus (GDM)* and *other types of diabetes*.

Type 2 diabetes: The most common form of diabetes, which is marked by reduced or less effective insulin. 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. See also *Type 1 diabetes*, *gestational diabetes mellitus (GDM)* and *other types of diabetes*.

underlying cause of death: The condition, disease or injury initiating the sequence of events leading directly to death; that is, the primary, chief, main or principal cause. Compare with *associated cause(s) of death*. See also *cause of death*.

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