

3 Determinants of health

As discussed briefly in chapter 1, the health of individuals and populations is determined by many factors acting alone or together, often in complex interplay. Information on the determinants of health is particularly important because it can help explain trends in health and why some groups have better or worse health than others. This knowledge can then guide the nature and focus of preventive activities. Prevention can occur through the efforts of individuals acting on their own behalf, through health professionals, and through governments and other agencies.

The health determinants outlined in this chapter comprise:

- **Environmental factors.** These include physical, chemical, biological, social, economic, cultural and political factors. Socioeconomic factors such as education and employment can affect an individual's ability and opportunity to make healthy choices. Physical, chemical and biological factors affect the quality and safety of air, water, soil and food by, for example, chemical pollution and waste disposal methods. Larger scale environmental disruptions, such as human-induced climate change and ozone depletion, can have major health implications.
- **Genetic factors.** Some diseases, such as muscular dystrophy, result entirely from an individual's genetic make-up whereas many others reflect the interaction between that make-up and environmental factors.
- **Attitudes and beliefs.** Attitudes, beliefs and knowledge influence individuals' lifestyle and behaviours and so affect health.
- **Lifestyle and behaviour.** Patterns of eating and drinking, use of tobacco and other drugs, physical activity, sexual practice, and other behaviours can all contribute strongly to a person's health (Box 3.1, page 134). Along with genetic factors, lifestyle and behaviour influence biomedical factors that affect health.
- **Biomedical factors.** Blood pressure, blood cholesterol and bodyweight are among the important biomedical factors that affect health (Box 3.1). The levels of these factors in an individual are the result of lifestyle, behaviour and genetic predisposition.

3.1 Environmental factors

Australia's present social, economic and physical environment generally provides access to good-quality food and water, housing and places for recreation as well as education and employment. These contribute to an overall standard of living and health that compares well with other developed countries (enHEALTH 1999; AIHW: de Looper & Bhatia 1998; AIHW: Lester 1994).

Box 3.1: Some behavioural and biomedical risk factors associated with major causes of morbidity, disability and mortality

Risk factors	Cause of ill health, disability and mortality
Behavioural	
<i>Poor diet and nutrition</i>	<i>Coronary heart disease, stroke, breast and digestive system cancers, type 2 diabetes, gallstones, osteoporosis, malnutrition, dental conditions</i>
<i>Excess alcohol consumption</i>	<i>Coronary heart disease, liver and pancreatic disease, stroke, high blood pressure, cancers of the digestive system, accidents, mental illness, violence</i>
<i>Smoking</i>	<i>Coronary heart disease, several cancers including lung, mouth and cervical cancers, stroke, chronic lung disease</i>
<i>Other drug abuse</i>	<i>HIV/AIDS, hepatitis, renal failure, mental illness, suicide, violence, accidents</i>
<i>Inadequate physical activity</i>	<i>Coronary heart disease, stroke, type 2 diabetes, colon cancer, osteoporosis, bone fractures, falls, mental illness, obesity</i>
<i>Excessive sun exposure</i>	<i>Melanoma and other skin cancers, premature ageing of the skin</i>
<i>Not vaccinated</i>	<i>Measles, diphtheria, tetanus, pertussis, poliomyelitis, Haemophilus influenzae type b</i>
<i>Unprotected sexual activity</i>	<i>HIV/AIDS, hepatitis, cervical cancer, infertility, pelvic infection, venereal disease</i>
Biomedical	
<i>Overweight and obesity</i>	<i>Coronary heart disease, type 2 diabetes, breast cancer, gallstones, degenerative joint disease, obstructive sleep apnoea</i>
<i>High blood pressure</i>	<i>Coronary heart disease, stroke</i>
<i>Raised blood cholesterol level</i>	<i>Coronary heart disease, stroke</i>

Despite this, some Australians such as Indigenous peoples have generally poor social and economic conditions and poor health. In addition, significant changes to Australia's physical environment since European settlement have been at considerable cost to resources such as soil, rivers and aquifers, and biodiversity (State of the Environment Advisory Council 1996; CSIRO 1998a). Also, material released into Australia's atmosphere and the oceans contributes to environmental issues that could have significant population health impacts in Australia and worldwide (Epstein 1999; McMichael 1993; McMichael & Powles 1999).

These changes to the physical environment are relevant to Australia's long-term ability to supply basic human needs and may also pose more direct threats to health. Unfortunately, although environmental factors are increasingly seen as important, there are presently insufficient data to monitor nationally the levels and changes in many of these factors or to accurately estimate their effect on current or future health.

Social, economic, cultural and political determinants

The strong association between health and social and economic factors has become increasingly recognised and documented. However, the mechanisms behind that association are less clear (Yen & Syme 1999). Much of the research on the social and economic bases of health focuses on the observation that people in poor circumstances have worse health than those in more advantaged conditions. Social and economic disadvantages (e.g. poor education, unemployment and few assets) tend to occur together, and magnify the negative effects on health (WHO 1998). Social and economic circumstances can also cause anxiety, low self-esteem and social isolation which in turn can influence health-related behaviours and health itself.

In Australia, men and women with lower socioeconomic status (as measured by education level, occupation, family income and areas of socioeconomic disadvantage), including many Indigenous peoples, bear a higher burden of disease (see chapter 4).

Social, economic and cultural determinants of health are closely related. Social circumstances affect behaviour, and socioeconomically disadvantaged people may be influenced by economic and cultural reasons in their choice of behaviours that affect health. People in lower socioeconomic groups are more likely to exhibit behaviours, such as smoking and heavy use of alcohol, that place them at higher risk (DHAC & AIHW 1999). Unhealthy behaviour may be driven partly by a lack of knowledge, partly by more fatalistic attitudes and feelings of hopelessness, and partly by desire for immediate gratification in the absence of other rewards.

Cultural factors may influence health because of traditions, attitudes and beliefs, and customs. Family life, parental support and social exclusion are other factors that cross the social and cultural boundaries and may affect health in various ways. There are also related issues of 'social capital', a concept developed to explain the apparent benefits that social ties within communities have by making resources, advantages and opportunities available to individuals. Migrants, minority groups and refugees may be susceptible to ill health due to social isolation and often have few social support networks (Kawachi et al. 1996; Wilkinson & Marmot 1998). Despite this, overseas-born Australians, especially those born in southern Europe, generally have lower death rates than those born in Australia (Powles & Gifford 1990).

Physical, chemical and biological determinants

Over the past decade there has been growing concern about the links between health and the damage that humans are doing to the physical environment (McMichael 1993). Humans now have a large and growing capacity to affect the life support systems of this planet such as water, agricultural land and climate.

Australia currently has no system of monitoring to provide regular national data about issues such as the quality of drinking water, food, sewerage, soil health and biodiversity.

In the absence of agreed national indicators, the following provides an overview of some significant environmental issues relating to the environment and health.

Australian climate

The atmosphere and its expression through the weather affect the economic and social health of the country (CSIRO 1998b). Average annual temperatures have gradually increased to be about 1° Celsius higher in the year 2000 than they were in 1900, with many of the warmest years on record having occurred in the 1980s and 1990s (Bureau of Meteorology 1999a). Although average annual rainfall in north-west and south-east Australia has increased since 1910, rainfall in the other quadrants shows little or no change (Bureau of Meteorology 1999b). Depending on location within Australia and the severity of global warming, temperatures are estimated to rise by between 0.6° and 3.8° Celsius within 70 years, and winter rainfall over most of Australia may fall by up to 20% (CSIRO 1998a).

Global climate is changing and the factors causing this are of both natural and human origin (enHEALTH 1999). Although the timing and size of future changes are difficult to predict, the consequences upon health are likely to be significant (enHEALTH 1999). Health impacts could include increases in vector-borne diseases such as dengue fever, water- and sewerage-related diseases, and respiratory problems related to urban pollution. There could also be indirect health impacts resulting from impairment of agriculture and water resources as well as damage to buildings and roads (Watson et al. 1997; enHEALTH 1999).

Some interesting environmental indicators are:

- a steady increase in atmospheric carbon dioxide concentrations from 330 parts per million (ppm) in 1976 to over 360 ppm in 1998 (CSIRO 1999);
- per capita carbon dioxide emissions from energy use of 16.6 tonnes, which is lower than those of the United States (20.4) but higher than those of the Organisation for Economic Co-operation and Development (OECD) average (11.1) (OECD 1997) and much higher than those for developing nations;
- estimated falling net greenhouse gas emissions from land clearing, from 103 million tonnes of carbon dioxide equivalents in 1990 to 65 million tonnes in 1997;
- an 11% increase in net emissions from all other sources (related mainly to energy and agriculture) between 1990 and 1997, from 389 to 431 million tonnes of carbon dioxide equivalents (Australian Greenhouse Office 1997);
- 3% of Australia's energy production occurring through renewable methods, compared with 11% in Canada, 17% in Japan, 1% in the Netherlands and 7% in the United States (ABS 1999b); and
- 79% of Australians driving to work, 7% being driven to work as car passengers, 16% travelling by bus or train and 9% walking or cycling (ABS 1996a).

Stratospheric ozone

The stratospheric ozone layer filters cancer-causing ultraviolet radiation from sunlight before it reaches the Earth's surface. This helps protect against skin cancer, cataracts and perhaps some suppression of the immune system (UNEP 1998). Human production and release of chlorofluorocarbons (CFCs) and similar compounds into the atmosphere has caused a decrease in the concentration of stratospheric ozone, especially evident over Antarctica in spring. Through international agreement, the release of CFCs into the

atmosphere has slowed. However, since many CFCs persist in the stratosphere for years, the concentration of the main CFCs has remained unchanged or is still increasing slightly (CSIRO 1999). The concentration of ozone over Antarctica in October has halved since the 1950s (Fraser 1999). The Commonwealth Scientific and Industrial Research Organisation (CSIRO) estimates that the ozone layer may recover between the years 2050 and 2070 (Fraser 1999). However, fair-skinned populations at mid-latitudes are predicted to experience a 5–10% increase in skin cancer incidence during the middle decades of the twenty-first century as a result of current higher ultraviolet light exposure (Slaper et al. 1996).

Human health indicators of environmental effects

Although the importance of the environment is increasingly being recognised, its contribution to health is often likely to be indirect, subtle, complex and delayed. It is therefore very difficult to estimate the full range and size of the health effects that can ultimately be traced to the environment, and so to plan accordingly. Australia's ability to report on health-related environmental issues is poorly developed, as elsewhere. The reporting that is currently possible relies mainly on measures of ill health rather than 'good health'. Three environment-related human health issues for which data exist are vector-borne diseases, skin cancer and low-level lead exposure of children.

A number of communicable diseases are influenced by environmental conditions or are kept in check by the efforts of environmental and other health workers. These diseases include Ross River virus, Murray Valley encephalitis, Japanese encephalitis, dengue fever, Barmah Forest virus, food poisoning diseases and legionellosis. The prevalence of diseases influenced by environmental conditions fluctuates considerably with changes in the weather and the prevalence of insect vectors. Surveillance of arboviruses and their vectors is important for the detection and management of these diseases, and climate and environmental changes associated with global warming are likely to result in higher numbers and wider geographic distribution of vector-borne diseases within Australia. The first case of Japanese encephalitis (a potentially fatal virus transmitted by mosquitoes) on the Australian mainland was diagnosed in March 1998 (Thomson et al. 1998). In recent years, Japanese encephalitis has also been diagnosed in the Torres Strait Islands.

Development of melanoma and other skin cancers is related to exposure to ultraviolet radiation in sunshine. Although the death rate from melanoma has remained relatively unchanged, the incidence of new cases is growing steadily (AIHW 1999b) (see section 2.2, page 70).

Industrial use of lead, especially in the manufacture of paint and as an additive in petrol, has resulted in the widespread distribution of lead in the environment where it is available for people, and especially children, to swallow or inhale. Community concern over the past decade about the health effects of lead, especially its effects on young children, has stimulated action to solve the problem. There has been only one systematic national study of blood lead concentration in children. This was conducted in 1995, and found that less than 1 in 12 children aged 1–4 years had blood lead concentrations greater than or equal to the 1993 National Health and Medical Research Council (NHMRC) goal for all Australians (AIHW: Donovan 1996). From many individual Australian studies there appears to be a general trend for blood lead concentrations in

children to have decreased over time. It appears likely that this decrease is in response to the introduction of legislation encouraging the use of unleaded petrol, the general lowering of paint-lead concentration over the decades and community awareness.

3.2 Genetic factors

Genetic factors play an important role in human health and disease. An individual's genetic make-up (genome) sets the main features and boundaries within which life is to be experienced. It also provides the blueprint for how the human body interacts with the environment. In addition, the genome is programmed to protect its own molecular structure and to repair any damage caused to it by environmental agents.

Human health also depends on the genetics of other life forms, especially organisms that infect humans. Therefore, human health should be seen as the result of our environment (including the genetics of other life forms), our genes, and the interaction between the two.

The spectrum of genetic diseases

Genetic factors contribute to diseases at various levels and in many different ways (Khoury 1996). A study in British Columbia, Canada, suggests that prior to age 25, more than 5% of all live-born individuals will be affected by a disease that primarily has a genetic component (Baird et al. 1988). Separate estimates put the proportion at about 10% when measured for recurrent genetic diseases over the whole lifetime (UNEP & ICPEMC 1992).

Broadly, three major types of genetic diseases/disorders are identified. (For explanation of various genetic terms and a description of the organisation of the human genetic material, see Box 3.2.) These are:

- single gene (monogenic) disorders, genetic defects that result from an alteration or a change (mutation) in the structure of the gene and can be traced through families and clearly defined;
- chromosomal abnormalities, caused by structural changes in the chromosomes or the gain or loss of whole chromosomes (or parts of chromosomes), some of which can be related to specific clinical syndromes; and
- multifactorial diseases, which seem to have a strong genetic component but are expressed following interaction of genes with environmental factors such as diet, chemical exposure and lifestyle.

About 2% of the population will have a monogenic problem or condition, with some of the problems showing up at birth and others showing up later in life. Common examples of monogenic disorders are muscular dystrophy, cystic fibrosis and haemophilia. Limited data are available to generate reliable estimates of the prevalence of these problems in Australia.

The incidence of chromosomal abnormalities or malformations among live-born infants is estimated to be at least 0.5%. In addition to well-defined clinical syndromes, e.g. Down syndrome, chromosomal abnormalities also account for more than 20% of spontaneous abortions (Riccardi 1977). Chromosomal abnormalities represented 13% of all notified