



# 8

## Changes in Australia's disease profile: a view of the twentieth century

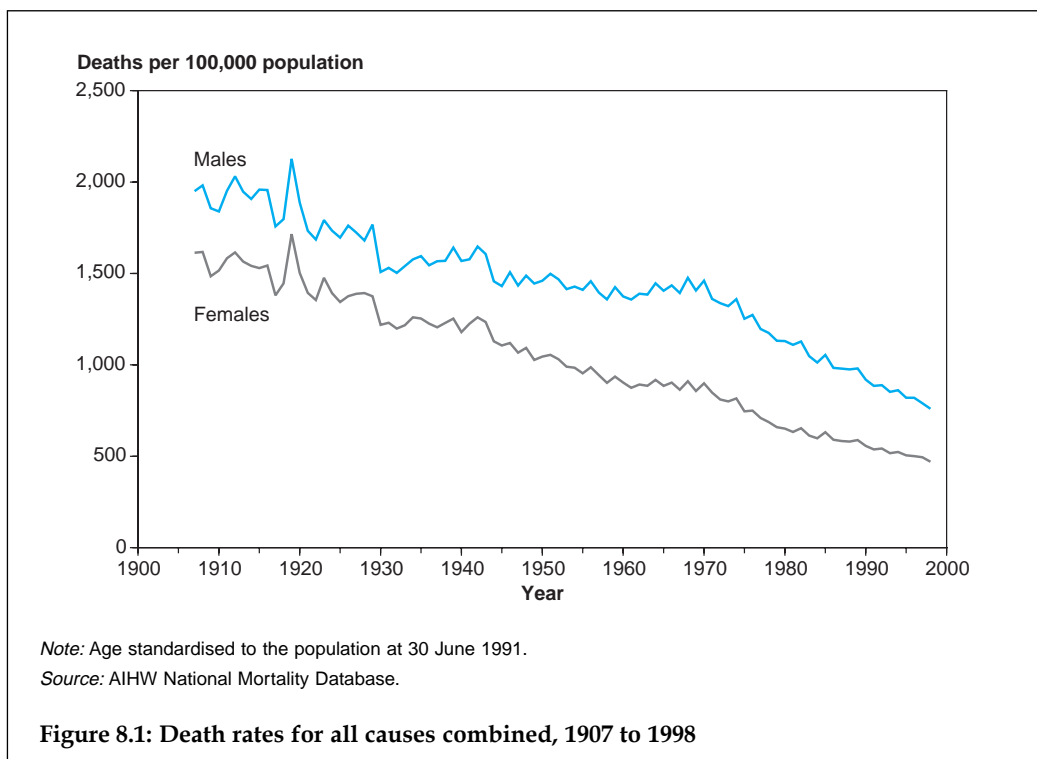
The twentieth century was a period of great social, economic and scientific development in Australia. In health, these developments brought better nutrition and living conditions from the start of the century, widespread immunisation and improvements in medical treatment in the second half, and a growing awareness in more recent times of the effect of lifestyle and socioeconomic factors on health. Such advances have resulted in death rates that are now less than half what they were in 1900, an improvement in life expectancy at birth of over 20 years, and a dramatic decline in perinatal mortality and deaths from infectious diseases. But there has also been a greater prominence of the chronic diseases (e.g. cardiovascular diseases and cancer) and the rise and partial fall of two epidemics, coronary heart disease and lung cancer.

This chapter examines these and other mortality trends in Australia over the past 100 years. Although mortality trends provide a limited picture of Australia's health, they are one of the few statistical series that were collected with some consistency over the whole century (AIHW: Taylor 1992). This chapter also highlights some critical factors that have influenced patterns of deaths in Australia.

### 8.1 General trends in health over the twentieth century

Mortality has shown a remarkably consistent decline during the century despite some short-term impacts of specific diseases (Figure 8.1). This decline has been consistent in both males and females, although there are differences in the timing and make-up in the patterns of causes of death. Age-standardised mortality rates declined by 61% in males and 71% in females between 1907 and 1998 (Knibbs 1909; ABS 1999). This is in line with mortality reductions seen elsewhere in the developed world. The death rate in males is consistently above that of females.

As expected, these mortality declines are reflected in the substantial increases in life expectancy that have occurred over the century (Figure 8.2, page 342). However, what is not evident from these declines are the significant changes in the main causes of death during the twentieth century. Also, these mortality declines may not have been equally distributed among all population groups such as the immigrant and Indigenous populations. For example, there is presently a substantial difference in life expectancy between Indigenous and non-Indigenous Australians and death rates are higher for the Indigenous populations for most causes of death. Indeed, the mortality patterns for Australian Indigenous peoples are strikingly worse than their indigenous counterparts in Canada, New Zealand and the United States, as shown by their lower life expectancies at birth and higher age- and cause-specific death rates (Hogg 1992). It is



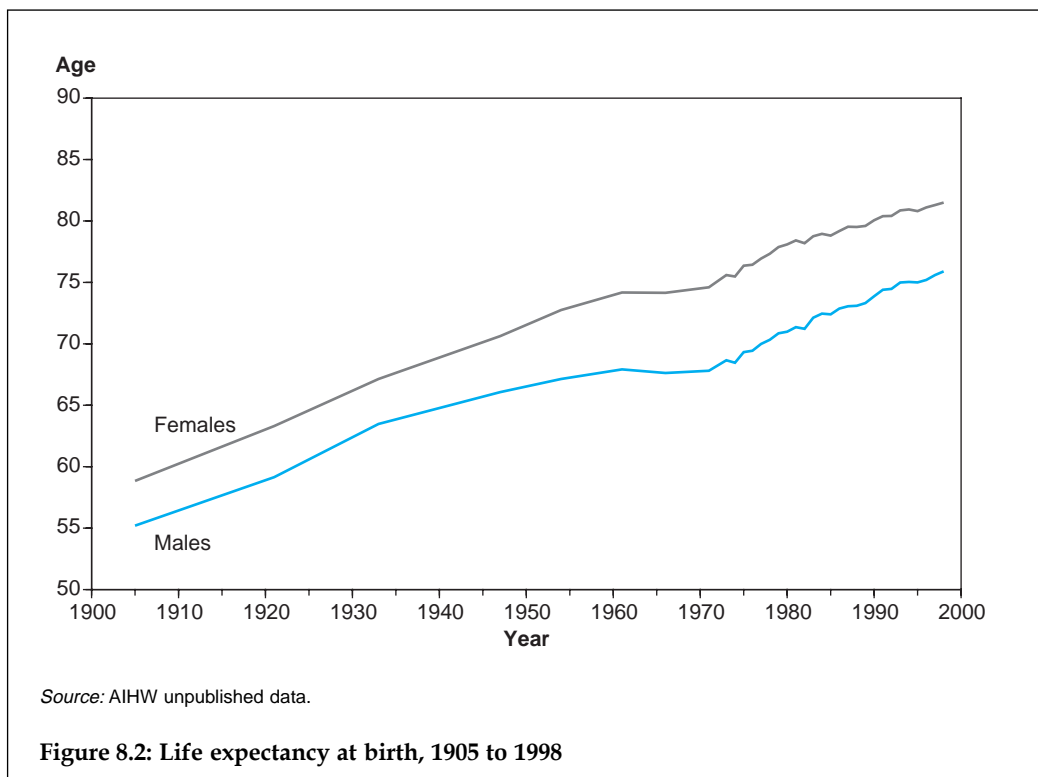
not known whether Indigenous health has improved over the century or whether it has maintained its relatively poor position. This is because Indigenous peoples have not been identified in many administrative or health-specific data collections. It is known that while the population of Australia has increased from around 4.4 million in 1899 to about 18 million a century later (an approximate fourfold increase) the Indigenous population has not yet doubled from its estimated level of 200,000 in 1898 (Coghlan 1900), and reached only 386,000 in 1996 (ABS 1998). However, it is not known what effect these changes in the relative sizes of the Indigenous and total populations have had on overall trends in mortality and life expectancy.

Many immigrant groups have proved to be healthier in some respects than the existing Australian population (e.g. cardiovascular disease, cancer). Young (1986) speculated that this healthy migrant effect is a result of immigrant selection, lifestyle and diet, and tobacco and alcohol consumption patterns. Young indicated that immigrants from Southern Europe, Lebanon and South East Asia had lower mortality rates than for Australians generally for many causes of death. Giles, Jelfs and Kliever (1995) showed this pattern existed for many of the major migrant groups in Australia in relation to cancer mortality, even showing that for some cancers these migrants fared better than those remaining in their own country. It is important to recognise these differences in mortality patterns when looking at long-term trends, as the impact of the large-scale immigration from the 1940s onwards would have tended to reduce the overall mortality rate from this point forward.

## Increased life expectancy

For the overall population, life expectancy at birth rose from 55.2 and 58.8 years at the beginning of the twentieth century to 75.9 and 81.5 years in the late 1990s for males and females respectively (ABS 1999) (Figure 8.2). This rise in life expectancy was relatively constant over the century, apart from a plateau during the 1960s that was related to an increase in deaths from heart disease.

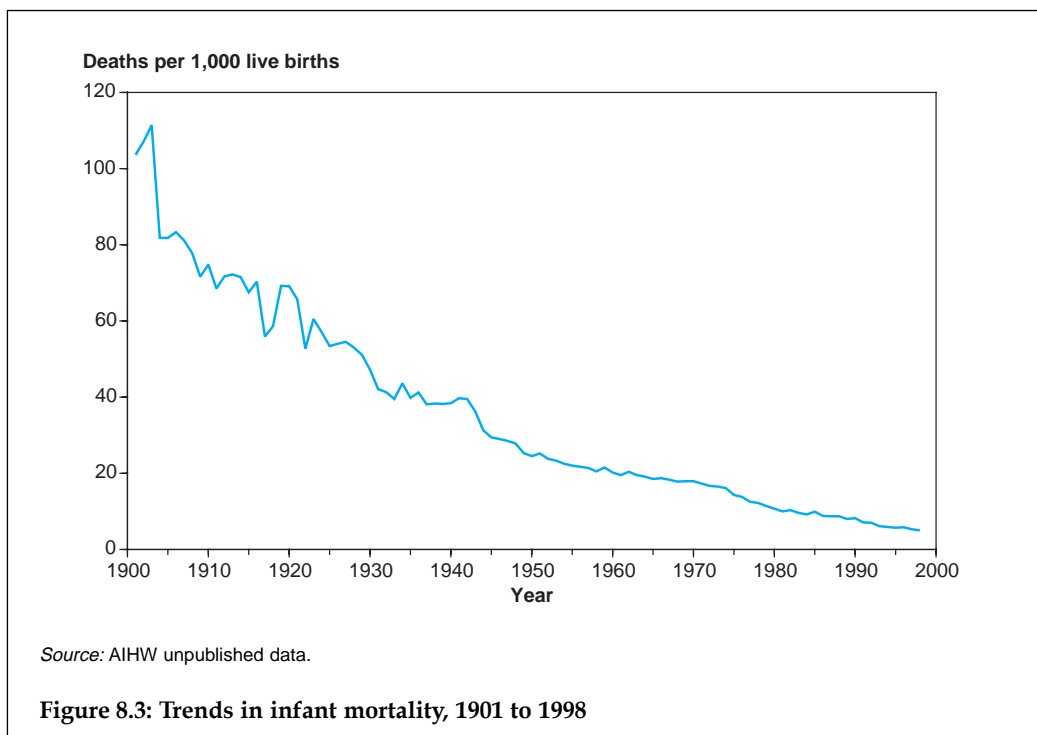
However, in the late 1990s, the life expectancy of Indigenous Australians was estimated to be 20 years less than the general population, at 56.9 years for males and 61.7 years for females (ABS & AIHW 1999). So life expectancies for Indigenous Australians are 100 years behind those for non-Indigenous people, and show that the high standard of health achieved by the general population over the last 100 years has not been shared by all Australians.



## Reductions in infant mortality

Increases in life expectancy are largely related to the substantial decrease in perinatal and infant mortality that occurred in the first half of the century (Figure 8.3). Infant mortality rates were very high in the 1880s (130.5 deaths per 1,000 live births in males and 114.1 in females) but had fallen to nearly half that by 1910–20 (Lancaster 1956). In the first decade of the twentieth century, 1 in 10 children died before the age of 5, most from infections such as diarrhoeal diseases and enteritis (Cumpston 1989:111).

By 1926, the infant mortality rate had been reduced by half and there had been a dramatic decline in deaths from gastrointestinal diseases. This followed the introduction of improved sanitation, such as the systematic collection and removal of 'nightsoil' (Cumpston 1989:113). Improvements in the quality of water and milk supplies, an increase in breast-feeding, better access to education and a decreasing number of births per woman were also likely to have played a part in the dramatic declines in child deaths through better infant health and increased resistance to infection (Gandevia 1978). Infant mortality continued to decrease after the 1940s with the introduction of antibiotics and improved perinatal care, and reached a low of between 5 and 7 deaths per 1,000 live births in the late 1990s (AIHW 1998). Few infants (other than Indigenous infants) now die from infection or from conditions in the perinatal period such as low birthweight or birth trauma. Congenital anomalies, sudden infant death syndrome (SIDS) and accidents have become the leading causes of death in young children (AIHW 1998). Indigenous infant mortality was around 18 per 1,000 live births at the end of the twentieth century (ABS & AIHW 1999).



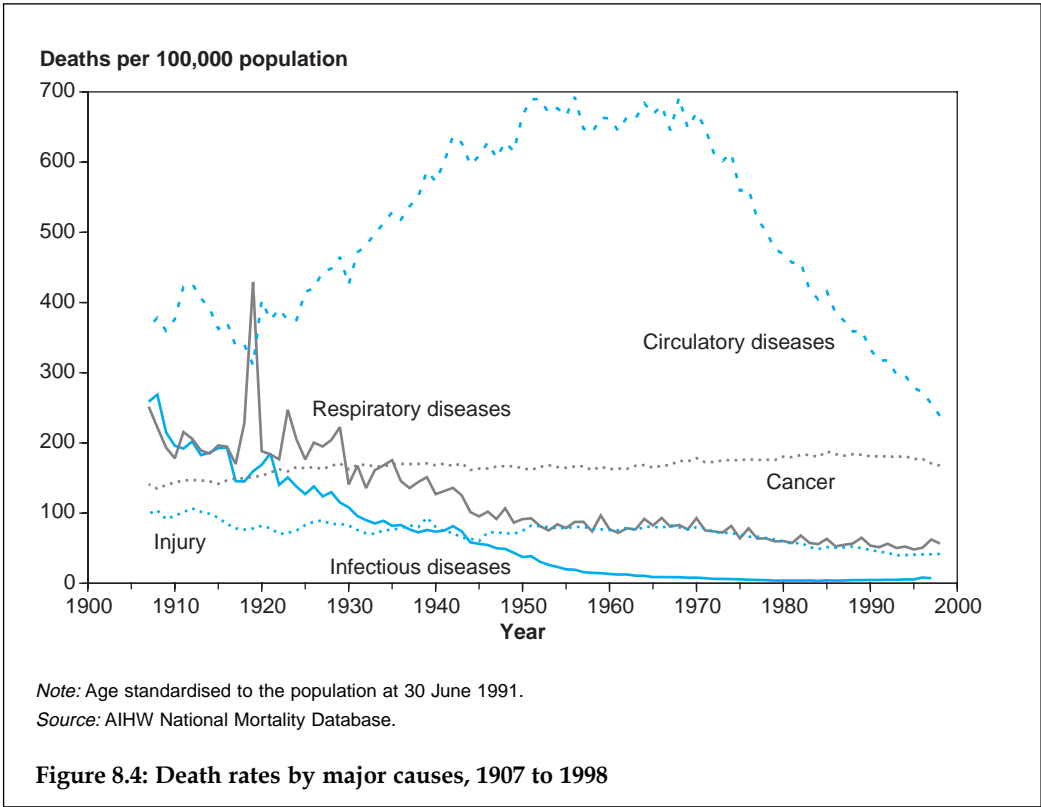
### Reductions in maternal mortality

As well as improvements in infant mortality, there has been a dramatic decline in mortality rates for women during childbirth in Australia. Childbirth was responsible for the death of around 6 women in every 1,000 live births (Cumpston 1989:138) in 1900. 'Puerperal fever', a condition now known as post-partum infection, was responsible for about one-third of these deaths. In the 1920s and 1930s, doctors attributed maternal death rates partly to the poor standards of obstetric care practised by some of their

peers, especially the use of unnecessary caesarean sections (Hughes 1939). Maternal death rates remained relatively high until a dramatic decline in 1937, when antibacterial drugs became available (Taylor et al. 1998). Improved nutrition, better general health, the advent of medical interventions such as antiseptic procedures, a decrease in pregnancies (from contraception and family planning), use of blood transfusions and the professional training of those attending births have all contributed to a sustained decrease in deaths of women following childbirth (Weil & Fernandez 1999). By the late 1990s, maternal mortality in Australia was rare and it remains among the lowest in the world. In the early 1990s, maternal mortality was 10.9 per 100,000 confinements (NHMRC 1998), around 2% of the rate in 1900.

**The transition from infectious to chronic disease**

As in many other developed nations, Australia has experienced a ‘health transition’ from infectious to chronic diseases, with influenza and tuberculosis being replaced by circulatory (cardiovascular) diseases and cancer as the major causes of death (Beaglehole & Bonita 1997:6) (Figure 8.4). More specifically, there was a decrease in death rates from infectious diseases, particularly from the early 1900s, and an increase in coronary heart disease, stroke and lung cancer from the 1920s and 1930s.



Better nutrition and public health measures such as improved sanitation and housing made a major contribution to the decrease in deaths from infectious diseases. Lifestyle factors such as changes in diet and smoking are considered responsible for the increase (and partly for the subsequent decline) in deaths from circulatory diseases and some cancers, and the increasing number of motor vehicles led to an increase in transport-related deaths.

Since the late 1960s, death rates from cardiovascular causes (in particular heart attack and stroke) have declined steadily and more recently there has been a slight rise in death rates from infectious disease in males. The reduction in cardiovascular death rates is related to the success of prevention strategies and better treatment of cardiovascular conditions. The rise in infectious disease death rates, although slight in Australia, has been seen around the world with the emergence of infections such as the human immunodeficiency virus (HIV) and hepatitis C. This has led to speculation that a further transition in the disease profile of Western countries may occur (Beaglehole & Bonita 1997:7).

## 8.2 Trends in the major causes of death in Australia

The following sections describe trends in the major causes of death for Australians over the twentieth century. The disease categories are defined by the International Classification of Diseases and include infectious diseases, cardiovascular disease (circulatory system diseases), cancer (malignant neoplasms), respiratory diseases, and deaths from external causes (injury and poisoning). Interpreting trends in death statistics poses some difficulties as international definitions, classification frameworks and diagnoses of disease have changed over time (AIHW: Taylor 1992; Taylor et al. 1998). In the early 1900s, causes of death were classified initially using a system devised by Dr William Farr, and then according to the Bertillon Index. The International Classification of Diseases, version 2 (ICD-2) was used in Australia from 1918, and ICD-10 was introduced in 1999. Because of the different classifications used, the following sections focus on broad trends in the data.

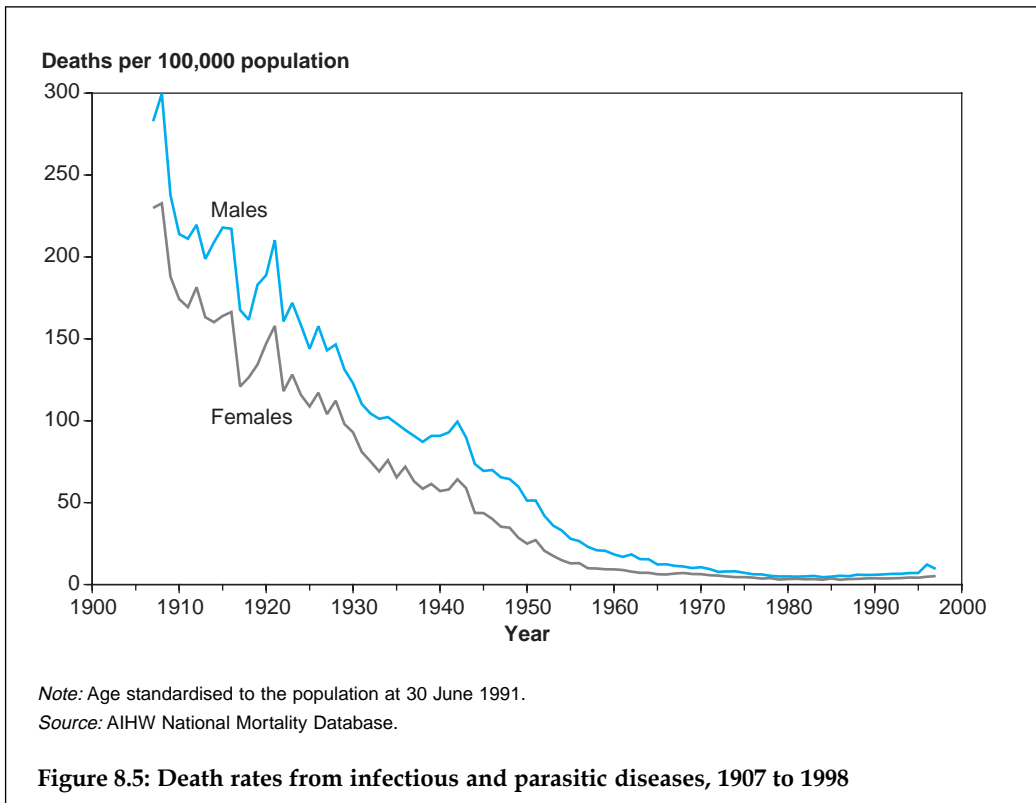
### Infectious diseases

Infectious diseases were the main cause of death in Australia in the first 100 years after European settlement. Dysentery, scurvy and typhus were the major infections, but epidemics of smallpox, cholera, tuberculosis and other infections were also common (Sax 1984:15). Children bore the brunt of infectious diseases as did the Indigenous populations who, having not encountered these diseases before, had no resistance to them and suffered very high death rates (Gordon 1976:182).

In the early 1800s, infectious diseases were of enormous public and political concern around the industrialised world, and governments in many countries were called upon to enact public health measures to reduce their spread. At the time, it was thought that infections were the result of 'miasmas' or foul vapours that arose from decaying matter, and sanitation was seen as an important way of arresting the spread of disease (Davis & George 1988:166). During the late 1800s, a range of public health measures was introduced in Australia including publicly financed water and sewerage schemes, improved sanitation and better housing to reduce overcrowding (Davis & George

1988:167). These measures were largely responsible for the decreases in infectious diseases that were already under way at the beginning of the twentieth century (Cumpston 1989:114).

Despite declines, infectious diseases remained a major cause of death in the early 1900s (Figure 8.5) with tuberculosis and venereal diseases being the most common (Sax 1984:16). Public health legislation had been enacted across Australia but was beginning to extend beyond sanitation to the compulsory notification of infectious cases and the isolation of infected individuals. In 1900, for example, when bubonic plague arrived in Sydney, officials isolated infected individuals in the quarantine station at North Head, closed their dwellings and coated their possessions in lime (Hickman 2000). An Australian researcher, Ashburton Thompson, established the connection between rats, fleas and the spread of the plague (and was the first in the world to do so) and public health inspectors were despatched to find and destroy rats and their breeding grounds (Hickman 2000). Despite a public outcry about the plague and its effects, only 463 people died from the disease in Australia between 1900 and 1909 (Cumpston 1978). This small number was undoubtedly due to the timely action of public health officials. The plague outbreak was the trigger for the first Commonwealth action in quarantine.



Influenza, although classified as a respiratory condition, has been responsible for a large numbers of deaths over the twentieth century, none more significant than the 1919 pandemic (see Figure 8.11, page 358). In that year approximately 12,000 Australians died, making influenza the most common cause of death, exceeding the number of deaths attributed to circulatory disease (Cumpston 1989). This outbreak was also responsible for the deaths of approximately 20 million people worldwide. A smaller but significant influenza outbreak also occurred in 1907–1908 and was responsible for around 700 deaths in each of those years, compared with an expected 200–300 deaths.

There was a steady decline in deaths from infectious diseases over the century (Figure 8.5). Mass vaccination occurred from the 1930s for diphtheria, from the 1950s for pertussis (whooping cough), tetanus and poliomyelitis (for which no cases have been reported since 1978), and from the 1960s for measles (Hall 1993). Widespread immunisation continued in the 1980s and 1990s, as other vaccines became available, and has been the focus of recent public health campaigns as immunisation levels have fallen. Some declines have also been attributed to the introduction of antibiotics from 1937 onwards, the anti-tuberculosis campaign, and to continued improvements in environmental health and socioeconomic conditions (Taylor et al. 1998).

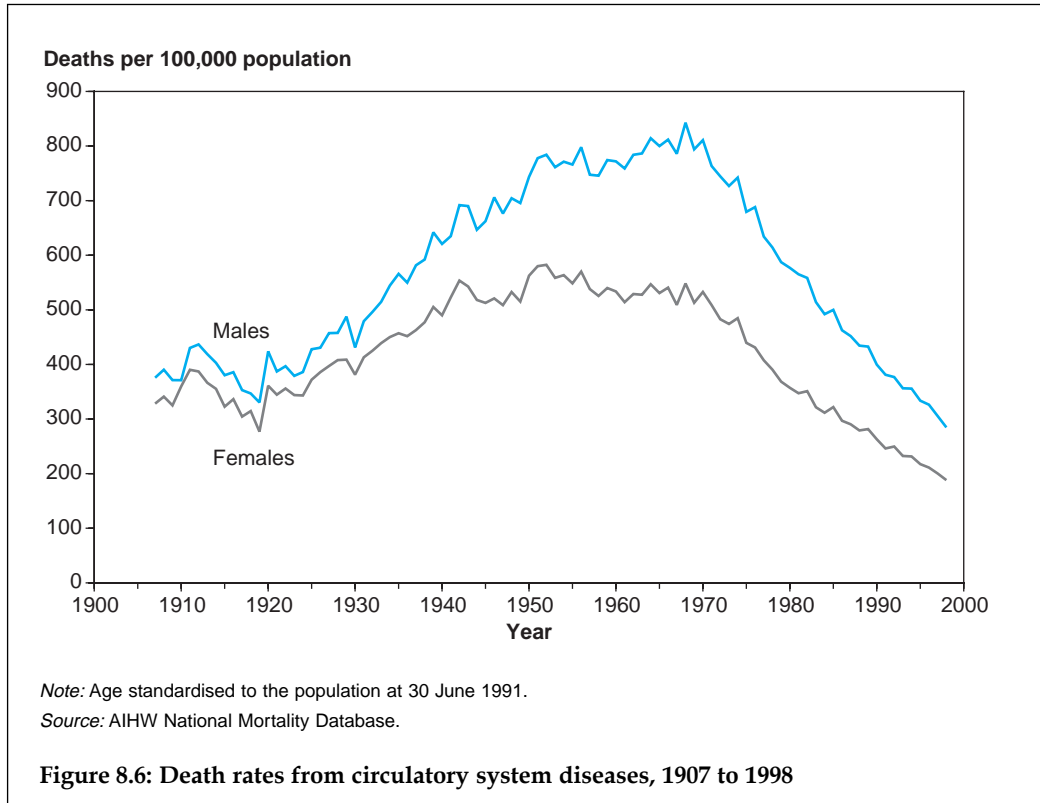
During the 1970s and 1980s a number of viral infections including hepatitis B, hepatitis C and the human papilloma virus were newly described, although it is likely that these diseases existed before this but had not been recognised. Viral conditions were largely untreatable and became a significant concern, especially with the emergence of HIV in the early 1980s. Acquired immunodeficiency syndrome (AIDS) (caused by HIV) has now led to the deaths of 13.9 million people worldwide and is among the top four causes of death globally (WHO 2000). The effect on overall life expectancy in many countries has been dramatic. In Australia, the epidemic has been controlled by relatively rapid public health interventions, and, although over 6,000 people have died in Australia from AIDS, the epidemic appears to have been slowing since 1994 (WHO 2000). Further information is contained in section 2.5 (page 112). Safe-sex and safe-injecting campaigns, blood supply regulation, infection-control guidelines and the introduction of new treatments have all contributed to the control of mortality from AIDS in this country.

In Australia, a combination of improved living conditions and access to readily available treatments over the twentieth century has resulted in many infectious diseases becoming comparatively rare (the 1998 death rate from infectious diseases was less than 1% of that in the 1930s). However, the levels of infectious diseases remain relatively high in the Indigenous populations. Diarrhoeal infections and infections that result in pre-term birth are still major problems for some Indigenous communities, reflected in their higher infant mortality rates (ABS & AIHW 1999).

## **Cardiovascular diseases**

Another striking trend in mortality in Australia in the first half of the twentieth century was the significant increase in death rates from circulatory system diseases, followed by an even greater fall beginning in the late 1960s (Figure 8.6). The main conditions contributing to this pattern were heart attack and stroke.

The evolution of the epidemic of cardiovascular disease was paralleled by a rapid increase in the understanding of how the heart functions and of the contribution of risk factors to heart disease. It was also a time of significant development in methods to diagnose and treat heart and other circulatory problems. The application of this knowledge ultimately resulted in a decline in cardiovascular death rates.



In the first years of the twentieth century, cardiovascular disease was already recognised as a significant contributor to the mortality of Australians. It was the fourth most common cause of death in Australia after pneumonia, tuberculosis, and diarrhoeal disease, and it was much more common than cancer (Cumpston 1989:133). In 1916, the Commonwealth Departmental Committee on Invalidity and Mortality, concerned at possible declines in the Australian population and its health status, recognised the risks of ‘middle age’ thus:

It is commonly said that a man is as old as his arteries ... about the age of 40, slow changes begin, which tend to make the coats more rigid ... But at the age of 40 ... when these quiet changes in the main arteries should be slowly beginning ... more serious evil often sets in ... more rapid in evolution ... the whole circulation is in a condition of strain. The persons affected think themselves robust ... But they often die suddenly ... Men suffer in this way far more than women, but even women are affected in large numbers. What are the causes of this disastrous series of changes which cut off thousands of people in their full maturity?

In the early 1900s, knowledge of the heart was limited to an understanding of its anatomy, and relatively little was known about how it worked. There was only a rudimentary appreciation of the relationship between the heart and other important facets of the circulation such as blood pressure, and the function of the heart as an 'electrically driven pump' within the body was largely unknown. The introduction of a portable instrument, the sphygmomanometer, and the interpretation of the sounds heard via the stethoscope, enabled doctors to measure blood pressure for the first time, and this became part of a routine physical examination. However, there were no effective remedies for the treatment of elevated blood pressure once it had been diagnosed. The recognition of disturbances in heart rhythm had developed as a clinical skill, but it was difficult for doctors to predict which rhythms were harmful, and treatments were largely unavailable, other than bed rest and the use of digitalis (derived from the foxglove flower) which had been available since Roman times (Porter 1997).

By 1910, circulatory system disease had become the most common cause of death in Australia and, except for a brief period following the great influenza epidemic in 1919, it has remained the leading cause of death. Over the first half of the century, the percentage of deaths due to cardiovascular disease increased substantially in all age groups and in both sexes, and by mid-century the disease accounted for more than half of all deaths, not only in Australia but also in most of the industrialised world (Braunwald 1997). The link between heart disease and infections such as rheumatic fever and syphilis was well known, and by 1950 antibiotics were available to treat these conditions, thereby preventing their cardiac consequences for the first time. However, the major causes of death from heart disease—sudden death and heart attack—were still unexplained and continuing to rise. Lancaster (1990) observed that part of this increase could be explained by better cause-of-death coding, with ill-defined causes of death falling to near zero as the epidemic gathered momentum.

During the first half of the twentieth century, changes in death rates from heart disease occurred in Western countries, with rises tending to follow increasing prosperity. Increasing rates were noted, for example, in the United States among affluent men who smoked (Keys et al. 1963), but in postwar Europe, cardiovascular disease rates decreased sharply in the wake of reduced food supplies. Changes in incidence rates seemed to reflect powerful socioeconomic and behavioural influences in newly rich countries operating with a relatively short incubation period for the disease, perhaps as short as a decade (Rose 1989).

In 1941, new X-ray techniques allowed doctors to view the pumping action of the heart (and, later, the health of the coronary arteries) using radio-opaque dye introduced through a fine tube inserted into an arm or groin blood vessel in a conscious person (cardiac catheterisation).

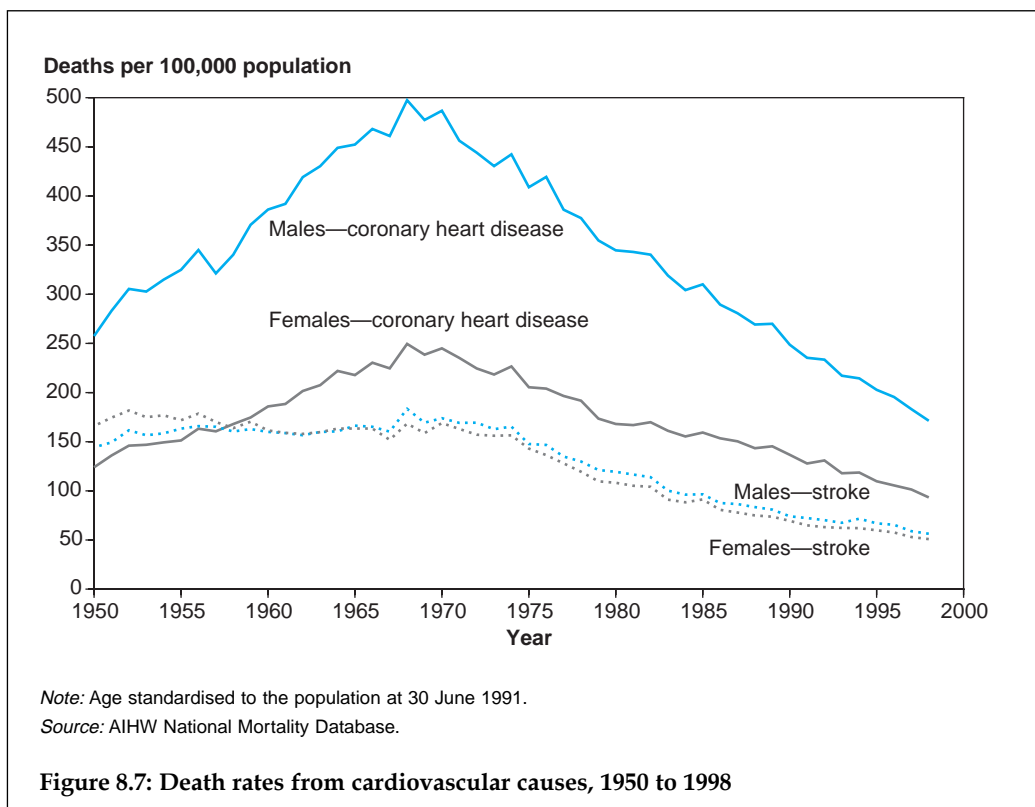
With improved diagnosis, attention was directed at treatment. In 1945 Blalock attempted surgical repair in a child with congenital heart disease, and this led to the development of open-heart surgery within a decade, providing some relief for those with congenital heart disease, disease of the heart valves and other conditions. In the mid-1950s, the invention of the heart-lung bypass machine (the pump-oxygenator), taking over the function of the heart and lungs outside the body, allowed surgeons enough time to undertake more complicated procedures.

From 1967 onwards, surgical techniques were used in Australia to bypass obstructions in the coronary arteries and so relieve the debilitating pain suffered by those with coronary artery disease. This operation, coronary artery bypass grafting, became one of the most frequently performed surgical procedures around the world (Mueller et al. 1997). Initially undertaken to relieve symptoms, it was also found to decrease mortality (Julian 1989). Other interventions followed including the use of specific drugs and anti-clotting agents. In-hospital care improved through the setting up of coronary care units with specifically trained nursing staff and intensive monitoring of patients. Other advances, including drugs and devices for correcting abnormal heart rhythm (pacemakers and defibrillators) and better training of emergency services personnel, also assisted survival in those with established coronary heart disease.

Attention was increasingly focused on the social and lifestyle factors that contribute to the development of cardiovascular disease in the healthy population. From this emerged the concept of risk factors for coronary heart disease and stroke. In 1961, results were published from a research project in the United States, the Framingham Heart Study, which became one of the cornerstones of cardiac epidemiology (Kannel et al. 1961). High blood pressure, smoking, elevated cholesterol in the blood and dietary factors (especially dietary saturated fat and salt) were identified as major contributors to the epidemic of cardiovascular disease. The importance of other factors such as socioeconomic status, obesity and physical inactivity was acknowledged (NHLBI 1994) as well as the significance of social, cultural and environmental factors.

Mortality rates from coronary heart disease increased dramatically after World War II, peaked in Australia in 1968 and then decreased substantially by over 60% among males and females (AIHW & HFA 1999) (Figure 8.7). Death rates for stroke remained constant through the 1950s and 1960s and have fallen by more than two-thirds since 1968 (Figure 8.7). These improvements are considerable, particularly as mortality from non-cardiovascular diseases decreased by about 20% only (AIHW & HFA 1999). The decline in coronary heart disease occurred in all age groups and for both sexes, with greater declines in the younger age groups and a greater rate of decrease for males than for females (Beaglehole et al. 1989). This implied that broadly operating effects such as market-led dietary change were responsible, more so than individual efforts to alter lifestyle, and that those changes acted with only a short lag period (Rose 1989). One suggested factor in Australia was the change in the balance and types of fats in the national diet (Hetzel & McMichael 1987).

Mortality rates from coronary heart disease in Australia declined by about 25% over the 1970s but the greatest declines were experienced by the professional occupations, whereas lower socioeconomic groups had higher mortality rates at the beginning of the period and experienced smaller declines. From a national survey in 1980, lower risk levels of blood pressure, cigarette smoking, body weight and exercise were significantly and consistently found among higher status occupation groups. This suggested that there was a pattern of coronary prevention behaviour spanning multiple risk factors that was associated with a reduction in coronary heart disease (Dobson et al. 1985).



The relative contributions of alterations in lifestyle and changed levels of risk factors in the population, and of medical interventions to declines in mortality rates for cardiovascular disease is still being assessed. The most important advances in medical care for coronary heart disease and stroke may well have occurred after the beginning of the decline in mortality (Hetzl & McMichael 1987). Recent Australian research has found a decline in rates of coronary heart disease events as well as deaths, consistent with reductions in risk-factor levels and improved acute medical treatment for the period 1985 to 1993 (Dobson et al. 1999).

Although a significant proportion of cardiovascular disease is preventable, the prevalence of risk factors, such as tobacco smoking, high blood pressure, physical inactivity and poor nutrition, that are amenable to change still remains high in the Australian population. It has been estimated that 80% of all adult Australians have one modifiable cardiovascular risk factor and 10% have three or more such factors (Tonkin et al. 1999).

In Indigenous people, death rates from cardiovascular disease are about twice those of non-Indigenous people. Among Indigenous Australians living in the Northern Territory the occurrence of rheumatic heart disease is the highest recorded in the world; the annual incidence of its precursor, acute rheumatic fever, for the years 1989 to 1993 was between two and seven cases for every 1,000 children aged 5–14 years. In contrast, not one non-Indigenous child suffered rheumatic fever over the same period (Carapetis & Currie 1998).

## Cancer

Over the twentieth century, there has been an increase in the proportion of deaths in Australia due to cancer. At the beginning of the century, cancer was the fifth leading cause of death among Australians after deaths from infectious diseases, cardiovascular disease, respiratory disease and injury (Cumpston 1989:133). Since then, cancer death rates have increased as a proportion of all-cause mortality, and cancer is now second only to cardiovascular disease as a major cause of death (AIHW 1998). Both the incidence and mortality of cancer are higher among males than among females, and there is also significant geographical and socioeconomic variation in cancer mortality within the Australian population (Armstrong 1985).

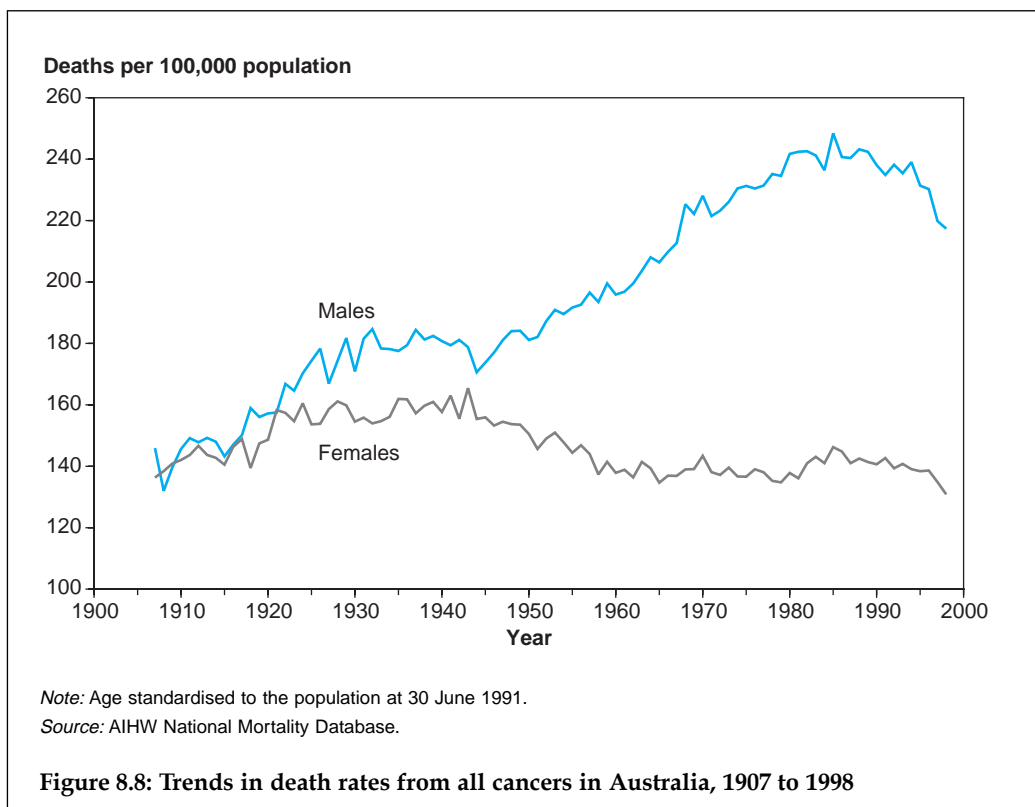
Trends in cancer mortality are difficult to interpret because there are many different types of cancer, each having different causes and some more amenable to treatment than others. Identifying carcinogens (cancer-causing agents) has been controversial, but it is now generally accepted that over 75% of cancers are associated with exposure to environmental factors that interact with an individual's genetic make-up (Carroquino et al. 1998). There is also a lag time of many years between contact with carcinogens and the emergence of disease which makes it difficult to identify all the factors which may have influenced the trends in death rates for cancer.

Over the century, public health turned its attention to environmental factors such as tobacco smoke, alcohol, air pollution, some industrial processes, manufactured products, sun exposure, certain viruses and diet in order to understand their relationship with cancer. Although some of these factors have proven amenable to public health control measures, others have proved more difficult. Changes in diagnosis, treatment and classification of cancers have also contributed to variations in mortality patterns, particularly for certain types of cancer (Armstrong 1985).

The overall increases in mortality from cancer over the twentieth century reflect changes in the age distribution of the population (due to increased life expectancy, postwar baby booms and significant immigration) and in exposure to various carcinogens, particularly tobacco.

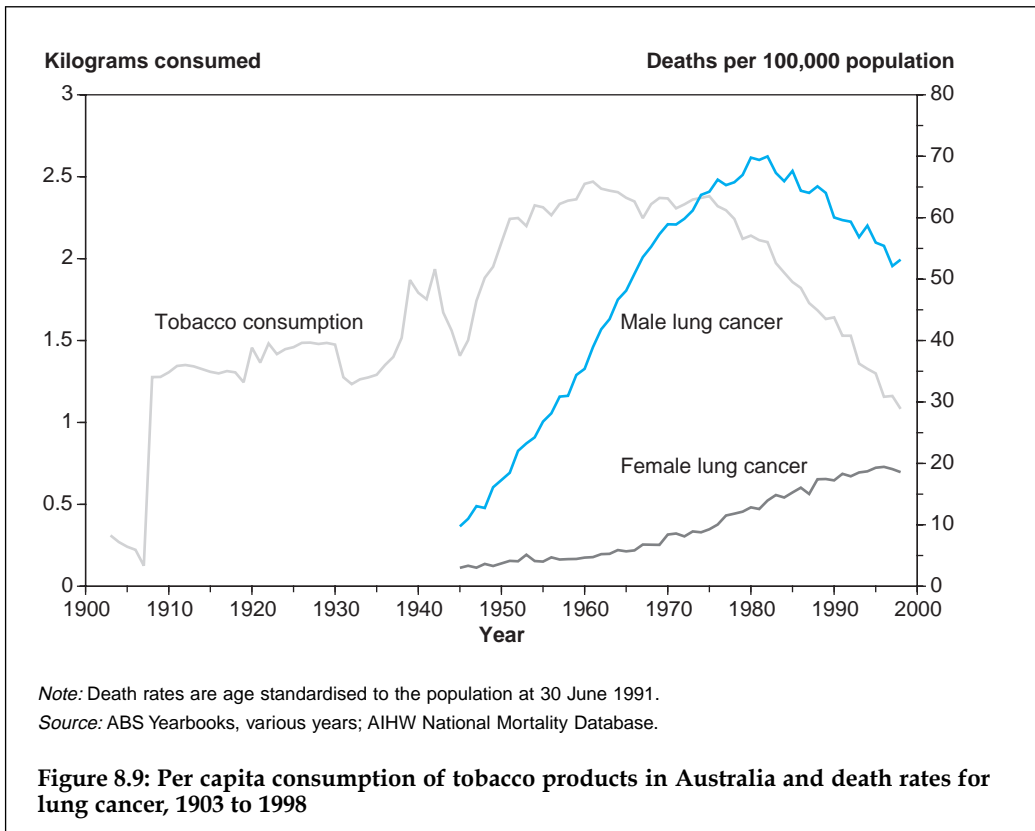
Analyses of trends in death rates over the century (Figure 8.8) have indicated that overall cancer death rates among females increased between 1907 and 1920, plateaued until approximately 1942, then declined through to the 1960s. Female cancer death rates were stable in the 1960s and 1970s before increasing slightly in the 1980s through to the mid-1990s. In males, there was an increase in cancer death rates during the period 1907–30 and then a significant increase after 1945, largely the result of a substantial rise in lung cancer (Armstrong 1985).

Tobacco consumption is by far the largest contributor to the increase in total cancer deaths in the twentieth century, having its greatest effect on lung and oral cancers. By the 1950s, Australia was in the grip of a smoking epidemic with 92 different types of cigarettes on the market (Office of Prices, Victoria 1990). A rise in lung cancer deaths followed as a direct result of increased tobacco consumption (Giles, Hill & Silver 1991). Smoking rates have declined substantially in males over the last several decades (AIHW 1996) and male deaths from lung cancer have subsequently declined since the 1970s (Figure 8.9, page 354). Smoking rates in females were much lower than in males



until recent times, and consequently females have lower lung cancer rates. The decline in smoking in females was less than in males and began much later. Due to the timelag of about 20 years between exposure to carcinogens in tobacco smoke and the diagnosis of cancer, lung cancer rates in females are expected to increase in the early 2000s. Further information on trends in tobacco smoking can be found in section 3.4, page 148.

At the end of the twentieth century, tobacco smoking continued to be by far the most important cause of cancer of the lung and is estimated to be responsible for approximately 80% of lung cancer and 20% of all cancer deaths (English et al. 1995). Reductions in the lung cancer death rate in the 1980s and 1990s was influenced by changes in prices of tobacco products, decreases in tar content, tobacco advertising reforms, and behavioural changes, resulting in smoking cessation (Giles, Hill & Silver 1991). However, although there have been overall reductions in smoking by Australians over the last three decades, the gap in smoking prevalence between groups is widening; individuals of higher socioeconomic status are more likely to avoid smoking, whereas those who are socioeconomically disadvantaged continue to smoke at higher rates (Hill et al. 1998).



Occupational exposures, including exposure to asbestos, are estimated to be responsible for 15% of lung cancers in males and air pollution is perhaps responsible for 5% of all cases of lung cancer (Giles et al. 1988). Asbestos was used widely throughout Australia by the 1950s and could be found in most homes, cars and workplaces. A substantial mining industry also existed, exposing thousands of workers to large doses of asbestos dust. In 1955, it was demonstrated that asbestos caused lung cancer.

In women, breast cancer is currently the major cause of cancer deaths (AIHW 1998) with deaths from colorectal (bowel) cancer and lung cancer in second and third places respectively. Breast cancer mortality rose steadily from the early decades of the twentieth century to peak in the early 1940s, decreased to the 1960s and 1970s before rising again in the late 1980s (Smith et al. 1998). It is thought that the increase to the mid-1940s was caused mainly by rapidly falling fertility in the late nineteenth century and the early twentieth century. The increase in mortality of women born in the first 30 years of the twentieth century is probably related to larger body size due to changes in nutrition resulting in an earlier age of menarche and, therefore, greater oestrogen exposure (Smith et al. 1998). Subsequent increases in fertility and earlier diagnosis may have contributed to the fall in mortality between the 1940s and early 1960s. However, it is also likely that improvements in survival have resulted from earlier detection through screening and newer medical treatments for breast cancer (Hermon & Beral 1996).

Alcohol consumption has been associated with cancers of the upper gastrointestinal tract and the liver and there is some evidence of changes in alcohol consumption paralleling a trend in death rates from these cancers (Armstrong 1985). Sun exposure is the main cause of skin cancers, and malignant melanoma of the skin is more common in Australia than anywhere else in the world. Increases in deaths from other types of cancer have been associated with a variety of carcinogens in the Australian environment. During the twentieth century, an array of potentially carcinogenic substances emerged as new industries and products were developed. These included radiation, pesticides, mining dusts, benzene (in petrol, paints and printing inks), chemicals used in the production of plastics and pharmaceuticals, and environmental pollutants. The contribution of many of these substances to the trends in cancer mortality remains to be measured.

Not all cancers have shown an increase in death rates. Mortality rates for cancers of the stomach, cervix, bowel (in females) and testes have all shown significant declines in the adult population. Mortality rates in children have fallen substantially for leukaemia and cancers of the brain and nervous system, due to an improvement in survival rates.

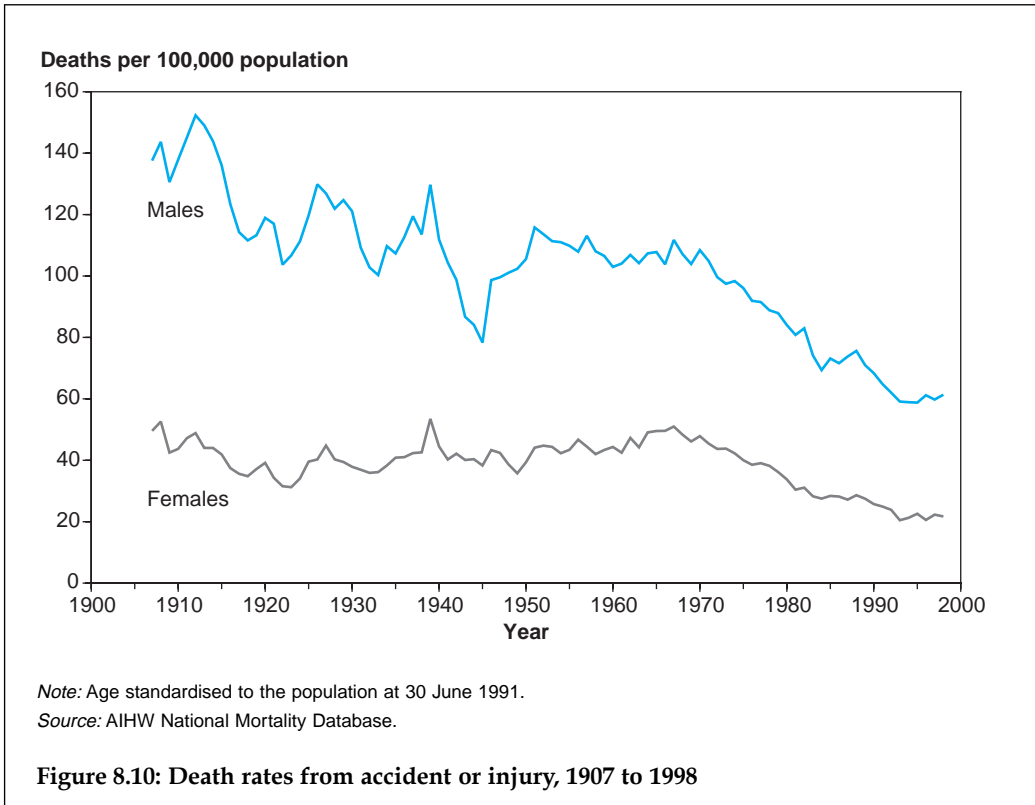
Patterns of exposure to risk factors differ according to occupation, socioeconomic groupings such as education and income, sex, race and ethnicity, and geographical location, and some of these patterns have changed over the twentieth century. In general, there is evidence of an inverse socioeconomic gradient for cancer mortality among both males and females in Australia (Glover et al. 1999). The persisting socioeconomic differences in cancer mortality at the end of the twentieth century are a reminder that there is much in the social environment that contributes to malignant disease.

## **Injury**

Over the twentieth century, although the contribution of injury to overall deaths in Australia has remained relatively stable at around 6–7% of all deaths, there has been a steady decline in death rates from this cause (AIHW 1998). Injury rates have been consistently higher in males than in females in all categories for the entire period (AIHW: d'Espaignet et al. 1991) and there have been some substantial changes within the injury categories (Figure 8.10, page 356). Most change has occurred in the accidental death category with the emergence of motor vehicle accident deaths offset by a large decrease in deaths from all other accidental causes (AIHW NISU 1999). The contributions made by both suicide and homicide have remained relatively stable. In the 1990s, injury was the fourth leading cause of death in Australia and is a major cause of premature death.

### **Accidental deaths**

Accidental deaths were relatively common in the early part of the twentieth century with drowning, burns, falls, work-related injuries and accidents with horses the most significant contributors to mortality rates (Gordon 1976:217). Deaths from accidents have always tended to have a greater impact on the younger age groups. In 1925, deaths from external causes were the leading cause of death (26%) for those aged 15 to 24 years (Cumpston 1989:132). This pattern still applies today, particularly to deaths from motor vehicle accidents. Drowning also remains a significant cause of injury deaths for children aged 1 to 4 years, many of whom drown in swimming pools.



The advent of motor vehicles in the early years of the twentieth century brought with it not only the advantages of more rapid transport and the ability to travel larger distances, but also a significant burden of mortality and morbidity for the population. For much of the century, road deaths accounted for a significant proportion of injury deaths in Australia. Fatality rates rose steeply in the 1950s and 1960s, peaking in 1970. Since then, the road accident death rates have decreased significantly despite an increase in the average amount of road travel per person (AIHW NISU: O'Connor 1995). This improvement can be attributed to a number of interventions, including better vehicle, road and traffic flow design; compulsory use of seat belts, child restraints and helmets for cyclists and motorcyclists; lower speed limits; restrictions on the use of alcohol and other drugs while driving; and public education campaigns (AIHW NISU: O'Connor 1995).

Work-related fatalities have also made up a significant proportion of accidental deaths through the century. Working conditions in the earlier part of the century were often dangerous, involving substantial exposure to a range of toxic substances or immediate physical risks. Occupational health and safety have only relatively recently become matters of legislative concern in Australia, with some employers and unions previously focusing more on agreed extra payments ('danger money') for working in risky or hazardous environments (Deery & Plowman 1985:415). Occupational health hazards are still present for many workers, with the complexity of modern work processes bringing new problems as well as some improvements.

## **Suicide**

An analysis of trends in suicide over the past 100 years shows that the overall suicide rate has remained relatively stable, fluctuating within a range between about 10–14 deaths per 100,000 population (DHAC 1998). The highest rates were recorded during the Depression of the 1930s, and in the 1960s and into the 1990s (Hassan 1996). The higher rates in the 1960s are likely to be related to the availability of medications such as barbiturates that were then restricted in subsequent years (Oliver & Hetzel 1972).

However, this relative stability hides some significant internal differences in the rates of suicide of males and females in Australian society. The most striking feature over the last 100 years is the change that has occurred in the age groups affected. Until the mid-1960s, suicide was a problem mainly among the older age groups but since then there has been a dramatic shift to the young. This increase in the suicide rate for the younger age groups has been largely offset by significant reductions in suicide in middle-aged and older Australians (Goldney & Harrison 1998).

Suicide rates for males are significantly greater than those for females. The rate of suicide among males aged 15–29 years has been increasing gradually over the last 30 years, although this upward trend may be levelling off (Glover et al. 1999). The rate of suicide among males aged 15–24 years has trebled since 1960. There has been no equivalent rise in the rate of suicide among young females. However, there is evidence to suggest a higher rate of attempted suicide among females than males, particularly for women under the age of 25 years (Ruzicka & Choi 1999; AIHW: Moon et al. 1999).

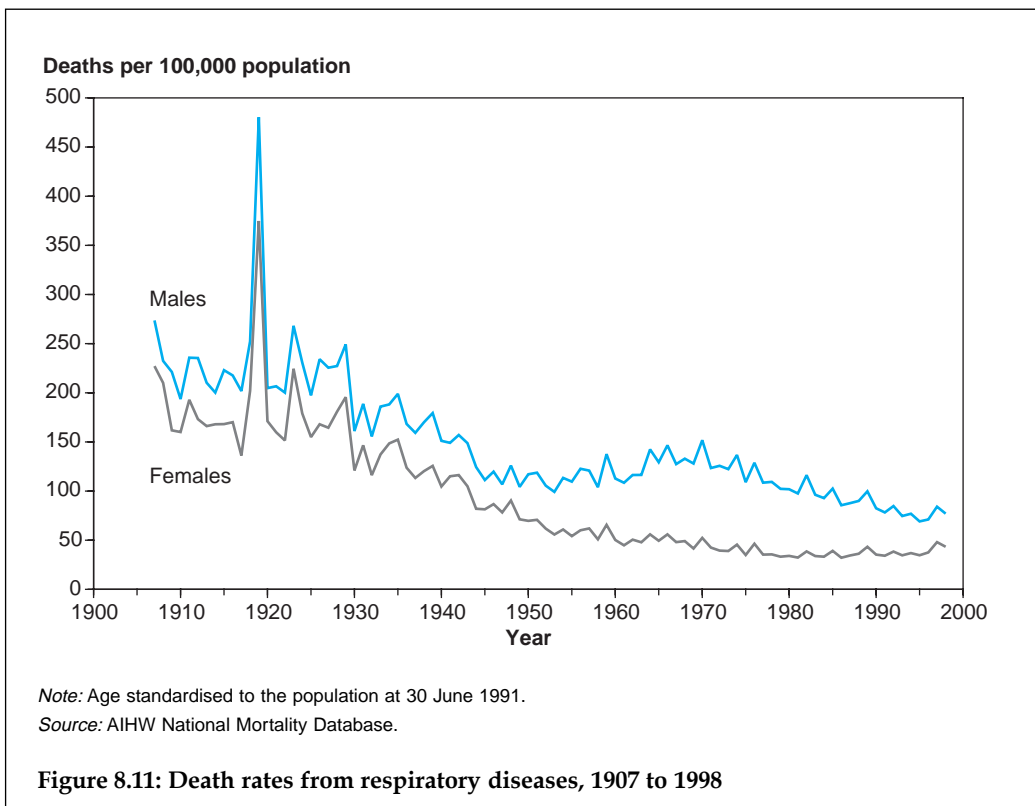
There is some evidence that risks for suicide increase significantly with decreasing socioeconomic status in males, but this is not the case in females. It has been noted that the fluctuations in male suicide rates over the century have coincided with periods of high unemployment, whereas the rates for females have remained fairly stable at those times (Morrell et al. 1993). Studies of the recent increase in suicides among the young have suggested a number of contributing factors, including unemployment, changing family structure, increasing violence and loss of autonomy (Hassan 1996). Suicide arises from a complex interaction of psychological, social and environmental factors. Social issues are important and there are also substantial data indicating the presence of psychiatric illness in the majority of those who commit suicide (Goldney 1993). Prevention efforts are now focusing on earlier detection of symptoms of illness and a range of other interventions.

## **Deaths from interpersonal violence**

Death rates from interpersonal violence have remained fairly constant during the twentieth century and homicide remains a rare event relative to other forms of violent death in Australia, such as suicide and road traffic accidents (James & Carcach 1997). Between 1915 and 1997, the average homicide rate per year was 1.6 per 100,000 population (AIC 1999). The present rates of homicide are similar to those prevailing from 1915 to 1925 (James & Carcach 1997). The homicide rate in Australia fell during the period between 1930 and 1950 but then increased to a plateau of about 1.5 per 100,000 population in the 1960s and 1970s. An upward trend then once again became apparent, reaching a level of around 2.0 per 100,000 population in the late 1980s and 1990s (James & Carcach 1997). The lowest homicide rate this century was recorded in 1941, 0.8 per 100,000 population (AIC 1999).

## Respiratory diseases

The death rate from respiratory diseases has decreased significantly over the twentieth century (Figure 8.11) to a rate now less than half of that in the early decades (AIHW 1998). The dramatic spike in death rates from respiratory disease in 1919–20 reflects the influenza pandemic. In 1921, the death rate from respiratory disease was 207 per 100,000 population. By 1941, the rate had fallen to 104 per 100,000 population. Between 1950 and 1996, the standardised death rate for diseases of the respiratory system fell for males from 107 to 61 per 100,000 and for females from 63 to 38 per 100,000 population (AIHW 1998). The causes of these respiratory deaths have also altered over the century. For example, the contribution of occupational exposure to substances that cause respiratory disease is thought to have decreased in importance. Early in the twentieth century, mining activity was responsible for various lung diseases and became the subject of government inquiries and trade union action, leading to major reforms throughout mining and related industries (Cumpston 1989:166). In contrast, tobacco smoking increased steadily throughout the century (with the exception of a fall in 1931–32) with substantial reductions in tobacco consumption occurring only since the 1970s. Pollution has also been associated with deaths from respiratory disease (Giles et al. 1988), and it is likely that levels of different pollutants have been significant contributors to deaths from respiratory disease over the twentieth century.



Chronic obstructive pulmonary disease is the fourth leading cause of death in Australia (AIHW 1998). There was a marked increase in death rates for this condition in the postwar years with the death rate from chronic bronchitis in males doubling between 1950 and 1964 (Gordon 1976:222). This upward trend, like the rise in lung cancer, was associated with increased tobacco consumption over the century. Male age-standardised death rates for chronic obstructive pulmonary disease increased 160% between 1964 and 1970, followed by a decline (Crockett et al. 1994). By 1990, the death rate was 5% less than in 1964. Female age-standardised mortality, on the other hand, showed a 260% increase from 1964 to 1990 (Crockett et al. 1994). These trends in mortality from chronic obstructive pulmonary disease for males and females reflect significant differences in their smoking habits over time (Hill et al. 1998).

Deaths from pneumonia have fallen markedly with the availability of antibiotics in the 1940s. However, an even greater fall occurred in the three decades before this, probably as a result of improvements in living conditions (Gordon 1976:233). The proportion of deaths from pneumonia dropped from 47% of all male deaths from diseases of the respiratory system in 1950 to 14% in 1986, and a similar trend occurred for females. Death from pneumonia is now seen mainly in people at the extremes of the lifespan and in those whose immunity is impaired. However, death from pneumonia is still relatively frequent among Indigenous peoples.

Rates of death from asthma have risen in Australia, as they have worldwide from the middle of the century onwards (Meza & Gershwin 1997), although asthma is still a relatively infrequent cause of death. Asthma is a disease that is exacerbated by a wide range of factors including infection, allergens, tobacco smoke and some environmental pollutants (Landrigan et al. 1998). Early Australian studies found that the mortality rate for asthma remained stable between 1900 and 1948. There was then an upward trend with some peaking of death rates in the 1960s (AIH 1988). The evidence for an upward trend in asthma deaths since the late 1940s appears to be real, despite changes in classifications and differences in medical treatments (Bauman & Lee 1990). Death rates for asthma peaked again in 1989 but have since declined. This may be partly due to public health campaigns aimed at improving the awareness and management of the disease (AIHW: Abraham et al. 1995).

## **Conclusion**

The decline in mortality over the twentieth century in Australia has been dramatic. Growth in income, increased educational levels and consequent improvements in food intake, water quality and sanitation have accounted for much of the decline. Access to new knowledge, medical treatments and vaccines has also been important. There have been far-reaching consequences for every aspect of life: populations have aged, fertility rates have decreased and better health has, in turn, contributed to social and economic wellbeing. This has led to a major shift in causes of death from infectious diseases to non-communicable diseases.

As the twenty-first century unfolds, there will be a number of challenges. Ironically, one of these challenges results from the success of the twentieth century – as a consequence of ageing and the effects of an affluent lifestyle, epidemics of non-communicable diseases may persist, driving the demand for health resources for some years to come. There is also the possibility of an emergence of new infectious diseases and the

re-emergence of others. Finally, not everyone has shared equally in the benefits of better health over the last 100 years. In the year 2000, although life expectancy for most Australians has increased significantly, that of Indigenous peoples is at levels not seen in the rest of the population since 1900. Large inequalities in death rates from many causes also persist for disadvantaged populations in Australia, in spite of the long list of achievements in health during the twentieth century. Reducing the inequalities will also be a priority for the twenty-first century.

## References

- ABS 1998. Experimental estimates of the Aboriginal and Torres Strait Islander population. ABS Cat. No. 3230.0. Canberra: ABS.
- ABS 1999. Deaths, Australia 1998. ABS Cat. No. 3302.0. Canberra: ABS.
- ABS & AIHW 1999. The health and welfare of Australia's Aboriginal and Torres Strait Islander peoples 1999. ABS Cat. No. 4704.0. AIHW Cat. No. IHW 3. Canberra: ABS.
- AIC (Australian Institute of Criminology) 1999. Australian crime—facts and figures 1999. Canberra: AIC.
- AIH (Australian Institute of Health) 1988. Australia's health. Canberra: AGPS.
- AIHW 1996. Tobacco use and its health impact in Australia. AIHW Cat. No. CVD 1. Canberra: AIHW.
- AIHW 1998. Australia's health 1998: the sixth biennial health report of the Australian Institute of Health and Welfare. Canberra: AIHW.
- AIHW 1999. Cancer in Australia: incidence and mortality data for 1996 and selected data for 1997 and 1998. AIHW Cat. No. CAN 7. Canberra: AIHW.
- AIHW NISU 1999. Australian Injury Prevention Bulletin. Issue 20. Adelaide: AIHW NISU.
- AIHW & HFA (Heart Foundation of Australia) 1999. Heart, stroke and vascular disease: Australian facts 1999. AIHW Cat. No. CVD 7. Cardiovascular Disease Series No. 10. Canberra: AIHW.
- AIHW: Abraham B, d'Espaignet ET & Stevenson C 1995. Australian health trends, 1995. Canberra: AIHW.
- AIHW: d'Espaignet ET, van Ommeren M, Taylor F, Briscoe N & Pentony P 1991. Trends in Australian mortality 1921–1988. Mortality Series No. 1. Canberra: AGPS.
- AIHW: Moon L, Meyer P & Grau J 1999. Australia's young people: their health and wellbeing 1999. AIHW Cat. No. PHE 19. Canberra: AIHW.
- AIHW NISU: O'Connor PJ 1995. Road injury in Australia 1991. Adelaide: AIHW NISU.
- AIHW: Taylor F 1992. Guide to use of international classifications of diseases in Australia. Classification in Health Series No. 1. Canberra: AGPS.
- Armstrong BK 1985. Epidemiology of cancer in Australia. Medical Journal of Australia 142:124–30.

- Bauman A & Lee S 1990. Trends in asthma mortality in Australia, 1911–1986. *Medical Journal of Australia* 153:366–7.
- Beaglehole R & Bonita R 1997. *Public health at the crossroads: achievements and prospects*. Cambridge: Cambridge University Press.
- Beaglehole R, Dobson A, Hobbs MST, Jadeson R & Martin CA 1989. CHD in Australia and New Zealand. *International Journal of Epidemiology* 18(3 Suppl. 1):S145–8.
- Braunwald E 1997. The Shattuck lecture—cardiovascular medicine at the turn of the millennium: triumphs, concerns, and opportunities. *New England Journal of Medicine* 337(19):1360–9.
- Carapetis JR & Currie BJ 1998. Preventing rheumatic heart disease in Australia. *Medical Journal of Australia* 168:428–9.
- Carroquino MJ, Galson SK, Licht J, Amler RW et al. 1998. The U.S. EPA Conference on preventable causes of cancer in children: a research agenda. *Environmental Health Perspectives* 106(Suppl. 3):867–73.
- Coghlan TA 1900. *A statistical account of the seven colonies of Australasia, 1899–1900*. Sydney: William Applegate Gullick, Government Printer.
- Crockett AJ, Cranston JM, Moss JR & Alpers JH 1994. Trends in chronic obstructive pulmonary disease mortality in Australia. *Medical Journal of Australia* 161:600–3.
- Cumpston JHL 1978. *The health of the people*. Canberra: Roebuck.
- Cumpston JHL 1989. *Health and disease in Australia: a history* (Lewis ML ed.). Canberra: AGPS.
- Davis A & George J 1988. *States of health—health and illness in Australia*. Sydney: Harper & Row Publishers.
- Deery S & Plowman D 1985. *Australian industrial relations*. 2nd ed. Sydney: McGraw-Hill.
- DHAC 1998. *Youth suicide in Australia, a background monograph*, 2nd ed. Canberra: DHAC.
- Dobson AJ, Gibberd RW, Leeder SR & O’Connell DL 1985. Occupational differences in ischaemic heart disease mortality and risk factors in Australia. *American Journal of Epidemiology* 122(2):283–90.
- Dobson AJ, McElduff P, Heller R, Alexander H, Colley P & D’Este K 1999. Changing patterns of coronary heart disease in the Hunter region of New South Wales, Australia. *Journal of Clinical Epidemiology* 52(8):761–71.
- English DR, Holman CDJ, Milne E, Winter MG, Hulse GK, Cudde JP et al. 1995. The quantification of drug caused morbidity and mortality in Australia 1995. Canberra: DHSH.
- Gandevia B 1978. *Tears often shed—child health and welfare in Australia from 1788*. Sydney: Charter Books.
- Giles G, Hill DJ & Silver B 1991. The lung cancer epidemic in Australia 1910 to 1989. *Australian Journal of Public Health* 15:245–7.

- Giles G, Jelfs P & Kliewer E 1995. Cancer mortality in migrants to Australia 1979–1988. Cancer Series No. 4. Canberra: AGPS.
- Giles G, Jolley D, Lecatsas S & Handsjuk H 1988. Atlas of cancer in Victoria. Melbourne: Anti-Cancer Council of Victoria.
- Glover J, Harris K & Tennant S 1999. A social health atlas of Australia, volume 1: Australia, 2nd ed. Department of Health and Aged Care. Adelaide: Openbook Publishers.
- Goldney R & Harrison J 1998. Suicide in the elderly: some good news. *Australasian Journal on Ageing* 17(2):54–5.
- Goldney RD 1993. Suicide in the young. *Journal of Paediatrics & Child Health* 29 (Suppl. 1):S50–2.
- Gordon D 1976. Health, sickness and society. Theoretical concepts in social and preventive medicine. Brisbane: University of Queensland Press.
- Hall R 1993. Notifiable diseases surveillance, 1917 to 1991. *Communicable Diseases Intelligence* 17(11):226–36.
- Hassan R 1996. Social factors in suicide in Australia. *Trends and Issues in Crime and Criminal Justice* No. 52. Canberra: Australian Institute of Criminology.
- Hermon C & Beral V 1996. Breast cancer mortality rates are levelling off or beginning to decline in many western countries. *British Journal of Cancer* 73(7):955–60.
- Hetzel BS & McMichael A 1987. The LS factor: lifestyle and health. Maryborough, Vic.: Penguin Books, 87–91.
- Hickman B 2000. Terror of the black death. *The Australian*, 19 January, 11.
- Hill DJ, White VM & Scollo MM 1998. Smoking behaviours of Australian adults in 1995: trends and concerns. *Medical Journal of Australia* 168:209–13.
- Hogg RS 1992. Indigenous mortality: placing Australian aboriginal mortality within a broader context. *Social Science & Medicine* 35(3):335–46.
- Hughes TD 1939. Excessive use of caesarean section rates. *Medical Journal of Australia* II:947–8; cited in Cumpston 1989.
- James M & Carcach C 1997. Homicide in Australia 1989–96. *Research and Public Policy Series* No. 13. Canberra: Australian Institute of Criminology.
- Julian D 1989. Treatment of chronic coronary heart disease. *International Journal of Epidemiology* 18(3 Suppl. 1):S228–30.
- Kannel WB, Dawber TR, Kagan A, Revotskie N & Stokes J 1961. Factors of risk in the development of coronary heart disease: the Framingham Study. *Annals of Internal Medicine* 55:33–50.
- Keys A, Taylor HL, Blackburn H, Brozek J, Andreson JT & Simonson E 1963. Coronary heart disease among Minnesota business and professional men followed 15 years. *Circulation* 28:381–95.

- Knibbs GH 1909. Official Year Book of the Commonwealth of Australia, containing authoritative statistics for the period 1901–1908 and corrected statistics for the period 1788 to 1900. Melbourne: Commonwealth Bureau of Census and Statistics.
- Kosky R 1987. Is suicide behaviour increasing among Australian youth? *Medical Journal of Australia* 147(4):164–6.
- Lancaster HO 1956. Infant mortality in Australia. *Medical Journal of Australia* 2:100–8.
- Lancaster HO 1990. Expectations of life: a study in the demography statistics, and history of world mortality. New York: Springer-Verlag.
- Landrigan PJ, Carlson JE, Bearer CF, Spyker Cranmer J, Bullard RD et al. 1998. Children's health and the environment: a new agenda for prevention research. *Environmental Health Perspectives* 106(Suppl. 3):787–94.
- Meza C & Gershwin ME 1997. Why is asthma becoming more of a problem? *Current Opinion In Pulmonary Medicine* 3(1):6–9.
- Morrell S, Taylor R, Quine S & Kerr C 1993. Suicide and unemployment in Australia, 1970–1990. *Social Science and Medicine* 36:749–56.
- Mueller RL, Rosengart TK & Isom OW 1997. The history of surgery for ischemic heart disease. *Annals of Thoracic Surgery* 63(3):869–78.
- NHLBI (National Heart, Lung and Blood Institute) 1994. Report of the task force on research in epidemiology and prevention of cardiovascular diseases. Rockville, Maryland: US National Institutes of Health.
- NHMRC 1998. Report on maternal deaths in Australia 1991–1993. Canberra: NHMRC.
- Office of Prices, Victoria 1990. Does smoking make cents? An Australian economic study of the relationship between cigarette pricing, consumption and health costs. Melbourne: VicHealth.
- Oliver RG & Hetzel BS 1972. Rise and fall of suicide rates in Australia: relation to sedative availability. *Medical Journal of Australia* 2(17):919–23.
- Porter R 1997. The greatest benefit to mankind: a medical history of humanity from antiquity to the present. London: Harper Collins Publishers.
- Rose G 1989. Causes of the trends and variations in CHD mortality in different countries. *International Journal of Epidemiology* 18(3 Suppl 1):S174–9.
- Ruzicka L & Choi CY 1999. Youth suicide in Australia. *Journal of the Australian Population Association* 16:29–46.
- Sax S 1984. A strife of interests: politics and policies in Australian health services. Sydney: Allen & Unwin, 3–28.
- Smith CL, Krickler A & Armstrong BK 1998. Breast cancer mortality trends in Australia: 1921 to 1994. *Medical Journal of Australia* 168:11–14.
- Taylor R, Lewis M & Powles J 1998. The Australian mortality decline: all-cause mortality 1788–1990. *Australian and New Zealand Journal of Public Health* 22(1):27–36.

- Tonkin A, Bauman AE, Bennett S, Dobson AJ, Hankey GJ & Ring IT 1999. Cardiovascular health in Australia: current state and future directions. *The Asia Pacific Heart Journal* 8(3):183-7.
- Weil O & Fernandez H 1999. Is safe motherhood an orphan initiative? *Lancet* 354:940-3.
- WHO 2000. Communicable disease surveillance and response. Geneva: WHO [cited March 2000] Available from Internet: URL: <http://www.who.int/emc/diseases/hiv/index.html>
- Young C 1986. Selection and survival: immigrant mortality in Australia. Department of Immigration and Ethnic Affairs. Canberra: AGPS.