Determinants: keys to prevention

4

Key points

- Tobacco smoking offers the greatest scope for prevention, closely followed by high blood pressure and overweight/obesity.
- Australia's level of smoking continues to fall and is among the lowest for OECD countries, with the daily smoking rate about one in six adults in 2007.
- About 7.4 million adults were overweight in 2004–05, with over a third of those being obese.
- Illicit drug use in Australia is generally declining, including the use of methamphetamine (the drug group that includes 'ice').
- Most Australians have access to good-quality drinking water, although some remote Indigenous communities have no organised water supply.
- Australia leads among OECD countries in vaccinating older people against influenza.
- Unsafe sexual practices continue, reflected in generally increasing rates of sexually transmitted infections.
- Risk factors account for over 30% of Australia's total burden of death, disease and disability.

The previous two chapters describe Australia's overall levels of health and disease, and the variations among selected population groups. The following two chapters discuss important health conditions and health across life stages, and chapters 7 and 8 outline the activities undertaken to improve our health and the resources used. But why do diseases and other health problems occur in the first place, and, importantly, can we prevent them? This chapter helps to answer these questions by providing statistics on health determinants—the factors that determine how likely we are to stay well or become ill or injured.

The framework for this book (Figure 1.1 in Chapter 1) shows determinants as biomedical and genetic factors, health behaviours, socioeconomic factors and environmental factors. These determinants influence health and wellbeing, and can be influenced by interventions and resources applied to them. Public health activities, for example, seek to modify determinants in the individual or population to improve health and wellbeing (see Chapter 7).

The first part of this chapter presents a conceptual framework for health determinants that illustrates how they can relate to and influence each other, along with health and wellbeing. The chapter then presents information on the main determinants of health, their separate and combined impact on the nation's health, and their levels, patterns and trends.

4.1 What are health determinants?

The health of individuals and populations is influenced and determined by many factors acting in various combinations; that is, health is multicausal. A person's health and functioning—the length and quality of the person's life—are seen as the result of the interactions among human biology, lifestyle and environmental (including social) factors, modified by health and other interventions (see Figure 4.1).

Factors such as tobacco smoking or low socioeconomic status increase the risk of ill health and are commonly termed 'risk factors'. Influences such as a high intake of fruit and vegetables are known as 'protective factors', because they reduce the risk of ill health.

Determinants help explain and predict trends in health, and provide insight as to why some groups have better or worse health than others. They are the crux of disease prevention and health promotion.

For almost all risk and protective factors, the associated effect is not 'all or nothing'. For risk factors, rather than there being one point at which risk begins, there is an increasing effect as the exposure increases. For example, each increment in a person's blood pressure above their 'optimal' level is associated with an increase in the risk of stroke. Depending on the risk factor, the increased risk may be uniform as exposure increases, or it may accelerate or diminish at higher thresholds. Although the increasing risk often starts at relatively low levels, the usual practice when monitoring is to focus on the riskier end of the spectrum. There is also value in monitoring moderate risk, however, to assess trends in the wider population.

Determinants can vary in the 'absolute risk' and 'relative risk' they pose. Absolute risk represents the chance of any person developing or having a particular disease or injury over a specified time period. A high relative risk means that those exposed to a risk factor have a markedly higher chance of developing a disease than those not exposed. For example, the chance of a smoker getting lung cancer is at least 10 times that of a non-smoker. Since lung cancer is, unfortunately, common, this means that smoking poses both a high absolute risk and high relative risk.

Determinants can also vary in how modifiable they are, and this is associated with the potential that any risk or protective factor has to contribute to the prevention of future disease or injury. For example, it is demonstrated throughout this report that age is a major risk factor for many conditions, but it is obviously not modifiable. On the other hand, obesity is also a risk factor for many conditions; yet in the vast majority of cases it can be modified in the individual, and therefore it features in current disease prevention activities.

In addition to influencing the occurrence of new cases of disease or injury, determinants can affect how a disease might worsen or improve, or the nature and extent of complications. The use of health-care interventions can also be regarded as a determinant in that context (see Chapter 7).

As part of their various effects on health, determinants can also influence how individuals function in terms of their activities and participation in society.

A framework for determinants

Determinants are often described as a web of causes, but they can also be thought of as part of broad causal 'pathways' or 'chains' that affect health. Figure 4.1 presents a conceptual framework that illustrates some of the complexity involved. It divides determinants into four broad groups whose main direction of influence goes from left to right—that is, from the 'upstream' background factors (such as culture and affluence) through to more immediate or direct influences (such as blood pressure).

The figure shows how one main group—the broad features of society and environmental factors—can determine the nature of another main group; that is, people's socioeconomic characteristics such as their level of education and employment. Both these main groups also influence people's health behaviours, their psychological state, and factors relating to safety. These in turn can influence biomedical factors, such as body weight and glucose metabolism, which may have health effects through various further pathways.

At all stages along the path these various factors interact with an individual's genetic composition. In addition, the factors within a box often interact and are closely related to each other.

Despite the general direction of these influences, they can occur in reverse. For example, an individual's health can also influence physical activity levels, employment status and wealth.

Five of these clusters of determinants are described in the major sections of this chapter. A summary of the remaining four, with some related statistics, follows here.

Broad features of society

The broad features of society affect the whole population to some extent, combining to influence the basic levels of security, safety, hygiene, nourishment, technology, information, freedom and morale of societies. These broad features set the background level around which variations then occur among groups and individuals. Despite their widespread influence, it is difficult to quantify most of these broad factors, and their impact cannot be precisely assessed.

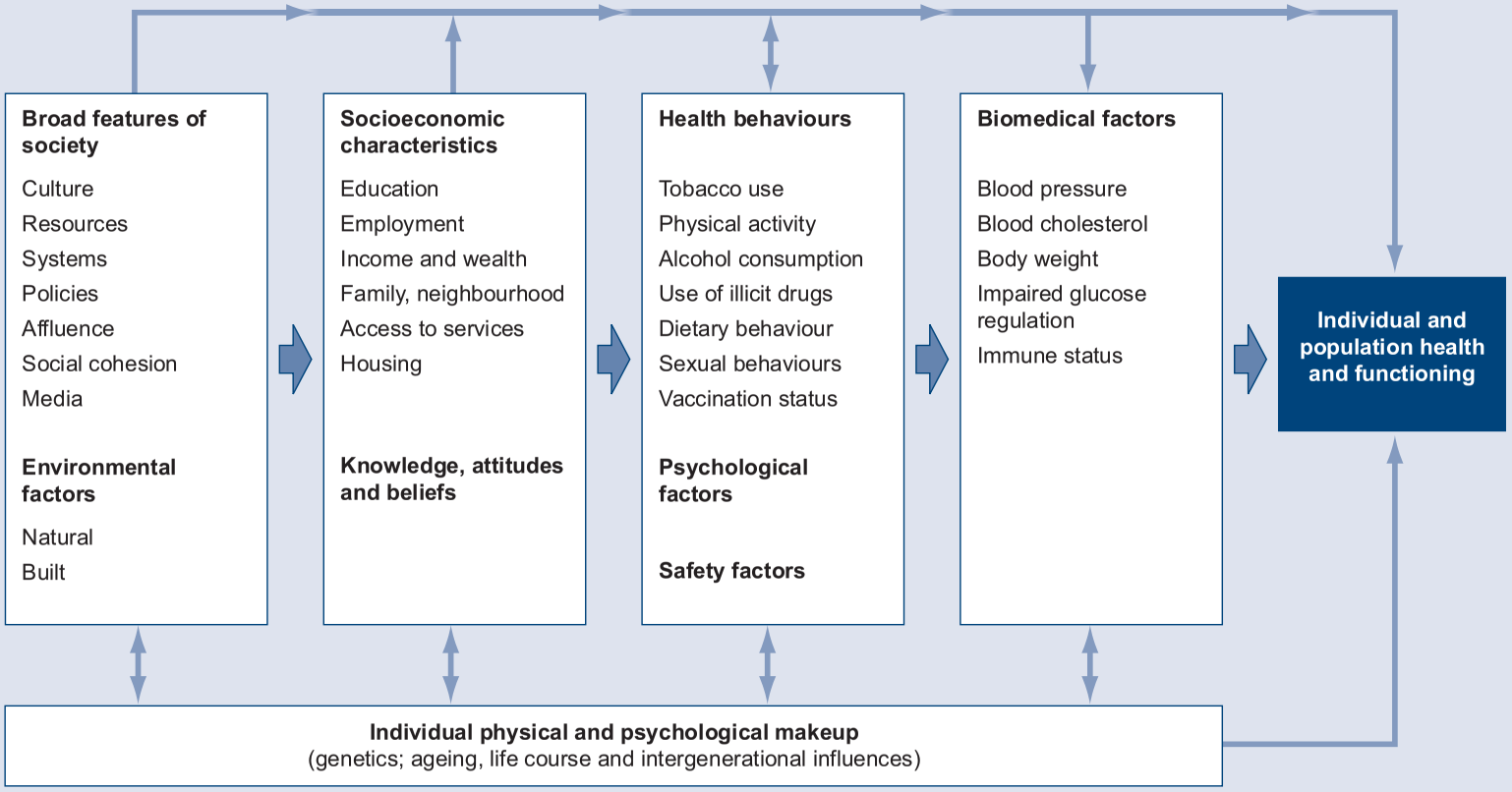
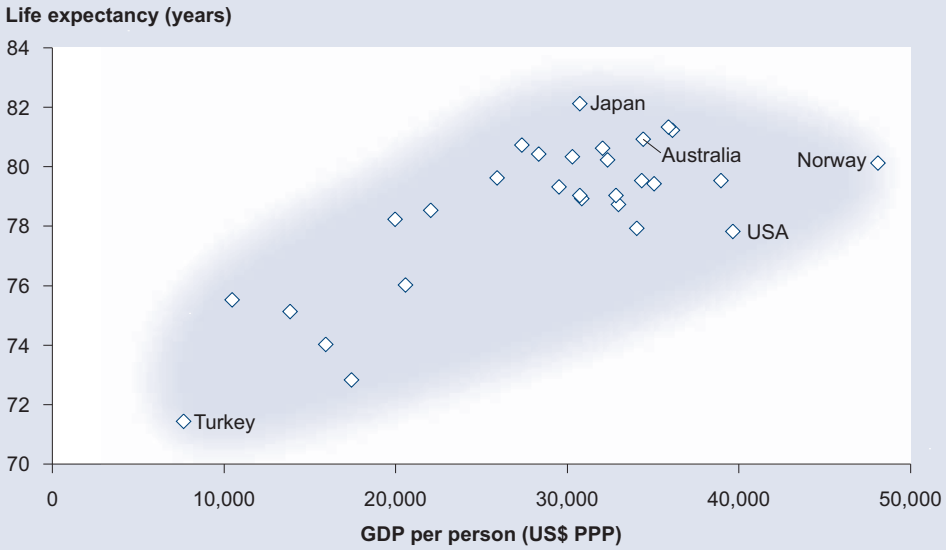


Figure 4.1: A conceptual framework for determinants of health

Included in these general background factors are affluence and social cohesion. The general wealth of a country, or its affluence, tends to be correlated with the health of its inhabitants. For example, among OECD countries in 2005–06 there was a generally positive relationship between per person gross domestic product and overall life expectancy at birth (Figure 4.2).



Notes

1. Excludes Luxembourg.
2. GDP per person (US$ PPP) is the gross domestic product expressed as purchasing power parity in US currency.

Source: OECD 2007.

Figure 4.2: Relationship between per person gross domestic product and life expectancy at birth, OECD countries, 2005–06

Social cohesion refers to the connections and relations among individuals, groups and associations in society. It is reflected in the levels of social and civic trust, the degree of community and civic engagement, and the extent to which people access social and support networks. For example, the Australia Bureau of Statistics (ABS) estimates that in 2006 just over half (54%) of adult Australians felt that 'most people can be trusted' (ABS 2007a). In terms of community engagement, 34% of adult Australians had been engaged in voluntary work in the previous 12 months. Another measure of community engagement is donating: in 2006, around three-quarters of adults had donated money to non-profit organisations (ABS 2007a).

Psychological factors

A person's psychological state and behaviour clearly affect each other and both can in turn lead to biomedical changes or disease. Diseases such as asthma, for example, are believed to be often influenced by psychological factors (AIHW: Australian Centre for Asthma Monitoring 2003). There is also evidence suggesting that depression, social isolation and a lack of quality social support can directly lead to problems such as heart disease, independent of any intermediary behavioural effects such as smoking or poor diet (Bunker et al. 2003).

Safety factors

Safety factors arise from aspects of the built and natural environment (for example, road and traffic conditions), personal behaviours (such as wearing of seatbelts), and policies (for example, regulations about product safety). They are in turn influenced by other determinants such as education, knowledge and attitudes. Safety factors are reflected in perceptions of harm and in actual harm.

In 2005, most adult Australians (95% of men and 83% of women) felt safe if alone in their own home at night (ABS 2006a). However, an estimated 6.2% of households experienced at least one household crime in the 12 months before the 2005 National Crime and Safety Survey, and an estimated 841,500 people aged 15 years and over were victims of at least one personal crime (ABS 2006b).

Individual makeup

Determinants act on and are influenced by an individual's physical and psychological makeup, which can greatly modify a person's response to other new or continuing determinants. This makeup can be seen as the complex product of a person's genes, their ageing, and physical or social influences at various stages over their life course. These factors can be built into a person's makeup for various periods, or for life. Some diseases, such as muscular dystrophy, result entirely from a person's genetic features, whereas most others reflect the interaction between those features and the many other influences mentioned here.

How much of the burden of disease is due to health determinants?

Later in this chapter, information is presented for specific determinants. The population health impact of individual risk factors varies, depending not only on their prevalence in the population, but also on their relative effects in contributing to disease and death. The disability adjusted life year (DALY) measure provides a means of directly comparing the effects of each determinant, because it deals with disability and death on the same terms, hence assessing the total contribution to the burden of disease (see also Chapter 2). In a major study (Begg et al. 2007) this method was applied to attribute burden to 14 risk factors in Australia. It estimated that tobacco smoking caused the greatest burden of disease among these risk factors in 2003, followed by high blood pressure and overweight/obesity (Table 4.1).

However, the total contribution of the studied determinants is not simply the sum of the individual contributions, because they can occur together in the same person, they can occur in various combinations, and they are known to interact. To take this overlap into account, their 'joint effects' were analysed. This resulted in an estimate that 32% of the total burden of disease was due to the studied determinants (Begg et al. 2007).

Table 4.1: Proportion of total disease burden attributed to determinants of health, 2003 (per cent)

Determinant	Males	Females	Persons
Tobacco smoking	9.6	5.8	7.8
High blood pressure	7.8	7.3	7.6
Overweight/obesity	7.7	7.3	7.5
Physical inactivity	6.4	6.8	6.6
High blood cholesterol	6.6	5.8	6.2
Alcohol			
Harmful effects	4.9	1.6	3.3
Beneficial effects	–1.1	–0.9	–1.0
Net effects	3.8	0.7	2.3
Low fruit/vegetable consumption	2.7	1.5	2.1
Illicit drugs	2.7	1.2	2.0
Occupational exposures	2.6	1.3	2.0
Intimate partner violence	n.a.	2.3	1.1
Child sexual abuse	0.3	1.5	0.9
Urban air pollution[(a)]	0.8	0.7	0.7
Unsafe sex	0.5	0.7	0.6
Osteoporosis	<0.1	0.3	0.2
Joint effect[(b)]	**35.1**	**29.1**	**32.2**

n.a. Not available.

(a) Estimate for long-term exposure; an additional 0.3% is attributable to short-term exposure.

(b) Estimate of the joint effect of all studied determinants, taking into account the overlapping effect among determinants on causal pathways.

Source: Begg et al. 2007.

4.2 Environmental factors

Environmental factors include many physical, chemical and biological conditions and agents that may affect human health, both positively and negatively.

Clean air, water and food, and safe human-made environments benefit the health and wellbeing of individuals and communities. On the other hand, the natural environment and natural disasters can be harmful, as can human-caused changes such as poor urban design, land degradation, freshwater depletion and climate change.

Environmental influences on health can be direct or indirect, obvious or subtle, straightforward or complex, and immediate or delayed. Hence it is challenging to assess the full scope and size of the harmful effects that the environment can have on health. These effects include:

- diseases due to microbial contamination of food or water
- vectorborne diseases transmitted by insects such as mosquitoes
- respiratory and heart diseases due to air pollution and to chemicals in workplaces

- other consequences of chemical toxicity
- damage from noise and heat
- injuries due to poorly designed home or workplace environments or traffic systems
- effects on ecological systems (and consequently human health) associated with climate change.

Of these various effects, only urban air pollution is included in the burden of disease analysis described above, mainly because of the complexities and uncertainties in applying that type of analysis to environmental factors.

The following sections present information on selected natural and human-made environmental factors.

Food quality

Foodborne illness is a considerable burden on Australian society, costing an estimated $1.2 billion dollars annually (Abelson 2006). Contamination of food anywhere in the food chain from 'paddock to plate' can lead to foodborne illness. An estimated 4–7 million cases of foodborne infection (gastroenteritis) occur annually in Australia (Hall et al. 2005), and foodborne infectious illnesses other than gastroenteritis can also occur. Although various pesticides and other non-natural contaminants can also be found in some foods, studies have consistently shown that Australian dietary exposures to pesticide residues and contaminants are well below Australian or international reference health standards and do not represent a major public health and safety risk (FSANZ 2005).

Poor hygiene and temperature control, as well as contamination at any point in the chain of food production or consumption, can potentially lead to illness. Preventing foodborne illness relies on a complex system of regulation, increasingly based on assessing risks associated with food businesses. Food safety also depends on kitchen hygiene levels, including in households.

Foodborne infections

Foodborne pathogens that commonly cause gastroenteritis in Australia include the bacteria *Campylobacter* and *Salmonella*, and viruses such as noroviruses. Sometimes the illness is part of a recognised 'outbreak', with a known or unknown food source responsible for infecting a number of people. In 2006, there were 115 foodborne disease outbreaks recorded in Australia (Table 4.2). These outbreaks affected 1,522 people, 146 of whom were hospitalised; there were no recorded deaths from foodborne disease in 2006 (OzFoodNet 2007).

Table 4.2: Foodborne disease outbreaks, number of outbreaks and persons affected, 2006

Agent category	Number of outbreaks	Persons affected	Average outbreak size (persons)	Hospitalised	Deaths
Campylobacter sp.	4	67	17	4	—
Ciguatera	7	30	4	8	—
Clostridium perfringens	6	199	33	—	—
Hepatitis A	1	10	10	1	—
Histamine poisoning	4	12	3	7	—
Norovirus	11	369	34	4	—
Salmonella typhimurium	25	258	10	76	—
Salmonella other	16	209	13	31	—
Staphylococcus aureus	1	3	3	—	—
Sodium nitrite	1	6	6	6	—
Vibrio cholerae	1	3	3	2	—
Unknown	37	342	9	7	—
Total	115	1,522	13	146	—

Source: OzFoodNet 2007.

Data from the OzFoodNet outbreak register indicate that fish was the food most commonly associated with outbreaks in 2006. Poultry and mixed meat dishes as well as eggs and water were also implicated as the cause in a number of outbreaks. Increasingly, fresh produce is being implicated as the cause of outbreaks, particularly salads, fruit juice, and sprouts (Dalton et al. 2004).

In Australia, notification rates for potentially foodborne infections have increased over recent decades. This is partly because of more complete reporting and improved laboratory capacity to identify pathogens, but is probably also due to changed behaviours—people are eating more takeaway and pre-prepared meals that may pose higher risks if not well prepared. Australia has well-regulated hygiene standards in the food production industry, but the increased scale of production, processing and distribution in recent decades has increased the potential for widespread outbreaks of foodborne infection (Kirk et al. 2004).

Air pollution

Many human activities pollute the outdoor air with potentially harmful substances. Notable examples are motor vehicle transport, mining, energy production and agriculture. Indoor pollution arises from activities such as cooking, heating and tobacco smoking, as well as from harmful odours and micro-organisms. Environmental events such as bushfires are also significant contributors to air pollution.

The health effects of air pollution range from mild and temporary respiratory symptoms through to asthma, cardiovascular conditions, chronic lung disease, and premature death (Table 4.3). Air pollutants are particularly harmful to the very young, the elderly, and people with chronic respiratory or cardiovascular diseases.

By international standards the quality of air in Australia is good (Manins et al. 2001). However, long-term exposure to air pollution is estimated to account for 0.7% of the total burden of disease and injury in Australia (Begg et al. 2007). Pollution from motor vehicles alone has been estimated to account for up to 4,500 cases of respiratory and cardiovascular disease and up to 2,000 premature deaths annually (BTRE 2005).

Table 4.3: Sources and health effects of major air pollutants

Pollutant	Sources	Health effects
Particulate matter	Motor vehicles, wood burning, power plants, bushfires, construction, wind-blown dust, tobacco smoke	Aggravates respiratory diseases; irritates upper airways and eyes; increases risk of death from chronic respiratory and cardiovascular diseases
Ozone	Volatile organic compounds and nitrogen oxides in the presence of sunlight	Aggravates respiratory diseases; decreases lung function; irritates airways
Carbon monoxide	Motor vehicles, wood burning, tobacco smoke	Aggravates cardiovascular disease; affects mental function
Nitrogen dioxide	Motor vehicles, power plants, industry, gas heaters, gas stoves, tobacco smoke	Aggravates respiratory diseases; decreases resistance to infection
Sulphur dioxide	Power plants, tobacco smoke	Aggravates respiratory diseases; irritates eyes and throat; can damage lungs
Lead	Leaded petrol (before 2001), lead smelters, tobacco smoke	Affects neurological developmental in children; can damage nervous system

Sources: BTRE 2005; DEH 2004; Katsouyanni 2003.

Australia's Environment Protection and Heritage Council has set National Environment Protection Measures (NEPMs) for particulate matter (inhalable particles with diameters of up to 10 microns (PM10) or less than 2.5 microns (PM2.5)), carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone and lead. Levels of these pollutants are regularly measured at several sites around Australia and reported in terms of the number of days per year when the average concentration exceeds the NEPM standard. Ozone is measured as an indicator of the amount of photochemical smog (as opposed to stratospheric ozone that protects us from excessive ultraviolet light). It is not a directly emitted pollutant but is formed in a reaction between volatile organic compounds and nitrogen oxides under sunlight.

Of the major air pollutants, current levels of ozone and particulate matter are of most concern and require continual monitoring. The number of days per year in which the concentration of PM_{10} exceeded the NEPM standard level of 50 micrograms per cubic metre was generally higher in Sydney and Melbourne than in the other major capital cities during the period 2001–2005 (Table 4.4). Perth was the only city which did not exceed the maximum allowable 5 days per year of excessive PM_{10}. Ozone concentrations exceeding 0.10 parts per million were more frequent in Sydney than in the other major capital cities. During this period, Adelaide and Perth were the only cities that did not exceed the maximum allowable 1 day per year of excessive ozone; no obvious trend of increase or decrease in ozone levels occurred for any of the capital cities.

Table 4.4: Days exceeding the ambient air quality NEPM standard levels for PM_{10} and ozone, major capital cities, 2001–2005

Measure/location	2001	2002	2003	2004	2005
Number of days when concentration of PM_{10} exceeded 50 µg/m³ (over 24 hours)[a]					
Sydney	5	17	10	2	2
Melbourne	2	6	13	11	9
Brisbane	1	7	2	2	2
Perth	1	2	1	1	3
Adelaide	—	1	6	4	6
Number of days when concentration of ozone exceeded 0.10 ppm (over 1 hour)[b]					
Sydney	9	2	4	7	6
Melbourne	—	—	2	1	—
Brisbane	—	2	—	—	—
Perth	—	—	—	1	—
Adelaide	—	—	—	—	—

(a) The maximum allowable number of days exceeding this level (50 micrograms per cubic metre) is 5 days per year, to be achieved by 2008.

(b) The maximum allowable number of days exceeding this level (0.10 parts per million) is 1 day per year, to be achieved by 2008.

Note: Numbers are based on the monitoring site with the most number of days exceeding the standard.

Sources: Environmental Protection and Heritage Council 2007.

Compared with outside air pollution, indoor air pollution is not well monitored, even though most Australians spend the vast majority of the time indoors. Indoor air pollutants include combustion by-products (especially nitrogen dioxide and particulate matter), volatile organic compounds, tobacco smoke, fibres and biologicals (for example dust mites, pet dander, moulds). Many factors influence the levels of indoor air pollution, including the building's location, design, constituent and content materials, and the number and activities of its inhabitants. Other factors, such as lifestyle, climate, ventilation and proximity to pollution sources will influence the amount of pollution entering the building from outside.

Water quality and supply

Access to a safe and adequate supply of water is a fundamental requirement for good personal and public health. This includes both drinking and recreational waters. As the term implies, 'drinking water' is water that is intended for human consumption; but in practice it also includes water used for other domestic purposes such as washing, since the source is usually the same. Recreational waters include swimming pools, lakes, rivers and so forth.

Drinking and recreational waters in Australia are generally of a very high standard. Contamination is rare, especially in and around major population centres. In addition, the fluoridation of tap water delivers public health benefits by reducing the incidence of dental caries (Box 4.1). However, the potential for harm caused by various chemicals and micro-organisms in the water requires constant surveillance and monitoring. There is also growing pressure on the availability of fresh water supplies in some regions, particularly in times of drought.

Box 4.1: Populations with access to fluoridated drinking water

Adjusting fluoride in drinking water to an optimal level is the most effective public health measure for preventing dental decay. In Australia, the optimal range for fluoridated drinking water is between 0.7 parts per million and 1.1 parts per million. Darwin has adopted 0.6 parts per million because of its climate and associated difference in water consumption patterns. Almost 70% of Australians live in areas where the public water supply meets these requirements (*NHPC indicator 2.02*). High percentages in most states and territories reflect the fact that their capital cities are fluoridated. The exception is Queensland, where Brisbane and most regional centres are presently not fluoridated. Nevertheless, compared with other OECD countries, Australia rates highly in the proportion of population with access to fluoridated drinking water and in preventing dental caries.

Sources: Armfield 2006; NHPC 2004.

Access to fluoridated drinking water, 2001

State/territory	Per cent of population[(a)]
NSW	89.8
Vic	75.3
Qld	4.7
WA	90.1
SA	82.6
Tas	94.7
ACT	100.0
NT	84.2

(a) Percentage of state/territory population in 2001 living in areas with optimal levels of fluoride in public water supplies. Optimal fluoride levels from natural or engineering sources are at concentrations of 0.7 parts per million or more, except for the Northern Territory where the optimal concentration is 0.6 parts per million or more.

Water quality

Safe water quality depends on controlling the concentrations of potentially harmful chemical and microbial contaminants. Drinking or bathing in contaminated water can result in health effects ranging from irritated eyes, skin and throat, to mild gastroenteritis, to more severe diarrhoea and potentially life-threatening dysentery, hepatitis and cholera. Some chemical contaminants are suspected of causing cancer.

Numerous chemicals (such as lead, copper, cyanide, arsenic, nitrate and fluoride) may contaminate water as a result of natural processes and the corrosion of pipes and fittings. Chemical contamination may also occur from human activities involving, for example, agricultural herbicides, pesticides, and disinfection by-products (especially chlorine).

In some parts of Australia, drinking and recreational water quality may be affected by cyanobacterial (blue-green algae) blooms and their toxins, resulting from increased nutrient levels, warm water temperatures and reduced water flows.

A broad range of viruses (for example adenovirus, hepatitis viruses, and rotaviruses), bacteria (for example *E. Coli*, *Enterococci*, *Campylobacter* and *Salmonella*) and protozoa (for example *Cryptosporidium* and *Giardia*) can be transmitted by contaminated water supplies. The presence of harmful microbes in drinking water is due mainly to contamination by human or animal faeces. The quality of natural recreational water bodies may be affected by discharges of sewage, stormwater and agricultural runoff; risks to swimming pool water quality arise from microbial contaminants originating from bathers themselves.

The 2004 Australian Drinking Water Guidelines encourage the adoption of standards that emphasise a multibarrier approach within a 'catchment-to-tap' risk assessment framework (NHMRC & NRMMC 2004). Barriers may include protection of source waters, prolonged

storage to reduce contaminant levels, filtration and disinfection, and maintaining the physical integrity of the distribution system. These guidelines are voluntary but have been adopted by several jurisdictions, which periodically report the results of monitoring.

Almost universally in Australia, water supplies meet the standards for chemical contamination and for key microbes (*E. Coli*, *Cryptosporidium* and *Giardia*). In 2005–06, all major water utilities supplying water to capital cities reported full compliance with microbiological and chemical contamination standards (Water Services Association of Australia 2007). Very high levels of compliance are observed in other regions as well. For example, safe levels of *E. Coli*—which are often used as an indicator for faecal contamination—were met by over 95% of water localities in Victoria in 2005–06 (Victorian Department of Human Services 2007).

Most Australians have access to good-quality drinking water, and disease outbreaks from public water supplies are rare. However, the 2006 Community Housing and Infrastructure Needs Survey found that 9 of the 1,187 discrete Indigenous communities surveyed had no organised water supply, compared with 21 communities in 2001 (ABS 2002, 2007b); 8 of these 9 communities were in Very Remote areas. Out of 164 Indigenous communities not connected to a town water supply and which had their water tested, 48 (with a combined population of about 12,000 people) had drinking water that failed testing (ABS 2007b). Also, recreational water activities, particularly in coastal regions, have been linked to incidences of intestinal, respiratory, skin, ear and eye conditions (Queensland Health 2001). Public swimming pools have been the source of a small number of outbreaks of cryptosporidiosis in recent years.

Besides drinking and recreational water, waterborne diseases can be spread through inhalation, food ingestion, and person-to-person contact. This makes it difficult to attribute drinking or recreational water as the source of an illness, particularly when symptoms tend to be similar and when there is a lag between initial exposure and illness. For example, swimming in contaminated water is likely to be responsible for over 50% of cases of cryptosporidiosis reported over the summer (NSW Health 2006); but various other modes of transmission are also possible, and many of the cases notified through the National Notifiable Diseases Surveillance System (3,209 reported in 2005) are likely to be caused by person-to-person contact.

Water supply

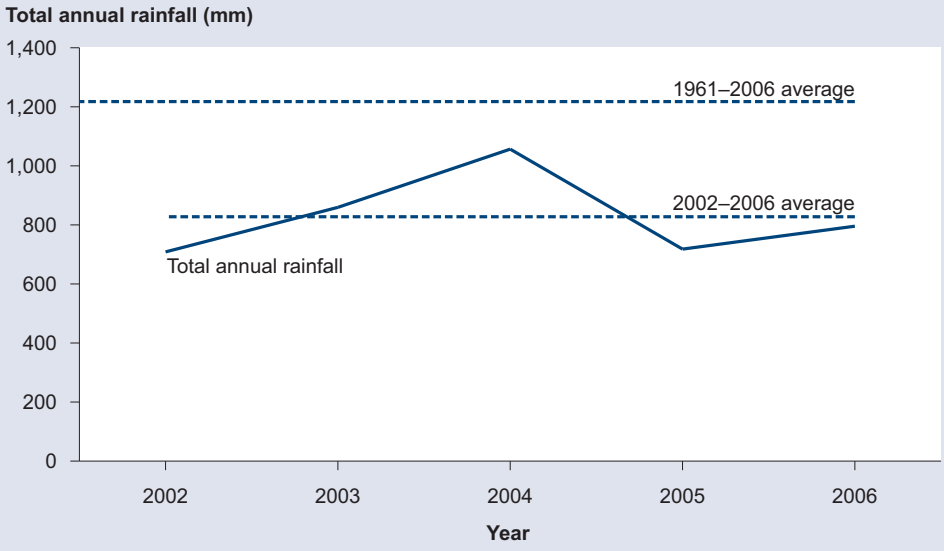
Less than 10% of the fresh water consumed in Australia is for domestic purposes, the rest being for agriculture, commerce and industry (Beeton et al. 2006).

About 93% of Australian households are connected to mains water supplies, and over 80% use mains water as their primary source of drinking water. Other important sources of drinking water are rainwater tanks (11% of households), particularly in rural areas, and bottled water (8% of households) (ABS 2005).

Droughts affect the water supply of major population centres to various extents. For example, Darwin's average total annual rainfall for the 5 years between 2002 and 2006 was just under 5% less than the average between 1961 and 1990. In contrast, Brisbane's rainfall over the same period was 32% down from the long-term average (Figure 4.3), resulting in Brisbane's water storage capacity dropping steadily from 64% in early 2004 to 17% in mid-2007; but more recent rainfall along with tight water restrictions saw dam levels restored to around 33% in early 2008 (SEQWater 2008).

Although short-term averages can vary greatly and should be treated with caution, such dramatic short-term declines, combined with growing populations, have led to low dam and reservoir levels and the introduction of water restrictions in many areas.

With concerns that pressures on the drinking water supply will continue to grow, supplementary supplies, such as recycling and desalination, have been proposed by several jurisdictions.



Source: Bureau of Meteorology 2007.

Figure 4.3: Annual rainfall in Brisbane, 2002–2006

Environmental changes, climate and health

Illness and death associated with environmental hazards such as extreme temperature, natural disasters, famine, poor air and water quality, and vectorborne diseases are much less common in Australia than in developing countries. This is largely because resource-rich communities usually adapt to environmental hazards despite the increasing pressure those same communities place on environmental systems in the pursuit of modern living. However, there are growing concerns that large-scale changes to the environment will expose Australians to a range of unfamiliar or amplified hazards. This may be of particular concern for vulnerable groups, such as Indigenous Australians and the elderly.

It is widely recognised that human activities are having an increasing impact on many environmental systems, including the global climate system (IPCC 2007a; Reid et al. 2005). Corvalan et al. (2005) note that environmental changes that may directly or indirectly affect human health and wellbeing include:

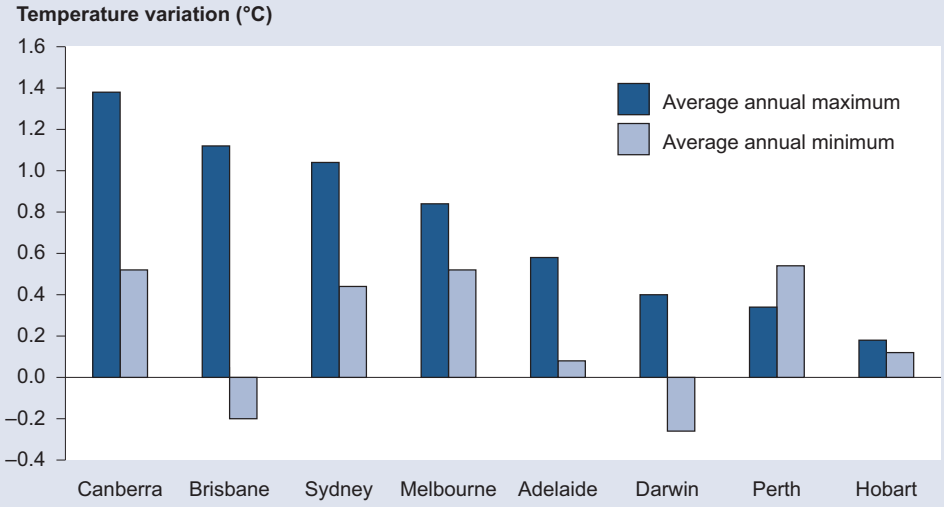
- depletion of stratospheric ozone
- deforestation
- land degradation

- loss and damage to wetlands
- loss of biodiversity
- depletion and contamination of fresh water
- urbanisation.

Some of these changes may be experienced at a local level and have local impacts. Others are likely to have global and long-term impacts, and most are interrelated and may influence or be influenced by climate change.

Climate change

In 2007, Working Group 1 of the Intergovernmental Panel on Climate Change stated that 'warming of the climate system is unequivocal' (IPCC 2007a). Since 1900, there has been a 0.7–0.8° Celsius rise in the global annual average temperature, with the annual average temperature in Australia rising by about 0.9 °Celsius since 1910 (Bureau of Meteorology 2007) (Figure 4.4). The year 2005 was the warmest in Australia since reliable records began in 1910 (Bureau of Meteorology 2006).



Source: Bureau of Meteorology 2007.

Note: Columns represent the difference in average annual maximum/minimum temperatures for the period 2002–2006 compared with the period 1961–1990. For example, the average annual maximum temperature for Canberra in the period 2002–2006 was nearly 1.4 °C warmer than the average in the period 1961–1990.

Figure 4.4: Average temperatures in capital cities: 2002–2006 compared with 1961–1990

Rising temperatures worldwide ('global warming') are expected to affect other aspects of the global climate by altering wind patterns, sea levels, and the frequency and/or intensity of extreme weather events such as heatwaves, droughts, floods and tropical storms (IPCC 2007a).

Although some effects of climate change and other environmental changes may be beneficial (such as increased crop yields or displacement of disease-carrying animals and insects in some areas), most are expected to be harmful, and are further discussed below.

Health effects of climate change

In general, it is difficult to measure or forecast with any precision how environmental conditions or hazards affect human health. The links often involve indirect and complex relationships and effects that are often delayed or displaced (Corvalan et al. 2005; Preston & Jones 2006). This is particularly true of health effects caused by or associated with large-scale and complex environmental changes, including climate change. However, recent research provides some idea of the effects of changes to the climate and environment on human health and wellbeing.

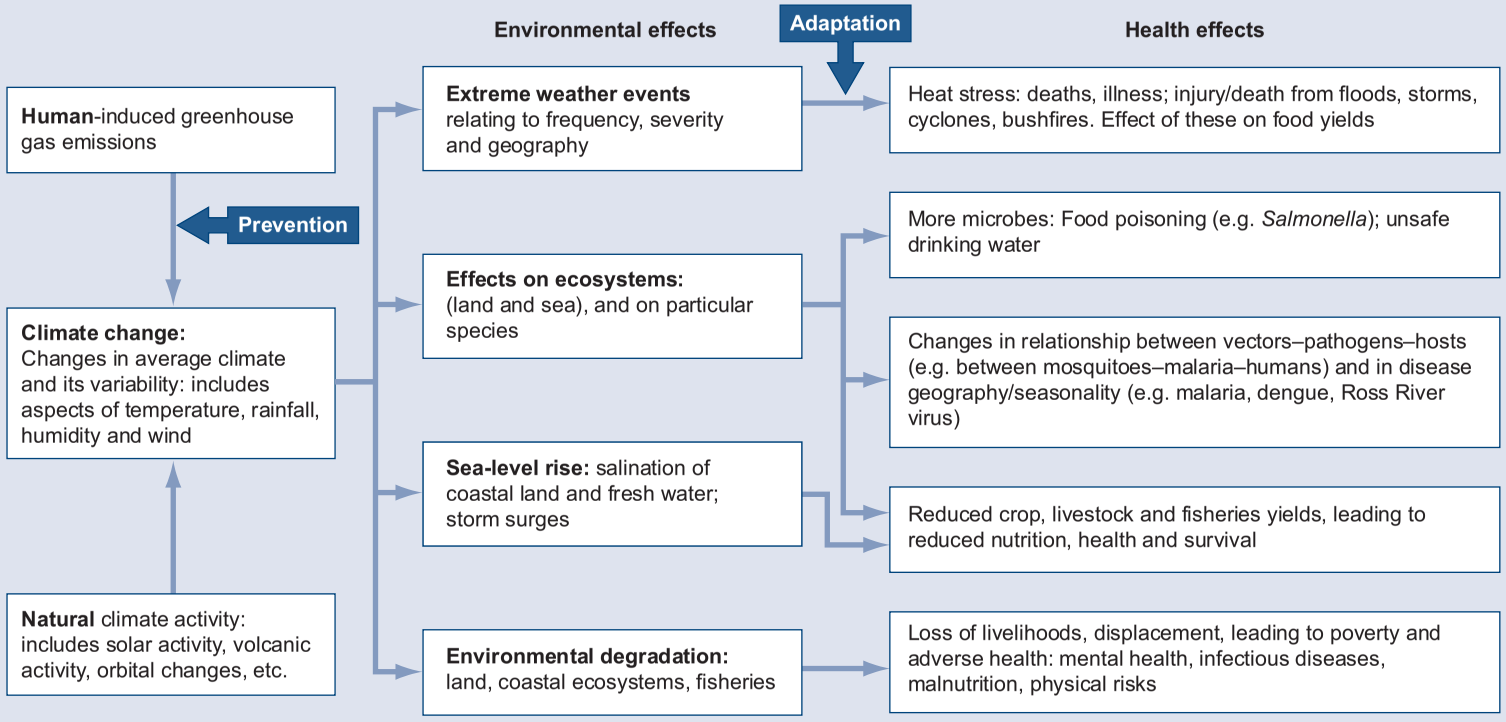
Direct risks to health from climate change and other environmental changes include those from heatwaves, bushfires, severe storms, floods and landslides (Corvalan et al. 2005; IPCC 2007b; McMichael et al. 2006; Preston & Jones 2006). Indirect effects from damaged or overstressed environmental systems may include increased exposure to ultraviolet light, air pollutants, airborne allergens and contaminated food and water. Other indirect effects include malnutrition among some groups (because of reduced availability or increased cost of some foods, such as vegetables and fish) and mental health problems arising from loss of livelihood, especially among rural workers (Corvalan et al. 2005; McMichael et al. 2006).

Climate change and other environmental changes may also affect health and wellbeing through population displacement (for example, immigration from badly-affected regions), and loss of sources of natural medicines (Corvalan et al. 2005; McMichael et al. 2006).

Infectious diseases may become more common in Australia because of changes in populations and distribution of pathogens, disease vectors, and non-human hosts. Epidemic polyarthritis is the most common vectorborne disease in Australia and is caused by infection by Ross River virus (2,544 reported cases in 2005) or Barmah Forest virus (1,319 reported cases in 2005). Increases in populations of mosquito species that transmit these and other diseases, such as encephalitis and dengue fever, are influenced by climatic factors, including temperature, rainfall, humidity and high tides (Peng & Parton 2003, Peng et al. 2004). Although it is difficult to predict accurately how the prevalence or distribution of vectorborne diseases will be affected by climate change, several models suggest that mosquitoes, if not controlled, will probably spread some of these diseases more widely (Woodruff et al. 2005).

Figure 4.5 summarises the main pathways by which climate change can affect population health, and suggests that interventions (shown as 'adaptation' in the figure) can reduce health damage.

To date there is no systematic attempt in Australia to monitor climate and health in a way that may show their relationship. The complex chains of effect mean there would be great uncertainty in showing that climate change over time—not just a particular climate event—has caused ill health in any particular individual. However, it may well be possible to show effects at a population level.



Note: Prevention refers to ways of reducing greenhouse gas emissions. Adaptation (a form of late primary prevention) entails interventions to reduce health damage.

Source: Adapted from McMichael et al. 2006.

Figure 4.5: Main pathways by which climate change affects population health

4.3 Socioeconomic characteristics

As indicated in Figure 4.1, socioeconomic factors play an important—albeit relatively 'upstream'—role in influencing the health of individuals and populations. The nature and degree of different levels of health associated with differing levels of socioeconomic resources is further described in Chapter 3. In short, people or groups who are socially and economically disadvantaged tend to have worse health across the vast majority of conditions (Glover et al. 2004; AIHW: Mathers 1994).

Yet the relationships between socioeconomic characteristics and health status are not simple. As noted above, people who are disadvantaged have poorer health than those with some social or economic advantages. In turn, illness or disability can contribute to unemployment or exit from the labour force (the 'health selection effect'), which generally results in reduced income. Health problems can also impair ability to continue or succeed in education.

The association between health status and a given socioeconomic factor can also be affected by the relationships between different factors. For example, people with a high level of education are more likely than others to be employed in a white-collar or professional job, and people in such occupations tend to have higher incomes than unskilled workers. Therefore some of the connection between income and health is due to the indirect effects of education and occupation.

A further possible mechanism behind these relationships is the existence of features common to health status and various socioeconomic characteristics. For example, one theory is that people who have advantages are more prepared to defer immediate pleasures so they can do better in the long term—whereas those who are disadvantaged are less likely to do so. If they are less likely to invest time and effort in, say, education, then they may also be less likely to engage in healthy behaviours or avoid health risks. This can be illustrated with smoking rates: as socioeconomic status improves the prevalence of smoking decreases (Table 4.5).

Table 4.5: Smoking status by selected socioeconomic characteristics, persons aged 14 years or over, 2007 (per cent)

Characteristic	Never smoked[a]	Ex-smokers[b]	Current smokers[c]
All persons	55.4	25.1	19.8
Education			
Without post-school qualifications	57.5	21.5	21.0
With post-school qualifications	53.4	27.9	18.8
Socioeconomic status (SES)[d]			
Group 5 (lowest SES)	49.5	24.6	25.9
Group 4	53.0	25.3	21.7
Group 3	55.9	24.0	20.1
Group 4	57.0	25.0	17.9
Group 1 (highest SES)	59.3	27.4	13.4

(a) Never smoked more than 100 cigarettes or equivalent amount of tobacco in lifetime.

(b) Smoked at least 100 cigarettes or equivalent amount of tobacco in lifetime, but no longer smoke.

(c) Smoke daily or less often.

(d) In this table those with the 'lowest' SES are living in the 'worst-off' fifth of Australia's 37,000 ABS Census Collection Districts and the 'highest' are in the 'best-off' fifth. Derived from the SEIFA 4—see Box 3.1.

Source: Preliminary data from the 2007 National Drug Strategy Household Survey.

This section provides details on a number of socioeconomic characteristics that have been shown to be determinants of health; that is, they play some causal role in health status. The most recent summary data are presented in the Australian context, along with an indication of trends in each indicator over the past decade.

Education

Education imparts health benefits to individuals, their families (particularly children), and societies as a whole (Wolfe & Zuvekas 1997, Groot & van den Brink 2006). Higher levels of education are related to higher income and better employment prospects (see below), and can also affect health directly by providing knowledge and skills for a healthy lifestyle and for gaining better access to health services.

Educational attainment among the Australian population is rising. More than half (51%) of all people aged 15–64 years had a post-school qualification in 2006, compared with 42% in 1996. Much of this growth reflects the increase in the proportion of people with bachelor or higher degrees (Table 4.6).

Table 4.6: Highest post-school qualification of persons aged 15–64 years, 1996–2006 (per cent)

Qualification	1996	1998	2000	2002	2004	2006
Bachelor degree or above	12.8	14.3	15.7	17.8	18.9	20.6
Diploma or certificate	29.4	27.6	28.1	29.8	31.3	30.8
None	57.7	58.1	56.2	51.8	49.1	47.6

Note: Totals may not add to 100% because the level of highest non-school qualification of some persons could not be determined.

Source: ABS 2006c.

Apparent retention rates to Year 12 reflect the proportion of students in a cohort who remain in secondary education from the beginning of secondary schooling to Year 12. In 2006, the national apparent retention rate was 75%, with some disparity between males (69%) and females (81%) (ABS 2007c). Rates more than doubled throughout the 1980s and early 1990s, but have stabilised over the past decade. Apparent retention rates in 2006 were significantly lower for Indigenous students (40%) than for Australian students generally.

Employment status and occupation

Employment status, and unemployment in particular, is strongly related to health status. Unemployed people have higher mortality and more illness and disability than those who are employed, even after taking other factors into account. Studies that follow people over time indicate that this relationship is not due to health selection effects; that is, it is not due to people first getting sick and then being unemployed as a result. Lack of work can contribute to poor health in at least two ways: first, it reduces people's ability to buy health-related goods and services (such as nutritious food, housing and health care); second, it can have strong psychological and social impacts (Mathers & Schofield 1998).

Between 1996–97 and 2006–07, total and part-time employment rates rose and unemployment rates fell for both sexes (Table 4.7). In 2006–07, 65% of Australians aged 15 years and over were in the labour force—62% were employed and 3% were unemployed, giving an unemployment rate of 4.5%. Here, the term 'unemployment' refers to those who wanted employment but could not get it. Females were less likely to be employed

(55%) than males (69%). Of those who were employed, 55% of females and 85% of males worked full time.

Among people who are employed, there is a relationship between occupation and health. Generally, people working in manual and low-skilled jobs have poorer health, more disability and higher mortality than people in managerial/professional occupations. This relationship exists even after allowing for differences in education (Li et al. 2000). A large part of this inequality has been attributed to different levels of risk from exposure to physical hazards, and to the psychosocial effects of lower levels of control in one's job (Schrijvers et al. 1998; Rahkonen et al. 2006).

Table 4.7: Employment status of persons aged 15 years and over, 1996–97 and 2006–07

	1996–97			2006–07		
Measure	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
			Number ('000)			
Labour force size	5,214	3,955	9,169	5,945	4,878	10,824
			Per cent			
Participation rate[(a)]	73.4	53.8	63.4	72.2	57.6	64.8
Employed persons[(a)]	67.1	49.5	58.1	69.2	54.8	61.9
Unemployment rate[(b)]	8.6	8.0	8.3	4.3	4.8	4.5
Part-time workers[(c)]	11.8	43.1	25.2	15.1	44.8	28.5

(a) Per cent of the total population aged 15 years and over.

(b) Per cent of the labour force.

(c) Per cent of all employed persons.

Note: Reference periods are annual averages for the year ending 30 June.

Source: ABS 2007e.

In Australia, occupation is classified by the Australian Standard Classification of Occupations, which has three broad categories: professional, 'white-collar' and 'blue-collar'. In the decade since 1997 the professional workforce has grown considerably and the proportion of people in white-collar and blue-collar occupations has fallen (Table 4.8). This is likely to have contributed to the generally improving health of Australians, given the association between occupation and health status.

The largest of the three occupation groups in 2007 was professionals (41%) followed by white-collar workers (34%). One in four (25%) employees was classified as blue-collar. White-collar workers were mostly females and blue-collar occupations were dominated by males. Males and females were equally likely to be employed in professional occupations.

Table 4.8: Occupational group of employed persons aged 15 years and over, 1997 and 2007 (per cent)

	1997			2007		
Occupational group	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Professional	37.6	33.1	25.6	40.7	40.7	40.7
White-collar	28.6	46.2	36.3	27.6	42.7	34.4
Blue-collar	33.8	20.7	28.1	31.7	16.6	24.9

Source: ABS 2007f.

Income and wealth

Income is related to health, both at the level of individuals and societies (see Figure 4.2). Much of this relationship appears to be due to the association between income, education and occupation. Apart from this, high incomes increase access to goods and services beneficial to health, such as health care, better food and housing, and preventive health measures.

It has been suggested that the degree of wealth inequality in a society, not just its average wealth, can affect its health. If two countries had the same average income, for example, but one had more inequality in its people's incomes, then that country would be expected to have worse health. However, this issue is strongly debated and it appears that any relationship may be weak in countries with high average incomes.

The period 1995–96 to 2005–06 has seen considerable growth in Australians' incomes. The 'median equivalised disposable household income' (that is, the income available to individuals, after adjusting for differences in household size) was $563 per week in 2005–06, 35% higher in real terms than for 1995–96 (ABS 2007d).

Income distribution across the population is commonly measured by percentile ratios. In 2005–06, the equivalised disposable household income level at the top of the 80th percentile (that is, the value dividing the bottom 80% of households from the top 20%) was $867 per week, and the income level at the top of the 20th percentile was $340. The ratio of these two income levels, known as the P80/P20 ratio, was 2.55 (*NHPC indicator 2.03*).

A number of changes were introduced to the ABS Survey of Income and Housing in 2003–04, making it difficult to assess trends in income distribution over recent years (ABS 2006e). However, according to the P80/P20 measure there do not appear to have been any significant changes in income distribution over the period 1995–96 to 2005–06 (Table 4.9).

Table 4.9: Income ratio of Australian households, 1995–96 to 2005–06

Ratio	1995–96	1996–97	1997–98	1999–2000	2000–01	2002–03	2003–04[a]	2005–06
P80/P20[b]	2.58	2.54	2.56	2.64	2.63	2.63	2.50	2.55

(a) A number of methodological improvements were made to the ABS Survey of Income and Housing in 2003–04. As a result, data from 2003–04 onwards are not directly comparable with those from previous surveys.

(b) The income at the upper value of the 80th percentile, divided by the income at the upper value of the 20th percentile, when households are ranked by equivalised disposable income.

Source: ABS 2007d.

Another common measure of relative income disadvantage is the proportion of people living in households with equivalised disposable incomes below 50% of the national median. According to this measure, 11% of Australians (more than 2.2 million people) experienced relative income disadvantage in 2005–06 (AIHW 2007).

An individual's wealth or accumulated assets can buffer material living standards, particularly in periods of low income. In 2003–04, Australian households had an average of $537,100 each in assets, of which three-quarters were non-financial assets, such as the family home. However this asset base was not evenly distributed: the wealthiest 20% of households accounted for 59% of total household wealth, and the least wealthy 20% owned just 1% of total household wealth (ABS 2006e).

Family structure

Married people tend to be healthier and live longer than those who are unmarried (Coombs 1991). Some of this is likely to be due to 'marital selection'—that is, people who are healthy, or with determinants of good health such as higher education or income, may make more attractive marriage partners. However, after accounting for this, being single is still associated with higher mortality than being married, according to studies that follow individuals through time (Cheung 2000). Health benefits are similar for those living together and those formally married (Wu et al. 2003). Reasons for this protective effect may include greater material resources and social support, and a positive impact of partners on health behaviours.

About half (50%) of all Australians aged 15 years and over were in a registered marriage in 2006, with a further 9% in a de facto marriage (including same-sex couples) (ABS 2007g). People aged less than 25 years, and 80 years and over, were substantially less likely to be married. Over the period 1996–2006 there was a small increase in the percentage of the population overall who were not married. In 2006 however, compared with 10 years earlier, higher proportions of people aged 65 years and over were currently married, probably because of increased life expectancy.

Research shows that children and young people in lone-parent households have poorer health than those in two-parent households. However, this increased risk in lone-parent households appears to be due to material disadvantage rather than the family structure itself, as these households are much more likely to experience unemployment and have low incomes (AIHW: Mathers 1995; Spencer 2005).

In 2006, 22% of families with children aged under 15 years were lone-parent families, an increase from 19% in 1996 (Table 4.10). There were over 450,000 lone-parent families with children in 2006.

Table 4.10: Families with children aged under 15 years, by family composition, 1996 and 2006

	1996		2006	
Family composition	**Number ('000)**	**Per cent**	**Number ('000)**	**Per cent**
Couple families	1,619	81	1,627	78
Lone-parent families	389	19	456	22
Total	**2,008**	**100**	**2,083**	**100**

Note: Families with children aged under 15 years may also have dependent students and non-dependent children.
Source: ABS 1997; 2007g.

4.4 Knowledge, attitudes and beliefs

People's knowledge, attitudes and beliefs about health can influence their health behaviours, and consequently their present and future health status. The likelihood of an individual being motivated to adopt health-enhancing behaviours—rather than behaviours which are not conducive to health—is in part a function of the level of knowledge, attitudes and skills which the person has in relation to health risks.

For this reason, measures of knowledge and attitudes are often taken to assess the reach and effectiveness of health promotion campaigns, or to provide insights into barriers to behaviour change.

With increasing availability of electronic information (via the Internet), never before has the general population had so much access to 'knowledge' about health. Similarly, in the last decade an increase in health information presented through the media (largely television) has resulted in entire programs devoted to good health and positive lifestyle behaviours. Yet many people still behave in ways that can harm their own health and even that of others around them.

For example, the ill effects of smoking have been well documented over time, and are the focus of many public health campaigns. For many, the messages are getting through—smokers have increasingly quit in recent decades, and results from the 2007 National Drug Strategy Household Survey show that two in five adults could correctly nominate tobacco as the leading cause of drug-related deaths in Australia. However, the survey showed that many Australians either approved of (14.3%) or were neutral about (22.5%) adults regularly smoking tobacco. Approval was greater among those who had smoked in the last 12 months (39.1%) than among those who had not (7.6%). This relationship also applied for many illicit drugs, where those who had recently used a particular drug were at least 10 times as likely to approve its use as those who had not.

Regular exercise helps to maintain good health by helping prevent or manage some conditions, maintaining a healthy musculoskeletal system, and controlling body weight. However, many people still do not exercise enough to benefit their health, with insufficient time to exercise being the most common constraint Australian adults report as a barrier to sports or physical recreation (Table 4.11). Health or fitness was the most common motivator for participation, suggesting that if a conviction in the value of positive health behaviours is strong enough it may be influential in choosing those behaviours.

Table 4.11: Participation in sport and physical recreation: main constraints and motivators, persons aged 15 years and over (per cent)

Factor	Males	Females	Persons
Main constraints[a]			
Insufficient time[b]	35.0	33.4	34.2
Not interested	18.9	18.2	18.5
Age/too old	15.8	17.8	16.8
Ongoing injury/illness	15.0	13.8	14.4
Main motivators[c]			
Health/fitness	49.6	58.6	54.2
Enjoyment	27.4	16.1	21.6
Wellbeing	6.0	8.8	7.5
Social/family	8.4	5.5	6.9

(a) For people who had little or no participation in the past 12 months.

(b) Because of work/study, family and other reasons.

(c) For people who participated at least 13 times in the past 12 months.

Source: ABS 2007h.

The ability to acquire knowledge about health enables a person to recognise health problems (in themselves or others), make choices about behaviours, and access health services when required. However, some groups within the community may have difficulty accessing, understanding or using information about health. For example, people from

non-English-speaking backgrounds may not assimilate new information as quickly as native English speakers, and they may therefore retain traditional beliefs and use traditional health treatments. Studies have also shown that some people from non-English-speaking backgrounds are not as informed about risky health behaviours as their English-speaking counterparts (Perusco et al. 2007). In some cases, those who come from countries where smoking is seen as the social norm are often not aware of the health and social problems associated with smoking (Le & Le 2005).

Knowledge may be misinterpreted, or missed altogether by the population groups that require it most. Results from the last National Breast Cancer Centre Breast Health Survey show that only 50% of females identified age as a risk factor for breast cancer—in Australia, about 75% of breast cancers occur in females aged 50 years and over (NBCC 2005). Many studies have indicated that early detection of breast cancer can make a difference to successful treatment; however, this survey showed that over one-third of women who noticed a breast symptom (that is, a change in the look or feel of a breast) waited more than 1 month before contacting a doctor.

There is wide acknowledgement within the community that exposure to the sun's rays places people at greater risk of developing skin cancer. Despite the level of public awareness, many Australians do not act on this message, particularly the younger population (Centre for Epidemiology and Research 2007). In general, many young people use sunscreen (43%). However, recommendations state that sunscreen should be used in combination with other forms of sun protection; that is, wearing of hats, sunglasses and appropriate clothing, as well as staying in the shade. In 2005, almost half (48%) of young people failed to combine the recommended three or more sun protective behaviours on sunny summer days.

Any amount of sunburn can damage skin cells and therefore increase the risk of developing skin cancer. One-third of adolescents (12–17 years of age) incorrectly believe that people only get skin cancer if they get burnt often, and about 80% of adolescents reported being burnt at least once in the last summer. Most teenagers also have a preference for getting a tan—70% of boys and 80% of girls (Centre for Epidemiology and Research 2007).

The positive attitude towards tanning in the general community is also reflected by the increase in the number of solariums in the last decade (Cancer Council of Victoria 2007). Despite evidence that links solarium use with the risk of melanoma and other skin cancers (WHO 2003), in capital cities the number of solariums has increased fourfold.

4.5 Health behaviours

Health behaviours can be influenced by any number of other determinants in combination with a person's individual makeup. For example, the level and pattern of physical activity can reflect a person's preferences modified by cultural and family influences. It can also be influenced by climate, availability of suitable spaces for exercise, and an individual's personal resources. Further, it can be affected by the presence of disease or disability.

In terms of contribution to the burden of disease, health behaviours featured as six of the top ten determinants in 2003 (see Table 4.1). The greatest single contributor to the burden was tobacco smoking (7.8% of total DALYs). Physical inactivity also made a substantial contribution at 6.6%.

Tobacco smoking

Impact and prevalence

Tobacco smoking is the single most preventable cause of ill health and death in Australia, contributing to more drug-related hospitalisations and deaths than alcohol and illicit drug use combined. It is a major risk factor for coronary heart disease, stroke, peripheral vascular disease, cancer and a variety of other diseases and conditions.

Tobacco smoking is estimated to be responsible for 7.8% of the burden on the health of Australians: around 10% of the total burden of disease in males and 6% in females (Table 4.1). The World Health Organization estimates that tobacco causes 8.8% of deaths (4.9 million) globally and 4.1% of the total burden of disease (WHO 2002).

The tangible costs of tobacco use in Australia were estimated to be $10.8 billion in 2004–05 (Collins & Lapsley 2008), or about 1.3% of gross domestic product.

Estimates from the 2007 National Drug Strategy Household Survey (NDSHS, see Box 4.2) indicate that one in six Australians aged 14 years and over smoked daily (16.6%, or around 2.9 million Australians) (*NHPC indicator 2.05*). Males were more likely to be daily smokers (18.0%) than females (15.2%). Former smokers outnumbered smokers at 25.1% of the population (27.9% of males and 22.4% of females) and 55.4% had never smoked (50.9% of males and 59.8% of females). Compared with overall smoking rates, smoking is far more common among those of lower socioeconomic status and among Indigenous Australians (see Chapter 3 and Section 4.3).

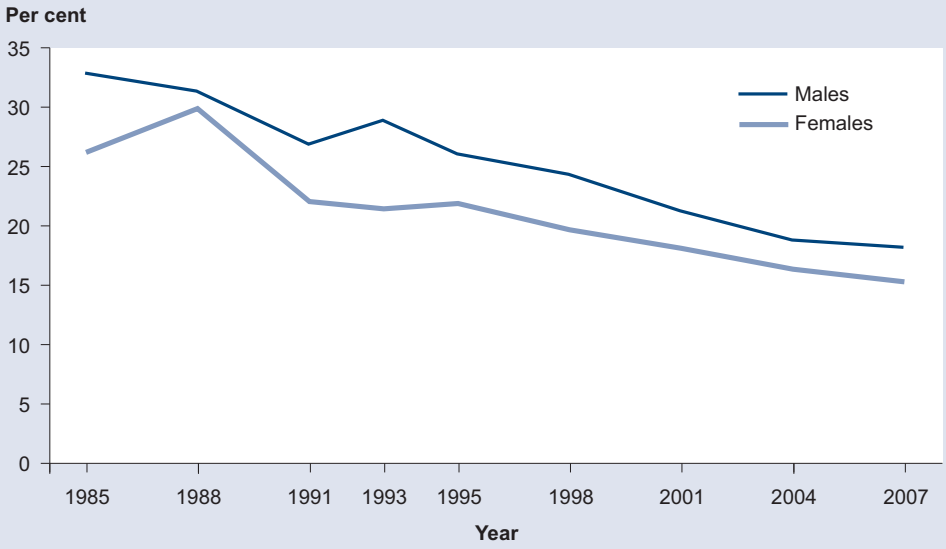
Box 4.2: The National Drug Strategy Household Survey

The National Drug Strategy Household Survey is conducted by the AIHW at 3-yearly intervals. It collects comprehensive information about people's use of and attitudes towards tobacco, alcohol and illicit drugs; experiences of alcohol- and other drug-related harm; and physical and mental health.

The latest survey, conducted in 2007, was the ninth in a series that began in 1985, and collected information from over 23,000 respondents. People living in non-private dwellings and institutions are not included in the sample. From 2004 onwards, the survey includes people aged 12 years and over; previously the scope was 14 years and over.

A limitation of the survey is that people may not accurately report information relating to illicit drug use and related behaviours because these activities may be illegal. This means that results relating to illicit drugs (see section below) are likely to underestimate actual prevalence.

In Australia, the overall smoking rate has been declining since the 1950s, when an estimated 70% of males and 30% of females smoked. Between 1985 and 2007, the prevalence of daily smoking declined by 14.7 percentage points for males and 10.9 percentage points for females (Figure 4.6). This general trend is corroborated by general practice data from the Bettering the Evaluation and Care of Health (BEACH) study, which shows daily smoking among patients aged 18 years and over declining from 19.2% in 1998–99 to 16.1% in 2006–07 (Britt et al. 2008).



Sources: AIHW 2005; data from the 2007 NDSHS.

Figure 4.6: Daily smokers, population aged 14 years and over, 1985–2007

Smoking among young people

In 2007, about one in 18 persons aged 12–19 years smoked daily. Rates were around 2% for those aged 12–15 years and markedly higher for those aged 16 years and over (Table 4.12). About 97% of the 12–15 years age group reported having never smoked a full cigarette; about the same proportions for both males and females. Estimates of tobacco use by younger people should be interpreted with caution, however, because of the low prevalence and relatively smaller sample sizes compared with those for adults.

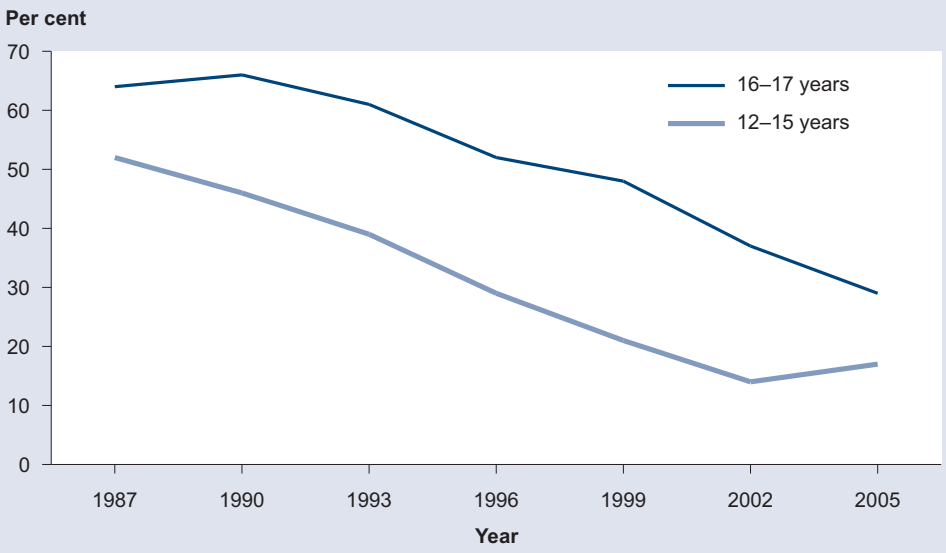
Table 4.12: Daily smokers: proportions among those aged 12–19 years, 2007 (per cent)

	Age group			
Sex	**12–15**	**16–17**	**18–19**	**12–19**
Males	1.5	4.1	11.6	4.7
Females	2.5	7.4	13.7	6.6
Persons	2.0	5.7	12.6	5.6

Source: Data from the 2007 NDSHS.

The ability of teenagers to purchase cigarettes increases their likelihood of smoking. Accordingly, all states and territories in Australia have legislation that prohibits the supply of cigarettes to people under the age of 18 years.

Estimates from the Australian Secondary Schools Alcohol and Drug surveys show that the proportion of current smokers aged 12–15 years who had purchased their most recent cigarette (instead of acquiring it in some other way) declined markedly from 52% in 1987 to 17% in 2005, and for current smokers aged 16–17 years the decline was from 64% to 29% (Figure 4.7) (*NHPC indicator 3.02*).



Source: White & Hayman 2006.

Figure 4.7: Teenage smokers who purchased their most recent cigarette, 1987–2005

Children exposed to tobacco smoke in the home

Children are particularly susceptible to the effects of passive smoking—when they are close to someone smoking and breathe in the smoke contaminating the air. For children, this so-called environmental tobacco smoke increases the risk of a range of health problems. These include respiratory infections, middle ear infections, onset and worsening of asthma, decreased lung function, eye and nose irritation, low birthweight, and sudden infant death syndrome (NDS 2002; NHMRC 1997).

The benefits of reducing children's exposure to environmental tobacco smoke at home include reduced school absenteeism, increased school performance, reduced uptake of smoking, and lower consumption of tobacco among children who smoke (NDS 2002).

Over the period 1995–2007, around one-third of all households included dependent children (that is, children aged under 15 years). In 1995, around 31% of these households included someone who smoked inside the home (Table 4.13). With the general decline in smoking prevalence, and the increasing awareness of the effects of environmental tobacco smoke, this figure fell to less than 8% of households in 2007, or around 300,000 dependent children exposed to tobacco smoke inside the home (*NHPC indicator 2.01*).

Table 4.13: Household smoking status[a], by dependent children status[b], 1995–2007 (per cent)

	Dependent children					No dependent children[c]				
Household smoking status	**1995**	**1998**	**2001**	**2004**	**2007**	**1995**	**1998**	**2001**	**2004**	**2007**
Smokes inside the home	31.3	22.6	19.7	12.3	7.8	32.2	26.6	21.3	17.4	14.8
Only smokes outside the home	16.7	21.5	24.9	28.1	29.2	13.7	18.0	19.8	17.6	19.0
No-one at home regularly smokes	52.0	55.9	55.4	59.6	63.1	54.1	55.4	58.9	65.0	66.2

(a) Household smoking status as reported by respondents aged 14 years and over.

(b) Households including dependent children aged 14 years and under.

(c) Includes dependents aged 15 years and over.

Source: AIHW analysis of the NDSHS from 1995 to 2007.

International comparisons

The most recent report on smoking among OECD member countries places Australia among the best in the world. More generally, the prevalence of daily smoking ranges from about one in three of the adult population in Greece, to less than one in six in Sweden (Figure 4.8).

With few exceptions, these countries saw a decline in the prevalence of daily smoking between 1966 and 2006, with major reductions in the early part of this period and a slowing of the decline in the last decade.

Physical inactivity

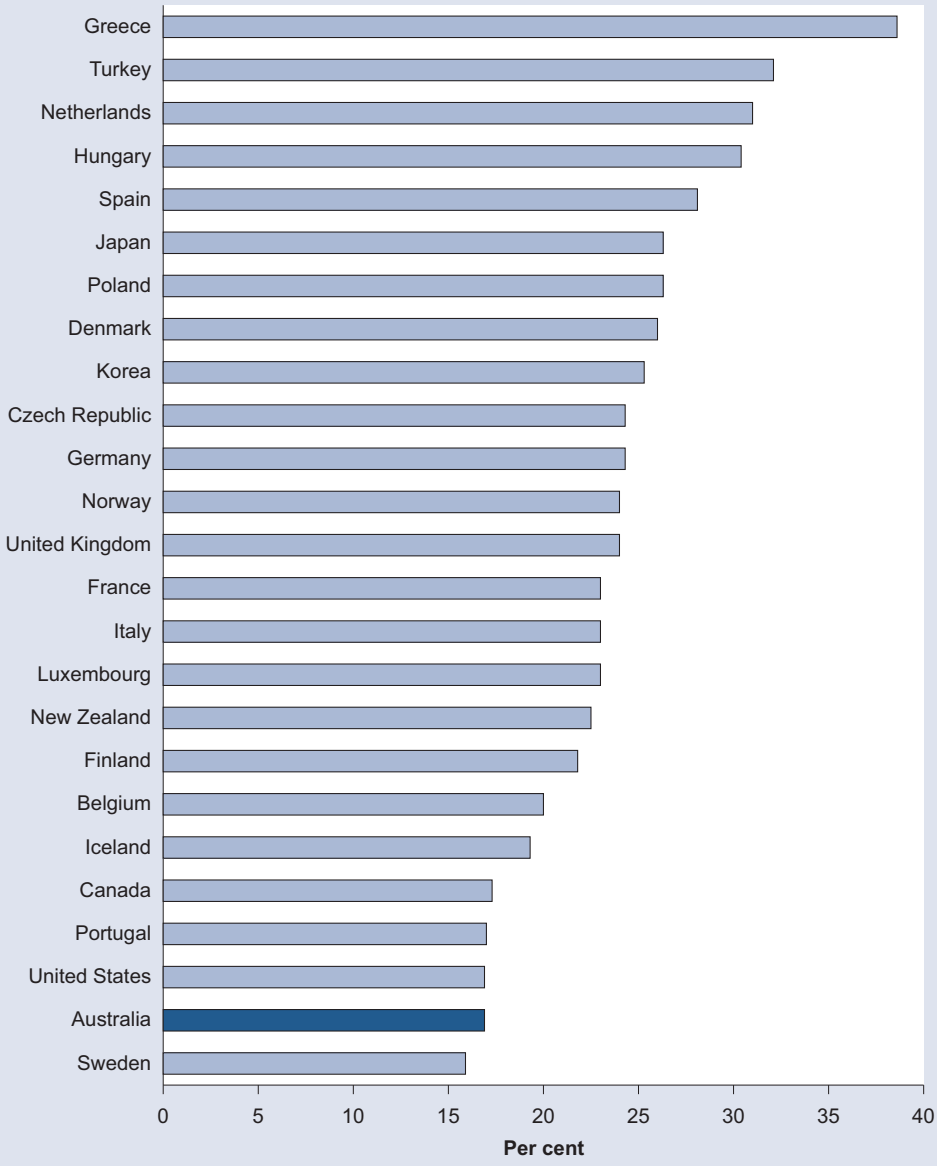
Physical inactivity is associated with an increased risk of ill health and death, particularly relating to cardiovascular disease. Put another way, regular physical activity reduces cardiovascular risk in its own right, reduces cardiovascular risk factors such as overweight and high blood pressure, and improves the levels of HDL (the 'good' cholesterol). Regular exercise also helps protect against Type 2 diabetes and some forms of cancer, and strengthens the musculoskeletal system, helping to reduce the likelihood of osteoporosis (low bone-mineral density) and the risk of falls and fractures. In addition, taking part in physical activity improves mental wellbeing (in both the short term and longer term) by reducing feelings of stress, anxiety and depression (Dunn et al. 2001).

Box 4.3 Understanding physical activity

Put simply, physical activity is any bodily movement produced by the muscles that results in energy expenditure. Exercise is a subset of physical activity—defined as planned, structured and repetitive bodily movement done to improve or maintain one or more components of physical fitness. As an example, most sports include physical activity done for enjoyment, exercise, or both.

Although most measures of physical activity focus on deliberate activity in leisure time, other forms of activity—such as walking/cycling for transport, and activity associated with a person's job—are important components of overall activity. Indeed, even the activity associated with everyday tasks like shopping and housework—or so-called incidental activity—is part of the physical activity spectrum and contributes to the health benefits.

Physical activity is a critical factor in determining a person's body weight. If the energy in (via food and drink) is not balanced by energy expenditure (via activity and internal bodily functions) and the situation is sustained, the excess food energy is stored as body fat. Hence, at a population level, physical inactivity may be an important contributor to rising levels of obesity.



Notes

1. Data are for the year specified, or one to three years earlier or later. No data within this range were available for the Slovak Republic.
2. The prevalence of 16.8% for Australia reported here is for persons aged 15 years and over, and differs from that reported at the beginning of this section for persons aged 14 years and over.

Sources: OECD 2007; data from the 2007 NDSHS.

Figure 4.8: Prevalence of daily smoking, population aged 15 years and over, selected OECD countries, 2006

Low levels of physical activity were estimated to have accounted for 6.7% of the burden of disease and injury in Australia in 2003, ranking it fourth among the more direct determinants of ill health (see Table 4.1). In addition, a recent report commissioned by Medibank Private estimated that the direct cost of physical inactivity in Australia was $1,494 million per annum (2006–07 prices), or about 0.15% of gross domestic product (Econtech 2007). This estimate was based on the direct costs attributable to physical inactivity for the following medical conditions: coronary heart disease, stroke, Type 2 diabetes, mental disorders, breast cancer, colon cancer, and the incidence of fall-related injuries.

Assessed against the national physical activity guidelines (see Box 4.4), a significant majority of Australians are not physically active enough. Levels of physical activity in recent decades may reflect increased time spent in sedentary or minimally active states, perhaps as a result of labour-saving devices and passive forms of entertainment (such as computers, television, video games and the Internet). Low physical activity levels may also be related to increasing urbanisation, as well as reductions in 'active transport' among adults and children associated with increased car ownership and use, along with safety concerns leading to less walking, cycling and transport-related physical activity. Research also indicates that people perceive that they have less discretionary time available for exercise or sporting activities than in previous years (Bauman et al. 2002).

Box 4.4: National guidelines for physical activity

The National Physical Activity Guidelines for Australians (DHAC 1999) recommend at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week. The guidelines for children and adolescents (DoHA 2004a, 2004b) 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 like football and basketball. These guidelines correspond to the notion of 'sufficient' activity—the amount needed to obtain health benefits.

For population-monitoring purposes, there are two ways of calculating 'sufficient' activity. These are: 'sufficient time' (at least 150 minutes per week of moderate-intensity physical activity, with each minute of vigorous activity counted as two minutes of moderate activity); 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). Sufficient time and sessions is the preferred measure of sufficient activity for health as it takes into account the frequency of physical activity as well as duration. 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.

Measuring physical activity

Various methods are available to measure physical activity, so results from different surveys can provide different estimates of the proportion of people who are sufficiently active for health. The data obtained from the 1997, 1999 and 2000 National Physical Activity Surveys (NPAS) align closely to the recommended levels of activity in the national guidelines and allow assessment of physical activity in relation to the 'sufficient time and sessions' measure (see Box 4.4). This series of surveys examined self-reported participation in walking (including walking for transport), other moderate activity and vigorous activity during leisure time, using the Active Australia Survey instrument. More recent data using

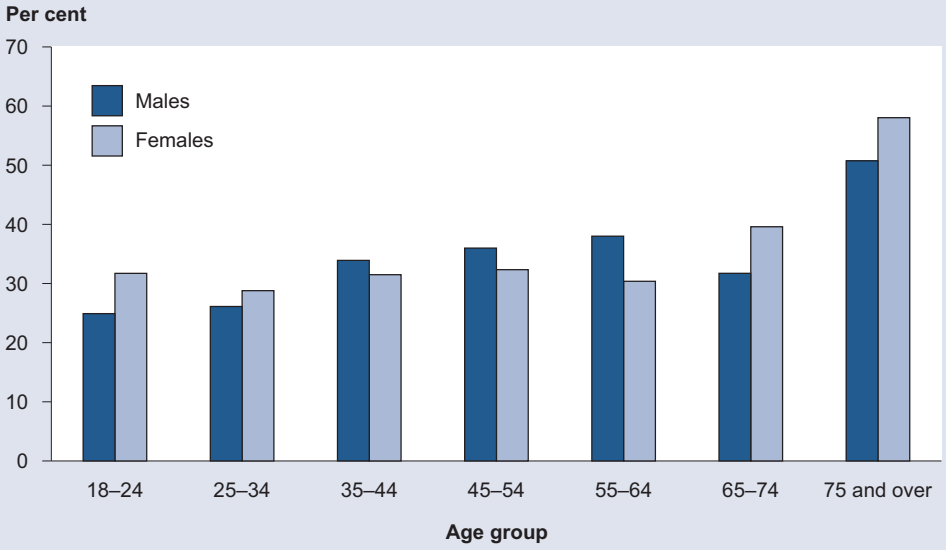
the same instrument are available from state and territory surveys, conducted using computer-assisted telephone interviewing (CATI).

Non-leisure time physical activity, such as activity at work or around the house, also contributes to overall physical activity. However, this component of physical activity is difficult to measure, and the methods used to measure it are not generally practical for use in population surveys.

Prevalence and trends

Estimates from the 2004 state and territory CATI surveys suggest that half of adults are not undertaking sufficient physical activity (AIHW 2006) (relates to *NHPC indicator 2.08*). Females reported higher levels of inactivity than males in all states and territories. Data from the 2000 NPAS show that the most inactive adults were aged 30–59 years and the most active were aged 18–29 years, for both males and females. The proportion reporting no leisure time physical activity over the previous week increased with age, from about 1 in 10 aged 18–29 years to 2 in 10 aged 45 years and over.

The 2004–05 National Health Survey (NHS) also included a measure of physical activity. Overall, about one-third of both men and women reported that they did not exercise in the 2 weeks before the survey. Somewhat surprisingly, the inactivity tended to increase only modestly with age, except that persons aged 75 years and over were much less likely to have exercised than the younger age groups (Figure 4.9).



Source: ABS 2006f.

Figure 4.9: Prevalence of no exercise in the previous 2 weeks, 2004–05

Available data suggest little change in physical activity patterns during the 1980s and much of the 1990s in Australia, although there was an increase in the estimated proportion of Australians with lower-than-recommended levels of physical activity between the 1997 and 2000 NPAS surveys (from 49% to 54%). During this latter period, the prevalence of insufficient levels of physical activity increased among males and females and for all age

groups under 60 years. Data from the 1995, 2001 and 2004–05 NHS also suggest little change in physical activity patterns, with the proportion of people aged 18 years and over reporting sedentary or very low levels of physical activity (that is, less than 100 minutes of exercise over 2 weeks) remaining around 30–35% (ABS 2006f).

Specific population groups

Physical activity is very important in maintaining and improving health and wellbeing in older age groups, particularly for preventing falls and broken bones. Inactivity in elderly people is associated with a loss of both balance and bone mass. The findings from the 2000 NPAS suggest that about 21% and 14% of older Australian males and females, respectively, had sedentary levels of activity, and a further 33% and 44% had some activity but it was not 'sufficient'.

Physical activity is also essential for the healthy growth and development of children. Although there are no recent national data on the physical activity levels of Australian children and adolescents, surveys conducted among school children in New South Wales and Western Australia found that between one-quarter and one-third of students surveyed had too little physical activity (Booth et al. 2006; Hands et al. 2004). However, the NSW survey showed that physical activity among school children had increased over the period 1985–2004, even though there were increases in rates of overweight and obesity over the same period.

The National Aboriginal and Torres Strait Islander Health Survey found that the proportion of Indigenous people aged 15 years and over in non-remote areas with sedentary or low levels of exercise was higher in 2004–05 than in 2001 (75% compared with 68%)(ABS 2006f, 2006g). After adjusting for differences in the age structure of the Indigenous and other Australian populations, Indigenous people in non-remote areas were as likely as other Australians to be sedentary or engaged only in low levels of exercise in 2004–05.

Alcohol consumption

Excessive alcohol consumption is a major risk factor for morbidity and mortality. The World Health Organization estimates that, worldwide in 2002, alcohol caused 3.2% of deaths (1.8 million) and 4.0% of the burden of disease (WHO 2002). In Australia, it has been estimated that harm from alcohol was the cause of 3.8% of the burden of disease for males and 0.7% for females, ranking it sixth out of the 14 risk factors studied (Table 4.1).

There are also social costs to the consumption of alcohol. In Australia in 2004–05, the total tangible cost attributed to alcohol consumption (which includes lost productivity, health-care costs, road accident-related costs and crime-related costs) was an estimated $10.8 billion (Collins & Lapsley 2008), or around 1.2% of gross domestic product.

Nevertheless, some benefits are thought to arise in the longer term from low to moderate alcohol consumption, largely through reduced risk of stroke and coronary heart disease and largely in older females. The net harm associated with alcohol consumption, after taking into account these benefits, was estimated at around 2.0% of the total burden of disease in Australia in 2003.

Alcohol consumption patterns

Analysis of the NDSHS from 1993 to 2007 shows that four in five Australians aged 14 years and over drank alcohol, and one in ten did so daily (Table 4.14). In 2007, an estimated 82.9% of Australians had drunk alcohol in the past year. These rates have been fairly stable since 1993.

Table 4.14: Alcohol drinking status, population aged 14 years and over, 1993–2007 (per cent)

Drinking status	1993	1995	1998	2001	2004	2007
Daily	8.5	8.8	8.5	8.3	8.9	8.1
Weekly	39.9	35.2	40.1	39.5	41.2	41.3
Less than weekly	29.5	34.3	31.9	34.6	33.5	33.5
Ex-drinkers[(a)]	9.0	9.5	10.0	8.0	7.1	7.0
Never a full serve of alcohol	13.0	12.2	9.4	9.6	9.3	10.1

(a) Ex-drinkers are those who consumed at least a full serve of alcohol in their lives, but not in the last 12 months.

Sources: AIHW 2005; data from the 2007 NDSHS.

International comparisons

For international comparison purposes, a useful measure is per person consumption of pure alcohol. This is a method of taking into account the different alcohol content of different beverages—for example, a typical Australian beer contains 5% alcohol per volume, meaning that a 375 mL bottle will contain about 19 mL of pure alcohol. Using this measure, in 2006 Australia ranked in the middle of the OECD countries, at around 10 litres of alcohol per person aged 15 years or over per year (Figure 4.10). Across these 30 countries, consumption ranged from 16 litres per person per year in Luxembourg down to 1 litre in Turkey.

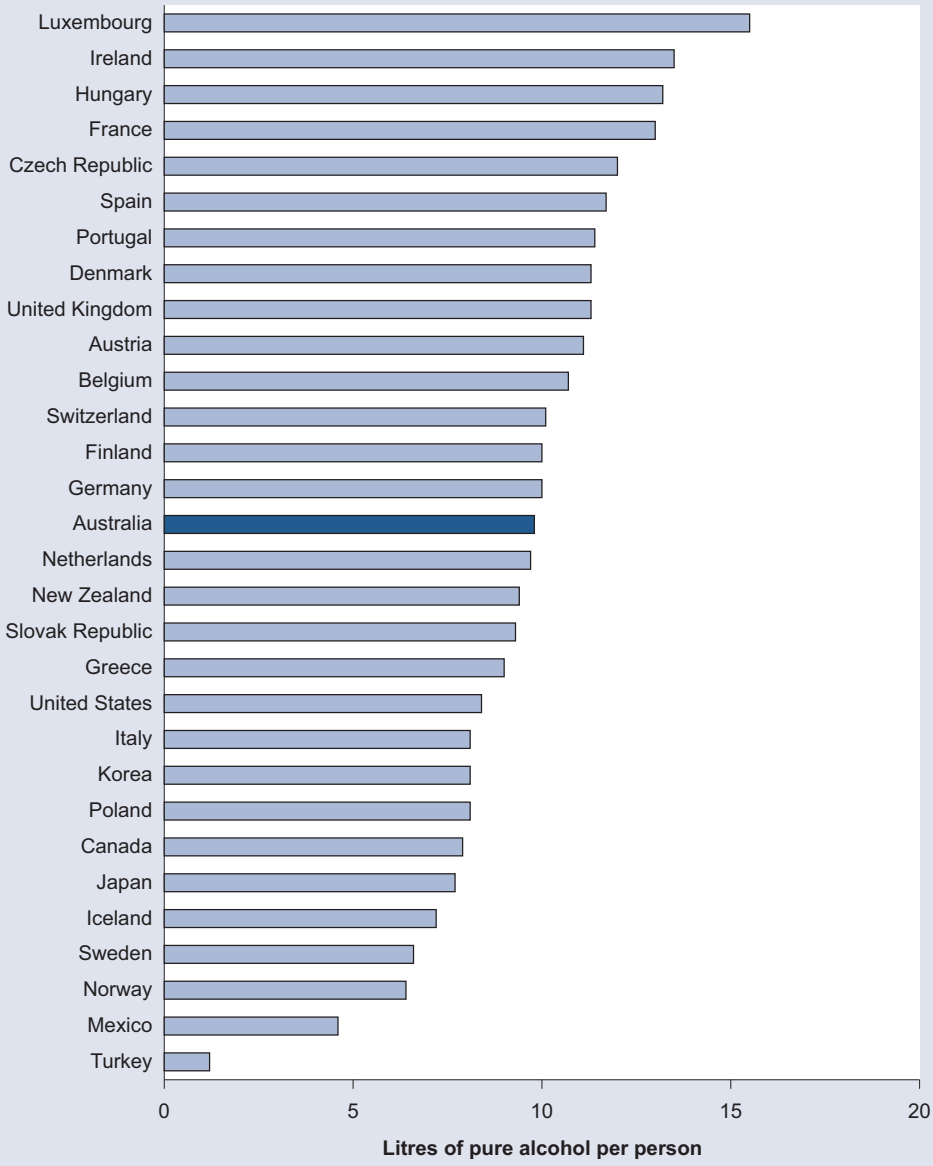
The pattern of change over time in per person alcohol consumption varies among the OECD countries. For the majority, including Australia, there appears to have been a peak of consumption in the 1970s and 1980s, then reductions over the 1990s and early 21st century. A few countries, notably Ireland and the United Kingdom, had an increase in consumption over the past 40 years, whereas Portugal and Italy had a major decrease.

Risk of harm from alcohol consumption

In 2001, the National Health and Medical Research Council (NHMRC) published alcohol consumption guidelines for males and females (NHMRC 2001a). They are expressed in terms of short-term and long-term risk of harm (injury, ill health and death). In late 2007, the NHMRC proposed revised guidelines, with the simplified overall recommendation that men and women not consume more than two standard drinks on any drinking occasion. This section reports against the 2001 guidelines, consistent with earlier AIHW reporting of alcohol risk.

According to the 2007 NDSHS, 17.1% of Australians aged 14 years and over had not consumed alcohol in the previous 12 months. Assessed against the 2001 guidelines, 10.3% had consumed at levels considered risky for health in the long term, and 20.4% had consumed—at least monthly—in a way that is risky for health in the short term (*NHPC indicator 2.06*).

Combining these, 60.8% of Australians in 2007 had drunk at levels considered low risk for harm in both the short and long term, and 8.6% had drunk at levels considered risky or high risk for both short-term and long-term harm (Table 4.15). (The words 'high risk', 'low risk' and 'risky' used below are also in terms of the 2001 guidelines.)



Note: Data are for 2006, or one to three years earlier or later.

Source: OECD 2007.

Figure 4.10: Alcohol consumption, population aged 15 years and over, OECD countries, 2006

Table 4.15: Risk of harm from alcohol, population aged 14 years and over, 2007 (per cent)

Long-term risk	Abstainer	Short-term risk[a]		Total
		Low risk	Risky or high risk	
Males				
Abstainer	14.0	. .	. .	14.0
Low risk	. .	60.9	14.9	75.8
Risky or high risk	. .	1.4	8.8	10.2
Total	*14.0*	*62.3*	*23.7*	*100.0*
Females				
Abstainer	20.1	. .	. .	20.1
Low risk	. .	60.6	8.8	69.4
Risky or high risk	. .	2.1	8.4	10.5
Total	*20.1*	*62.7*	*17.2*	*100.0*
Persons				
Abstainer	17.1	. .	. .	17.1
Low risk	. .	60.8	11.8	72.6
Risky or high risk	. .	1.7	8.6	10.3
Total	*17.1*	*62.5*	*20.4*	*100.0*

. . Not applicable.

(a) At least once per month.

Source: Data from the 2007 NDSHS.

Alcohol use and psychological distress

Analysis of the 2007 NDSHS shows that adult high-risk drinkers (15.3%) were more likely than adult low-risk drinkers (8.5%) to experience high or very high levels of psychological distress. These findings were based on the Kessler 10 scale (K10), which was developed for screening populations for psychological distress. The scale consists of 10 questions on non-specific psychological distress and relates to the level of anxiety and depressive symptoms a person may have experienced in the preceding 4-week period. The psychological distress may have preceded the alcohol use for some and, for others, alcohol use may have preceded the psychological distress.

Illicit drug use

Illicit drug use covers:

- the use of drugs which are illegal to possess (such as heroin and ecstasy)
- the use of volatile substances as inhalants (such as glue, solvent and petrol)
- the non-medical use of prescribed drugs.

Illicit drug use is a major risk factor for ill health and death, being associated with HIV/AIDS, hepatitis C virus (HCV), low birthweight, malnutrition, infective endocarditis (leading to damage to the heart valves), poisoning, mental illness, suicide, self-inflicted injury and overdose. The WHO estimates that globally 0.4% of deaths (0.2 million annually) and 0.8% of the total burden of disease are attributable to illicit drug use (WHO 2002).

In Australia, it is estimated that 2.0% of the burden of disease in 2003 was attributable to the use of illicit drugs, ranking it eighth out of the 14 risk factors studied (Table 4.1).

Trends in recent illicit drug use

According to the 2007 NDSHS, around 13.4% of the Australian population aged 14 years and over used illicit drugs in 2007 (Table 4.16). However, over recent years there have been decreases for each type of drug, with few exceptions. Marijuana/cannabis, at 9.1%, was the recently used illicit drug most commonly reported by this population—a small decline from rates of around 13% in most survey years between 1993 and 2001. Ecstasy was the second most common, used by an estimated 3.5% of the population in 2007, and more prevalent than meth/amphetamine (mainly methamphetamine, which includes 'ice') at 2.3%.

Table 4.16: Summary of recent[a] illicit drug use; population aged 14 years and over, 1993–2007 (per cent)

Substance	1993	1995	1998	2001	2004	2007
Marijuana/cannabis	12.7	13.1	17.9	12.9	11.3	9.1
Ecstasy[b]	1.2	0.9	2.4	2.9	3.4	3.5
Pain-killers/analgesics[c]	1.7	3.5	5.2	3.1	3.1	2.5
Meth/amphetamine, including 'ice'[c]	2.0	2.1	3.7	3.4	3.2	2.3
Cocaine	0.5	1.0	1.4	1.3	1.0	1.6
Tranquillisers/sleeping pills[c]	0.9	0.6	3.0	1.1	1.0	1.4
Hallucinogens	1.3	1.8	3.0	1.1	0.7	0.6
Injected drugs	0.5	0.6	0.8	0.6	0.4	0.5
Inhalants	0.6	0.6	0.9	0.4	0.4	0.4
Ketamine	n.a.	n.a.	n.a.	n.a.	0.3	0.2
Heroin	0.2	0.4	0.8	0.2	0.2	0.2
Other opiates/opioids[c]	n.a.	n.a.	n.a.	0.3	0.2	0.2
Barbiturates[c]	0.4	0.2	0.3	0.2	0.2	0.1
Methadone[d]	n.a.	n.a.	0.2	0.1	0.1	0.1
Steroids[c]	0.3	0.2	0.2	0.2	—	0.1
GHB[e]	n.a.	n.a.	n.a.	n.a.	0.1	0.1
Any illicit drug	*14.0*	*17.0*	*22.0*	*16.9*	*15.3*	*13.4*
None of the above	86.0	83.0	78.0	83.1	84.7	86.6

(a) Used in last 12 months.

(b) This category included substances known as 'designer drugs' before 2004.

(c) For non-medical purposes.

(d) For non-maintenance purposes.

(e) Gamma-hydroxybutyrate.

Source: AIHW 2005, data from the 2007 NDSHS.

Young people's use of illicit drugs

In 2007, of the population aged 12–15 years, an estimated 4.6% had used an illicit drug in the previous year. Illicit drug use was more common for young people aged 16–17 years (18.9%), and even more common for those aged 18–19 years (23.4%).

Most illicit drug use in the 12–15 years age group was of marijuana/cannabis (2.7%), followed by the non-medical use of pain-killers (1.1%). For all other substances surveyed, the prevalence in this age group was less than 1%.

Illicit drug use and psychological distress

Illicit drug use can be associated with a range of mental illnesses, and there has been much recent discussion of a relationship between heavy cannabis use and psychosis.

The 2007 NDSHS included the K10 scale of psychological distress, a set of questions that measures non-specific psychological distress related to the level of anxiety and depressive symptoms a person may have had over the previous 4 weeks.

Among the general community (aged 18 years and over, being the age range for which the K10 analysis is valid), less than 10% experienced high or very high levels of psychological distress (Table 4.17). But when this group is split into those who had used and those who had not used selected drugs in the last month, there was at least a twofold difference in that experience, with an almost sevenfold difference between users and non-users of heroin. However, by themselves these findings do not establish that drug use causes psychological distress, or vice versa.

Table 4.17: Psychological distress[(a)], by use of selected illicit drugs, persons aged 18 years and over, 2007 (per cent)

	Level of psychological distress		
Substance/behaviour	**Low**	**Moderate**	**High and very high**
All persons (aged 18+)	69.0	21.1	9.8
Any illicit drug			
Used in the last month	51.2	28.6	20.2
Not used in the last month	70.8	20.5	8.7
Marijuana/cannabis			
Used in the last month	51.2	27.2	21.5
Not used in the last month	70.1	20.8	9.1
Heroin			
Used in the last month	20.9	14.2	64.9
Not used in the last month	69.2	21.1	9.6
Meth/amphetamines			
Used in the last month	43.5	35.3	21.2
Not used in the last month	69.6	21.0	9.5
Ecstasy			
Used in the last month	45.4	34.4	20.2
Not used in the last month	69.5	20.9	9.6

(a) Using the Kessler 10 scale of psychological distress.

Source: Data from the 2007 NDSHS.

Injecting drug use

Apart from other risks, injecting drug use is a significant risk factor for transmitting bloodborne viruses such as HIV and HCV. From a national survey of clients of needle and syringe programs in 2006, around 2.8% of new HIV infections and 62% of HCV infections were attributed to injecting drug use (NCHECR 2007a).

Further, there is a strong association between the length of injecting practice and the prevalence of HCV. Of people with a history of injecting drug use for 10 years or more, 72% tested positive to HCV antibody compared with 18% of people with a history of injecting drug use of less than 3 years (Table 4.18). There is less evidence of such a relationship for HIV—only 1.6% of the long-term injecting drug users tested were positive for HIV antibody.

Table 4.18: Prevalence of HIV or HCV antibodies among injecting drug users aged 14 years and over, by history of injecting drug use, 2006 (per cent)

History of injecting drug use	Tested positive to HIV antibody			Tested positive to HCV antibody		
	Males	Females	Persons[(a)]	Males	Females	Persons[(a)]
Less than 3 years	1.7	—	1.0	16	22	18
3–5 years	2.5	—	1.4	32	28	30
6–10 years	1.8	0.6	1.5	49	65	55
10 or more years	2.3	0.3	1.6	70	75	72
History not reported	1.8	—	1.4	59	60	59
All	**2.1**	**0.3**	**1.5**	**60**	**64**	**62**

(a) Includes people whose sex was reported as transgender or whose sex was not reported.

Source: NCHECR 2007a.

The proportion of injecting drug users at needle and syringe programs around Australia who reported re-use of someone else's used needle and syringe in the previous month rose from 16% in 2001 to 18% in 2004, then fell to 13% in 2006 (NCHECR 2007b) (*NHPC indicator 3.01*).

In 2006, re-use of someone else's needle and syringe was generally reported as after use by only one person (7% of all participants), typically a regular sex partner (6%). Re-use of someone else's used equipment (other than needles and syringes) in the previous month was somewhat more common, at 20% for spoons and 15% for water.

Dietary behaviour

Diet plays a major role in health and in recent decades much evidence has shown that it can either reduce or increase the risk of various diseases (NHMRC 2003a). The *Global strategy on diet, physical activity and health* highlights the role of healthy diets in preventing diseases such as cardiovascular disease, Type 2 diabetes and certain types of cancer, which contribute substantially to the global burden of disease, death and disability (WHO 2006).

In Australia, current priorities for action on nutrition include promoting fruit and vegetable consumption, healthy weight, and good nutrition for mothers, babies and school-aged children, as well as improving nutrition for vulnerable groups and fostering the supply of safe and healthy food (SIGNAL 2001). There is evidence that Indigenous peoples have poorer nutrition-related health, so these priorities apply especially for them (NATSINWP 2001).

The NHMRC dietary guidelines for children, adults and older Australians (2003a, 2003b, 1999) recommend consuming a wide variety of nutritious foods, including a high intake of plant foods such as cereals, fruit, vegetables, legumes and nuts; choosing foods low in salt; and limiting alcohol intake. The guidelines also highlight the value of breastfeeding, and of preparing and storing food safely. Moderating sugar and fat intake—especially saturated fat—is also a key component of Australian dietary guidelines.

It is widely believed that general overconsumption—consuming more kilojoules than are required to meet energy needs—is contributing to Australia's increase in obesity, although the extent of any overconsumption is not well documented at present.

There have been few national nutrition-related data collected in recent years in Australia, with detailed information about food and nutrient intakes last collected in 1995. However, the regular National Health Survey (NHS) collects limited information on nutrition-related behaviours, and there are also recent data available from state and territory health surveys.

Fruit and vegetable consumption

Fruit and vegetable consumption is strongly linked to the prevention of chronic disease and to better health. Inadequate fruit and vegetable consumption was estimated to be responsible for 2.1% of the total burden of disease in Australia in 2003, ranking seventh of the 14 risk factors studied (see Table 4.1), and 1.8% of the global burden of disease.

The NHMRC dietary guidelines recommend that adults consume two to four serves of fruit and four to eight serves of vegetables per day (NHMRC 2003a)—see Box 4.5 for examples of serves. However, large sections of the population do not consume these amounts. Analysis of self-reported data from the 2004–05 NHS shows that 86% of people aged 12 years or over consumed fewer than five serves of vegetables per day, and 46% consumed fewer than two serves of fruit (relates to *NHPC indicator 2.07*). The NHS data also show that younger adults tend to have lower levels of fruit and vegetable consumption than older adults.

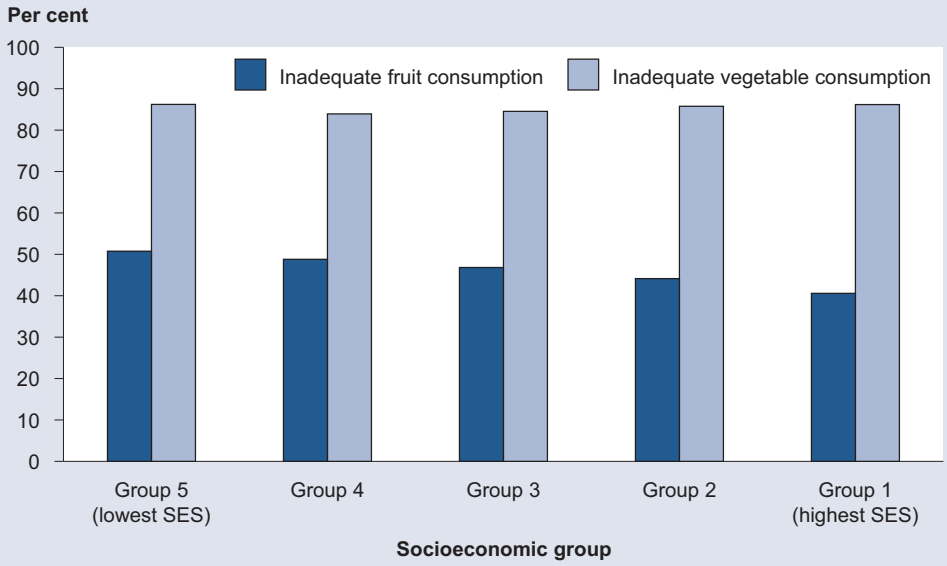
Box 4.5 How much is a serve?

By convention a serve of fruit is 150g, and a serve of vegetables is 75g. The table below sets out some examples of everyday fruit and vegetables in terms of a 'serve'.

Fruit	Vegetables
1 medium apple, orange, banana, etc.	1 medium potato, ½ medium sweet potato
2 items of small fruit such as apricots, plums, etc.	1 cup of salad vegetables
About 8 strawberries	½ cup tomatoes, capsicum, cucumber, etc.
1 cup of canned fruit	½ cup carrots, swede, turnip, etc.
½ cup of fruit juice	½ cup peas, broad beans, lentils, green beans, etc.
About 4 dried apricots, 1½ tablespoons of sultanas	½ cup spinach, cabbage, broccoli, etc.
About 20 grapes or cherries	

Source: Adapted from DOHA & NHMRC 2003.

Differences in consumption have also been noted in relation to socioeconomic status (SES) (Mishra et al. 2002), with persons from higher socioeconomic areas often found to have a healthier diet. From the NHS, it can be seen that 51% of those living in the worst-off areas ate too little fruit, compared with 41% of those in the best-off areas (Figure 4.11). In addition, a higher proportion of males ate too little fruit compared with females, across all SES groups. There was little difference in vegetable consumption across groups, with around 88% of males and 84% of females eating too few serves of vegetables.



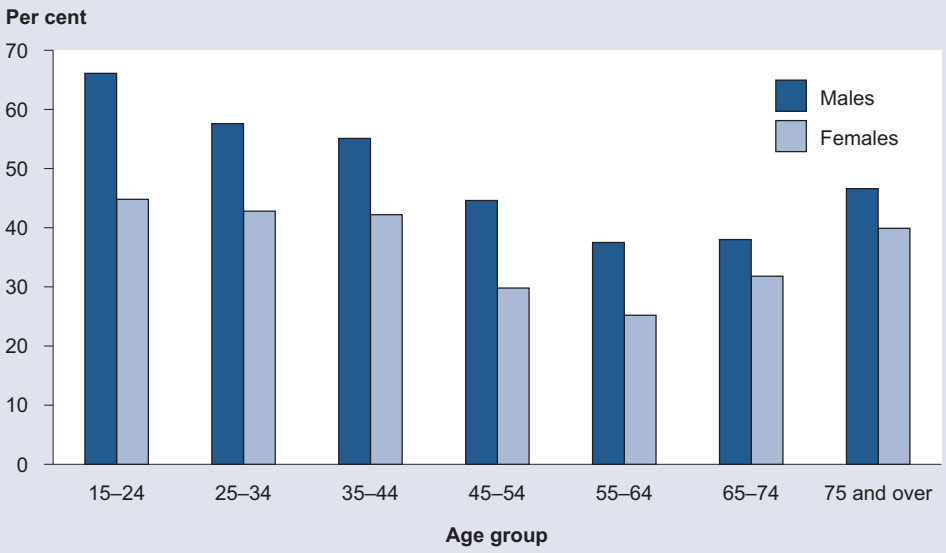
Source: AIHW analysis of the 2004–05 National Health Survey.

Figure 4.11: Inadequate consumption of fruit and vegetables, by socioeconomic status (SES), 2004–05

Saturated fat intake

Saturated fat is one of the three main types of fat, the other two being polyunsaturated and monounsaturated. It is solid at room temperature, as distinct from the other two 'oily' groups, and is mainly found in animal meats and products. A diet high in saturated fat increases the risk of coronary heart disease through its effect on raising the blood cholesterol level, notably its low-density lipoprotein component.

As dairy products contribute significantly to saturated fat intake, the proportion of people who usually consume whole ('full-cream') milk may be a useful indicator of saturated fat intake (Marks et al. 2001). Data from the 2004–05 NHS indicate that, overall, males were more likely than females to usually consume whole milk (52% compared with 39%), and that consumption of whole milk was lowest among those aged 45–74 years (Figure 4.12). In 1995, saturated fat accounted for around 13% of total energy intake by Australian adults, higher than the recommended maximum level of 10% (AIHW 2004).



Source: ABS 2006f.

Figure 4.12: Proportion consuming whole (full-cream) milk by age and sex, 2004–05

Another fat linked to an increased risk of heart disease is 'trans fat'. It is a type of unsaturated fat but it has an effect on the blood cholesterol level similar to saturated fat. It occurs naturally in very small amounts, but is also formed in commercial production of fats and is found in some margarines and processed foods. However, it is estimated that the amount in the Australian diet is quite low by international standards (FSANZ 2006).

Nutrient deficiencies

Nutrient deficiencies are a re-emerging issue in Australia. Concerns over deficiency of folate (a B vitamin) in the Australian population has led to the mandatory fortification of foods with folic acid—the synthetic form of folate used in supplements and for fortifying foods (FSANZ 2007). Folate is important for preventing spina bifida and other neural tube defects during fetal development, and the NHMRC (1994) recommends that females capable of becoming pregnant consume 400 micrograms per day of folate.

However, the 1995 National Nutrition Survey showed that only 1% of females aged 15–49 years consumed the recommended amount in their diet (excluding supplements) (Abraham & Webb 2001). Data from the 2001 NHS showed that 11% of females aged 18–49 years were deliberately increasing their intake of folate, with 7% deliberately taking vitamin or mineral supplements because they contained folic acid. Further, 6.5% of females deliberately consumed food fortified with folic acid and 2.1% deliberately consumed fortified drinks (ABS 2003a).

Concerns over vitamin D deficiency have also been raised recently (for example Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia & Osteoporosis Australia 2005). Vitamin D is obtained through the diet and also via the skin as a result of exposure to sunlight. Populations with limited sun exposure—for example, those in aged care facilities, or women whose clothes cover nearly all their

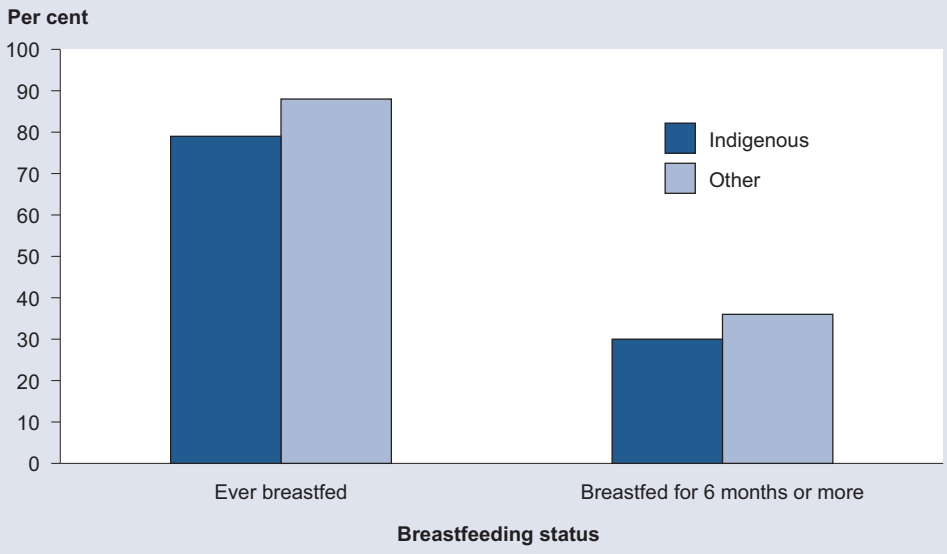
body—may be at risk of deficiency (Mason & Diamond 2001), potentially leading to osteoporosis in adulthood.

Another modern nutrient deficiency concern relates to low fruit and vegetable consumption: a case of scurvy (vitamin C deficiency) was recently documented in a young Australian male who consumed almost no fruit and vegetables as part of his usual diet (Mapp & Coughlin 2006). Data from the 2004–05 NHS indicate that 7% of the population do not usually eat fruit each day, and 1% do not usually eat vegetables (ABS 2006f).

Breastfeeding

Australian recommendations for breastfeeding reflect the international recommendations of exclusive breastfeeding for the first 6 months of life, with introduction of complementary foods and continued breastfeeding from 6 months of age (NHMRC 2003b). These recommendations are based on the nutritional, health, social and economic benefits of breastfeeding. Evidence is accumulating of the protective role breastfeeding may have in several chronic diseases including Type 1 diabetes, inflammatory bowel disease and allergic diseases (NHMRC 2003b). Breastfeeding has also been seen to play an important role in helping to prevent obesity in children, attributed to physiological factors in human milk as well as feeding and parenting patterns associated with breastfeeding.

The proportion of Australian infants ever breastfed has remained fairly constant over the period 1995–2005, at around 86–88% (ABS 2003b, 2006f). However, in non-remote areas Indigenous mothers appear to be less likely to initiate and continue breastfeeding than other Australian mothers: in 2004–05, 79% of Indigenous children aged 0–3 years were reported as having ever been breastfed (including those currently breastfed) compared with 88% of other children. Similarly, 30% of Indigenous children in non-remote areas had been breastfed for 6 months or more compared with 36% of other children (Figure 4.13).



Source: ABS 2006g.

Figure 4.13: Breastfeeding status of infants aged 0–3 years in non-remote areas, 2004–05

Food security

The term 'food security' refers to the availability of healthy, affordable foods and the capacity of individuals and communities to obtain them. Food insecurity can affect nutritional status. In the 1995 and 2001 NHS surveys, around 5% of the adults (slightly more females than males) reported that there had been times in the previous 12 months when they had run out of food and could not afford to buy more (AIHW unpublished analysis of NHS data). Australians at particular risk of food insecurity include older people, those living in rural and remote areas, and those with a disability.

Sexual behaviours

Sexual activity can be associated with health risks, and unsafe sex was estimated to have been the cause of 0.6% of the burden of disease in Australia in 2003 (see Table 4.1). Unprotected intercourse can transmit infections such as chlamydia, gonorrhoea, HIV and syphilis, and can also result in unwanted pregnancies. Unprotected sexual activity has also been associated with an increased risk for specific cancers such as cervical cancer and anal cancer. The risk for these outcomes rises with increasing numbers of sexual partners.

Among the whole population, rates of sexually transmitted infections (STIs) have been generally increasing over at least the past decade. According to the National Notifiable Diseases Surveillance System, chlamydia was the most frequently reported STI in Australia in 2007, with a notification rate of 238 per 100,000 population, up from 57 in 1998.

The reporting of syphilis was changed in 2004 to differentiate new (infectious) cases from 'tertiary' ones (the chronic, non-infectious stage of the disease that can result from untreated early syphilis). Since 2004, notifications of infectious syphilis increased from 3.1 per 100,000 population to 5.7 in 2007.

The Australian Study of Health and Relationships was a telephone survey of a representative sample of males and females aged 16–59 years, conducted between May 2001 and June 2002. Those who identified as homosexuals reported a much higher lifetime number of sexual partners (males: an average 79.1 same-sex partners; females: 7.8) than did heterosexuals (males: 16.7 opposite-sex partners; females: 6.5) (de Visser et al. 2003a; Grulich et al. 2003). This means that male homosexuals are at generally increased risk of STIs.

Using surveys of homosexually active males in capital cities, the National Centre for HIV Epidemiology and Clinical Research (NCHECR 2007a) estimates that the proportion having unprotected anal intercourse with casual partners was around 20–21% in Sydney, Melbourne and Perth in 2006, although slightly higher at 23% in Brisbane and down to 15% for Adelaide and Canberra. Trends in rectal isolates of gonorrhoea among males support the reports of unprotected anal intercourse.

Among the general heterosexual population in 2002, 8% of males and 6% of females always used a condom in the past year for sexual activity with a regular partner. Substantially higher rates were observed for always using a condom with casual heterosexual partners: 45% of males and 35% of females (de Visser et al. 2003b).

Vaccination

Vaccination is the administration of a vaccine to a person to stimulate the immune system and protect against a specific infectious disease. Apart from effectively protecting the individual concerned, vaccination has a further purpose: if enough people in a population are vaccinated, the spread of infection is limited and the disease can be controlled or

in some cases eliminated. This phenomenon is termed 'herd immunity'. For example, smallpox has been eliminated worldwide, allowing routine smallpox vaccination to be discontinued. Similarly, poliomyelitis has been eradicated in most parts of the world including the western Pacific region, although universal vaccination is continued because of the potential for reintroduction from areas where infection persists.

The National Health and Medical Research Council recommends a range of vaccinations for all children, older persons and others (including Indigenous Australians) who are at higher risk of contracting vaccine-preventable diseases. The Australian Government provides free vaccines for 17 vaccine-preventable diseases, and these are set out in the National Immunisation Program Schedule (NIPS).

Vaccination for children

For children, the NIPS currently covers diphtheria, tetanus, pertussis (whooping cough), polio, measles, mumps, rubella, *Haemophilus influenzae* type b (Hib), meningococcal type C disease, varicella (chickenpox), pneumococcal disease, hepatitis B, rotavirus, and, for Aboriginal and Torres Strait Islander children living in high-risk areas, hepatitis A.

To be considered fully immunised, children should have received all the vaccinations appropriate to their age. Administered vaccinations are recorded in the Australian Childhood Immunisation Register (ACIR), from which coverage rates are calculated for children aged 1, 2 and 6 years.

In December 2007, full vaccination coverage for children aged 12–15 months (as at 30 September 2007) was 91.5% nationally (Table 4.19). The coverage for individual vaccines was as high as 94.4% for *Haemophilus influenzae* type B (*NHPC indicator 3.05*). Note that the 'fully immunised' rate is lower than the rate for each of the individual vaccines, because any one child may not have yet received the full schedule of vaccinations at the time the rate was calculated. Across the country, the fully immunised rate for children of this age varied from 88.8% in Western Australia to 93.5% in Tasmania.

For children aged 24–27 months the full vaccination coverage was 93.0%, again lower than the rates for each of the individual vaccines (the highest coverage being for hepatitis B at 96.0%) (*NHPC indicator 3.05*). The fully immunised rate for this age group varied from 91.4% in Western Australia to 95.7% in Tasmania. For older children—aged 72–75 months—the full coverage was 88.8%, with virtually no difference in the rates for each vaccine.

Table 4.19: Vaccination status for children, as at December 2007 (per cent)

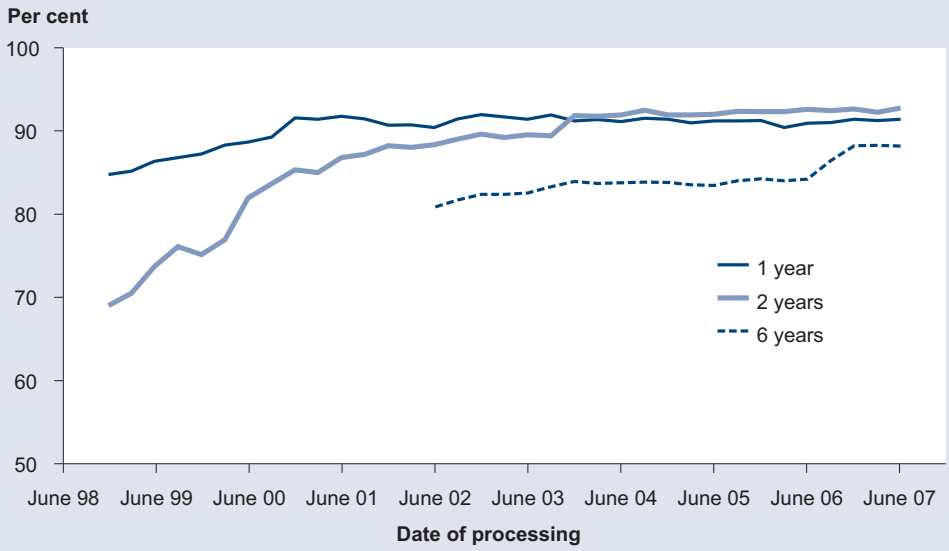
	Age in months[a]		
Measure	**12–15**	**24–27**	**72–75**
Diphtheria, tetanus and pertussis	92.1	95.3	89.4
Poliomyelitis	92.1	95.2	89.5
Haemophilus influenzae type B	94.4	94.8	. .
Hepatitis B	94.4	96.0	. .
Measles, mumps and rubella	. .	94.2	88.7
Fully immunised	**91.5**	**93.0**	**88.8**

(a) Age as at 30 September 2007.

Source: Medicare Australia 2008.

After the introduction of the ACIR over 10 years ago, reported vaccination rates for younger children rose for the first few years, but have recently been stable (Figure 4.14). Reporting of rates for 6 year olds began in 2002, seeing coverage climb from around 81% then, up to 88% in June 2007.

The spike in coverage for 2 year olds in 2003 was due to the removal from the schedule of the 4th dose of diphtheria-tetanus-pertussis vaccination (due at 18 months) from the December 2003 quarter onwards, such that only three vaccinations are now used in the coverage assessment. Similarly for 6 year olds, from June 2006 the introduction of a combination vaccine onto the schedule reduced the number of vaccines to be recorded from three to two.



Source: Data from the Australian Childhood Immunisation Register.

Figure 4.14: Vaccination status for children, 1998–2007

Human papillomavirus vaccination for girls and young women

From 2007 the Australian Government is funding the purchase of human papillomavirus (HPV) vaccine to be provided to girls and young women. The vaccine is delivered as a course of three injections over 6 months and protects against the strains of HPV that cause 7 out of 10 cervical cancers and 9 out of 10 cases of genital warts.

By the end of 2008, all girls currently aged 12–18 years will have had access to the vaccine in school. For young women who are not in school and aged under 27 years, GPs and community immunisation clinics will provide the free vaccine until the end of June 2009, as a 'catch-up' program.

The vaccine is not approved for use in women aged over 26 years, and all those vaccinated will still need to have regular Pap smears to ensure that any cervical abnormalities are detected early.

Influenza and pneumococcal vaccination for adults

Vaccination against influenza and pneumococcal infection (which typically causes pneumonia) is available in Australia and is free for all Indigenous Australians aged 50 years and over, for all others aged 65 years and over, and for Indigenous Australians aged 15–49 years in high-risk groups.

A national telephone survey on adult vaccination in 2006 showed that 77.5% of Australians aged 65 years and over were vaccinated against influenza in 2006 (*NHPC indicator 3.06*). This is the highest vaccination coverage of all OECD countries, and a marked increase from 61% in 1998. When the vaccination status of aged care residents was taken into account, the estimated coverage for 2006 lifted slightly to 78.0%.

For pneumococcal disease, the estimated vaccination coverage of Australians aged 65 years and over in 2006 was 62.2%, compared with 51.1% in 2004. More of this target group may have been vaccinated, but the currency of their vaccination could not be fully determined from the survey.

4.6 Biomedical factors

As distinct from behaviours and other determinants discussed earlier in this chapter, biomedical factors represent actual bodily states. Factors such as high blood pressure and high blood cholesterol, for example, can therefore be regarded as relatively 'downstream' in the process of causing ill health. They carry comparatively direct and specific risks for health. They are often influenced by behavioural factors which are in turn influenced by socioeconomic factors and other 'upstream' determinants.

Health behaviours tend to interact with each other and influence a variety of biomedical factors. Both physical activity and diet, for example, can affect body weight, blood pressure and blood cholesterol. They can each do this independently, or, with greater effect, they can act together. Further, behavioural and biomedical risk factors tend to increase each other's effects when they occur together in an individual.

Note that several of the biomedical risk factors discussed here are often highly interrelated in causing disease. Excess body weight, high blood pressure and high blood cholesterol, for example, can all contribute to the risk of heart disease and amplify each other's effects if they occur together. In addition, obesity can in itself contribute to high blood pressure and high blood cholesterol.

Similarly, Type 2 diabetes is often regarded as a biomedical risk factor, as it is essentially defined by an abnormal biomedical process (see the section on impaired glucose regulation later in this chapter), and because an individual with diabetes is more at risk of other diseases, particularly cardiovascular disease (Diabetes Australia 2006a). Diabetes is discussed in more detail in Chapter 5.

Blood pressure

High blood pressure (often referred to as hypertension; see Box 4.6) is a major risk factor for coronary heart disease, stroke, heart failure and kidney failure. 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).

Nearly 8% of the burden of disease in Australia in 2003 can be attributed to high blood pressure. It ranks as a close second to tobacco use on this score, with coronary heart disease and stroke accounting for 93% of the burden of high blood pressure. Four-fifths of the burden of high blood pressure was considered to be due to premature death and the remainder to disability.

Major causes of high blood pressure include diet (particularly a high salt intake), obesity, excessive alcohol consumption, and insufficient physical activity. Attention to health determinants such as body weight, physical activity and nutrition plays an important role in maintaining healthy blood pressure.

Box 4.6: High blood pressure

Blood pressure represents the forces exerted by blood on the wall of the arteries and is written as systolic/diastolic (for example 120/80 mmHg, stated as '120 over 80'). Systolic blood pressure reflects the maximum pressure in the arteries when the heart muscle contracts to pump blood. Diastolic blood pressure reflects the minimum pressure in the arteries when the heart muscle relaxes before its next contraction.

There is a continuous relationship between blood pressure levels and cardiovascular disease risk. This makes the definition of high blood pressure somewhat arbitrary. The World Health Organization defines high blood pressure as:

- systolic blood pressure of 140 mmHg or more; or
- diastolic blood pressure of 90 mmHg or more; or
- receiving medication for high blood pressure.

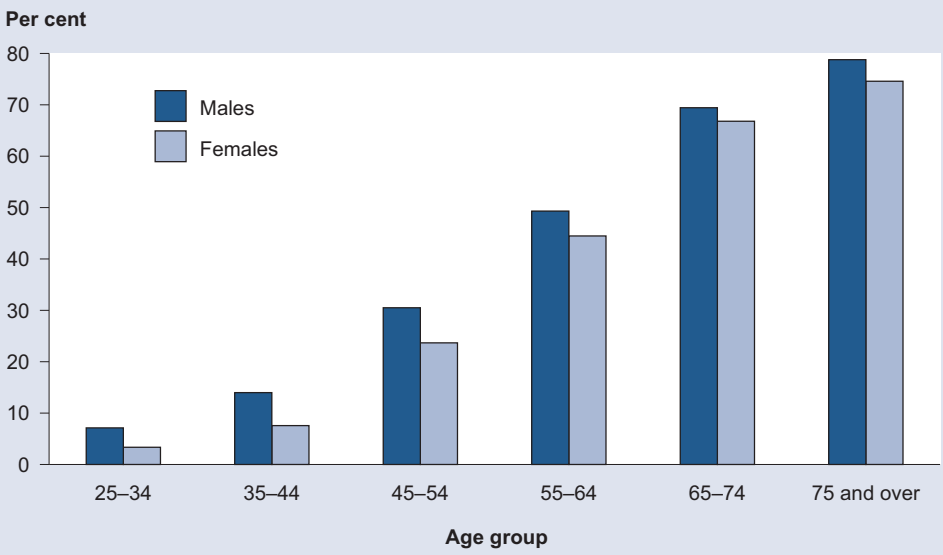
In this report high blood pressure is defined using these guidelines.

Source: WHO–ISH 2003.

Despite the definition of high blood pressure in Box 4.6, there is in fact no threshold level of risk. Starting from quite low levels, as blood pressure increases so does the risk of stroke, heart attack and heart failure. Elevated levels of systolic and diastolic blood pressure are each predictors of cardiovascular disease.

Prevalence of high blood pressure

The 1999–2000 Australian Diabetes, Obesity and Lifestyle Study (AusDiab study) measured people's blood pressure and the results indicated that 30% of Australians aged 25 years and over (3.7 million) had high systolic or diastolic blood pressure or were on medication for high blood pressure—32% of males and 27% of females (relates to *NHPC indicator 2.11*). The proportion of males and females with high blood pressure increased markedly with age (Figure 4.15).



Note: Based on WHO definition of high blood pressure (Box 4.5).

Source: AIHW analysis of 1999–2000 AusDiab study.

Figure 4.15: Proportion of adults with high blood pressure, 1999–2000

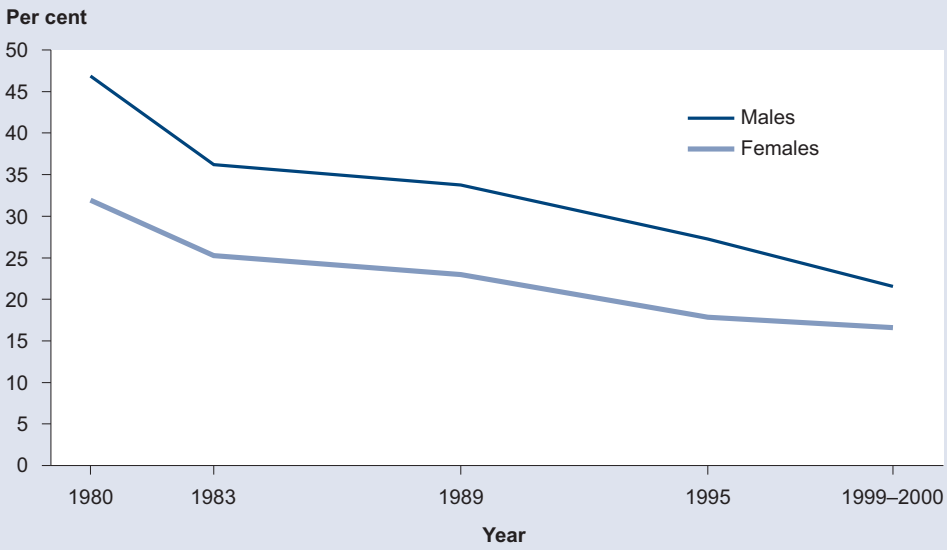
Trends

Between 1995 and 1999–2000 the prevalence of measured high blood pressure among Australians aged 25 years and over remained about the same—31% in 1995 and 30% in 1999–2000. However, looking at just the urban population aged 25–64 years—the population for which longer term trends are available—the prevalence of high blood pressure has decreased appreciably since 1980 for both males and females (Figure 4.16). The proportion of males aged 25–64 years with high blood pressure more than halved, from 47% in 1980 to 21% in 1999–2000. It correspondingly halved for females, from 32% to 16%.

It is important to note that average blood pressure also decreased in this particular group over this period. Average systolic blood pressure decreased from 134 to 128 mmHg for males, and from 127 to 121 mmHg for females. Average diastolic blood pressure decreased from 85 to 74 mmHg for males, and from 79 to 68 mmHg for females (AIHW 2004).

Aboriginal and Torres Strait Islander peoples

There have been no national surveys that directly measured blood pressure among Aboriginal and Torres Strait Islander peoples. However, from self-reported data collected in the 2004–05 National Aboriginal and Torres Strait Islander Health Survey, 7% of Indigenous Australians overall, and 22% of those aged 35 years and over, had high blood pressure as a long-term condition. After adjusting for differences in the age structure of the Indigenous and non-Indigenous populations, high blood pressure was 60% more prevalent among Indigenous Australians than among other Australians (AIHW: Penm 2007). Indigenous people also reported high blood pressure from a younger age than other Australians.



Notes

1. Age-standardised to the 2001 Australian population.
2. People aged 25–64 years, in urban areas only.
3. Based on WHO definition of high blood pressure (Box 4.5).

Sources: AIHW analysis of 1980, 1983, 1989 Risk Factor Prevalence Surveys; 1995 National Nutrition Survey; 1999–2000 AusDiab study.

Figure 4.16: Proportion of adults with high blood pressure, 1980 to 1999–2000

Blood cholesterol

High blood cholesterol (see Box 4.7) is a major risk factor for coronary heart disease and ischaemic stroke. It is a basic cause of plaque, the process by which the blood vessels that supply the heart and certain other parts of the body become clogged.

Box 4.7: High blood fats—cholesterol and triglyceride

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 artery-clogging plaques that can bring on heart attacks, angina or stroke. 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' but this is an arbitrary definition.

Two important parts of blood cholesterol are:

- low-density lipoprotein (LDL) cholesterol, often known as 'bad' cholesterol. Excess levels of LDL cholesterol are the main way that cholesterol contributes to plaque.
- high-density lipoprotein (HDL) cholesterol, often known as 'good' cholesterol. High levels have a protective effect against heart disease by helping to reduce plaque.

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 plaque.

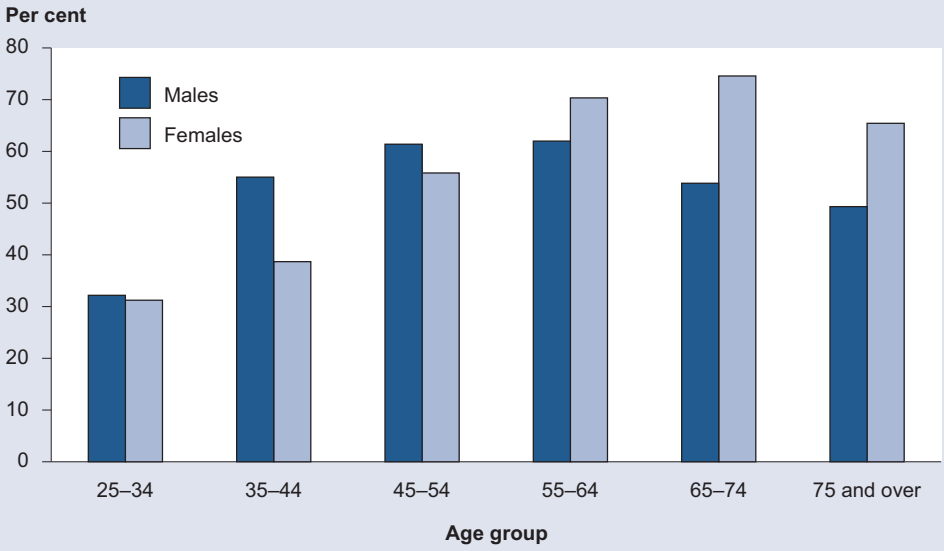
In this report, levels of high blood cholesterol are based on a total cholesterol level of 5.5 mmol/L or more.

High blood cholesterol was estimated to have caused about 6% of the total burden of disease among Australians in 2003 (Table 4.1), with coronary heart disease and stroke accounting for the whole of cholesterol's burden. About 80% of this burden was considered to be due to deaths and 20% to disability.

For most people, saturated fat in the diet is the main factor that raises blood cholesterol levels. Genetic factors can also affect blood cholesterol levels, severely in some individuals. Attention to health risk factors such as physical activity and diet plays an important role in maintaining a healthy blood cholesterol level. Some societies have much lower average cholesterol levels than Australia, with a correspondingly lower rate of cardiovascular disease.

Average blood cholesterol and prevalence of high blood cholesterol

The 1999–2000 AusDiab study estimated that around half those aged 25 years and over in 1999–2000 had levels of 5.5 mmol/L or more, corresponding to nearly 6.5 million Australians with high cholesterol. The prevalence of high blood cholesterol increased with age to a peak for females aged 65–74 years and for males aged 55–64 years (Figure 4.17).



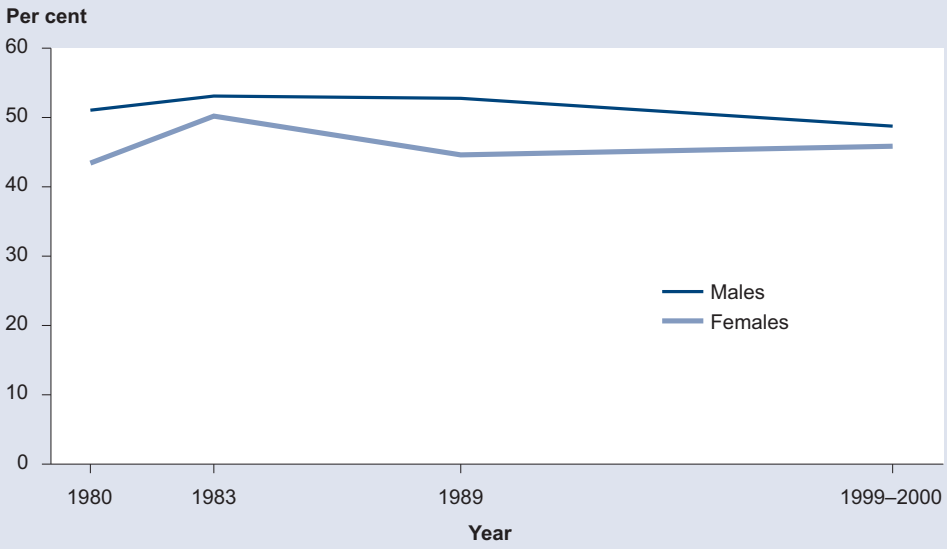
Note: High blood cholesterol is a total cholesterol level of 5.5 mmol/L or more.

Source: AIHW analysis of 1999–2000 AusDiab study.

Figure 4.17: Proportion of adults with high blood cholesterol, 1999–2000

Trends

Data on trends in average blood cholesterol and high blood cholesterol prevalence are available only to the year 2000 and for people aged 25–64 years living in capital cities. Average blood cholesterol levels of adults in 1999–2000 were very similar to those 20 years earlier. Consistent with the trends in average levels, there was no apparent reduction in the prevalence of people with high blood cholesterol over that period (Figure 4.18).



Notes

1. Age-standardised to the 2001 Australian population.
2. People aged 25–64 years in capital cities only.
3. High blood cholesterol is a total cholesterol level of 5.5 mmol/L or more.

Source: AIHW analysis of 1980, 1983 and 1989 Risk Factor Prevalence surveys and 1999–2000 AusDiab study.

Figure 4.18: Proportion of adults with high blood cholesterol, 1980 to 1999–2000

Body weight

Current concerns about body weight centre on overweight and obesity, because of the significant rise in prevalence in Australia over the past 20–30 years. The dramatic increase in obesity worldwide over this period has resulted in the WHO labelling it a global epidemic. Excess body fat increases the risk of developing a range of health problems, including Type 2 diabetes, cardiovascular disease, high blood pressure, certain cancers, sleep apnoea, osteoarthritis, psychological disorders and social problems (WHO 2000).

At the other end of the weight spectrum, underweight is associated with malnutrition and poor health. Although underweight is mainly a problem in developing countries, disordered eating—for example, anorexia and bulimia—among people in the developed world also results in poor health. This discussion focuses on overweight and obesity, because of the large scale of such conditions for Australia (see Box 4.8 for more information on classifying body weight).

High body weight—also referred to as high body mass—was estimated to be responsible for 7.6% of the total burden of disease in Australia in 2003, placing it a close third behind tobacco smoking and high blood pressure (Begg et al. 2007). In addition, there is likely to be strong growth in the level of diabetes over the next 20 years, mostly as a direct result of increasing levels of obesity. Access Economics (2006) estimated that the total financial cost of obesity in Australia in 2005 was nearly $4 billion, or about 0.4% of gross domestic product.

Box 4.8: Classifying body weight

Body mass index (BMI) and waist circumference are the two main methods used for monitoring body weight. The most common measure used is the BMI (particularly in self-report surveys), as people are more likely to know their height and weight than their waist circumference. The BMI is calculated by dividing weight in kilograms by the square of height in metres (kg/m^2).

The standard recommended by the World Health Organization for adults aged 18 years and over is based on the association between BMI and illness and mortality (WHO 2000):

- underweight: BMI < 18.5
- healthy weight: BMI ≥ 18.5 and BMI < 25
- overweight but not obese: BMI ≥ 25 and BMI < 30
- obese BMI ≥ 30.

This classification may not be suitable for all ethnic groups and it is not suitable for children. Compared with the rest of the population, some groups may have equivalent levels of risk at lower BMI (for example Asians) or higher BMI (for example Polynesians). 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 circumferences of 94 cm or more in males and 80 cm or more in females indicate increased risk (referred to here as abdominal overweight). Waist circumferences of 102 cm or more in males and 88 cm or more in females indicate substantially increased risk (referred to here as abdominal obesity). 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.

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.

Data from the 2004–05 National Health Survey (NHS) indicate that the 'average' Australian aged 25 years or over is overweight, using average weight and height for each age group. Males aged 45–64 years have the highest average BMI, with a weight loss of 8 kg required to bring them into the 'healthy' BMI category. Persons aged 75 years and over have the least weight to lose, with a loss of 0.4 kg enough to bring them into the healthy category.

Overweight and obesity arises through an energy imbalance over a sustained period. Although many factors may influence a person's weight, weight gain is essentially due to the energy intake from the diet being greater than the energy expended through physical activity. The sustained energy imbalance need only be minor for weight gain to occur, and some people—because of genetic and biological factors—may be more likely to gain weight than others (WHO 2000). For related information, see the sections on dietary behaviour and physical activity in this chapter.

Although the evidence remains strong that obesity is a risk factor for ill health, including overall mortality, there is some debate about the contribution of lesser degrees of overweight to mortality rates. A recent study showed that obesity and underweight, but

not overweight, resulted in higher mortality rates in the United States, and that the impact of obesity on mortality may have decreased over time, perhaps because of improvements in public health and medical care (Flegal et al. 2005).

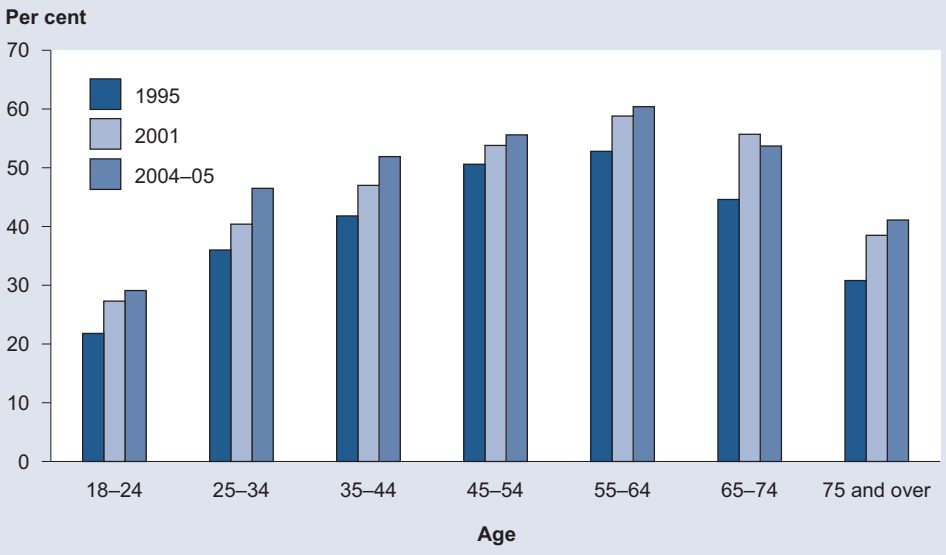
Prevalence and trends

In Australia, the prevalence of overweight and obesity has been increasing over at least the past 20–30 years. National data are available from a number of surveys, using either a BMI derived from self-reported or measured height and weight, or using waist circumference (see Box 4.8).

About half of Australian adults are overweight or obese according to the 2004–05 NHS, which provides the most recent national data and records self-reported height and weight. From this survey, an estimated 2.5 million Australian adults were obese (19% of males and 17% of females aged 18 years and over). A further 4.9 million Australian adults were estimated to be overweight but not obese (41% of males and 25% of females aged 18 years and over) (*NHPC indicator 2.09*). Among adults, 1% of males and 4% of females were estimated to be underweight. The highest rates of obesity were seen among males aged 45–54 years (23.2%) and females aged 55–64 years (21.7%) (ABS 2006f).

The prevalence of overweight and obesity has increased across all age groups from 1995 to 2004–05. The most marked increases were among those aged 25–44 years and 75 years and over, where rates increased by over 10 percentage points over that period (Figure 4.19).

This general trend is confirmed by the Bettering the Evaluation and Care of Health (BEACH) study, which shows that among adult patients attending general practice there has been a steady increase in the prevalence of overweight and obesity, from 51.1% in 1998–99 to 58.5% in 2006–07 (Britt et al. 2008).



Source: ABS 2006f.

Figure 4.19: Trends in overweight and obesity prevalence, by age

Prevalence based on measured data

Measured height and weight were last collected nationally in the 1999–2000 AusDiab study. Analysis of this survey found that 19% of males and 22% of females aged 25 years and over were obese and an additional 48% of males and 30% of females were overweight but not obese. The prevalence of underweight was less than 1% for males and nearly 2% for females. Overall, males were more likely than females to be overweight or obese (67% versus 52%). Among adults, the prevalence of obesity was highest among those aged 55–64 years (29%), with the lowest rates being among those aged 25–34 years (15%) or 75 years and over (14%). A similar pattern was seen for people who were overweight (but not obese), with the prevalence increasing with age to 65–74 years and declining thereafter.

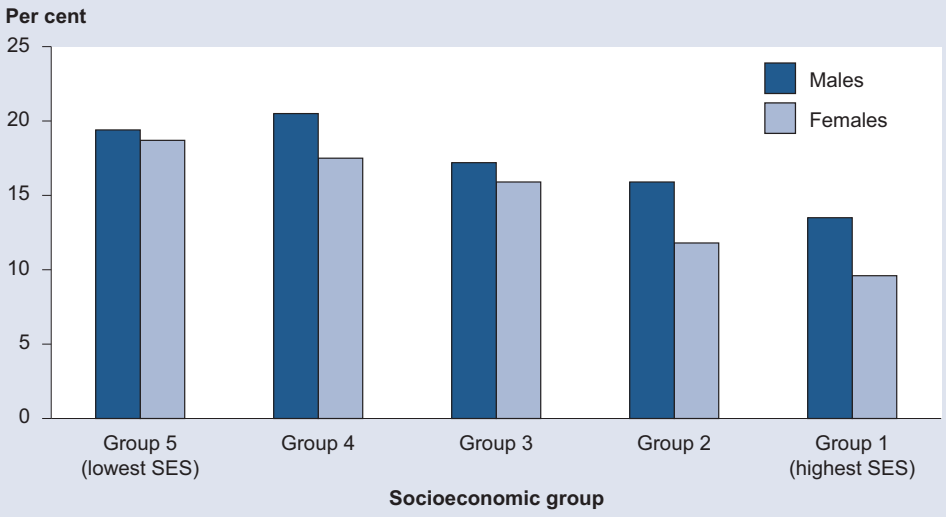
Waist circumference is also a useful indicator of abdominal obesity, which is an independent risk factor for Type 2 diabetes, coronary heart disease and other health disorders (WHO 2000). In 1999–2000, data from the AusDiab study showed that more than a quarter of males (27%) and over a third of females (34%) aged 25 years and over were abdominally obese.

Older Australians

Excess weight in older age has been seen to impair mobility, participation in social activities and quality of life (Villareal et al. 2005). It has been estimated that Australian males aged 30–34 years in 1980 gained over 8 kg as they aged to 50–54 years in 2000, and similarly females gained 12 kg over the same period (AIHW: Bennett et al. 2004). Underweight in older people also appears to be associated with impaired physical, social and mental wellbeing (Yan et al. 2004).

Socioeconomic status

Results from the 2004–05 NHS for adults aged 18 years and over show that people in the most socioeconomically disadvantaged fifth of the population had the highest rates of overweight and obesity. For them, 50% were overweight or obese, compared with 45% of adults in the best-off fifth of the population (ABS 2006f). The gradient is more marked when considering obesity alone. Based on self-reports, adults in the highest socioeconomic fifth were least likely to be obese: 9.6% of females and 13.5% of males (Figure 4.20). In comparison, 18.7% of females and 19.4% of males in the lowest socioeconomic fifth were obese.



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

Figure 4.20: Prevalence of obesity (BMI of 30 or more) by sex and socioeconomic status (SES)

Aboriginal and Torres Strait Islander peoples

Data from the 2004–05 National Aboriginal and Torres Strait Islander Health Survey show that 28% of Indigenous Australians aged 15 years and over were overweight and a further 29% were obese (ABS 2006g). After adjusting for differences in the age structures of the Indigenous and non-Indigenous populations, Indigenous Australians were just as likely as other Australians to be overweight (but not obese), and almost twice as likely to be obese.

International comparisons

Based on an analysis by the World Health Organization (WHO 2005), the prevalence of obesity among males and females 15 years and over in Australia (24% and 25%) is much lower than that in the United States of America (37% and 42%). However, it is similar to that in Canada (24% and 23%) and the United Kingdom (22% and 24%), and considerably higher than that in France (8% and 7%) and Japan (2%).

Impaired glucose regulation

Impaired glucose regulation is the metabolic state between normal glucose regulation and the failed regulation known as diabetes (WHO 1999). There are two categories of impaired glucose regulation: impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) (see Box 4.9). 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 (NHMRC 2001b; Dunstan et al. 2001). Studies have found that about 60% of people who developed diabetes had either IGT or IFG five years before they were diagnosed with diabetes (Unwin et al. 2002).

Box 4.9: Defining impaired glucose regulation

Impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) are measured using an oral glucose tolerance test (OGTT)—the same test that is used to assess for diabetes. In the OGTT a blood glucose measurement is taken after a period of about 8 hours of fasting; then an additional measurement is taken 2 hours after consuming 75 g of glucose (typically 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 first measurement) is 6.0 mmol/L or more 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 the level does not rise abnormally after taking 75 g of glucose (Diabetes Australia 2006).

IGT is diagnosed when the 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 11 mmol/L.

(Note that diabetes—rather than just impaired glucose regulation—is diagnosed when the fasting blood glucose level is 7.0 mmol/L or more, or the OGTT result is 11.1 mmol/L or more, or both.)

Risk and prevention

Impaired glucose regulation is most common in people who also have other risk factors for diabetes or cardiovascular disease, including being overweight or obese, being physically inactive, and having high levels of triglycerides, low HDL cholesterol, high total cholesterol or high blood pressure. Preventing these risk factors, as well as early treatment and improved management of impaired glucose regulation, can reduce the progression to Type 2 diabetes. Results from a follow-up study by Tuomilehto et al. (2001) showed that lifestyle interventions among obese adults with IGT—such as counselling aimed at reducing weight and total fat intake, increasing fibre intake, and physical activity—reduced the rate of progression to diabetes by 40–60% over a 3–6 year period.

How many Australians have impaired glucose regulation?

Based on measured data from the 1999–2000 AusDiab study, it is estimated that about one in six Australians aged 25 years or over had impaired glucose regulation, with IGT more prevalent than IFG (11% and 6% respectively) (Table 4.20).

A comparison of results from the 1981 Busselton Study and 1999–2000 AusDiab study indicated a large increase for both males (from 3% to 10%) and females (from 3% to 12%) in the age-standardised prevalence of IGT over the 20-year period (Dunstan et al. 2001).

Table 4.20: Prevalence of impaired glucose regulation among adults aged 25 years and over, 1999–2000 (per cent)

Measure	Males	Females	Persons
Impaired glucose tolerance	9.2	11.9	10.6
Impaired fasting glucose	8.1	3.4	5.8
Total impaired glucose regulation	**17.4**	**15.4**	**16.4**

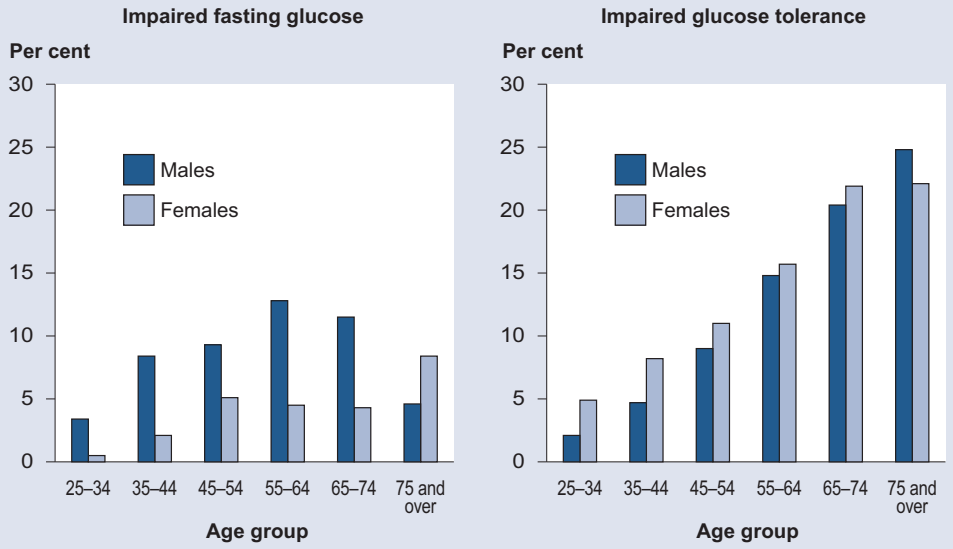
Source: AIHW analysis of the 1999–2000 AusDiab study.

Variations with sex and age

The prevalence and type of impaired glucose regulation vary with sex and age. For example, the 1999–2000 AusDiab study found that the overall prevalence of IFG was significantly higher in males than females (8% compared with 3%) (Table 4.20). This pattern is consistent with results of other studies which report IFG prevalence as being 1.5 to 3 times as high in males as in females (DECODE Study Group 2003; DECODA Study Group 2003).

The age-specific prevalence of IFG indicates that, compared with females, males had higher rates of IFG at all ages except 75 years and over, at which point the female prevalence exceeded that of males. The prevalence of IFG is highest for males aged 55–64 years and for females aged 75 years and over (Figure 4.21).

In contrast, among those aged 25–74 years, the prevalence of IGT was higher in females than in males (12% compared with 9%). From age 75 years and over 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 increasing age for both sexes.



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

Figure 4.21: Prevalence of impaired fasting glucose and impaired glucose tolerance among adults aged 25 years and over, by age group and sex, 1999–2000

References

Abelson P 2006. The cost of foodborne illness in Australia. Canberra: Australian Government Department of Health and Ageing.

Abraham B & Webb K 2001. Interim evaluation of the voluntary folate fortification policy. Canberra: Department of Health and Aged Care.

ABS (Australian Bureau of Statistics) 1997. 1996 Census data: Australia. Basic community profile—Australia: B24 family type by weekly family income. Canberra: ABS. Viewed 27 June 2007, <www.abs.gov.au>.

ABS 2002. Housing and infrastructure in Aboriginal and Torres Strait Islander communities, 2001. ABS cat. No. 4710.0. Canberra: ABS.

ABS 2003a. Measuring dietary habits in the 2001 National Health Survey, Australia. ABS cat. no. 4814.0.55.001. Canberra: ABS.

ABS 2003b. Breastfeeding in Australia. ABS cat. no. 4810.0.55.001. Canberra: ABS.

ABS 2005. Environmental issues: people's views and practices. ABS cat. no. 4602.0. Canberra: ABS.

ABS 2006a. Personal safety, Australia, 2005. ABS cat. no. 4906.0. Canberra: ABS.

ABS 2006b. Crime and safety, Australia, 2005. ABS cat. no. 4509.0. Canberra: ABS.

ABS 2006c. Education and work, Australia, May 2006. ABS cat. no. 6227.0. Canberra: ABS.

ABS 2006d. Household Expenditure Survey and Survey of Income and Housing user guide, Australia, 2003–04. ABS cat. no. 6503.0. Canberra: ABS.

ABS 2006e. Household wealth and wealth distribution, Australia, 2003–04. ABS cat. no. 6554.0. Canberra: ABS.

ABS 2006f. National Health Survey: summary of results, Australia 2004–05. ABS cat. no. 4364.0. Canberra: ABS.

ABS 2006g. National Aboriginal and Torres Strait Islander Health Survey 2004–05, Australia. ABS cat no. 4715.0. Canberra: ABS.

ABS 2007a. General Social Survey: summary results, Australia, 2006. ABS cat. no. 4159.0. Canberra: ABS.

ABS 2007b. Housing infrastructure in Aboriginal and Torres Strait Islander communities, 2006. ABS cat. no. 4710.0. Canberra: ABS.

ABS 2007c. Schools, Australia. Various years. ABS cat. no. 4221.0. Canberra: ABS.

ABS 2007d. Household income and income distribution, Australia, 2005–06. ABS cat. no. 6523.0. Canberra: ABS.

ABS 2007e. Labour force, Australia, detailed—electronic delivery, June 2007. ABS cat. no. 6291.0.55.001. Canberra: ABS.

ABS 2007f. Labour force, Australia, detailed, quarterly, August 2007. ABS cat. no. 6291.0.55.003. Canberra: ABS.

ABS 2007g. 2006 Census tables: Australia. Family composition—Australia. ABS cat. no. 2068.0. Canberra: ABS.

ABS 2007h. Participation in sports and physical recreation, 2005–06. ABS cat no. 4177.0.

Access Economics 2006. The economic costs of obesity: report prepared for Diabetes Australia. Canberra: Access Economics.

AIHW (Australian Institute of Health and Welfare) 2004. Heart, stroke and vascular diseases—Australian facts 2004. Cat. no. CVD 27. Canberra: AIHW and National Heart Foundation of Australia.

AIHW 2005. 2004 National Drug Strategy Household Survey: first results. Cat. no. PHE 57. Drug statistics series no. 13. Canberra: AIHW.

AIHW 2006. Australia's health 2006. Cat. no. AUS 73. Canberra: AIHW.

AIHW 2007. Australia's welfare 2007. Cat. no. AUS 93. Canberra: AIHW.

AIHW: Australian Centre for Asthma Monitoring 2003. Asthma in Australia 2003. Cat. no. ACM 1. Asthma series no. 1. Canberra: AIHW.

AIHW: Bennett S, Magnus P & Gibson D 2004. Obesity trends in older Australians. Cat. no. AUS 42. Bulletin no. 12. Canberra: AIHW.

AIHW: Mathers C 1994. Health differentials among adult Australians aged 25–64 years. Cat. no. PHE 17. Health monitoring series no. 1. Canberra: AGPS.

AIHW: Mathers C 1995. Health differentials among Australian children. AIHW Health monitoring series no. 3. Canberra: AGPS.

AIHW: Penm E 2008. Cardiovascular disease and its associated risk factors in Aboriginal and Torres Strait Islander peoples. Cat. no. CVD 41. Cardiovascular disease series no. 29. Canberra: AIHW.

Armfield JM 2006. The extent of water fluoridation coverage in Australia. Australian and New Zealand Journal of Public Health 30(6):581–2.

Bauman A, Bellew B, Vita P, Brown W & Owen N 2002. Getting Australia active: towards better practice for the promotion of physical activity. Melbourne: National Public Health Partnership.

Beeton RJS, Buckley KI, Jones GJ, Morgan D, Reichelt R & Trewin D 2006. Australia state of the environment 2006, Independent report to the Australian Government Minister for the Environment and Heritage. Canberra: Department of Environment and Heritage.

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

Booth M, Okely AD, Denney-Wilson E, Yang B, Hardy L & Dobbins T 2006. NSW schools physical activity and nutrition survey (SPANS) 2004. Sydney: NSW Department of Health.

Britt H, Miller GC, Charles J, Bayram C, Pan Y et al. 2008. General practice activity in Australia 2006–07. Cat. no. GEP 21. General Practice Series no. 21. Canberra: AIHW.

BTRE (Bureau of Transport and Regional Economics) 2005. Health impacts of transport emissions in Australia: economic costs. Working Paper 63. Canberra: BTRE.

Bunker S, Colquhoun D, Esler E et al. 2003. 'Stress' and coronary heart disease: psychosocial risk factors. National Heart Foundation of Australia position statement update. Medical Journal of Australia 178:272–6.

Bureau of Meteorology 2006. Annual Australian climate summary 2005. Viewed 30 July 2007, <www.bom.gov.au>.

Bureau of Meteorology 2007. Annual Australian climate summary 2006. Viewed 30 July 2007, <www.bom.gov.au>.

Cancer Council of Victoria 2007. Solarium boom shocks skin cancer experts. Viewed 3 October 2007, < www.cancervic.org.au>.

Centre for Epidemiology and Research 2007. New South Wales school students health behaviours survey: 2005 report. Sydney: NSW Department of Health.

Cheung YB 2000. Marital status and mortality in British women: a longitudinal study. International Journal of Epidemiology 29:93–9.

Cole TJ, Bellizzi MC, Flegal KM & Dietz WH 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. British Medical Journal 320:1–6.

Collins D & Lapsley H 2008. The costs of tobacco, alcohol and illicit drug abuse to Australian society in 2004/05. National Drug Strategy Monograph Series no. 66. Canberra: Department of Health and Ageing.

Coombs RH 1991. Marital status and personal wellbeing: a literature review. Family Relations 40:97–102.

Corvalan C, Hales S & McMichael A 2005. Ecosystems and human well-being: health synthesis. A report of the Millennium Ecosystem Assessment. Washington, DC: Island Press.

Dalton C, Gregory J et al. 2004. Foodborne disease outbreaks in Australia, 1995 to 2000. Communicable Diseases Intelligence 28:211–24.

DECODA Study Group 2003. Age- and sex-specific prevalence of diabetes and impaired glucose regulation in 11 Asian cohorts. Diabetes Care 26(6):1770–80.

DECODE Study Group 2003. Age- and sex-specific prevalences of diabetes and impaired glucose regulation in 13 European cohorts. Diabetes Care 26(1):61–9.

DEH (Department of Environment and Heritage) 2004. State of the air, national ambient summary report 1991–2001. Canberra: Department of Environment and Heritage.

de Visser RO, Smith AMA, Rissel CE, Richters J & Grulich AE 2003a. Sex in Australia: Heterosexual experience and recent heterosexual encounters among a representative sample of adults. Australian and New Zealand Journal of Public Health 27(2):146–54.

de Visser RO, Smith AMA, Rissel CE, Richters J & Grulich AE 2003b. Sex in Australia: Safer sex and condom use among a representative sample of adults. Australian and New Zealand Journal of Public Health 27(2):223–9.

DHAC (Commonwealth Government Department of Health and Aged Care) 1999. National physical activity guidelines for Australians. Canberra: DHAC.

Diabetes Australia 2006a. Heart disease and diabetes. Viewed 20 February 2008, <www.diabetesaustralia.com.au>.

Diabetes Australia 2006b. What is diabetes? Viewed 9 October 2007, <www.diabetesaustralia.com.au>.

DoHA (Australian Government Department of Health and Ageing) 2004a. Active kids are healthy kids. Australia's physical activity recommendations for 5–12 year olds. Canberra: DoHA.

DoHA 2004b. Get out and get active. Australia's physical activity recommendations for 12–18 year olds. Canberra: DoHA.

DoHA & NHMRC (National Health and Medical Research Council) 2003. Food for health—Dietary guidelines for Australians (A4 booklet). Canberra: DoHA & NHMRC.

Dunn A, Trivedi M & O'Neal H 2001. Physical activity dose-response effects on outcomes of depression and anxiety. Medicine and Science in Sports and Exercise 33:S587–S597.

Dunstan D, Zimmet P, Welborn T, Sicree R, Armstrong T, Atkins R et al. 2001. Diabesity and associated disorders in Australia—2000: the accelerating epidemic. The Australian Diabetes, Obesity and Lifestyle Study (AusDiab). Melbourne: International Diabetes Institute.

Econtech 2007. Economic modelling of the net costs associated with non-participation in sport and physical activity. Report prepared for Medibank Private.

Environmental Protection and Heritage Council 2007. Jurisdictional monitoring reports, 2002–2006. Viewed 8 October 2007, <www.ephc.gov.au>.

Flegal KM, Graubard BI, Williamson DF & Gail MH 2005. Excess deaths associated with underweight, overweight and obesity. Journal of the American Medical Association 293:1861–7.

FSANZ (Food Standards Australia New Zealand) 2005. The 21st Australian Total Diet Study: a total diet study of sulphites, benzoates and sorbates. Canberra: FSANZ.

FSANZ 2006. Trans fatty acids. Viewed 11 February 2008, <www.foodstandards.gov.au>.

FSANZ 2007. Australia and New Zealand Food Regulation Ministerial Council joint communiqué 22 June 2007: Food Ministers protect public health. Viewed 24 July 2007, <www.foodstandards.gov.au>.

Glover J, Hetzel D & Tennant S 2004. The socioeconomic gradient and chronic illness and associated risk factors in Australia. Australia & New Zealand Health Policy 1:8.

Groot W & van den Brink HM 2006. Measuring the effects of education on health and civic engagement: proceedings of the Copenhagen symposium. 4A. What does education do to our health? Paris: OECD.

Grulich AE, de Visser RO, Smith AMA, Rissel CE, & Richters J 2003. Sex in Australia: Homosexual experience and recent homosexual encounters among a representative sample of adults. Australian and New Zealand Journal of Public Health 27(2):155–63.

Hall G, Kirk MD et al. 2005. Estimating foodborne gastroenteritis, Australia. Emerging Infectious Diseases 8:1257–64.

Hands B, Parker H, Glasson C, Brinkman S & Read H 2004. Physical activity and nutrition levels in Western Australian children and adolescents: report. Perth: Western Australian Government.

IPCC (Intergovernmental Panel on Climate Change) 2007a. Climate change 2007: the physical science basis, summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

IPCC 2007b. Climate change 2007: impacts, adaptation and vulnerability, summary for policymakers. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Katsouyanni K 2003. Ambient air pollution and health. British Medical Bulletin 68:143–56.

Kirk M, Little C et al. 2004. An outbreak due to peanuts in their shell caused by Salmonella enterica serotypes Stanley and Newport—sharing molecular information to solve international outbreaks. Epidemiology and Infection 132:571–7.

Le Q & Le T 2005. Cultural attitudes of Vietnamese migrants on health issues. Viewed 3 October 2007, <www.aare.edu.au>.

Li C-Y, Wu SC & Wen SW 2000. Longest held occupation in a lifetime and risk of disability in activities of daily living. Occupational and Environmental Medicine 57:550–4.

Manins P, Allan R, Beer T, Fraser P, Holper P, Suppiah R et al. 2001. Atmosphere: Australia state of the environment report 2001 (theme report). Canberra: CSIRO.

Mapp SJ & Coughlin PB 2006. Scurvy in an otherwise well young man. Medical Journal of Australia 185(6):331–2.

Marks GC, Rutishauser IHE, Webb K & Picton P 2001. Key food and nutrition data for Australia 1990–1999. Australian Food and Nutrition Monitoring Unit. Viewed 4 September 2007, < www.health.gov.au>.

Mason RS & Diamond TH 2001. Vitamin D deficiency and multicultural Australia. Medical Journal of Australia 175:236–7

Mathers CD & Schofield DJ 1998. The health consequences of unemployment: the evidence. Medical Journal of Australia 168:178–82.

McMichael AJ, Woodruff R & Hales S 2006. Climate change and human health: present and future risks. Lancet 367:859–69.

Medicare Australia 2008. Australian Childhood Immunisation Register statistics. Viewed 9 February 2008, <www.medicareaustralia.gov.au>.

Mishra G, Ball K, Arbuckle J & Crawford D 2002. Dietary patterns of Australian adults and their association with socioeconomic status: results from the 1995 National Nutrition Survey. European Journal of Clinical Nutrition 56:687–93.

NATSINWP (National Aboriginal and Torres Strait Islander Nutrition Working Party) 2001. National Aboriginal and Torres Strait Islander nutrition strategy and action plan. Canberra: National Public Health Partnership.

NBCC (National Breast Cancer Centre) 2005. Key findings: National Breast Cancer Centre Breast Health Survey results. Viewed 3 October 2007, <www.nbocc.org.au>.

NCHECR (National Centre in HIV Epidemiology and Clinical Research) 2007a. HIV/AIDS, viral hepatitis and sexually transmissible infections in Australia annual surveillance report 2007. Cat. no. PHE 92. Canberra: AIHW.

NCHECR 2007b. Australian needle and syringe program survey national data report 2002–2006. Sydney: NCHECR.

NDS (National Drug Strategy) 2002. Environmental tobacco smoke in Australia. National Tobacco Strategy 1999 to 2002–03. Occasional paper. Canberra: Department of Health and Ageing.

NHMRC (National Health and Medical Research Council) 1994. Folate fortification. Report of the expert panel on folate fortification. Endorsed at the 117th session of the NHMRC, Sydney, 1–2 June 1994. Canberra: AGPS.

NHMRC 1997. The health effects of passive smoking: a scientific information paper. Canberra: AGPS.

NHMRC 1999. Dietary guidelines for older Australians. Canberra: NHMRC.

NHMRC 2001a. Australian alcohol guidelines: health risks and benefits. Canberra: NHMRC.

NHMRC 2001b. National evidence based guidelines for management of Type 2 diabetes mellitus. Part 3—Primary prevention of Type 2 diabetes. Viewed 3 October 2007, <www.nhmrc.gov.au>.

NHMRC 2003a. Dietary guidelines for Australian adults. Canberra: NHMRC.

NHMRC 2003b. Dietary guidelines for children and adolescents. Canberra: NHMRC.

NHMRC & NRMMC (Natural Resource Management Ministerial Council) 2004. National water quality management strategy: Australian drinking water guidelines. Canberra: NHMRC.

NHPC (National Health Performance Committee) 2004. National report on health sector performance indicators 2003. Cat. no. HWI 78. Canberra: AIHW

NSW Health 2006. Communicable diseases report, New South Wales, for January and February 2006. NSW Public Health Bulletin 17(3–4):58–9.

OECD (Organisation for Economic Co-operation and Development) 2007. OECD health data 2007: statistics and indicators for 30 countries. Paris: OECD.

OzFoodNet 2007. Monitoring the incidence and causes of diseases potentially transmitted by food in Australia: annual report of the OzFoodNet network, 2006. Communicable Diseases Intelligence 31(4):345–65.

Peng B & Parton KA 2003. Climate variations and the transmission of Ross River virus infection in coastal and inland region of Queensland: an analysis from Townsville and Toowoomba. Environmental Health 3(4):73–9.

Peng B, Parton KA & Donald K 2004. Climate variability and the transmission of Ross River virus in coastal regions of Queensland, Australia. Environmental health 4(2):88–94.

Perusco A, Rikard-Bell G, Mohsin M, Millen E, Sabry M, Poder N et al. 2007. Tobacco control priorities for Arabic Speakers: key findings from a baseline telephone survey of Arabic speakers residing in Sydney's south-west. Health Promotion Journal of Australia 18(2):121–6.

Preston BL & Jones RN 2006.Climate change impacts on Australia and the benefits of early action to reduce global greenhouse gas emissions. Canberra: CSIRO.

Queensland Health 2001. Cyanobacteria in recreational and drinking waters, Environmental health assessment guidelines. Brisbane: Queensland Health.

Rahkonen O, Laaksonen M, Martikainen P, Roos E & Lahelma E 2006. Job control, job demands, or social class? The impact of working conditions on the relation between social class and health. Journal of Epidemiology and Community Health 60:50–4.

Reid WV, Mooney HA, Cropper A et al. 2005. Ecosystems and human well-being: synthesis. A report of the Millennium Ecosystem Assessment. Washington, DC: Island Press.

Schrijvers CTM, Dike van de Mheen H, Stronks K & Mackenbach JP 1998. Socioeconomic inequalities in health in the working population: the contribution of working conditions. International Journal of Epidemiology 27:1011–8.

SEQWater 2008. Current dam levels. Viewed 8 February 2008, <www.seqwater.com.au>.

SIGNAL (Strategic Inter-Governmental Nutrition Alliance) 2001. Eat well Australia: an agenda for action for public health nutrition. Canberra: National Public Health Partnership.

Spencer N 2005. Does material disadvantage explain the increased risk of adverse health, educational, and behavioural outcomes among children in lone parent households in Britain? A cross sectional study. Journal of Epidemiology and Community Heath 59:152–7.

Tuomilehto J, Lindstrom J, Eriksson J et al. 2001. Prevention of Type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. New England Journal of Medicine 344 (18):1343–50.

Unwin N, Shaw J, Zimmet P & Alberti KGMM 2002. Impaired glucose tolerance and impaired fasting glycaemia: the current status on definition and intervention. Diabetic Medicine 19(9):708–23.

Victorian Department of Human Services 2007. Drinking water annual report. Viewed 8 October 2007, <www.health.vic.gov.au>.

Villareal DT, Apovian CM, Kushner RF & Klein S 2005. Obesity in older adults: technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. American Journal of Clinical Nutrition 82:923–34.

Water Services Association of Australia 2007. National performance report 2005–06. Viewed 3 October 2007, <www.wsaa.asn.au>.

White V & Hayman J 2006. Smoking behaviours of Australian secondary students in 2005. National Drug Strategy monograph no. 59. Canberra: Department of Health and Ageing.

WHO (World Health Organization) 1999. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus. Geneva: Department of Noncommunicable Disease Surveillance, WHO.

WHO 2000. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. WHO Technical Report Series 894. Geneva: WHO.

WHO 2002. World health report 2002: reducing risk, promoting healthy life. Geneva: WHO.

WHO 2003. Artificial tanning sunbeds: risks and guidance. Viewed 18 February 2008, <www.who.int>.

WHO 2005. WHO global comparable estimates 2005. Viewed 4 September, <www.who.int>.

WHO 2006. Global strategy on diet, physical activity and health. Geneva: WHO.

WHO–ISH (World Health Organization–International Society of Hypertension) 1999. Guidelines for the management of hypertension. Journal of Hypertension 17:151–83.

WHO–ISH 2003. 2003 World Health Organization (WHO)–International Society of Hypertension (ISH) statement on management of hypertension. Journal of Hypertension 21:1983–92.

Wolfe B & Zuvekas S 1997. Nonmarket outcomes of schooling. International Journal of Education Research 27:491–501.

Woodruff R, Hales S, Butler C & McMichael AJ 2005. Climate change health impacts in Australia. Effects of dramatic CO_2 emission reductions. Canberra: Australian Conservation Foundation and Australian Medical Association.

Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia & Osteoporosis Australia 2005. Vitamin D and adult bone health in Australia and New Zealand: a position statement. Medical Journal of Australia 182(6):281–5.

Wu Z, Penning MJ, Pollard MS & Hart R 2003. In sickness and in health. Does cohabitation count? Journal of Family Issues 24:811–38.

Yan L, Daviglus M, Lui K, Pirzada A, Garside D, Schiffer L et al. 2004. BMI and health-related quality of life in adults 65 years and over. Obesity Research 12(1):69–75.