

3.3 Health behaviours

Dietary behaviour

Diet plays a major role in health and disease. In recent decades much evidence has shown that dietary patterns can either reduce or increase the risk of various diseases and their risk factors. There are many areas of interest in dietary behaviour, but the greatest issue in Australia today is overconsumption.

Dietary guidelines from the National Health and Medical Research Council (NHMRC) (2003a, 2003b) recommend consuming a wide variety of nutritious foods including a high intake of plant foods (such as cereals, fruit, vegetables, legumes and nuts). They also recommend moderating total fat intake and limiting saturated fat intake to reduce the risk of coronary heart disease, Type 2 diabetes, several of the common cancers, and overweight and obesity. Other common diseases and risk factors where good nutrition may reduce risk include stroke, osteoporosis, tooth decay and high blood pressure (Table 3.4).

Table 3.4: Components of food which may help protect against diseases and conditions of public health importance

Dietary factor	Diseases (or conditions) against which protection may be provided or for which risk may be reduced
High intake of plant foods, low fat and saturated fat intake, high dietary fibre intake	Coronary heart disease, angina, colon, bowel, breast and prostate cancers, overweight and obesity
High intake of plant foods, low salt intake	High blood pressure, stroke
High intake of plant foods	Type 2 diabetes, constipation, gastrointestinal cancers (including cancers of the colon, rectum, stomach, pancreas and oesophagus), lung cancer and cancers of the breast, prostate, cervix and bladder
Low fat and saturated fat intake	Colorectal cancer
Low alcohol intake	Most cancers, liver cirrhosis, brain damage and foetal alcohol syndrome
Adequate to high calcium intake	Osteoporosis
Infrequent and low sugar intake	Tooth decay

Source: Adapted from Smith et al. 1998.

There have been so few data collected in recent years on the food and nutrient intake of Australians that much of the following discussion relates to data that are five to ten years old.

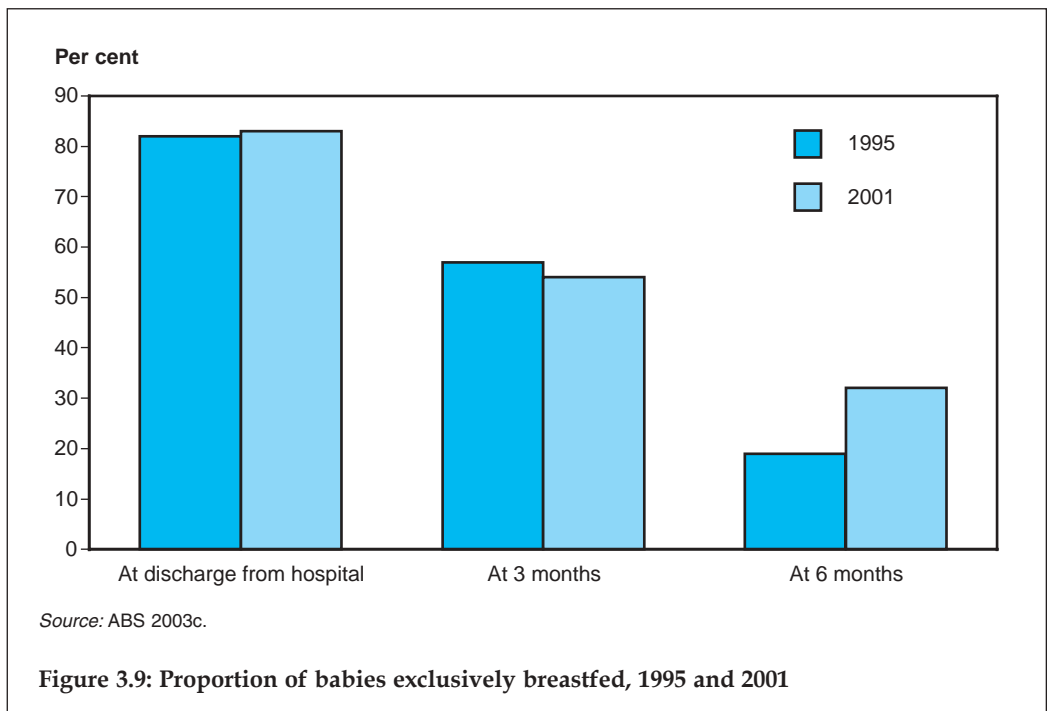
Folate intake

The impact of good nutrition on health begins early in life. It has been known for many years that insufficient folate or folic acid (a B vitamin) in the diet of women of child-bearing age increases the risk of having a foetus affected with spina bifida or other neural tube defects. The NHMRC (1994) recommends that women capable of becoming pregnant consume 400 µg per day of folate. Based on analysis of data from the 1995 National Nutrition Survey, only 1% of women aged 15–49 years consumed the recommended amount in their diet (excluding supplements) (Abraham & Webb

2001). To increase folate intakes, particularly among women of child-bearing age, voluntary folate fortification (at the discretion of food manufacturers) of selected staple foods was introduced in 1995. However, by late 1998, it was estimated that voluntary fortification had had little effect on folate intakes among the target population, due largely to the small number of foods that were fortified (Abraham & Webb 2001). More recent information from the 2001 NHS shows that few women aged 18–49 years (11.4%) are deliberately increasing their intake of folate either through the use of supplements containing folate or through consuming foods fortified with folate.

Breastfeeding

Breastfeeding is an important contributor to infant health and may influence health status in adults. Evidence is accumulating that breastfeeding may have a protective role in several chronic diseases including Type 1 diabetes, inflammatory bowel disease, allergic diseases and obesity (NHMRC 2003b). It is recommended that babies be exclusively breastfed for six months, with the introduction of complementary foods and continued breastfeeding thereafter (NHMRC 2003b). In 1995, Australian breastfeeding rates were quite high at discharge from hospital (82%), 57% of babies were exclusively breastfed at 3 months (includes water and water-based drinks such as fruit juice) but just 19% were exclusively breastfed at 6 months (Donath & Amir 2000). More recent data from the 2001 NHS showed an initiation rate of 83%, with 54% exclusively breastfed at 3 months and 32% exclusively breastfed at 6 months (Figure 3.9) (ABS 2003c).



The prevention of weight gain can begin early in life. The American Academy of Pediatrics recently acknowledged the role of breastfeeding in the prevention of overweight and obesity in children (Krebs et al. 2003). The authors cite several studies which identify both the extent and duration of breastfeeding and their role in protecting against the risk of obesity in later childhood. The association is attributed to physiological factors in human milk as well as feeding and parenting patterns associated with nursing.

Undernutrition and food security

Nutritional deficiencies are rare among Australian children and adults, although they can be of concern for some population groups: the aged, people with a chronic disability, some Aboriginal and Torres Strait Islander communities, the poor, the homeless, and those who suffer from substance abuse, alcoholism and some chronic diseases. Undernutrition (defined as a deficiency of energy or nutrients) in young children may contribute to an increased risk of abdominal obesity, Type 2 diabetes, hypertension, cardiovascular disease and renal disease in adult life – and the association is strongest when undernutrition occurs before birth (SIGNAL 2001).

The availability of healthy, affordable foods and the capacity of individuals and communities to access them can affect nutritional status. In the 2001 NHS, 4.7% of the male respondents and 5.6% of the females aged 19 years and over indicated that there had been times in the last two months when they had run out of food and could not afford to buy more. These results were similar to those obtained in the 1995 National Nutrition Survey (4.5% and 5.8%, respectively). In the 2001 survey, those without post-school qualifications were more likely to report having run out of food (6.5%) than those with a diploma or higher qualification (3.0%). People living in rural and remote areas of Australia are also vulnerable as they typically pay more for healthy foods, and perishable items such as dairy foods, fruit and vegetables are frequently in short supply and of poorer quality (NHMRC 2003a). Many Aboriginal and Torres Strait Islander people live in these areas and poor nutrition contributes to their poor health (NHMRC 2000).

Overconsumption of food

Despite continuing concerns about undernutrition in some sections of the Australian population, the most important dietary issue to emerge in recent years is the overconsumption of food. Overconsumption, or the consumption of more calories than are required to meet energy needs, is contributing to Australia's increase in obesity which in turn is a significant contributing factor in the development of many diseases (see section on body weight earlier in this chapter).

Overconsumption of food among children and adolescents is also contributing to the rise in overweight and obesity in these age groups. A comparison of food and nutrient intake among Australian children aged 10–15 years showed that average intake of energy increased significantly, by nearly 15% for boys and nearly 12% for girls, between 1985 and 1995 (Table 3.5). The increases were mainly attributable to an increased intake of carbohydrate from a range of foods including cereals and cereal-based foods, confectionery, non-alcoholic beverages and sugar products. Among

males and females aged 25–64 years living in state capital cities there were also significant increases in energy intake (but to a lesser extent than in children) between 1983 and 1995.

Table 3.5: Average daily intake of energy (kJ) among children and adults, 1983, 1985 and 1995

	1983	1985	1995	Percentage increase ^(a)
Boys 10–15 years	n.a.	9,670	11,088	14.7
Girls 10–15 years	n.a.	7,586	8,488	11.9
Males 25–64 years	10,824	n.a.	11,195	3.4
Females 25–64 years	7,299	n.a.	7,624	4.5

(a) Differences between estimated averages for 1985 and 1995 (children) and 1983 and 1995 (adults) are statistically significant at the 0.01 level.

Notes

1. Analysis of data for children: adjustments for changes in the food composition database were made to enable estimates of 'real change' in food and nutrient intakes to be better assessed. However, differences in the dietary methods between surveys could not be adjusted for due to small sample sizes. Adjustments could not be made for sample design differences (such as season and day of week) or demographic changes between the 1985 and 1995 surveys.
2. Analysis of data for adults: adjustments for changes in survey design (relating to age, geographical coverage, season and day of week), changes in the food composition database and changes in the Australian population profile between 1983 and 1985 were made to enable estimates of 'real change' in food and nutrient intakes to be assessed.
3. Adult data are for state capital cities only.

Source: Cook et al. 2001.

Fruit and vegetable intake

Despite concerns about overconsumption of food in Australia and its contribution to the rising prevalence of overweight, large sections of the population are not consuming adequate amounts of fruit and vegetables. The NHMRC dietary guidelines recommend that adults consume at least two serves of fruit and five serves of vegetables per day (NHMRC 2003a). Analysis of self-reported data from the 2001 NHS showed that just 30% of people aged 12 years or more usually ate four or more serves of vegetables per day and 53% usually ate two or more serves of fruit (ABS 2002b). It is estimated that, in 1996, inadequate fruit and vegetable consumption (defined in the study as less than five serves per day) was responsible for 3% of the total burden of disease and 11% of the total cancer burden in Australia (AIHW: Mathers et al. 1999).

Saturated fat intake

A diet high in saturated fat increases the risk of coronary heart disease through its effect on raising both total and LDL cholesterol. In 1995, among Australian adults, saturated fat accounted for around 13% of total energy intake, higher than the recommended maximum level of 10% (AIHW 2004a). The major sources of saturated fats in the adult diet are milk, cream, cheese, butter, pastries and fatty meats.

National nutrition strategies

The evidence linking diet with preventable disease is recognised in Australia and internationally. Australia's response has included the establishment of the Strategic Inter-Governmental Nutrition Alliance (SIGNAL) in 1997 which was responsible for the

development of the National Public Health Nutrition Strategy 2000–2010 (referred to as Eat Well Australia). A complementary strategy for Indigenous Australians (the National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan) was also developed by the National Aboriginal and Torres Strait Islander Nutrition Working Party.

Eat Well Australia focuses on areas where nutrition can bring the greatest health gain. These include promoting fruit and vegetable consumption, promoting healthy weight, promoting good nutrition for mothers and babies, promoting good nutrition for school-aged children, improving nutrition for vulnerable groups, and addressing structural barriers to safe and healthy food (SIGNAL 2001). The Indigenous strategy focuses on nutrition issues and diet-related diseases affecting Aboriginal and Torres Strait Islander peoples. These include food access, promotion of breastfeeding, nutrition for mothers and babies, infections and childhood growth, renal disease and dental health (NATSINWP 2001).

Physical activity

Physical activity is an important factor in maintaining good health. However, a significant and possibly growing majority of Australians are not physically active enough to obtain health benefits. 'Sufficient' activity for health benefit reflects both the time and number of sessions spent on physical activity (see Box 3.4). People who do lower-than-recommended levels of physical activity have an increased risk of mortality and morbidity from a range of diseases and conditions. Low levels of physical activity have been ranked second only to tobacco smoking, in terms of the burden of disease and injury from risk factors in Australia (AIHW: Mathers et al. 1999).

Box 3.4: What is sufficient physical activity for health?

The National Physical Activity Guidelines for Australians recommend 'at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week' to obtain health benefits. This is generally interpreted as 30 minutes on at least five days of the week, a total of at least 150 minutes of moderate activity per week. Examples of moderate-intensity activity are brisk walking, swimming, doubles tennis and medium-paced cycling. More vigorous physical activity such as jogging and aerobics provides further health benefits.

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

Sources: DHAC 1999; AIHW 2003b.

The strongest evidence for the benefits of regular physical activity concerns its ability to reduce the risk of cardiovascular disease, particularly coronary heart disease. People who do not take part in regular moderate-intensity physical activity are nearly twice as likely to have a heart attack as those who do (Blair et al. 1996). Maintaining regular physical activity improves levels of other cardiovascular risk factors such as overweight, high blood pressure, low levels of HDL (the 'good' cholesterol) and Type 2 diabetes, and can help protect against some forms of cancer. It also strengthens the musculoskeletal system, helping to reduce the likelihood of osteoporosis (low bone-mineral density) and the risk of falls and fractures. Taking part in physical activity also improves mental wellbeing (in both the short term and longer term) by reducing feelings of stress, anxiety and depression.

Despite the recognised health benefits, physical activity levels are low in industrialised countries. Labour-saving devices and passive forms of entertainment (such as computers, television, video games and the Internet) have increased the time spent in sedentary or minimally active states. At the same time, increased car ownership, increases in traffic and safety concerns have led to less walking, cycling and transport-related physical activity. Research also indicates that people perceive they have less discretionary time available for exercise or sporting activities (Bauman et al. 2002).

Prevalence and trends

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 or insufficiently active for health. Most of the information presented here is based on data obtained from the 1997, 1999 and 2000 National Physical Activity surveys. This series 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 (Box 3.5). Non-leisure time physical activity such as work or domestic activity also contributes to overall physical activity. However, this component of physical activity is difficult to measure accurately, and the instruments used to measure it are not generally practical for use in population surveys. Work is currently under way internationally to develop simpler instruments.

Box 3.5: The Active Australia Survey

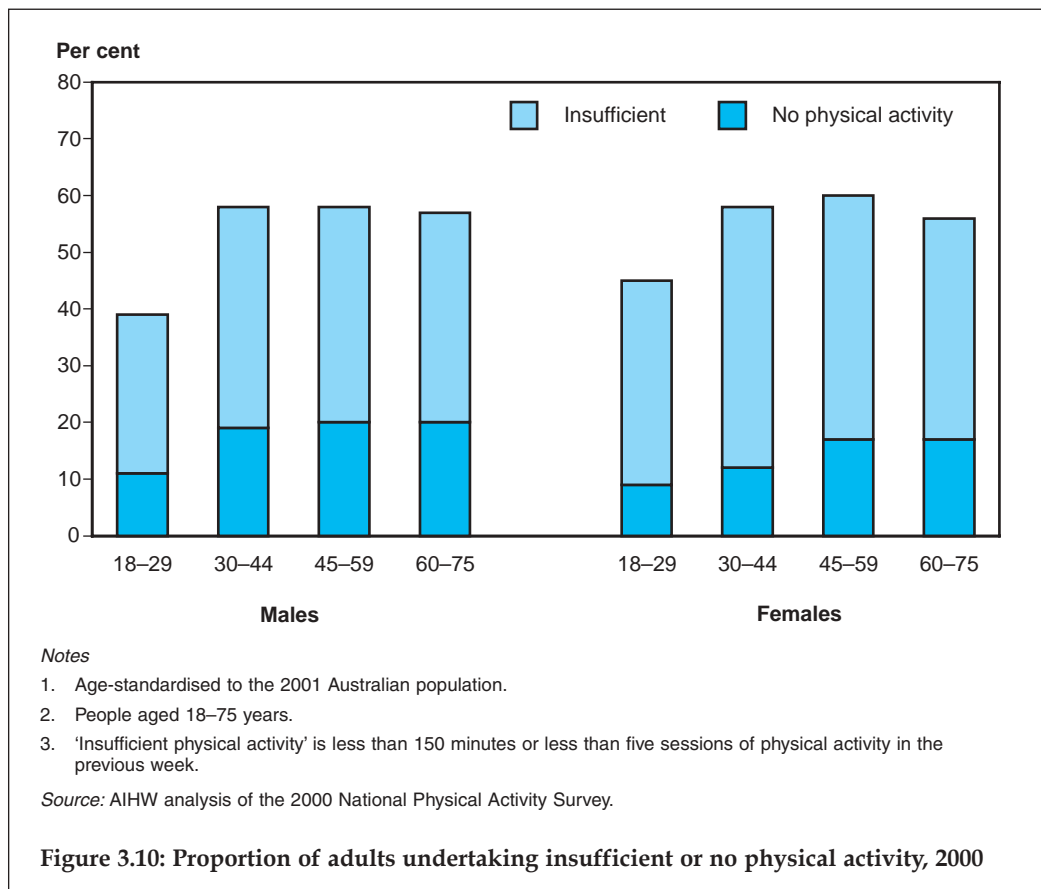
The Active Australia Survey is designed to use self-reporting to measure participation in leisure-time physical activity (including walking, vigorous gardening or yard work, and other vigorous or moderate physical activity) and to assess knowledge of public health messages about the health benefits of physical activity. It offers a short and reliable set of questions that can be easily implemented via computer-assisted telephone interviewing techniques or in face-to-face interviews. This survey has been run nationally through the National Physical Activity surveys in 1997, 1999 and 2000, and AusDiab in 1999–2000.

Sources: AIHW 2003a; AIHW 2003b.

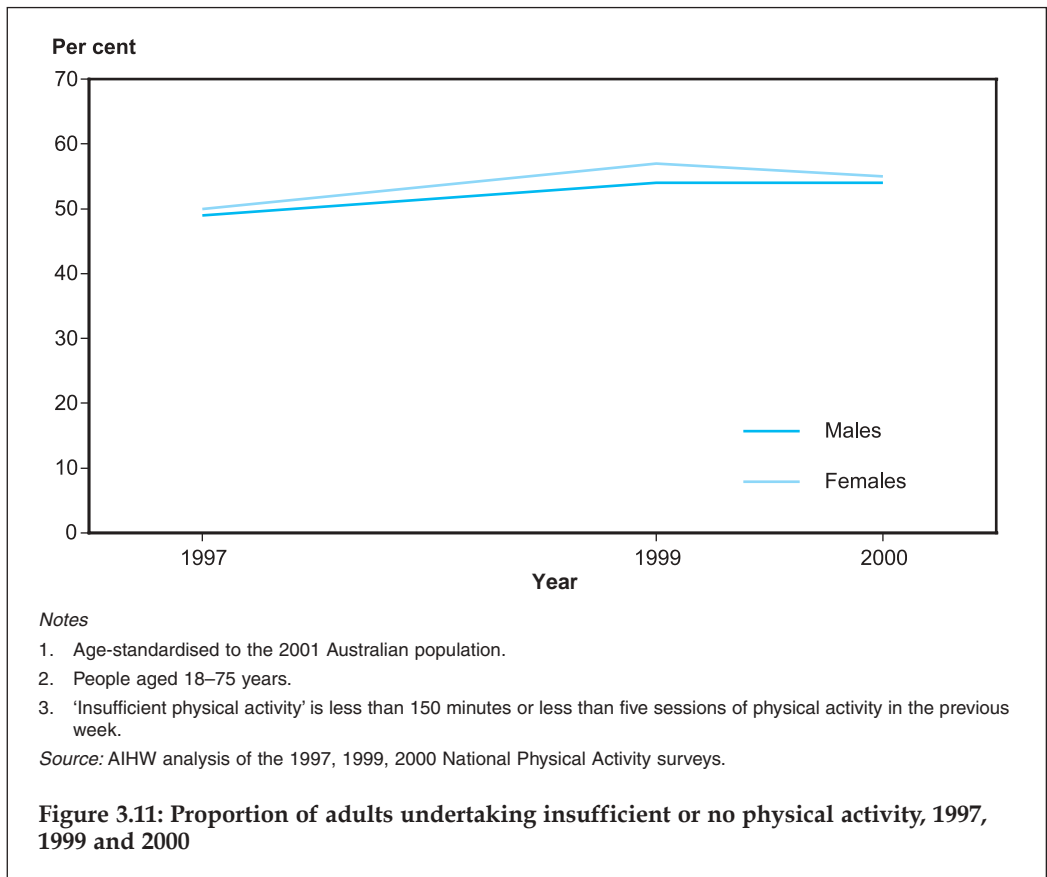
Here, 'sufficient time and sessions' is used as the measure of 'sufficient' physical activity for health. 'Sufficient time and sessions' is defined as at least 150 minutes (two-and-a-half hours) of at least moderate-intensity physical activity accrued over at least five separate sessions (10 minutes or more) in the previous week. 'Insufficient physical activity' is the completion of some physical activity but either not enough in total or not regularly enough to meet the 'sufficient time and sessions' criteria.

Data from the 2000 National Physical Activity Survey showed that more than half (54%) of Australians aged 18–75 years did not undertake leisure-time physical activity at the levels recommended to achieve health benefits. Around 15% of people reported 'no physical activity' during the previous week, and around 39% reported some activity but for either insufficient time or for too few sessions. More men (18%) than women (13%) reported 'no physical activity'.

Rates of 'insufficient' physical activity were highest among 30–59-year-olds and lowest among 18–29-year-olds, for both men and women (Figure 3.10). The proportion of people reporting 'no physical activity' increased with age, from 11% of men and 9% of women aged 18–29 years to 20% of men and 17% of women aged 45 years and over.



Available data suggest little change in physical activity patterns during the 1980s and much of the 1990s in Australia. However, between 1997 and 2000 the proportion of Australians reporting lower-than-recommended levels of physical activity rose (from 49% to 54%) (Figure 3.11). During this period, the prevalence of 'insufficient' levels of physical activity increased among men and women, and across all age groups with the exception of those aged 60–75 years (for whom activity levels remained fairly constant). The proportion of people reporting 'no physical activity' also rose slightly between 1997 and 2000 (from 14% to 16%). This rise was due to an increase in the proportion of men reporting 'no physical activity' (from 14% in 1997 to 18% in 2000). The proportion of women reporting 'no physical activity' did not change during this period.



Children and adolescents

There are no national trend data on the physical activity patterns of Australian children and adolescents. However, many activities now widely undertaken by young people involve very little physical activity. In the 2000 Australian Bureau of Statistics' Children's Participation in Cultural and Leisure Activities Survey, the most popular leisure activity outside school hours during the previous two weeks was watching

television and videos (undertaken by 97% of boys and girls aged 5–14 years) (ABS 2001). Playing electronic or computer games was also a popular leisure-time activity (69% of boys and girls combined). Decreasing levels of physical activity are believed to have contributed to the doubling in the prevalence of overweight and obesity among Australian children and adolescents over the past two decades (Magarey et al. 2001).

Health inequalities

Socioeconomic groups

Participation in physical activity varies across socioeconomic groups, with people from the lowest socioeconomic backgrounds more likely to have lower-than-recommended levels. In 2000, 61% of people with less than 12 years of education did not undertake physical activity at the recommended levels, compared with 52% of people who completed secondary school and 51% of those with a TAFE or tertiary qualification. Around one in five adults with less than 12 years of education reported 'no physical activity', nearly twice the rate for the TAFE or tertiary-educated group. However, the survey questions omit work-related physical activity, which could affect this finding.

Aboriginal and Torres Strait Islander people

Aboriginal and Torres Strait Islander people are more likely than other Australian adults to report no physical activity in their leisure time. In the 2001 NHS, around 43% of Indigenous Australian adults living in non-remote areas reported 'no leisure-time physical activity', compared with about 30% of other Australians living in the same areas (ABS 2002c).

Overseas-born Australians

In 2000, people who usually spoke a language other than English at home (64%) were more likely than people who spoke English at home (54%) to report lower-than-recommended levels of physical activity (AIHW: Holdenson et al. 2003).

Tobacco smoking

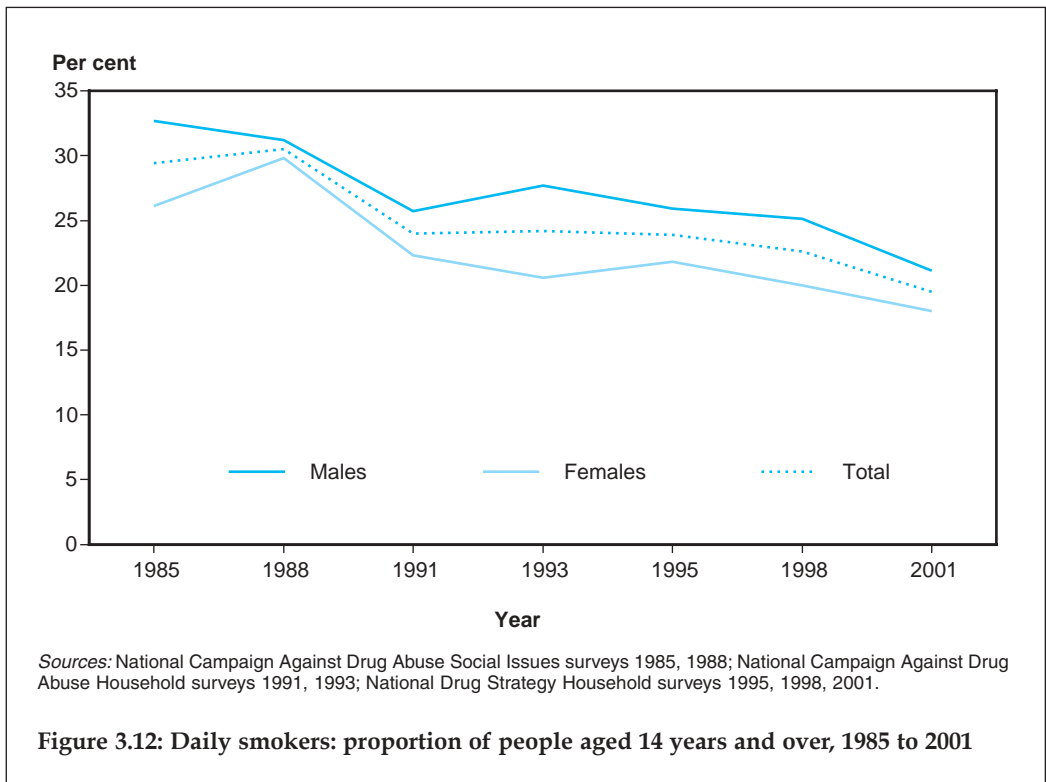
Impact and prevalence

Tobacco smoking contributes to more deaths and drug-related hospitalisations 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.

Of all the health risk factors, smoking is responsible for the greatest disease burden in Australia: around 12% of the total burden of disease in males and 7% in females (AIHW: Mathers et al. 1999). Globally, the WHO estimates that tobacco causes 8.8% of deaths and 4.1% of the total burden of disease (WHO 2002).

Estimates from the 2001 National Drug Strategy Household Survey (NDSHS) indicate that around 3.1 million Australians (19.5% of people aged 14 years and over) smoked tobacco daily. Males were more likely to be daily smokers (21.1%) than females (18.0%). Further, 26% of the population were former smokers (30% of males and 23% of females) and 51% had never smoked (45% of males and 56% of females). Data from the 2001 NHS showed similar results for adults.

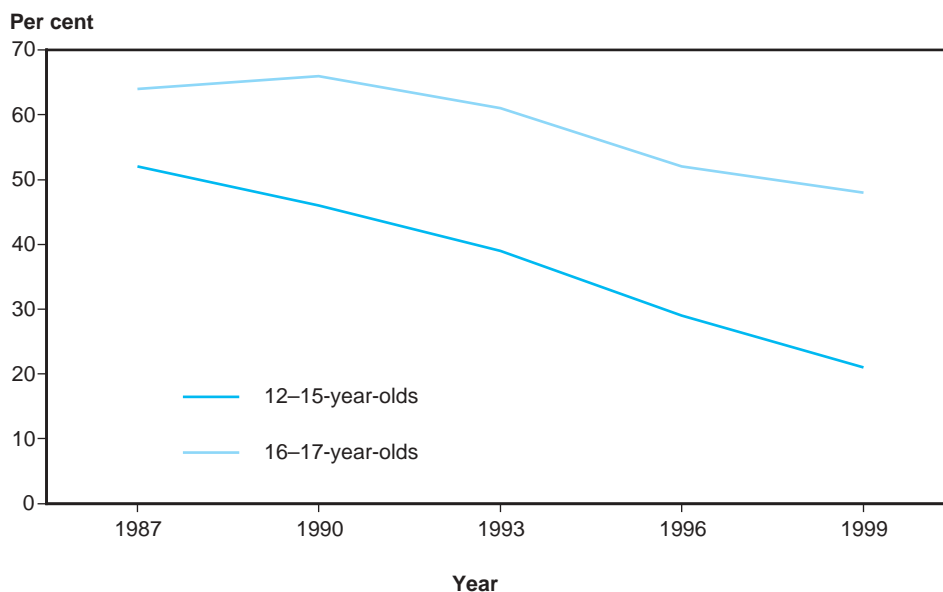
In Australia, smoking rates have been declining since the 1950s, when it was estimated that around 70% of men and 30% of women smoked (Department of Community Services and Health 1990). Over the past 15 years, both male and female smoking prevalences have continued to decline, with rates around 20% in 2001 (Figure 3.12).



Smoking among young people

All states and territories in Australia have enacted legislation prohibiting the sale of cigarettes to people under the age of 18 years. However, in 2001 around 12% of young Australians aged 14–17 years were daily smokers, with a further 4% smoking occasionally (AIHW 2002b). Teenage girls were more likely to be daily smokers (13%) than teenage boys (10%). The NDSHS results corroborate findings of the Australian Secondary Schools Alcohol and Drug Surveys (ASSADS): around the turn of the century smoking trends among teenagers were declining or at least stable (Hill et al. 2002).

The ability of teenagers to purchase cigarettes increases the likelihood of smoking and there is evidence that purchasing such products may be decreasing. Estimates from the ASSADS show that the proportion of 12–15-year-old current smokers who purchased their most recent cigarette declined from 52% in 1987 to 21% in 1999, while for 16–17-year-olds the corresponding decline was from 64% to 48% (Figure 3.13).



Source: Hill et al. 2002.

Figure 3.13: Teenage smokers: proportion who purchased their most recent cigarette, 1987 to 1999

Children exposed to tobacco smoke in the home

Passive smoking has been shown to contribute to a variety of health problems in adults and children, with children being particularly susceptible. Passive smoking is considered a factor in respiratory infections, middle ear infections, the onset and worsening of asthma, decreased lung function, eye and nose irritation, low birthweight and sudden infant death syndrome (NHMRC 1997; NDS 2002).

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

Over the period 1995–2001, around one-third of all Australian households included dependent children (that is, children aged 14 years and under). In 1995, around 31% of these households had someone who smoked inside the home (Table 3.6). With the general decline in smoking prevalence and increasing awareness of the harmful effects of passive smoking, this figure has fallen in 2001 to less than 20% of households, or just over 800,000 dependent children exposed to tobacco smoke inside the home. A similar decline is observed in households with no dependent children aged 14 years or under.

Table 3.6: Household smoking status^(a) by dependent children status^(b), 1995 to 2001

Household smoking status	Dependent children			No dependent children ^(c)		
	1995	1998	2001	1995	1998	2001
	(per cent)					
Smokes inside the home	31.3	22.6	19.7	32.2	26.6	21.3
Only smokes outside the home	16.7	21.5	24.9	13.7	18.0	19.8
No-one at home regularly smokes	52.0	55.9	55.4	54.1	55.4	58.9

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

(b) Households contain dependent children aged 14 years or under.

(c) May include dependants aged 15 years and over.

Source: National Drug Strategy Household surveys 1995, 1998, 2001.

Smoking trends among older Australians

Adults of all ages are now less likely to smoke than their counterparts in the past. For younger age groups this is increasingly due to fewer people having started to smoke, whereas for older adults the reasons are more likely to be that they stopped smoking.

Analysis of the NDSHS from 1991 to 2001 shows that among people born in the period 1932–41 (aged 62–72 years in 2004), the proportion of daily smokers decreased from around 27% in 1991 to 11% in 2001 (Table 3.7). Declines were also observed for people born before 1932. Almost all of this decrease in the proportion of smokers is accounted for by the increase in the proportion of former smokers. However, some of the decrease in smoking rates as age increases is likely to be due to smokers having already died.

Table 3.7: Changes in smoking status among older Australians: persons aged 60 years or more in 2001, 1991 to 2001

Year of birth cohort	1991	1995	2001
	(per cent)		
	Daily smokers		
1932–41	26.5	20.9	11.4
1922–31	13.7	12.5	6.6
1921 or earlier	9.3	13.7	3.4
	All smokers		
1932–41	28.7	22.6	12.6
1922–31	16.5	14.2	7.0
1921 or earlier	10.8	13.7	3.8
	Former smokers^(a)		
1932–41	20.8	23.5	37.5
1922–31	32.0	32.5	39.9
1921 or earlier	25.3	31.3	40.7
	Never smokers^(b)		
1932–41	50.5	53.9	49.9
1922–31	51.5	53.3	53.0
1921 or earlier	63.9	55.0	55.5

(a) Have not smoked in the last 12 months.

(b) Have smoked 100 cigarettes or less in their life.

Sources: National Campaign Against Drug Abuse Household Survey 1991; National Drug Strategy Household surveys 1995, 2001.

Alcohol consumption

Excessive alcohol consumption is a major risk factor for morbidity and mortality. In Australia in 1998, 3,271 deaths were attributable to excessive consumption of alcohol (AIHW: Ridolfo & Stevenson 2001).

In contrast to the effects of excessive use, some longer term benefits are thought to arise from low to moderate alcohol consumption, largely through reduced risk of stroke and coronary heart disease. The net harm associated with alcohol consumption, after taking into account these benefits, is around 2.2% of the total burden of disease. The distribution of harm and benefit varies with age. For both males and females, the harmful burden of disease is highest in the 15–24-year age group, mainly due to road trauma and other injury. The largest protective effect is realised in persons over 65 years of age, because of the increased underlying risk of cardiovascular disease in this age group.

Prevalence

Analysis of the NDSHS from 1991 to 2001 shows that around four in five Australians aged 14 years and over drank alcohol, but only about one in ten did so daily (Table 3.8). These rates have been fairly stable since 1993.

Table 3.8: Alcohol drinking status: proportion of the population aged 14 years and over, 1991 to 2001

Drinking status	1991	1993	1995	1998	2001
			(per cent)		
Daily	10.2	8.5	8.8	8.5	8.3
Occasional ^(a)					
Weekly	41.0	39.9	35.2	40.1	39.5
Less than weekly	30.4	29.5	34.3	31.9	34.6
Total occasional ^(a)	71.4	69.4	69.5	72.0	74.1
All drinkers	81.6	77.9	78.3	80.5	82.4
Ex-drinker ^(b)	12.0	9.0	9.5	10.0	8.0
Never a full serve of alcohol	6.5	13.0	12.2	9.4	9.6

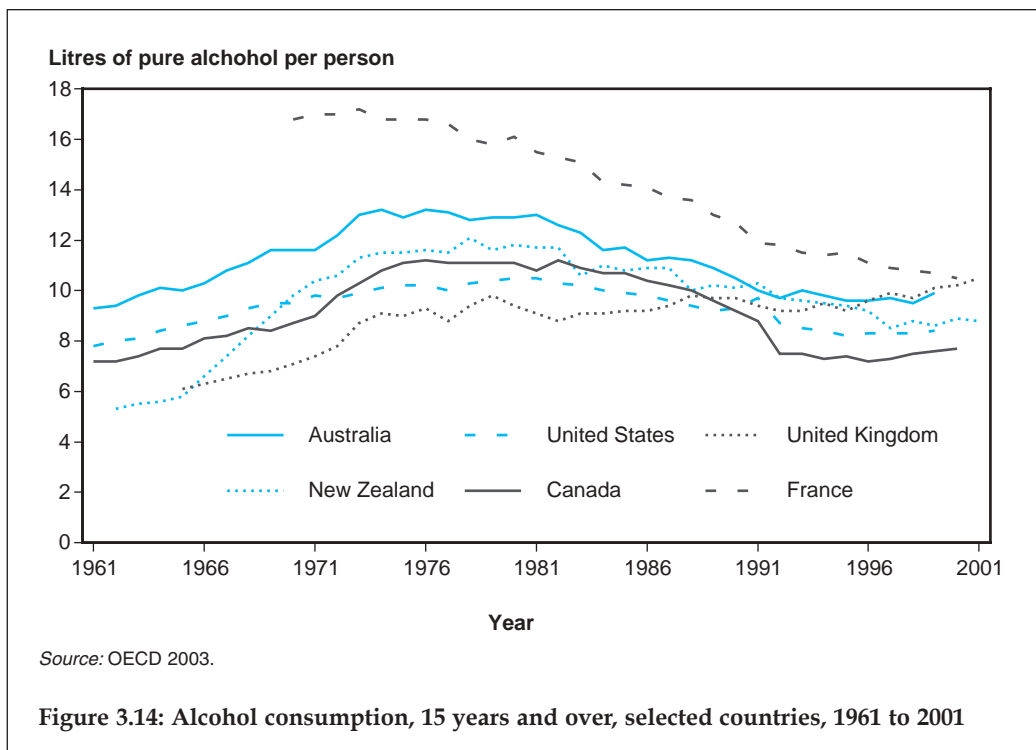
(a) Occasional drinkers are those that drink alcohol less than daily, that is, weekly or less than weekly.

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

Sources: National Campaign Against Drug Abuse Household surveys 1991, 1993; National Drug Strategy Household surveys 1995, 1998, 2001.

International comparison

Alcohol consumption (litres of pure alcohol per person aged 15 years or more) for six selected OECD countries has varied considerably since 1961 (Figure 3.14). In general, Australia followed the trend of the other countries, with increasing consumption up to the mid-1970s followed by a decline over the next two decades. Throughout most of this period Australia had the second highest consumption among these countries, behind France. Since 1996, the continued gentle and slowing decline in consumption in Australia, the steeper decline in France, and the consistent growth in the United Kingdom, have seen alcohol consumption in the United Kingdom exceed that of the other five countries.



Risk of harm from alcohol consumption

In 2001 the NHMRC published revised alcohol consumption guidelines for men and women. They are expressed in relation to the short-term and long-term risk of injury, ill health and death. An overview of the principal guidelines is in Box 3.6.

Box 3.6: Summary of Australian alcohol guidelines for short-term and long-term patterns of drinking

*Men who consume no more than 4 standard drinks a day on average or no more than 28 drinks in a week avoid the **long-term** risk of ill health and death related to alcohol and maximise the potential long-term health benefits.*

The equivalent amounts for women are 2 standard drinks per day on average and 14 over a week (because of their lower average body mass and the different way their bodies process alcohol).

*Men who consume more than 6 standard drinks in any one day significantly increase the **short-term** risk of health and social problems, including (but not only) the risk of injury or death from accident, assault and self-harm.*

For women the equivalent limit is 4 standard drinks.

Source: NHMRC 2001.

In Australia in 2001, 17.5% of the population could be classified as non-drinkers (Table 3.9). Some 60.5% of the population drank at levels of low risk in the short and long term and 8.2% drank at levels that risked harm in the short and long term.

Table 3.9: Risk of harm from alcohol consumption, persons aged 14 years and over, 2001

Long-term risk	Abstainer	Short-term risk ^(a)		Total
		Low risk	Risky or high risk	
		(per cent)		
Abstainer	17.5	17.5
Low risk	..	60.5	12.1	72.7
Risky or high risk	..	1.6	8.2	9.8
Total	17.5	62.2	20.3	100.0

(a) Monthly basis.

Note: For description of long- and short-term risk see Box 3.6.

Source: National Drug Strategy Household Survey 2001.

Drinking during pregnancy and breastfeeding

Australian women are advised to consider not drinking at all when pregnant or breastfeeding. They are advised that if they do drink they should avoid becoming intoxicated and in general should restrict their consumption to no more than seven standard drinks per week (NHMRC 2001). In 2001, it appeared that this advice was generally heeded:

- almost 60% of pregnant women (aged 14 years and older) reduced their consumption and a further 36% did not drink; and
- 66% of breastfeeding women (aged 14 years and older) reduced their consumption and a further 28% did not drink.

Overall, 53% of women aged 14–49 years consumed alcohol while pregnant or breastfeeding, compared with 84% of women in this age group that were not pregnant or breastfeeding (AIHW 2003c).

Use of illicit drugs

Illicit drug use refers to drugs such as marijuana, heroin, ecstasy and cocaine; volatile substances such as glue, solvent and petrol as inhalants; or the non-medical use of prescribed drugs.

Illicit drug use is a major risk factor for ill health and can also be a direct cause of death. Ill health associated with illicit drug use includes HIV/AIDS, hepatitis C virus (HCV), low birthweight, malnutrition, infective endocarditis (inflammation of the lining of the heart), poisoning, suicide, self-inflicted injury and death by drug overdose. Many of these conditions are the result of risky behaviours, for example sharing needles.

Illicit drug use was estimated to be responsible for 1.8% of the total burden of disease in Australia in 1996. The age-specific burden of disease attributable to illicit drug use peaked at 25–34 years of age. Around 1,000 people die from illicit drug use each year in Australia (AIHW 2002a). Globally, the WHO estimates that 0.4% of deaths (0.2 million) and 0.8% of the total burden of disease are attributable to illicit drug use (WHO 2002).

Trends in recent illicit drug use

Around 17% of people aged 14 years and over reported using illicit drugs in 2001, and this figure has fluctuated moderately over the 10-year period from 1991 (Table 3.10). Marijuana/cannabis was the most common recently used illicit drug for those aged 14 years and over, and this remained stable at around 13% of those surveyed between 1991 and 2001, except for 1998 when the figure was 18%. Amphetamines were the second most commonly used illicit drug at an average of around 2.8% from 1991 to 2001. The recent use of ecstasy has increased from 1.1% in 1991 to 2.9% in 2001.

Table 3.10: Summary of recent^(a) illicit drug use: proportion of the population aged 14 years and over, 1991 to 2001

Substance/behaviour	1991	1993	1995	1998	2001
	(per cent)				
Marijuana/cannabis	13.7	12.7	13.1	17.9	12.9
Pain killers/analgesics ^(b)	n.a	1.7	3.5	5.2	3.1
Tranquillisers/sleeping pills ^(b)	n.a	0.9	0.6	3.0	1.1
Steroids ^(b)	n.a	0.3	0.2	0.2	0.2
Barbiturates ^(b)	1.5	0.4	0.2	0.3	0.2
Inhalants	0.8	0.6	0.6	0.9	0.4
Heroin	0.4	0.2	0.4	0.8	0.2
Methadone ^(c)	n.a	n.a	n.a	0.2	0.1
Other opiates ^(b)	n.a	n.a	n.a	n.a	0.3
Amphetamines ^(b)	2.6	2.0	2.1	3.7	3.4
Cocaine	0.7	0.5	1.0	1.4	1.3
Hallucinogens	1.6	1.3	1.8	3.0	1.1
Ecstasy/designer drugs	1.1	1.2	0.9	2.4	2.9
Injected drugs	0.5	0.5	0.6	0.8	0.6
<i>Any illicit drug</i>	<i>22.8</i>	<i>14.0</i>	<i>17.0</i>	<i>22.0</i>	<i>16.9</i>
None of the above	77.2	86.0	83.0	78.0	83.1

(a) Used in last 12 months.

(b) For non-medical purposes.

(c) For non-maintenance purposes.

Source: AIHW 2003c.

Injecting drug use history

The duration of injecting drug use is associated with a higher risk of transmitting bloodborne viruses such as HIV and HCV. A 2002 survey of injecting drug users showed that 69% of people with a history of injecting drug use for 10 years or more tested positive to HCV compared with 38% of people with a history of injecting drug use of less than three years (Table 3.11). A total of 56% of the people tested positive to the HCV virus with a clear association between the duration of injecting drug use and the presence of HCV antibody. A total of 1.3% of people who were injecting drug users tested positive to the HIV antibody.

Table 3.11: Prevalence of HIV or HCV antibodies among injecting drug users aged 14 years and over, by history of injecting drug use, 2002

History of injecting drug use	Tested positive to HIV antibody			Tested positive to HCV antibody		
	Males	Females	Persons ^(a)	Males	Females	Persons ^(a)
	(per cent)					
Less than 3 years	1.3	—	0.9	38	38	38
3–5 years	0.9	1.3	1.1	46	43	45
6–10 years	0.8	—	0.7	47	55	50
10 or more years	2.3	0.6	1.9	69	67	69
History not reported	2.4	—	1.5	41	44	43
Total	1.6	0.5	1.3	56	55	56

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

Source: NCHECR 2003.

Vaccination status

Vaccination is the administration of a vaccine that protects children and adults against some infectious diseases. There are two main purposes of vaccination. First, it is the most effective way of providing individual protection against diseases. Second, 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. For example, smallpox has been eliminated worldwide, and poliomyelitis eradicated in most parts of the world including the Western Pacific region. This has allowed routine smallpox vaccination to be discontinued but vaccination against poliomyelitis must be continued because of the potential for reintroduction from areas where infection persists.

Vaccination in children

Childhood vaccination has been routinely used for over fifty years in Australia and has had a significant impact on the morbidity and mortality associated with many diseases (Gidding et al. 2001). In the late 1800s, vaccines were developed against smallpox, plague and typhoid, and were used extensively throughout Australia. Over time, new vaccines have been developed for a range of infectious diseases and large-scale vaccination programs have been implemented. Diseases targeted by the Australian childhood vaccination program in 2002 were diphtheria, tetanus, whooping cough (pertussis), poliomyelitis, measles, mumps, rubella, *Haemophilus influenzae* type B (Hib) and hepatitis B. A schedule of vaccination is provided in the *Australian Immunisation Handbook* (NHMRC 2003c) and sets out the time frames (from birth) for a vaccination provider to administer the vaccine for each disease.

In 1997, to improve vaccination coverage in Australia, the Federal Government initiated the Immunise Australia campaign. The main goals of the program were to achieve:

- greater than 90% vaccination coverage of children at 2 years of age for all diseases specified in the schedule;
- near-universal vaccination coverage at school entry; and
- near-universal vaccination coverage of girls and boys under 17 years of age for MMR (measles, mumps and rubella).

To accomplish these goals, the Seven Point Plan was announced which included initiatives for parents (Maternity Allowance and Childcare Assistance Rebate), a larger role for GPs (through the introduction of the General Practitioner Immunisation Incentives) and measles eradication.

Vaccination coverage

Vaccination coverage in Australia is monitored through the Australian Childhood Immunisation Register (ACIR), operated by the Health Insurance Commission with the cooperation of the state and territory health departments. This register contains vaccination data since 1 January 1996 for Australian children under 7 years of age, which forms the basis of the ACIR. The register is updated from Medicare enrolments to obtain the total number of children in Australia under 7 years of age. The vaccination status of each child is updated when a vaccination provider administers the age-appropriate vaccination and notifies the ACIR of this vaccination encounter. Vaccination coverage estimates are reported as the percentage of a three-month birth cohort of children who are up to date for the relevant vaccinations by the time they are 1 year, 2 years, and 6 years of age (O'Brien et al. 1998).

For Australia as a whole, vaccination coverage at 1 year of age calculated at 31 March 2002 was 90.5% (Table 3.12). Western Australia had the lowest proportion of children fully vaccinated at 1 year of age at 88.0% and the Australian Capital Territory had the highest proportion at 91.4%. Vaccination coverage for Australia at 1 year of age was highest for the Hib vaccine (94.5%) and the hepatitis B vaccine (94.4%) and lowest for the poliomyelitis vaccine (91.9%), but coverage for all individual vaccines was greater in all jurisdictions than the 90% target.

Table 3.12: Proportion of children vaccinated at 1 year of age^(a) for the birth cohort born 1 October to 31 December 2000; assessment date 31 March 2002

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Number of children	21,340	15,258	12,019	5,848	4,231	1,535	1,084	845	62,160
Diphtheria, tetanus and pertussis (%)	91.9	92.8	92.0	90.1	92.2	92.1	92.9	90.7	92.0
Poliomyelitis (%)	91.8	92.8	91.9	90.0	92.0	92.1	92.8	90.5	91.9
<i>Haemophilus influenzae</i> type b (%)	94.5	95.0	94.3	93.1	94.5	95.7	94.7	96.1	94.5
Hepatitis B (%)	94.7	94.1	94.8	92.2	94.9	94.9	95.0	96.3	94.4
Fully immunised (%)^(b)	90.6	91.0	90.8	88.0	90.6	91.0	91.4	89.7	90.5

(a) Aged 12–15 months at 31 December 2001.

(b) Fully immunised (%) = no. children vaccinated/no. children in register × 100.

Source: Australian Childhood Immunisation Register.

The proportion of children fully vaccinated at 2 years of age was lower and below target at 87.8% (Table 3.13). Tasmania had the highest percentage of children fully vaccinated at 2 years of age at 89.6% and the Northern Territory had the lowest proportion of children fully vaccinated at 85.9%. For individual vaccines, coverage for diphtheria, tetanus and pertussis vaccine at 2 years of age was the lowest at 90.2% whilst coverage was highest for Hib vaccine at 95.4%.

Table 3.13: Proportion of children vaccinated at 2 years of age^(a) for the birth cohort born 1 October to 31 December 1999; assessment date 31 March 2002

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Number of children	20,711	15,149	11,714	6,132	4,417	1,483	999	759	61,364
Diphtheria, tetanus and pertussis (%)	89.7	90.9	91.1	89.1	90.0	90.4	89.9	86.8	90.2
Poliomyelitis (%)	94.1	95.2	94.0	93.8	94.6	96.1	95.0	94.6	94.4
<i>Haemophilus influenzae</i> type b (%)	95.4	96.1	95.0	94.7	95.4	96.6	95.8	94.1	95.4
Measles, mumps and rubella (%)	92.8	94.1	93.2	92.9	93.2	95.1	94.4	94.2	93.4
Fully immunised (%)^(b)	86.9	88.8	88.8	86.3	87.5	89.6	88.5	85.9	87.8

(a) Aged 24–27 months at 31 December 2001.

(b) Fully immunised (%) = no. children vaccinated/no. children in register × 100.

Source: Australian Childhood Immunisation Register.

Vaccination coverage at 6 years of age for Australia, assessed for the first time in 2002, was considerably lower at 80.6% (Table 3.14). Victoria had the highest percentage of children fully vaccinated at 6 years of age at 83.3% and the Northern Territory had the lowest proportion at 72.0%. Vaccination coverage for Australia at 6 years of age was highest for poliomyelitis vaccine (84.0%) and lowest for the MMR vaccine (82.4%).

Table 3.14: Proportion of children vaccinated at 6 years of age^(a) for the birth cohort born 1 January to 31 March 1996; assessment date 30 June 2002

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
Number of children	21,859	15,885	12,715	6,621	4,818	1,555	1,031	881	65,365
Diphtheria, tetanus and pertussis (%)	83.2	85.0	84.5	81.2	84.7	82.4	83.7	75.8	83.7
Poliomyelitis (%)	83.2	85.6	84.9	81.3	84.9	83.1	83.7	76.4	84.0
Measles, mumps and rubella (%)	80.0	85.0	84.1	80.6	83.4	81.4	82.7	76.4	82.4
Fully immunised (%)^(b)	78.3	83.3	82.6	78.3	81.8	79.7	81.3	72.0	80.6

(a) Aged 72–75 months at 31 March 2002.

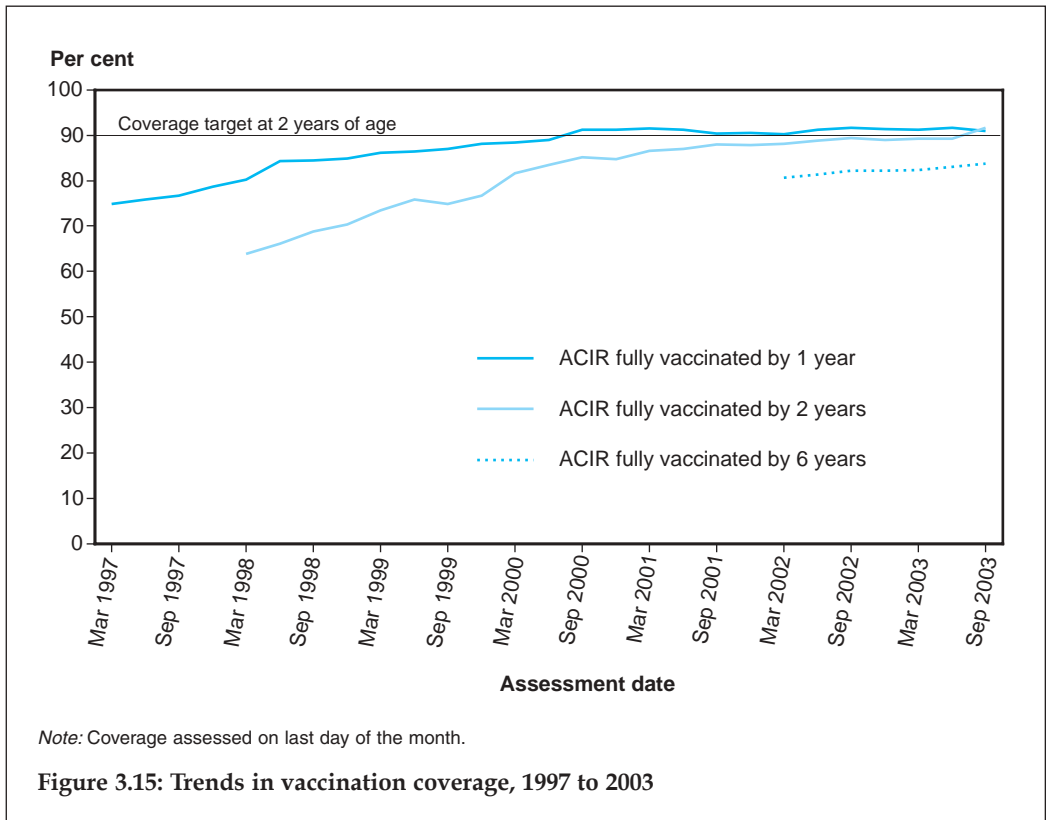
(b) Fully immunised (%) = no. children vaccinated/no. children in register × 100.

Source: Australian Childhood Immunisation Register.

Recorded coverage at all three milestone ages is less than 100% due to both underreporting of vaccinations to the ACIR by providers and incomplete vaccination uptake. 'Parents disagreeing with or having concerns about vaccination' is the main reason why uptake is incomplete (Hull et al. 2002).

Figure 3.15 shows the trends in vaccination coverage, from the first ACIR-derived published coverage estimates in 1997 to the current estimates. There is a clear trend of

increasing vaccination coverage over time for children aged 1, 2 and 6 years, although the rate of increase has slowed over the past two years, especially for children in the 1-year and 2-year age groups.



Influenza vaccination coverage in older people

Vaccination against influenza is available in Australia and is free to those aged 65 years and over, for Indigenous Australians aged 50 years and over, and for Indigenous Australians aged 15–49 years in high-risk groups. The Influenza Vaccine Program for Older Australians was introduced in 1999, and is designed to remove cost and physical barriers that may have prevented older persons from having influenza vaccines in the past.

In recent years, national telephone surveys have been conducted annually to monitor the proportion of Australians aged 65 years and over vaccinated for influenza. In 1998, 61% of that age group were vaccinated. In 2003, the proportion had increased to 77%, with increases occurring in all states and territories (AIHW 2004b).

Of those aged 65 years and over and not vaccinated in 2003, 17% reported having had an influenza vaccination in the previous year and 21% reported intending to have an influenza vaccination in the next year.

Sexual practices

Sexual activity can carry health risks such as sexually transmitted infections (STIs) and cancer of the cervix. It can also lead to unplanned pregnancy. Some STIs such as HIV can also be passed to children born to infected mothers. The risks are mainly due to 'unsafe sex', where precautions are not taken against transmitting infections or against unintended pregnancy. Unsafe sex can lead to infections such as chlamydia, gonorrhoea, genital herpes, genital warts, syphilis, hepatitis B and HIV/AIDS. The use of condoms is very important in preventing the spread of STIs, HIV in particular.

A recent survey, the Australian Study of Health and Relationships, collected information about the sexual health, experience and attitudes of Australian adults including contraceptive practices, the frequency and extent of STIs, and knowledge about STIs and HIV/AIDS. The survey, conducted between May 2000 and June 2001, used computer-assisted telephone interviews and involved nearly 20,000 Australian adults aged 16–59 years from all states and territories (Smith et al. 2003).

Of those at risk of pregnancy (that is, women aged 16–59 years who were heterosexually active and fertile but not pregnant or trying to become pregnant), 95% were using some form of contraception. Among all women in the survey, oral contraceptives were the most frequently used method (34%), with sterilisation (tubal ligation/hysterectomy) the second most common method (23%), followed by condom use (21%) and vasectomy of partner (19%). As expected, the method of contraception depended on age. The pill and condoms were the most common form of contraception among 16–19-year-olds whereas among 40–49-year-olds tubal ligation and vasectomy of partner were more commonly used (Table 3.15).

Table 3.15: Some of the most commonly used forms of contraception among women exposed to the risk of pregnancy, by age group, 2000–2001

Age (years)	Contraceptive pill	Tubal ligation/ hysterectomy	Condom	Vasectomy
		(per cent)		
16–19	51.2	0.4	53.2	0.0
20–29	63.3	0.9	32.8	0.6
30–39	31.6	15.1	17.9	20.6
40–49	11.7	33.0	10.8	34.6
50–59	2.8	59.9	5.1	24.3

Note: More than one contraceptive method could be reported.

Source: Richters et al. 2003.

The majority of respondents in the study had used a condom at some time in their lives. However, among those who engaged in casual heterosexual activity in the past six months, fewer than half had used a condom (45% of men and 35% of women). Among male and female heterosexuals in the survey, condom use was higher in people who were younger, had higher levels of education, lived in major cities, had lower levels of income and who had more than one partner in the past year. Condom use for heterosexual activity was less likely among men in the survey who consumed alcohol in

excess according to the NHMRC guidelines; this was not the case among women. Among men who reported having sex with men in the past year, only 59% had used a condom (de Visser et al. 2003).

STIs were common among sexually active respondents in the survey. Overall, 20% of men and 17% of women reported having ever been diagnosed with an STI or blood-borne virus. Recent infection was higher among those who identified as homosexual or bisexual, had engaged in sex work or had been a client of a sex worker, had reported injecting drug use or had reported having more than one partner in the past year. Rates of infection among respondents with an Aboriginal or Torres Strait Islander background were similar to those of other Australians. Around 40% of men and women reported having been tested for HIV at some time in their lives, which is substantially higher than is found in United States, British and European national surveys, and was particularly high in those at risk of HIV infection such as homosexual men or among those who had injected illicit drugs (Grulich et al. 2003b).

Knowledge of transmission routes and health consequences of the most common STIs (in particular gonorrhoea, genital warts and chlamydia) is poor. Individuals with the best STI knowledge were those who identified as homosexual or bisexual and individuals with a history of an STI. Women were found to have significantly more knowledge about STIs than men. Higher educational and occupational status among both men and women were associated with better knowledge (Grulich et al. 2003a).

3.4 Socioeconomic characteristics

The strong association between health and socioeconomic factors both within and between countries is well documented. However, the mechanisms behind this association are less clear (Pearce & Davey Smith 2003; Marmot 1999).

Socioeconomic factors that influence health include education, income, occupation, and characteristics of the area of residence (Lynch & Kaplan 2000). Social and economic disadvantages (for example poor education, unemployment and few assets) tend to occur together and magnify the negative effects on health.

While the mechanisms through which socioeconomic factors act on health continue to be researched and discussed, a number of perspectives contribute to our understanding (Mackenbach & Howden-Chapman 2003; Adler & Ostrove 1999). It is widely acknowledged that the availability of material resources and the income to buy them affect health. This is demonstrated through higher income countries having better health than lower income countries, and individuals with higher incomes within countries having better health than their lower income counterparts. Increasingly, it is also being suggested that less favourable social and economic circumstances can cause anxiety, low self-esteem and social isolation, which in turn can influence health-related behaviours and health itself.

This section describes socioeconomic determinants in their own right, rather than their relationships with health. In Australia, men and women with lower socioeconomic status, including many Indigenous people, bear a higher burden of disease. These patterns are described in Chapter 4.

Socioeconomic indicators

The main socioeconomic factors identified as important for health are education, income, employment status, and geographical area characteristics. These factors also overlap. For example, higher levels of education are more likely to result in better employment prospects and higher income. Often one or more of these socioeconomic factors is used to define socioeconomic groups in the population (as in Chapter 4). In this section, indicators of education and income are presented, drawing substantially on recent work examining welfare indicators, where further details can also be found (AIHW 2003d).

Education

Education is an important determinant of health, particularly through its link to future occupational opportunities and income potential. It also provides knowledge and skills on how individuals can improve their own health and on available health services (Adler & Newman 2002). Two measures of education are briefly described here: school retention rates and educational attainment.

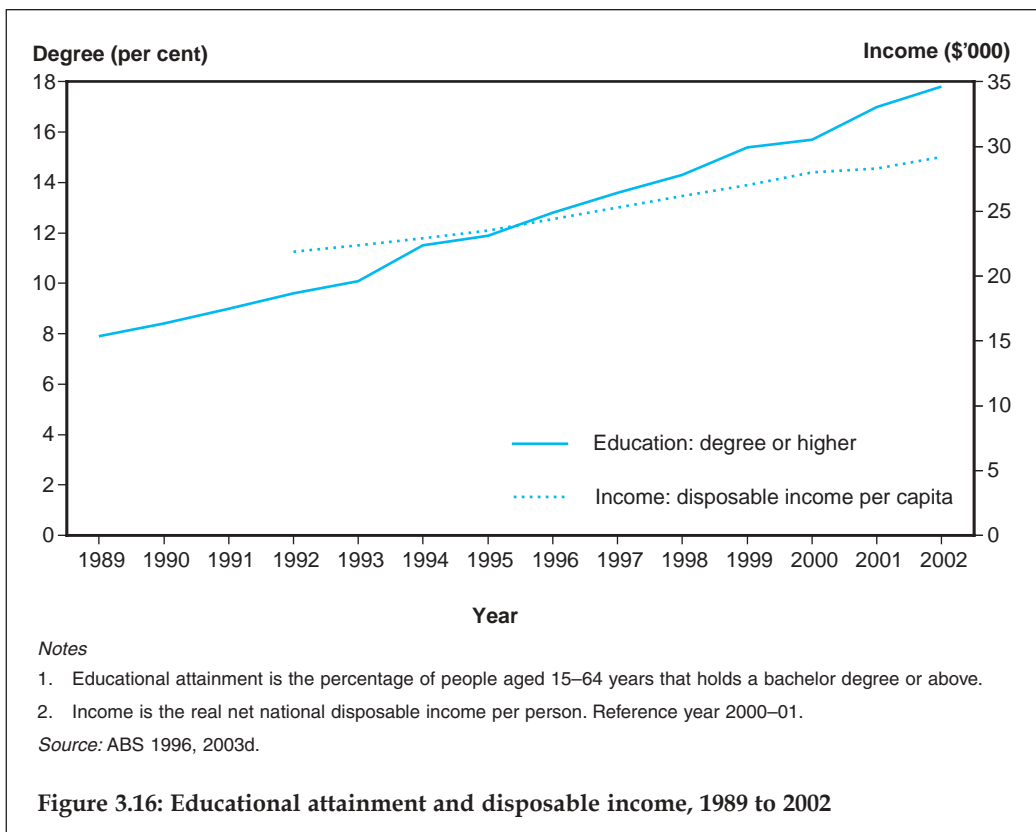
Retention rates provide an indication of the percentage of students that completes high school. This section presents data on the 'apparent retention rate' from the beginning of high school to Year 12. The term 'apparent' reflects that no adjustments are made for movements of students in and out of the country or between states and territories. The most recent national data show that in 2002 around three-quarters of students stayed at school until Year 12. Females had higher apparent retention rates than males (81% compared to 70%), and rates for Indigenous students were considerably lower (38%) than for all Australians (75%) (ABS 2003d).

Educational attainment measures the highest level of completed education for an individual. In 2002, 20% of Australians aged 25–64 years held a bachelor degree or above, another 26% a certificate or diploma, and for a further 54% their highest level of completed education was Year 12 or lower. These percentages differ by age group, indicating that levels of education have been increasing over time. Thus a higher proportion (25%) of those aged 25–34 years held a bachelor's degree or higher compared with those aged 55–64 years (13%) (ABS 2002a).

Longer term trends in education levels indicate that Australia has made large advances in this area over the last 15 years (Figure 3.16). Education levels have increased, as indicated by the consistent trend data available on the proportion of people age 15–64 years that holds a bachelor's degree or higher, which more than doubled from 8% to 18% between 1989 and 2002. These gains will have contributed to improvements in population health status.

Income

The link between income and health occurs through the income level of the country, the income of individuals, and the distribution of income (Marmot 2002; Turrell & Mathers 2000). Higher incomes can enable purchase of health-related goods and services such as better food, housing, recreation and health care, and may provide psychological benefits such as a greater sense of control. Two indicators of income are presented here: weekly household income and income disadvantage.



Weekly income data show that in 2000–01 the median weekly disposable income in Australia was \$414 per household (adjusted for household size). For the lowest 20% of households, this median income was \$202, while for the highest 20% it was \$802. Disposable income is calculated as gross income less direct tax and Medicare levy (ABS 2003e).

Measures of income disadvantage are often used to identify households with levels of income below a defined threshold. The measure of income disadvantage presented here is the proportion of households with a weekly disposable income below 50% of the median; this and other measures of income disadvantage and ‘poverty’ are further detailed elsewhere (AIHW: Bricknell et al. 2004). In 2000–01, 10.9% of households in Australia had incomes below 50% of the median disposable income. In an even more disadvantaged situation are the 5.2% of households with incomes below 40% of the median disposable income. It is likely that the lowest income households are at greater risk of health-related problems than other households.

In addition, the link between the distribution of income—or income inequality—and health remains an area of continued discussion in the research literature. It has been argued that higher levels of income inequality within a population have a negative effect on health, over and above levels of absolute income. However, absolute income is likely to be more important than the level of income inequality (Mackenbach & Howden-Chapman 2003; Pearce & Davey Smith 2003). Income inequality can be

measured, and recent analysis suggests that levels of income inequality in Australia have remained stable in recent years (NHPC forthcoming).

As was the case for education levels, longer term trends in income levels show large advances over the last 15 years (Figure 3.16). Net disposable income per person has increased from a little under \$22,000 to just over \$29,000 between 1992 and 2002 (in real terms). Again, these gains will have contributed to improvements in population health status.

3.5 Environmental factors

Environmental factors include a vast array of 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 greatly benefit the health and wellbeing of individuals and communities. On the other hand, the natural environment and human-caused changes such as land degradation and global warming may be harmful.

The environment's influence on health can be direct or indirect, obvious or subtle, straightforward or complex, and immediate or delayed. This makes it very challenging to estimate the full range and size of the harmful health effects that can be linked to the environment. Nevertheless, a number of respiratory complaints can be attributed to gases, particles, micro-organisms and pollens in the air. In addition, certain chemicals and micro-organisms in food and water can lead to intestinal and neurological diseases; insects such as mosquitoes and fleas can transmit a large number of serious diseases; and human-made environments can contain hazards such as noise and traffic. Also, there is a clear excess of deaths in the winter months, although this may be decreasing (AIHW: de Looper 2002).

According to the 2001 state of the environment report (Australian State of the Environment Committee 2001), urban air quality has generally improved since 1996, streetscapes and parks have improved in most urban areas, and energy efficiency in residences has improved. However, over the same period the quality of water bodies deteriorated and invasive species have continued to pose a serious problem. Furthermore, many of the warmest years on record have occurred in the last two decades.

Air pollution

The air can be contaminated by pollutants, micro-organisms and odours, all of which can be harmful. Exposure to air pollutants has been associated with cardiovascular disease, respiratory illness and other problems such as preterm births.

In Australia, the National Environment Protection Council has identified and set National Environment Protection Measures for six major ambient air pollutants: airborne particles (particulate matter with diameters of up to 10 microns), carbon monoxide, nitrogen dioxide, sulphur dioxide, ozone, and lead. Ambient air pollution in Australia is primarily caused by emissions from motor vehicles (especially from diesel fuel), and heavy industry and mining activities. Air may also contain emissions from the combustion of fossil fuels for electricity generation, smoke from home heating and bush fires, and wind-blown dust. Indoor air may contain other harmful substances such as volatile organic compounds, fibres, moulds and tobacco smoke.

Globally, air pollution is estimated to cause approximately 5% of lung cancer deaths, 2% of cardiorespiratory mortality, and about 1% of respiratory infection mortality (WHO 2002). Studies in the United States (Pope et al. 2002) and Europe (Kunzli et al. 2000) have attributed 4–6% of total mortality to air pollution. Although Australia’s ambient air quality is comparatively good, studies based in Brisbane, Sydney and Melbourne have found an association between air pollution levels and mortality and/or hospital admissions (EPA Victoria 2000, 2001; Morgan et al. 1998a, 1998b; Petroschevsky et al. 2001). Lead exposure damages nerve function and can be a particular concern in the mental development of children. However, the concentration of lead in the air has decreased substantially in Australia since unleaded fuels were introduced in the mid-1980s (Australian State of the Environment Committee 2001).

Water and food contamination

Safe water and food are important for general health. Further benefit can be obtained through the fluoridation of water supplies, which helps to prevent dental decay (see Box 3.7). Recreational water bodies such as pools, spas and ‘swimming holes’ can benefit health and wellbeing through improved physical fitness and quality of life.

Box 3.7: Population exposure to fluoridated drinking water

The most effective public health measure for preventing dental decay is the adjustment of fluoride in drinking water to a range of 0.5 ppm to 1.0 ppm (varying by climate to reflect differences in patterns of water consumption). Over two-thirds of Australians (69.1%) live in areas where the public water supply meets these requirements. 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 not fluoridated.

Exposure to fluoridated drinking water^(a)

State/territory	% of population
NSW	89.8
Vic	75.3
Qld	4.7
SA	90.2
WA	90.1
Tas	94.7
NT	84.2
ACT	100.0

(a) Percentage of state/territory population living in areas with fluoride in public water supplies. Fluoride from natural or engineering sources at concentrations of 0.7 ppm or more (except SA and NT where concentration is 0.5 ppm or more).

Water and food can also be hazardous to human health. Drinking water and water for cooking, domestic use, personal hygiene and recreation can be contaminated with bacteria natural to the environment (for example *Clostridium botulinum*) as well as bacteria and parasites (for example *Giardia*) from animal sources. Inorganic chemicals such as nitrates and organic chemicals such as disinfectant by-products can also contaminate water. Food can be contaminated by bacteria, viruses and parasites through unhygienic handling, and by biological toxins (for example toxic mushrooms and moulds) and chemicals (for example pesticides and heavy metals).

According to the *World Health Report 2002* (WHO 2002), about 3.1% of deaths worldwide (1.7 million) are attributable to unsafe water and poor sanitation or hygiene. All but about 0.2% of these deaths occur in developing countries. It has been estimated that in a typical year there are between 4.0 and 6.9 million cases of foodborne gastroenteritis in Australia (OzFoodNet Working Group 2003). Identifying whether gastrointestinal diseases have been transmitted by contaminated water or food, or by person-to-person contact is difficult. Nevertheless, in Australia the proportion of gastrointestinal disease attributable to drinking water is likely to be small (McConnell et al. 2001).

Vectorborne and zoonotic diseases

The prevalence of vectorborne and zoonotic diseases (diseases which can be transmitted from animals to humans) fluctuates considerably with changes in the weather, the prevalence and spread of disease vectors such as mosquitoes, and the movement of people into areas with high vector populations. Changes in the environment and climate, as may be associated with global warming, may influence the prevalence and geographic distribution of some vectorborne diseases within Australia.

Mosquitoes are highly efficient vectors of viruses and protozoa which affect humans. In Australia, they transmit diseases such as Ross River virus disease, Murray Valley encephalitis and Japanese encephalitis (see Chapter 2). Malaria kills many people worldwide every year but is not endemic in Australia. Other diseases can be spread by ticks and flies. Flies are also responsible for the spread of the eye disease trachoma in remote Indigenous communities. Mammals and birds can also be reservoirs for a variety of pathogens that cause diseases in humans.

Built environments

The built environment consists of the structures and spaces built or modified by people. These include houses, commercial and public buildings, parks and roads. Well-designed built environments can be beneficial to health and wellbeing by providing green spaces, safe roads, and bicycle and walking paths. Dwellings can be designed to minimise exposure to allergens, microbes and physical hazards, and to reduce energy consumption. Built environments may also contain physical hazards such as machinery and poor lighting in the workplace, and chemical hazards such as tobacco smoke and solvents in the home. Hazards may also be created by the design of the built environment. High-density living spaces, for example, create conditions favourable to the spread of infectious diseases. On the other hand, urban sprawl can encourage reliance on motor vehicle transport and deter physical activity. This contributes to traffic noise, air pollution and traffic accidents. Recent research from the United States has linked urban sprawl to obesity and high blood pressure (Ewing et al. 2003).

Ecology

As a discipline, environmental health has traditionally focused on the health effects attributable to environmental exposures, such as those described above. In recent times, it has taken a more ecological approach ('ecology' being the study of the relationship

between organisms and their natural and social environments). Natural processes and human activities place great stress on ecological systems on both a global and local level. The result may be changes to the environment including:

- global warming
- extreme weather events
- depletion of stratospheric ozone
- deforestation
- land degradation
- loss of biodiversity
- coastal pollution
- depletion and contamination of freshwater.

These changes may have both beneficial and harmful effects on humans. For example, land clearing can deny habitats to disease-carrying animals and insects. Conversely, land clearing can also allow the emergence and spread of disease-carrying animals and insects, while a warmer climate may influence their geographic range and the frequency, timing and intensity of disease outbreaks (McMichael 2001).

In general, effects on human health determined by natural or human-made changes to the environment are difficult to measure or forecast. For example, although many exposure–effect relationships are well established, it is difficult to accurately factor in the moderating influences of evolving demographics, economics and technology with certainty. There are concerns over the potential health impact of environmental changes, especially climate changes. For example, see McMichael et al. (2003).

References

- 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) 1996. Australian social trends 1996. ABS Cat. No. 4102.0. Canberra: ABS.
- ABS 1998. How Australians measure up. ABS Cat. No. 4359.0. Canberra: ABS.
- ABS 2001. Children's participation in cultural and leisure activities, Australia. ABS Cat. No. 4901.0. Canberra: ABS.
- ABS 2002a. Education and work. ABS Cat. No. 6227.0. Canberra: ABS.
- ABS 2002b. National Health Survey 2001: summary of results. ABS Cat. No. 4364.0. Canberra: ABS.
- ABS 2002c. National Health Survey 2001: Aboriginal and Torres Strait Islander results, Australia. ABS Cat. No. 4715.0. Canberra: ABS.
- ABS 2003a. Measuring learning in Australia – a framework for education and training statistics. ABS Cat. No. 4213.0. Canberra: ABS.

- ABS 2003b. Australian economic indicators April 2003. ABS Cat. No. 1350.0. Canberra: ABS.
- ABS 2003c. Breastfeeding in Australia. ABS Cat. No. 4810.0.55.001. Canberra: ABS. Viewed 23 March 2004, <[//www.abs.gov.au/Ausstats/](http://www.abs.gov.au/Ausstats/)>.
- ABS 2003d. Australian social trends 2003. ABS Cat. No. 4102.0. Canberra: ABS.
- ABS 2003e. Household and income distribution 2000–01. ABS Cat. No. 6523.0. Canberra: ABS.
- Adler NE & Newman K 2002. Socioeconomic disparities in health: pathways and policies. Inequality in education, income, and occupation exacerbates the gaps between the health 'haves' and 'have-nots'. *Health Affairs* 21(2):60–76.
- Adler NE & Ostrove JM 1999. Socioeconomic status and health: what we know and what we don't. In: Adler NE et al. (eds). *Socioeconomic status and health in industrial nations: social, psychological and biological pathways*. New York: New York Academy of Sciences.
- AIHW (Australian Institute of Health and Welfare) 2002a. Australia's health 2002. AIHW Cat. No. AUS 25. Canberra: AIHW.
- AIHW 2002b. 2001 National Drug Strategy Household Survey: first results. Drug Statistics Series No. 9. AIHW Cat. No. PHE 35. Canberra: AIHW.
- AIHW 2003a. The Active Australia Survey: a guide and manual for implementation, analysis and reporting. AIHW Cat. No. CVD 22. Canberra: AIHW.
- AIHW 2003b. Indicators of health risk factors: the AIHW view. AIHW Cat. No. PHE 47. Canberra: AIHW.
- AIHW 2003c. Statistics on drug use in Australia 2002. Drug Statistics Series No. 12. AIHW Cat. No. PHE 43. Canberra: AIHW.
- AIHW 2003d. Australia's Welfare 2003. Canberra: AIHW.
- AIHW 2004a. Heart, stroke and vascular diseases, Australian facts 2004. Cardiovascular Disease Series No. 22. AIHW Cat. No. CVD 27. Canberra: AIHW & National Heart Foundation of Australia.
- AIHW 2004b. 2003 Influenza Vaccine Survey: summary results. AIHW Cat. No. PHE 51. Canberra: AIHW & Department of Health and Ageing.
- AIHW: Australian Centre for Asthma Monitoring 2003. Asthma in Australia 2003. AIHW Asthma Series 1. AIHW Cat. No. ACM 1. Canberra: AIHW.
- AIHW: Bennett SA, Magnus P & Gibson D 2004. Obesity trends in older Australians. Bulletin No. 12. AIHW Cat. No. AUS 42. Canberra: AIHW.
- AIHW: Bricknell S, Fortune N & Madden R 2004. Indicators of Australia's welfare: development and discussion. Welfare Working Paper No. 42. Canberra: AIHW.
- AIHW: Britt H, Miller GC, Knox S et al. 2003. General practice activity in Australia 2002–03. General Practice Series No. 14. AIHW Cat. No. GEP 14. Canberra: AIHW.

- AIHW: de Looper M 2002. Seasonality of death. Bulletin No. 3. AIHW Cat. No. AUS 29. Canberra: AIHW.
- AIHW: Dixon T & Waters A-M 2003. A growing problem: trends and patterns in overweight and obesity among Australian adults, 1980–2001. Bulletin No. 8. AIHW Cat. No. AUS 36. Canberra: AIHW.
- AIHW: Holdenson Z, Catanzariti L, Phillips G & Waters A-M 2003. A picture of diabetes in overseas-born Australians. Bulletin No. 9. AIHW Cat. No. AUS 38. Canberra: AIHW.
- AIHW: Mathers C, Vos T & Stevenson C 1999. The burden of disease and injury in Australia. AIHW Cat. No. PHE 17. Canberra: AIHW.
- AIHW: O'Brien K & Webbie K 2003. Are all Australians gaining weight? Differentials in overweight and obesity among adults, 1989–90 to 2001. Bulletin No. 11. AIHW Cat. No. AUS 39. Canberra: AIHW.
- AIHW: O'Brien K & Webbie K 2004. Health, wellbeing and body weight: characteristics of overweight and obesity in Australia, 2001. Bulletin No. 13. AIHW Cat. No. AUS 43. Canberra: AIHW.
- AIHW: Ridolfo B & Stevenson C 2001. The quantification of drug-caused mortality and morbidity in Australia in 1998. Drug Statistics Series No. 7. AIHW Cat. No. PHE 29. Canberra: AIHW.
- AIHW: Waters A-M 1993. Assessment of self-reported height and weight and their use in the determination of body mass index. Canberra: AIHW.
- Australian State of the Environment Committee 2001. Australia state of the environment 2001. Independent report to the Commonwealth Minister for the Environment and Heritage: Canberra. CSIRO Publishing on behalf of the Department of the Environment and Heritage.
- Baird PA, Anderson TW, Newcombe HB & Lowry RB 1988. Genetic disorders in children and young adults: a population study. *American Journal of Human Genetics* 42:677–93.
- 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.
- Blair S, Kampert J, Kohl H et al. 1996. Influences of cardiorespiratory fitness and other precursors on cardiovascular disease and all-cause mortality in men and women. *Journal of the American Medical Association* 276(3):205–10.
- Bunker S, Colquhoun D, Esler D 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.
- Colagiuri S, Zimmet P, Hepburn A & Colagiuri R 2002. Evidence based guidelines for Type 2 diabetes: primary prevention, case detection and diagnosis. Canberra: Diabetes Australia & NHMRC.
- 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 DJ & Lapsley HM 2002. Counting the cost: estimates of the social costs of drug abuse in Australia in 1998–99. National Drug Strategy Monograph Number 49. Canberra: Department of Health and Ageing.
- Cook T, Rutishauser I & Seelig M 2001. Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 national surveys. Canberra: Department of Health and Aged Care.
- Department of Community Services and Health 1990. Tobacco in Australia: a summary of related statistics. Canberra: AGPS.
- de Visser RO, Smith AMA, Rissel CE, Richters J & Grulich AE 2003. Safer sex and condom use among a representative sample of adults. Australian and New Zealand Journal of Public Health 27(2):223–9.
- DHAC (Department of Health and Aged Care) 1999. National physical activity guidelines for Australians. DHAC: Canberra.
- Donath S & Amir LH 2000. Rates of breastfeeding in Australia by state and socio-economic status: evidence from the 1995 National Health Survey. Journal of Paediatric and Child Health 36(2):164–8.
- Dunstan D, Zimmet P, Welborn T et al. (AusDiab Steering Committee) 2001. Diabetes and associated disorders in Australia—2000: the accelerating epidemic. The Australian Diabetes, Obesity and Lifestyle Study (AusDiab). Melbourne: International Diabetes Institute.
- Dunstan D, Zimmet P, Welborn T et al. 2002. The rising prevalence of diabetes and impaired glucose tolerance: the Australian Diabetes, Obesity and Lifestyle Study. Diabetes Care 25(5):1–6.
- EPA Victoria (Environment Protection Authority Victoria) 2000. Melbourne mortality study: effects of ambient air pollution on daily mortality in Melbourne 1991–1996. Melbourne: EPA Victoria. Viewed 23 March 2004, <://www.epa.vic.gov.au/Air/health.asp>.
- EPA Victoria 2001. Ambient air pollution and daily hospital admissions in Melbourne 1994–1997. Melbourne: EPA Victoria. Viewed 23 March 2004, <://www.epa.vic.gov.au/Publications/>.
- Ewing R, Schmid T, Killingsworth R, Zlot A & Raudenbush S 2003. Relationship between urban sprawl and physical activity, obesity, and morbidity. American Journal of Health Promotion 18(1):47–57.
- Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S & Murray CJL 2002. Selected major risk factors and global and regional burden of disease. The Lancet 360:1347–360.
- Flood V, Webb K, Lazarus R & Pang G 2000. Use of self-report to monitor overweight and obesity in populations: some issues for consideration. Australian and New Zealand Journal of Public Health 24:96–9.
- Forge B 1999. Cholesterol in perspective. Medical Journal of Australia 170:385–90.
- Gidding HF, Burgess MA & Kempe AE 2001. A short history of vaccination in Australia. Medical Journal of Australia 174:37–40.

- Grulich AE, de Visser RO, Smith AMA, Rissel CE & Richters J 2003a. Knowledge about sexually transmissible infections and blood-borne viruses in a representative sample of adults. *Australian and New Zealand Journal of Public Health* 27(2):230–3.
- Grulich AE, de Visser RO, Smith AMA, Rissel CE & Richters J 2003b. Sexually transmissible infection and blood-borne virus history in a representative sample of adults. *Australian and New Zealand Journal of Public Health* 27(2):234–41.
- Harris MI & Zimmet PZ 1992. Classification of diabetes mellitus and other categories of glucose intolerance. In: Keen H, DeFronzo R, Alberti K & Zimmet P (eds). *The international textbook of diabetes mellitus*. London: John Wiley.
- Hill D, White V & Effendi Y 2002. Changes in the use of tobacco among Australian secondary students: results of the 1999 prevalence study and comparison with earlier years. *Australian and New Zealand Journal of Public Health* 26(2):156–63.
- Hull BP, Lawrence GL, MacIntyre CR & McIntyre PB 2002. *Immunisation coverage: Australia 2001*. Canberra: Department of Health and Ageing.
- Khoury MJ 1996. From genes to public health: the applications of genetic technology to public health. *American Journal of Public Health* 86:1717–22.
- Krebs NF, Baker RD, Greer FR et al. 2003. Prevention of pediatric overweight and obesity. *Pediatrics* 112(2):424–30.
- Kunzli N, Kaiser R, Medina S et al. 2000. Public-health impact of outdoor and traffic-related air pollution: a European assessment. *The Lancet* 356:795–801.
- Ludwig DS & Ebbeling CB 2001. Type 2 diabetes mellitus in children. Primary care and public health considerations. *Journal of the American Medical Association* 286:1427–30.
- Lynch J & Kaplan G 2000. Socioeconomic position. In: Berkman L & Kawachi I (eds). *Social epidemiology*. Oxford: Oxford University Press.
- Mackenbach JP & Howden-Chapman P 2003. New perspectives on socioeconomic inequalities in health. *Perspectives in Biology and Medicine* 46(3):428–44.
- Magarey AM, Daniels LA & Boulton JC 2001. Prevalence of overweight and obesity in Australian children and adolescents: reassessment of 1985 and 1995 data against new standard international definitions. *Medical Journal of Australia* 174:561–4.
- Marmot M 1999. Epidemiology of socioeconomic status and health: are determinants within countries the same as between countries? In: Adler NE et al. (eds). *Socioeconomic status and health in industrial nations: social, psychological and biological pathways*. New York: New York Academy of Sciences.
- Marmot M 2002. The influence of income on health: views of an epidemiologist. *Health Affairs* 21(2):31–46.
- McConnell S, Horrocks M, Sinclair MI & Fairley CK 2001. Changes in the incidence of gastroenteritis and the implementation of public water treatment. *International Journal of Environmental Health Research* 11:299–303.
- McMichael A 2001. *Human frontiers, environments and disease: past patterns, uncertain futures*. Cambridge: Cambridge University Press.

- McMichael A, Woodruff R, Whetton P et al. 2003. Human health and climate change in Oceania: a risk assessment 2002. Canberra: Department of Health and Ageing.
- Morgan G, Corbett S & Wlodarczyk J 1998a. Air pollution and hospital admissions in Sydney, Australia, 1990 to 1994. *American Journal of Public Health* 88:1761-6.
- Morgan G, Corbett S, Wlodarczyk J & Lewis P 1998b. Air pollution and daily mortality in Sydney, Australia, 1989 through 1993. *American Journal of Public Health* 88:759-64.
- NATSINWP (National Aboriginal and Torres Strait Islander Nutrition Working Party) 2001. National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan 2000-2010. Canberra: National Public Health Partnership.
- NCHECR (National Centre in HIV Epidemiology and Clinical Research) 2003. HIV/AIDS, viral hepatitis and sexually transmissible infections in Australia: annual surveillance report 2003. Sydney: NCHECR, University of New South Wales.
- 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.
- NHDC (National Health Data Committee) 2003. National health data dictionary. Version 12. AIHW Cat. No. HWI 43. Canberra: AIHW.
- NHFA (National Heart Foundation of Australia) 1999. A review of the relationship between dietary fat and cardiovascular disease. *Australian Journal of Nutrition and Dietetics* 56(4 Suppl):S5-S22.
- 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 2000. Nutrition in Aboriginal and Torres Strait Islander peoples: an information paper. Canberra: NHMRC.
- NHMRC 2001. Australian alcohol guidelines: health risks and benefits. Canberra: NHMRC.
- NHMRC 2003a. Dietary guidelines for Australian adults. Canberra: NHMRC.
- NHMRC 2003b. Dietary guidelines for children and adolescents in Australia. Canberra: NHMRC.
- NHMRC 2003c. The Australian immunisation handbook, 8th edition. Canberra: NHMRC.
- NHPC (National Health Performance Committee) forthcoming. National report on health sector performance indicators 2003. AIHW: Canberra.
- Niedhammer I, Bugel I, Bonenfant S, Goldberg M & Leclerc A 2000. Validity of self-reported weight and height in the French GAZEL cohort. *International Journal of Obesity and Related Metabolic Disorders* 24(9):1111-18.
- O'Brien ED, Sam GA & Mead C 1998. Methodology for measuring Australia's childhood immunisation coverage. *Communicable Diseases Intelligence* 22:36-7.

- OECD (Organisation for Economic Co-operation and Development) 2003. OECD Health Data 2003: a comparative analysis of 30 countries, 3rd edition. CD-ROM. Paris: OECD.
- OzFoodNet Working Group 2003. Foodborne disease in Australia: incidence, notifications and outbreaks. Annual report of the OzFoodNet network, 2002. *CDI* 27:209–43.
- Pearce N & Davey Smith G 2003. Is social capital the key to inequalities in health? *American Journal of Public Health* 93(1):122–9.
- Petroeschovsky A, Simpson RW, Thalib L & Rutherford S 2001. Associations between outdoor air pollution and hospital admissions in Brisbane, Australia. *Archives of Environmental Health* 56:37–52.
- Pope CA, Burnett RT, Thun MJ et al. 2002. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association* 287:1132–41.
- Richters J, Grulich AE, de Visser RO, Smith AMA & Rissel CE 2003. Contraceptive practices among a representative sample of women. *Australian and New Zealand Journal of Public Health* 27(2):210–16.
- SIGNAL (Strategic Inter-Governmental Nutrition Alliance) 2001. Eat well Australia: an agenda for action for public health nutrition 2000–2010. Canberra: National Public Health Partnership.
- Smith A, Kellett E & Schmerlaib Y 1998. *The Australian guide to healthy eating*. Canberra: Department of Health and Family Services.
- Smith AMA, Rissel CE, Richters J, Grulich AE & de Visser RO 2003. The rationale and methods of the Australian study of health and relationships. *Australian and New Zealand Journal of Public Health* 27(2):106–17.
- Turrell G & Mathers CD 2000. Socioeconomic status and health in Australia. *Medical Journal of Australia* 172(9):434–8.
- UNODC (United Nations Office on Drugs and Crime) 2003. *Global illicit drug trends 2003*. New York: United Nations Publications.
- Wilkins C, Casswell S, Bhatta K & Pledger M 2003. *New Zealand country report*. Wellington: Ministry of Health.
- WHO (World Health Organization) 1999. Definition, diagnosis and classification of diabetes mellitus and its complications: diagnosis and classification of diabetes mellitus. Report of a WHO consultation. Geneva: 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 risks, promoting healthy life*. Geneva: WHO.
- WHO-ISH (World Health Organization–International Society of Hypertension) 1999. 1999 Guidelines for the management of hypertension. *Cardiovascular Prevention* 2(2):76–111.