

## 4 Broad causes of mortality

Most deaths over the twentieth century fall into five broad ICD categories; they accounted for around 60% of all deaths at the start of the century and 83% at the end (Table 4.1). They are:

- circulatory diseases
- cancers
- respiratory diseases
- infectious diseases
- injury and poisoning.

In addition to discussion on these five broad causes, this chapter includes some discussion on two other broad conditions: mental and behavioural disorders, and diseases of the nervous system. Although these have not made such a large contribution to total mortality, they have been included because their death rates appear to have increased markedly during the past 20 or so years.

This chapter examines trends in age-standardised deaths in the five main broad causes and shows their relative and changing contributions to all-cause mortality over the century. In addition, the major components for each of these groups are shown over the period – for example, the changing distribution of heart disease, cerebrovascular disease and similar problems within the broad category of circulatory diseases. Box 4.1 discusses some important classification issues relating to this and the remaining chapters of this report.

### **Box 4.1: Classification issues in analysing trends**

*In the International Classification of Diseases (ICD), the broadest groupings are known as ‘chapters’. Each chapter includes a range of more-specific conditions that are grouped on the basis of similar causes or body systems. For example, the chapter of ‘diseases of the circulatory system’ includes rheumatic fever, hypertensive diseases, ischaemic heart disease, and a range of diseases associated with the circulation of blood. These ‘specific’ conditions in turn contain subconditions, meaning that mortality coding in the ICD covers three levels in total. In earlier versions of the ICD there were 14 broad ‘classes’ of causes. Classes were later renamed ‘chapters’, and in the current Tenth Revision there are 22 chapters, 19 of which are used for coding underlying causes of mortality.*

*Changing classifications can pose difficulties for trend analysis. For example, two ICD chapters will not each contain a consistent range of causes over time if any specific causes are transferred from one chapter to another. One case in point is cerebrovascular disease. In more recent versions of the ICD, cerebrovascular disease has been included as a subchapter within the circulatory system diseases, whereas it had earlier appeared as a subchapter of ‘nervous system diseases’. To analyse overall circulatory system trends, therefore, cerebrovascular disease has to be added to the circulatory chapter in the earlier versions. Since cerebrovascular disease has been wholly included with its own code wherever it has appeared, this method has been relatively simple.*

*Similarly, tracking a subchapter over time may be straightforward when it is identified and kept intact over the years, even if it changes chapters. However, not all changes have been so simple.*

*The alignments of the ICD codes used in constructing all the broad causes over time are presented in Appendix A3. Also, see Appendix A4 for a broader discussion on the process used in developing definitions for the longer term broad causes and specific conditions.*

To cover all causes of death in this chapter, those broad areas outside the main five listed above have been put into one very large group, as ‘other’. This ‘other’ group includes nervous, mental, genitourinary, pregnancy, perinatal and congenital conditions. Just over 40% of deaths fell into this ‘other’ group at the beginning of the century and 17% at the end (tables 4.1, B5 and B6).

## The changing contribution to overall mortality

Table 4.1 shows the percentage contribution of the broad causes to overall deaths in 1907 and 2000, without regard to the levels and trends in the actual death rates. By contrast, figures 4.1 and 4.2 indicate how those ‘shares’ have changed over the entire period and give a rough idea of their rates (tables B5 and B6).

Together these two figures show that circulatory conditions and cancers, both heavily age-related, were the two leading broad causes of death in the twentieth century. This applies to both males and females. Table 4.1 shows that at the beginning of the century these two broad causes accounted for about a quarter of all deaths and this increased to two-thirds by 2000 as the population aged.

**Table 4.1: Distribution of leading broad causes of death, persons, 1907 and 2000**

Cause of death	1907		2000	
	Per cent deaths	Rank <sup>(a)</sup>	Per cent deaths	Rank <sup>(a)</sup>
Circulatory diseases	20.0	1	38.6	1
Respiratory diseases	14.3	2	8.9	3
Infectious diseases	12.6	3	1.3	5
Cancer	7.8	4	28.1	2
Injury and poisoning	4.9	5	6.1	4
Other	40.3		17.1	
Total	100.0		100.0	

(a) In making these rankings, only those broad causes that were the top five in 1907 are considered.

Source: GRIM Books.

As shown in figures 4.1 and 4.2, circulatory diseases remained the single greatest broad cause of death throughout the century, despite a major fall in its rates over the last three decades. Cancer ranked second from the late 1950s onwards. Infectious diseases accounted for about 13% of deaths early in the century but little more than 1% by 2000. The contribution of respiratory diseases fell from around 14% of the total deaths to 9%. The contributions of injury and poisoning were similar in 2000 (6.1%) and 1907 (4.9%).

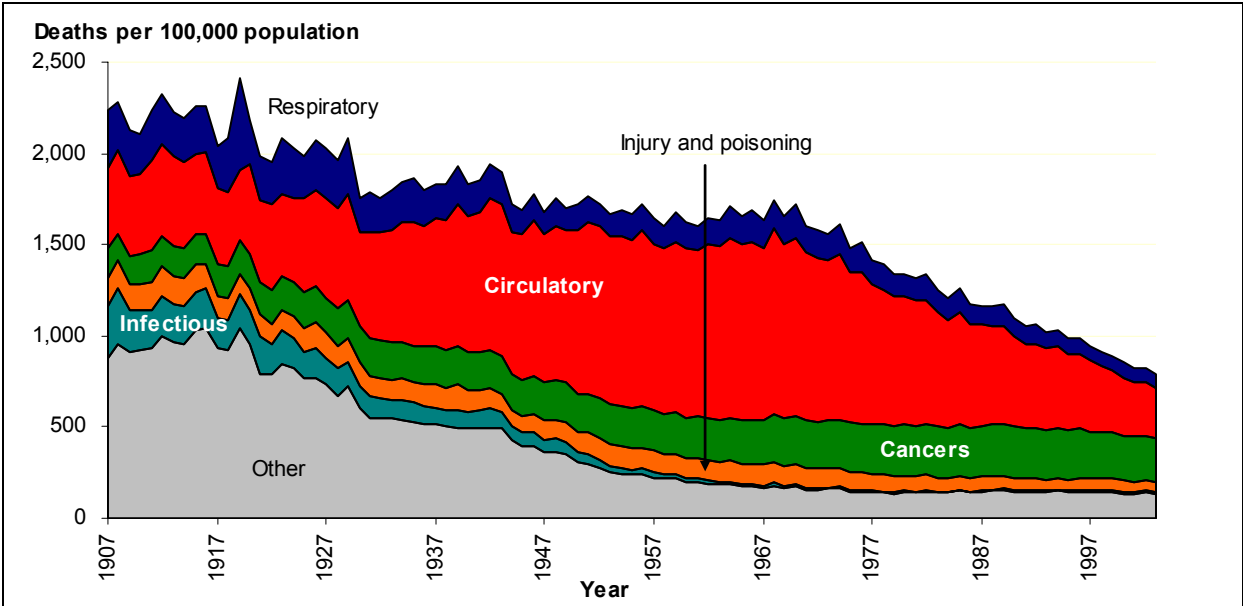
Box 4.2 discusses the features of figures such as 4.1, whose ‘stacked’ style is used throughout this report. These figures show the changing contribution of the broad causes to all-cause mortality rates as well as their levels across the century.

**Box 4.2: How to interpret 'stacked' figures such as Figure 4.1**

Figure 4.1 and similar figures throughout this report are known as 'stacked' figures. They are used to indicate the 'share' of various components and how this may change over time.

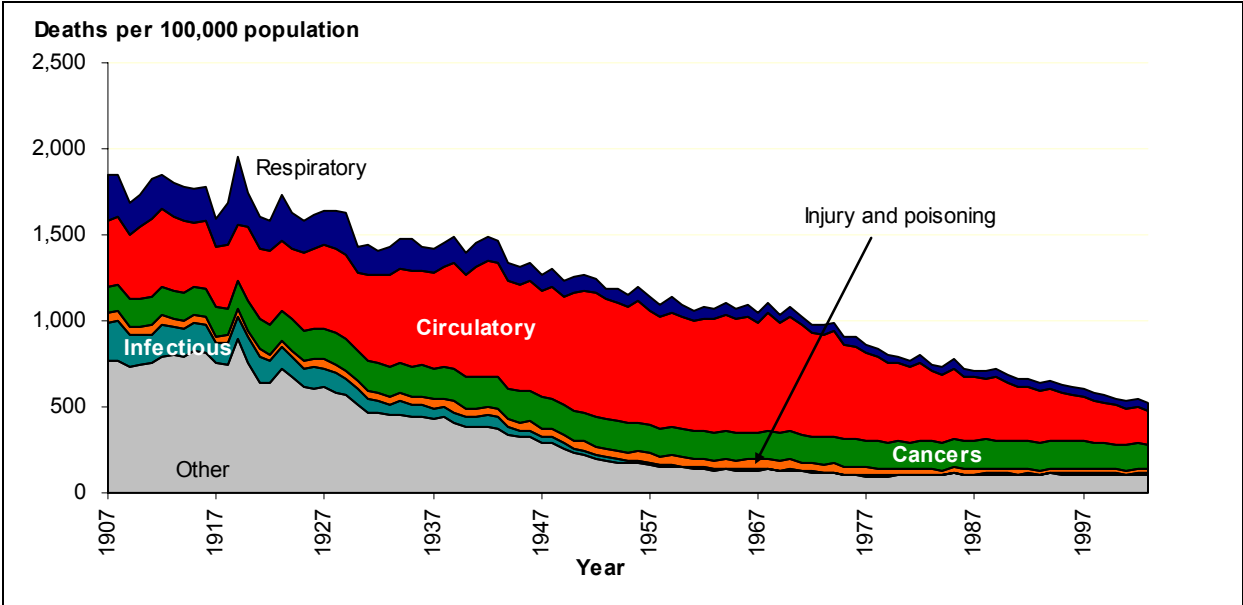
In these types of figures, the various coloured bands representing causes are stacked on top of each other. Age-standardised rates indicated on the left of the figure are cumulative; for example, the almost 2,250 deaths per 100,000 at the top of Figure 4.1 for 1907 correspond to all causes of death combined for males. Similarly, the rate of about 1,900 that year corresponds to all the causes except respiratory diseases (shown in blue) and the rate of just under 1,500 covers all causes except circulatory (in red) and respiratory.

Each group's rate at any point in time corresponds to the width of the coloured band that represents it. For example, Figure 4.1 makes it clear that circulatory disease rates in males were large and dominant over the century, although this dominance reduced in the later decades. The figure also allows a crude comparison of the causes' rates by comparing their widths. However, these stacked figures are not useful for precisely examining trends in death rates for various individual causes; other figures such as Figure 4.3 are used in this report for that purpose. Reinforcing the cumulative nature of the figure, the top line ends at around 800 deaths per 100,000 in 2003. Hence the top line exactly reflects Figure 3.1 in Chapter 3 and shows that overall death rates for males declined dramatically over the century. Note: due to technical limitations with the graphing software used, lines that indicate changes in coding are sloped rather than vertical for the year of change.



Source: AIHW GRIM Books.

**Figure 4.1: Death rates by broad causes, males, 1907-2003**



Source: AIHW GRIM Books.

**Figure 4.2: Death rates by broad causes, females, 1907-2003**

## Trends and patterns of broad causes of mortality

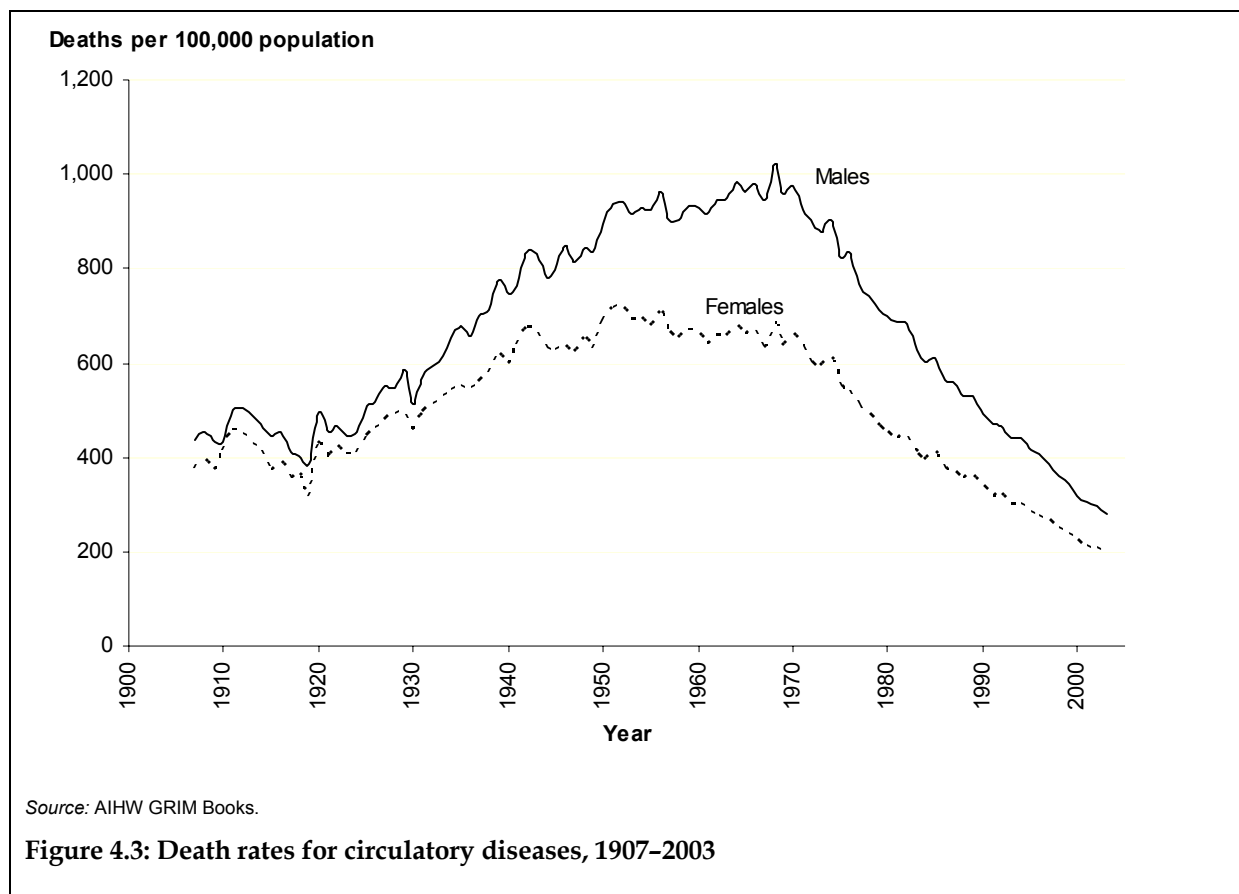
The following sections outline the trends in age-standardised death rates for each broad cause over the century, and the patterns of their components. Tables B5 to B18 in Appendix B present the age-standardised rates used in this chapter.

### Circulatory diseases

Circulatory diseases comprise numerous specific causes involving the heart and blood vessels, whose function is to ensure that blood is circulated throughout the body. The diseases include heart attack, angina, stroke, high blood pressure and many others. They are also commonly known as cardiovascular diseases, referring to the heart (cardio) and to the blood vessels (vascular). The two specific causes shown briefly here and at more length in the next chapter are ischaemic heart disease (coronary heart disease, notably heart attack) and cerebrovascular disease (mainly stroke).

The twentieth century saw the great rise and even greater fall of death rates for circulatory diseases, the century's dominant broad cause of death. Even at the beginning of the century, circulatory diseases had the highest death rates among the broad causes for both males and females. This remained so for the entire century (figures 4.1 and 4.2; tables B5 and B6), although it will be shown below that in recent decades cancer has overtaken circulatory disease as the main cause of premature death.

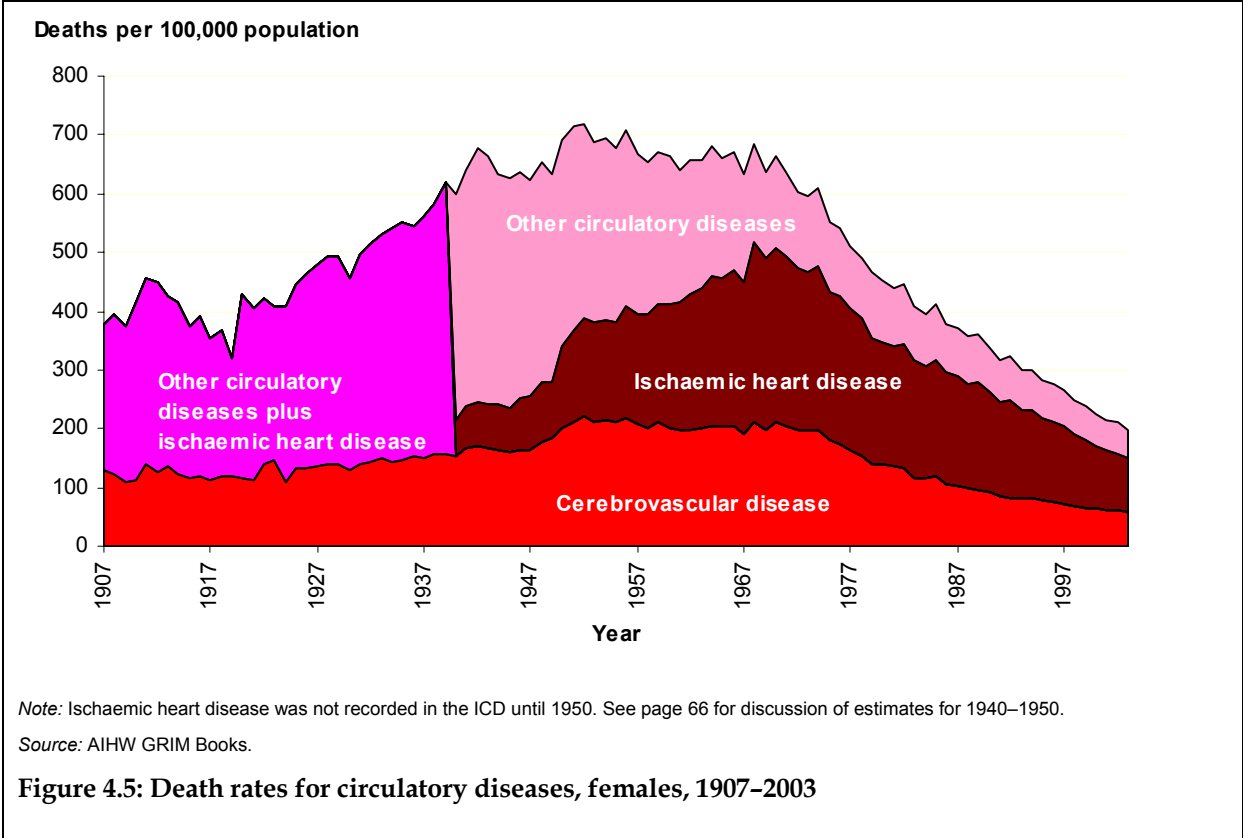
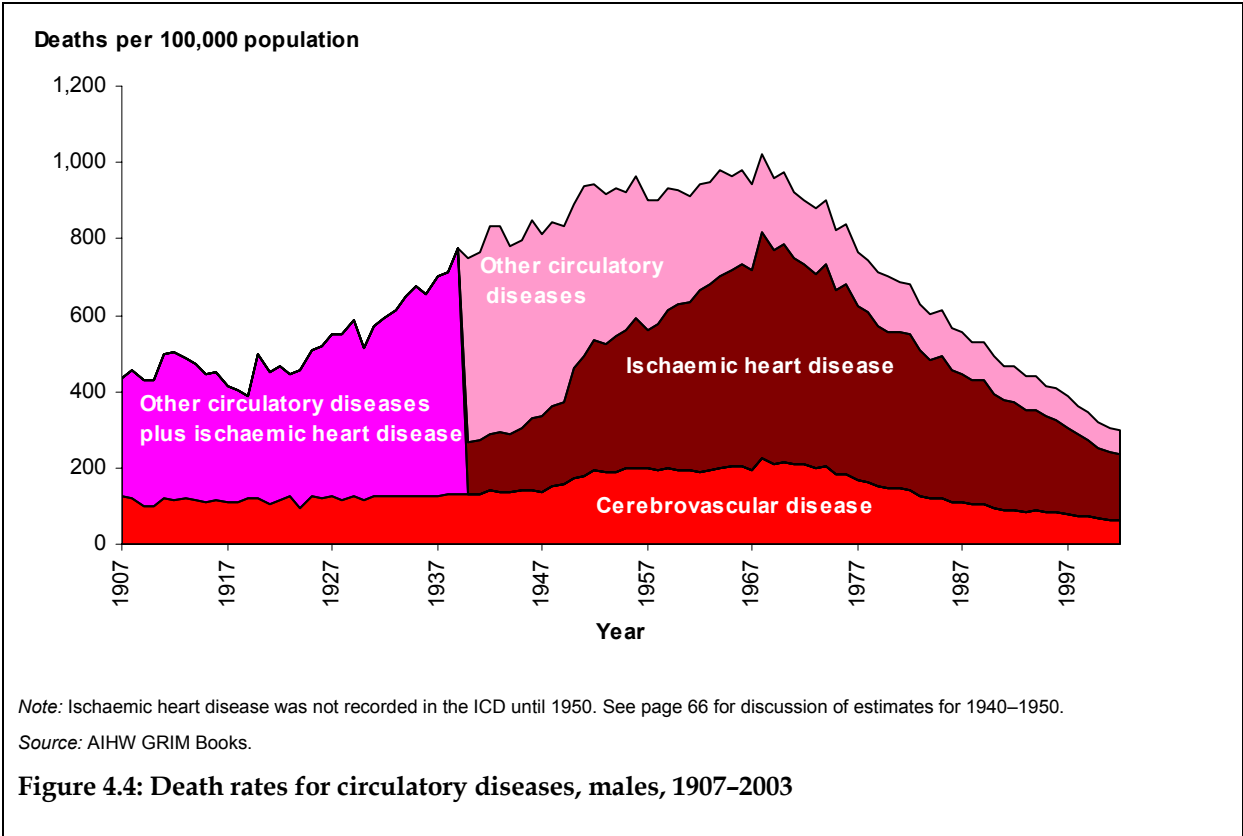
Figure 4.3 shows that the circulatory disease rates for males and females were reasonably equal in 1907, at 437 and 379 deaths per 100,000 population respectively.



For both sexes the rates rose rapidly from at least the 1920s and were at their highest during the two decades from 1950 to 1970. Male rates peaked at 1,020 deaths per 100,000 in 1968; the female rates peaked at 718 in 1952 then remained relatively flat until 1970. After 1970 for both sexes, the death rates dropped even more rapidly than they had risen, to 319 for males and 224 for females in 2000 (Figure 4.3). By the early 1990s the female rates had clearly fallen below their early-century level and the same occurred for males a few years later.

Figures 4.4 and 4.5 show the changing components in circulatory causes of death over the twentieth century. (Cerebrovascular disease has been separately identified from early in the century but ischaemic heart disease not until decades later; for early decades, ischaemic heart disease has been included with the ‘other circulatory’ category.) Ischaemic heart disease was clearly the dominant cause of deaths from circulatory disease for males for at least the second half of the century (Figure 4.4) and for females over the last four decades (Figure 4.5; tables B7 and B8).

The statistics suggest that ischaemic heart disease played a large role in the rise in mortality from circulatory diseases up to the end of the 1960s, certainly in the 1950s and 1960s; although a substantial increase in cerebrovascular disease mortality also contributed. In addition, the figures show that the various specific circulatory diseases grouped as ‘other’ played a significant role in circulatory diseases mortality, especially over the first seven decades. There are many other important causes in this group, including rheumatic heart disease and pulmonary heart disease.



## Cancers

Cancers include a wide range of specific conditions that can occur in all organs and body parts. Their common feature is that some of the body's cells become abnormal and begin to multiply out of control, can invade and damage the area around them, and can also spread to other parts of the body to cause further damage. Cancers are separately classified in their own ICD chapter, so they are not included in ICD chapters related to specific conditions.

This report discusses overall cancer rates, and then focuses on a few selected cancers that have made a significant contribution to those rates during the century.

When data for males and females are combined, cancer death rates rose moderately across the century, with a peak in the mid 1980s (Figure 4.6). However, this masks some differing trends, namely:

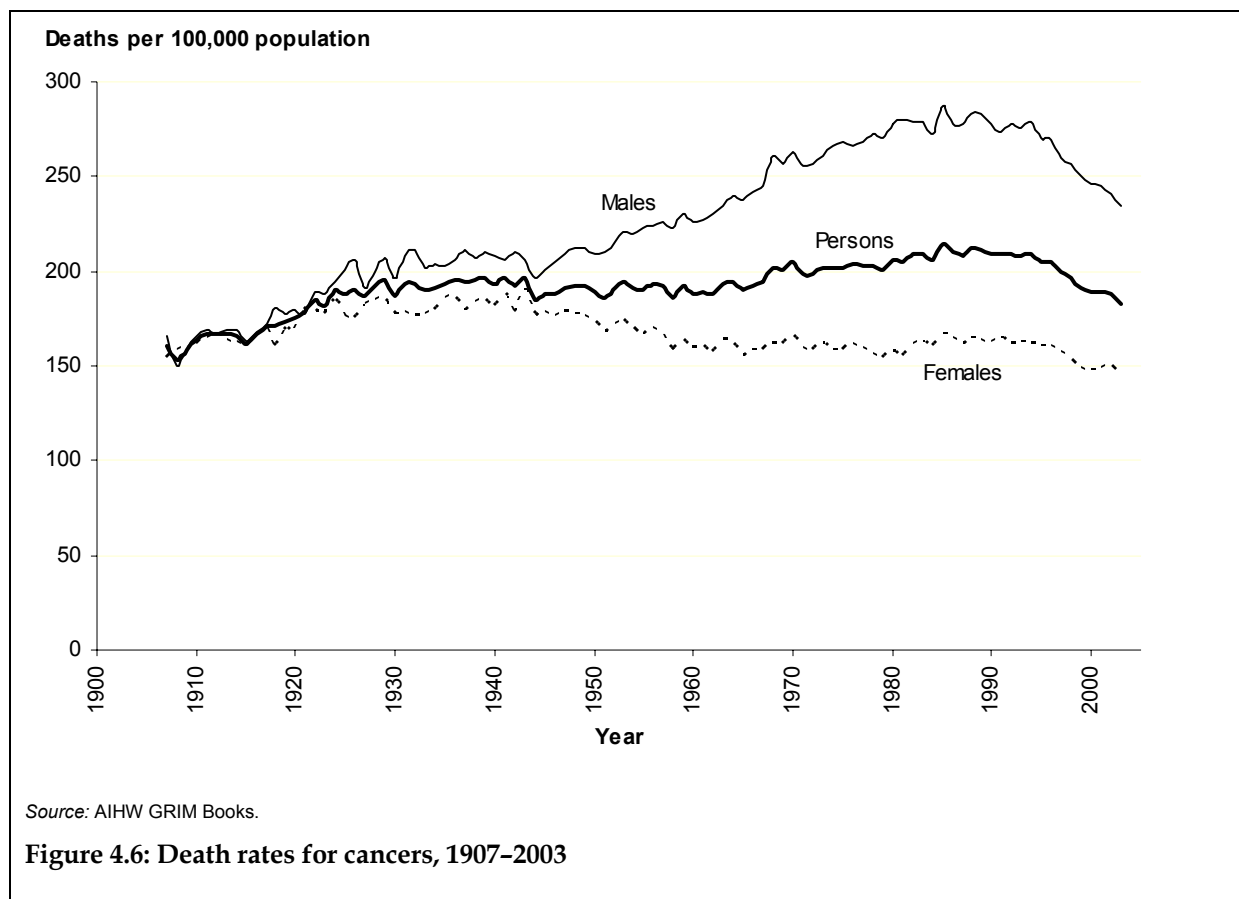
- a large rise for males over most years until 1985
- a moderate rise for females followed by a return to the early level, then staying steady for most of the remaining four decades
- a fall in male and female rates over the last decade or so of the century.

As will be seen later in this chapter, the male rise can essentially be attributed to the rise in an almost fully avoidable cancer – lung cancer. For their part, female rates would have fallen more had lung cancer not increased (tables B9 and B10).

As with circulatory diseases, male and female cancer death rates were very similar in 1907. However, although cancer was a leading cause of death early in the century, its rate then was less than half the rate for circulatory diseases. At around 155–165 deaths per 100,000 population in 1907 (tables B5 and B6), it also ranked behind both infectious and respiratory diseases. Since the 1920s, cancer death rates for males and females diverged, reflecting the earlier uptake of cigarette smoking by males.

For males, the century's cancer death rates peaked during the 1980s at nearly 290 deaths per 100,000 population, with a fall from then to 247 in 2000 as the decline in male smoking rates that began earlier took effect (Figure 4.6, Table B5). As can be seen, however, the male cancer death rate at the end of the century was still much higher than at its beginning.

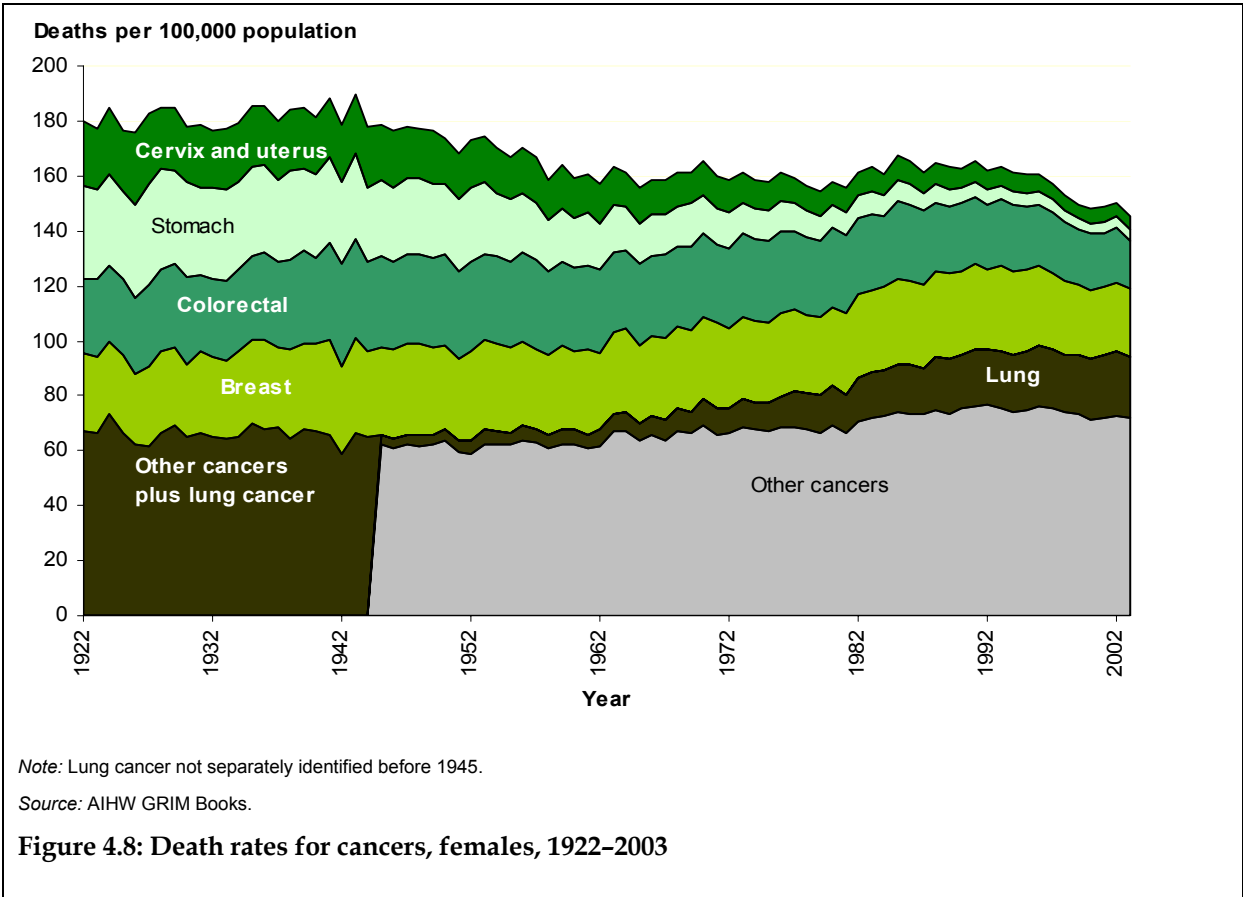
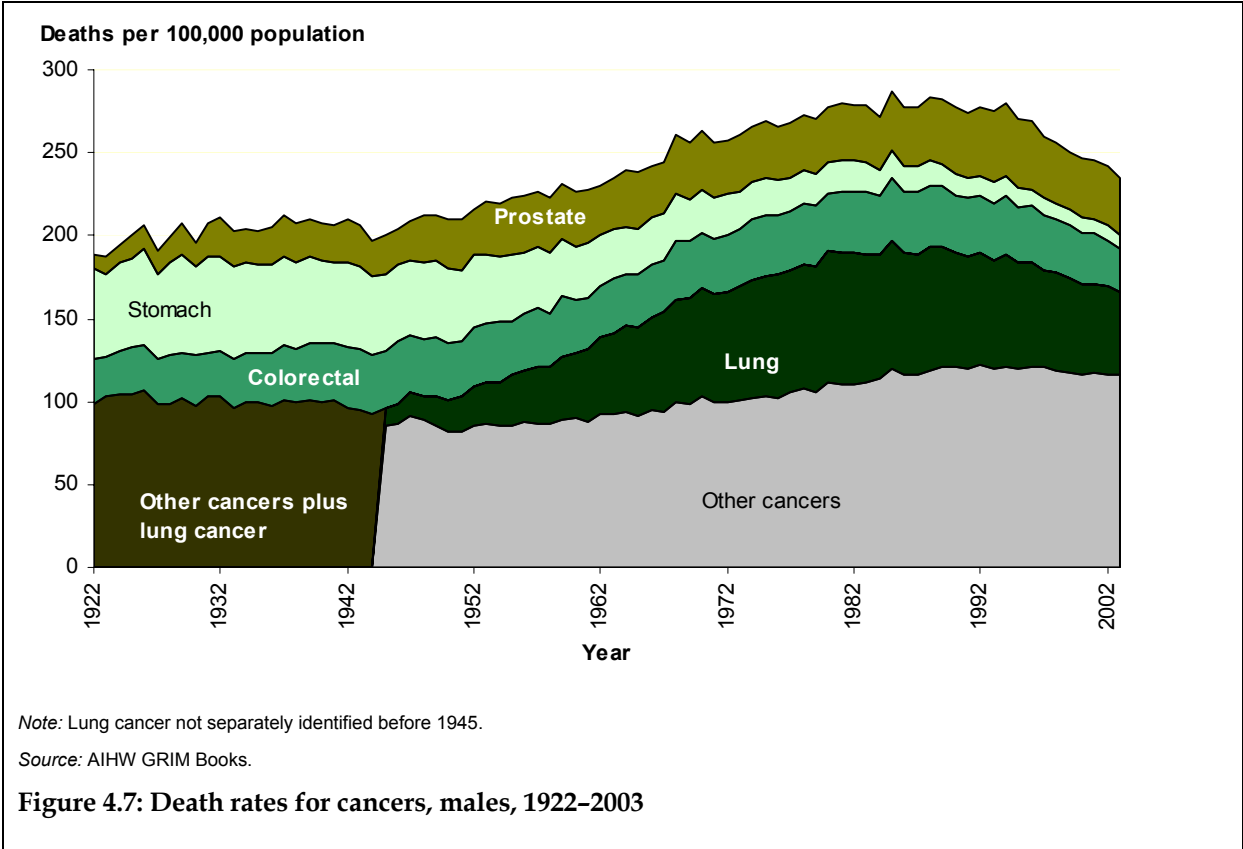
The trends in cancer death rates for females over the century were different from those of the males. Between 1907 and 1940, the rates increased from 154 to 181 deaths per 100,000 population. After 1940, the rates dropped steadily to around 160 deaths per 100,000 in the late 1950s, remaining fairly constant until the second half of the 1990s, and then falling to 148 in 2000 (Table B6). In contrast to the picture for males, female cancer rates over the last four decades of the century were similar to those at the beginning.



During the 1990s, female death rates fell for all major cancers except for lung cancer (Table B10), which had been increasing since 1945 when its measurement began. This trend reflects the pattern of the more recent uptake and then decline of smoking by females compared with males, with the female decline in smoking having too little time to show its effect.

Figures 4.7 and 4.8 show the changing components of cancer mortality over most of the twentieth century. The most notable features shared by males (Figure 4.7) and females (Figure 4.8) are the marked fall over the century in the prominence of stomach cancer (which had been the largest cause of death among cancers in the 1920s) and the reverse story for lung cancer. For males, there was also an increase in the prominence of deaths from prostate cancer, whereas for females there was a fall in the contribution of deaths from cancers of the cervix and uterus. Colorectal cancer deaths made a fairly uniform contribution for both males and females throughout the century, as did breast cancer for females. Details of trends in these specific cancers are given in Chapter 5.

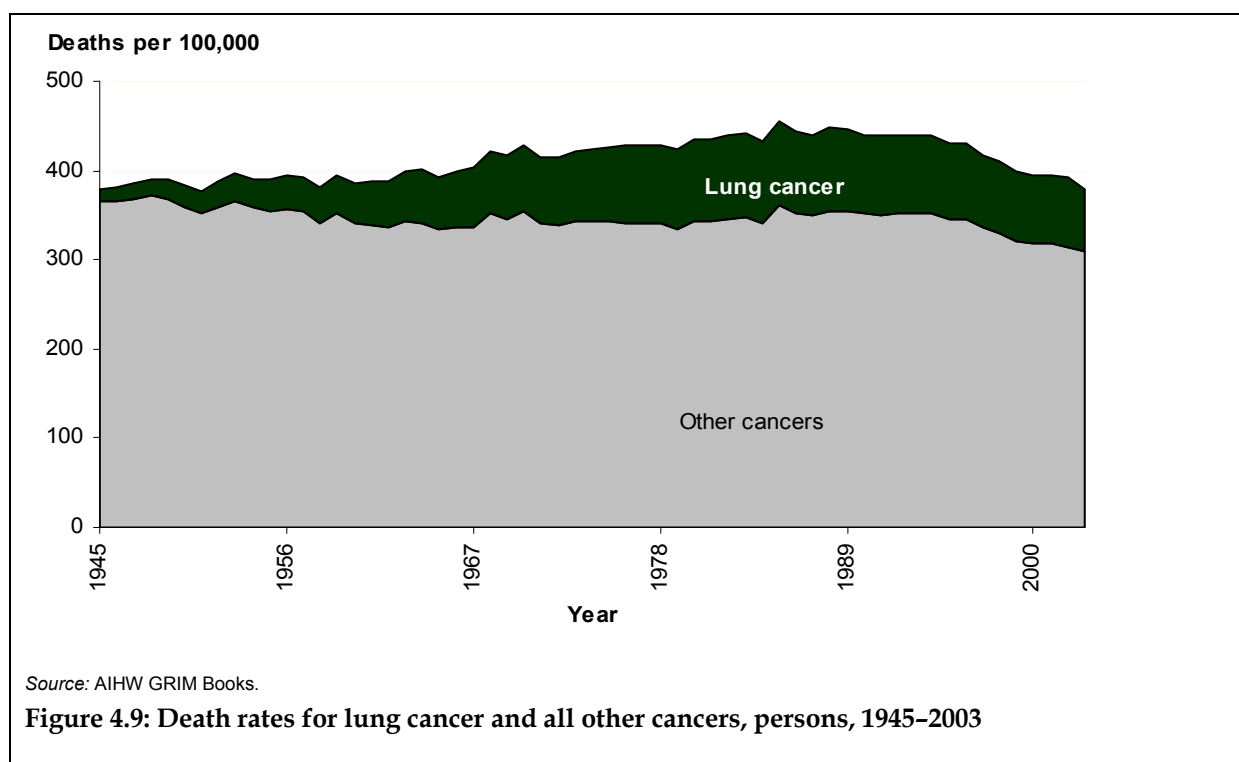
The death rates from other cancers combined increased across the century, representing almost half of all cancer deaths by 2000.



## The impact of lung cancer and cigarette smoking on overall cancer death rates

Figure 4.9 shows the impact of the rise in lung cancer on overall cancer death rates in the second half of the century. Although those overall rates increased for persons (males and females combined), without lung cancer the rates would have decreased over time. For males specifically, the rates would have remained almost steady without the rise in lung cancer, instead of increasing markedly as they did (Figure 4.6); similarly, female rates would have been substantially lower. It is estimated that cigarette smoking was responsible for 83% of lung cancer deaths near the end of the century (AIHW: Ridolfo & Stevenson 2001).

It should also be noted that the trend in lung cancer rates does not show the full impact of cigarette smoking, which contributes strongly to numerous other cancers (AIHW & AACR 2003).



## Comparing cancer and circulatory diseases as causes of premature death

Because circulatory diseases are strongly related to age and as the Australian population has aged, circulatory diseases have caused considerably more deaths than cancer in the 85 years or over group. Consequently, there are more deaths from circulatory diseases overall. However, because death rates from circulatory diseases have fallen so dramatically over recent decades, cancer now causes far more premature deaths. This is a major reversal of the picture from a few decades ago and is true no matter what definition may be used for 'premature'.

In 1970, when circulatory death rates were around their highest for the century, circulatory diseases caused more deaths under the age of 46 years than cancer

(Table 4.2), and certainly far more under the age of 65 years. In fact, ischaemic heart disease alone caused more deaths under 58 years than all cancers.

In 2000, however, cancer caused far more deaths under 65 years of age than circulatory diseases and it was not until the age of 85 that circulatory disease had accumulated more deaths. In other words, cancer now causes more deaths under the age of 85 than circulatory diseases. Table 4.2 illustrates these points, showing that cumulative circulatory disease deaths begin to dominate by the age of 45 in 1970 but not until age 85 in 2000.

**Table 4.2: Comparison of cumulative number of deaths from circulatory diseases and cancer, 1970 and 2000**

Year and age (years)	Circulatory <sup>(a)</sup>	Cancer <sup>(a)</sup>
<b>1970</b>		
≤ 44	1,368	1,393
≤ 45	1,562	1,501
≤ 46	1,788	1,657
<b>2000</b>		
≤ 84	30,435	30,607
≤ 85	32,671	31,442
≤ 86	34,907	32,178

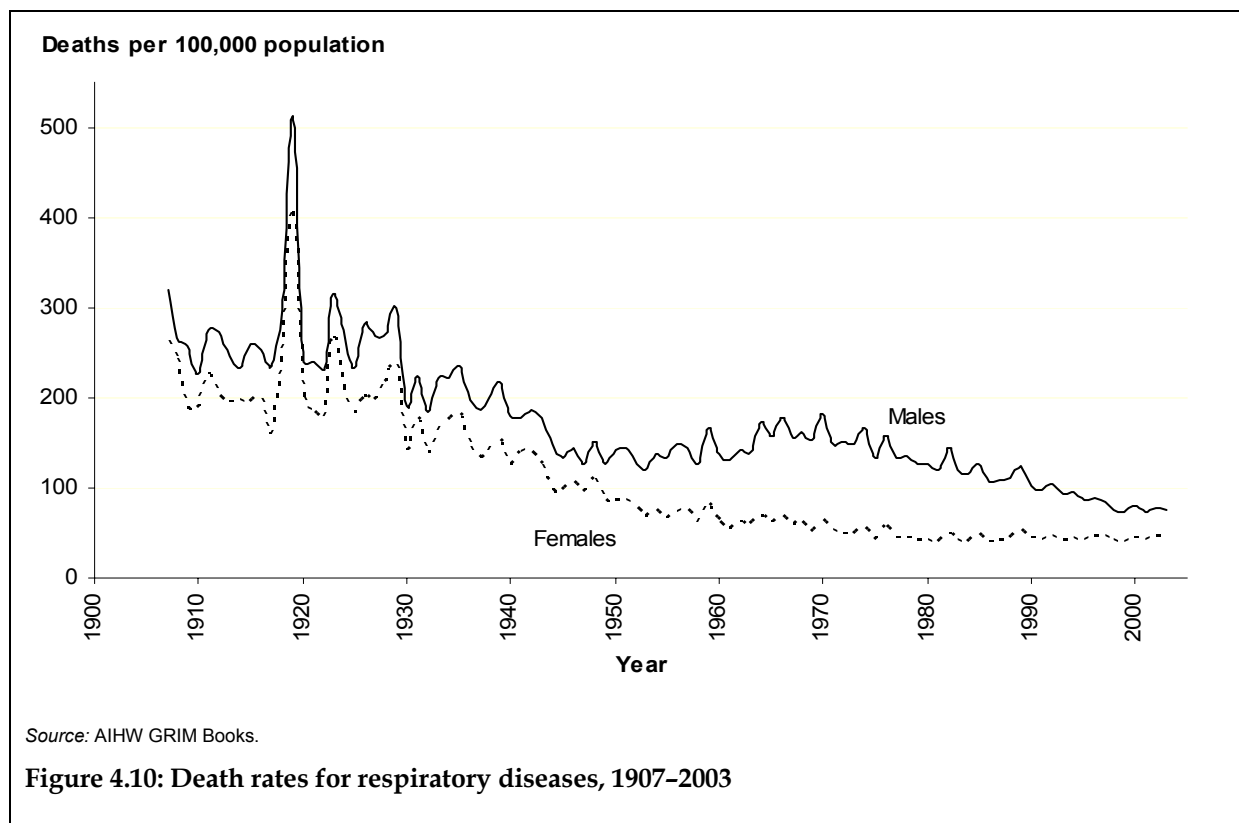
(a) The cumulative number of deaths at that age.

Source: AIHW GRIM Books.

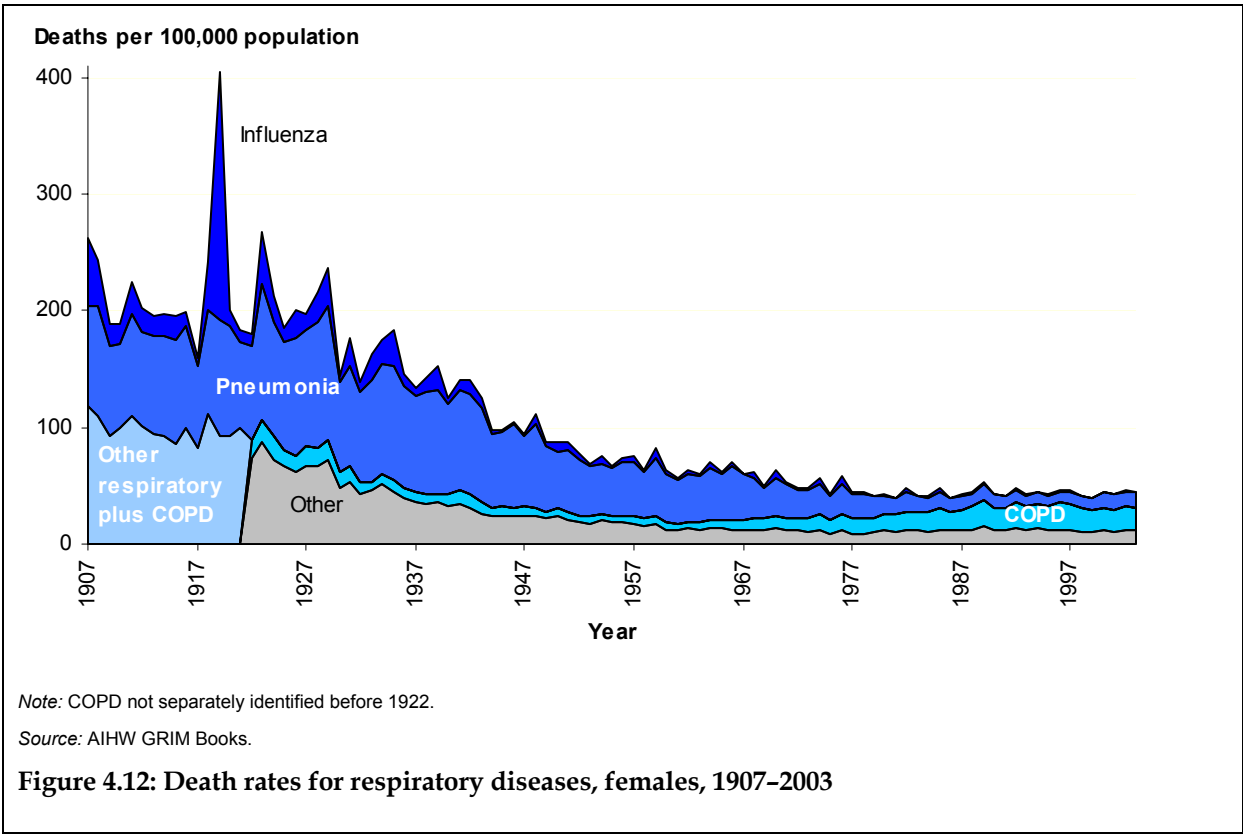
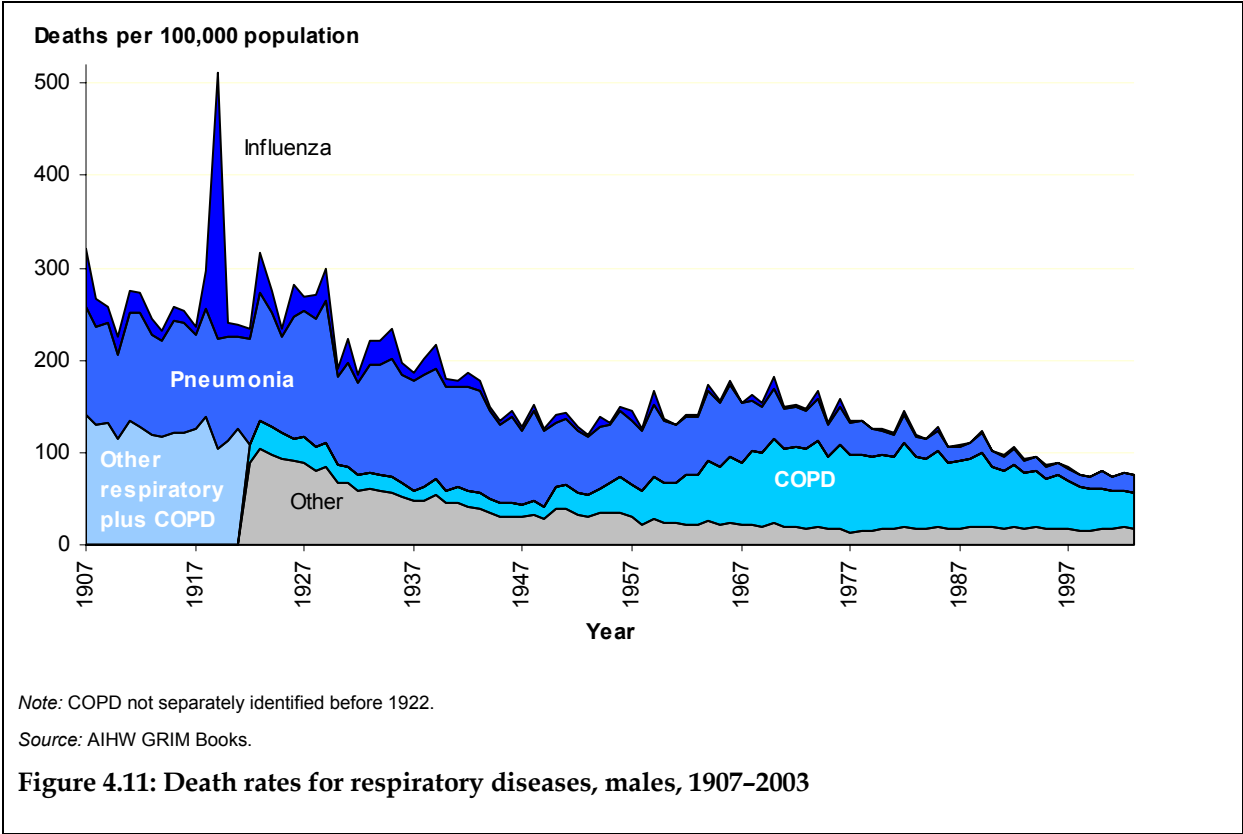
## Respiratory diseases

Respiratory diseases are those affecting the lungs and other parts involved in breathing. Major forms of respiratory disease include pneumonia, influenza, asthma and chronic obstructive pulmonary disease (COPD), but others include diseases caused by dusts and asbestos. It should also be noted that among the wide range of diseases classified as respiratory are some of infectious origin, notably influenza and pneumonia.

Over the century, death rates from respiratory diseases fell to about a quarter of their initial levels for males and around a sixth for females. From 320 deaths for males and 263 for females per 100,000 population in 1907, the rates declined to 81 for males in 2000 and 44 for females. The fall was progressive for both males and females except for the great spike from the Spanish influenza pandemic in 1918–1919 and a modest rise for males from around 1950–1970 (figures 4.11–4.12; tables B5 and B6).



Figures 4.11 and 4.12 show the changing main contributors to respiratory disease mortality over the century. Pneumonia and influenza were the major contributors in 1907 but by 2000 were clearly outranked by COPD, whose rates increased markedly over the 30 years after 1950. Apart from the 1919 pandemic, death rates from influenza fell dramatically across the century and in 2000 they had fallen by 99% from their 1907 level. Pneumonia deaths also fell considerably (tables B11 and B12).

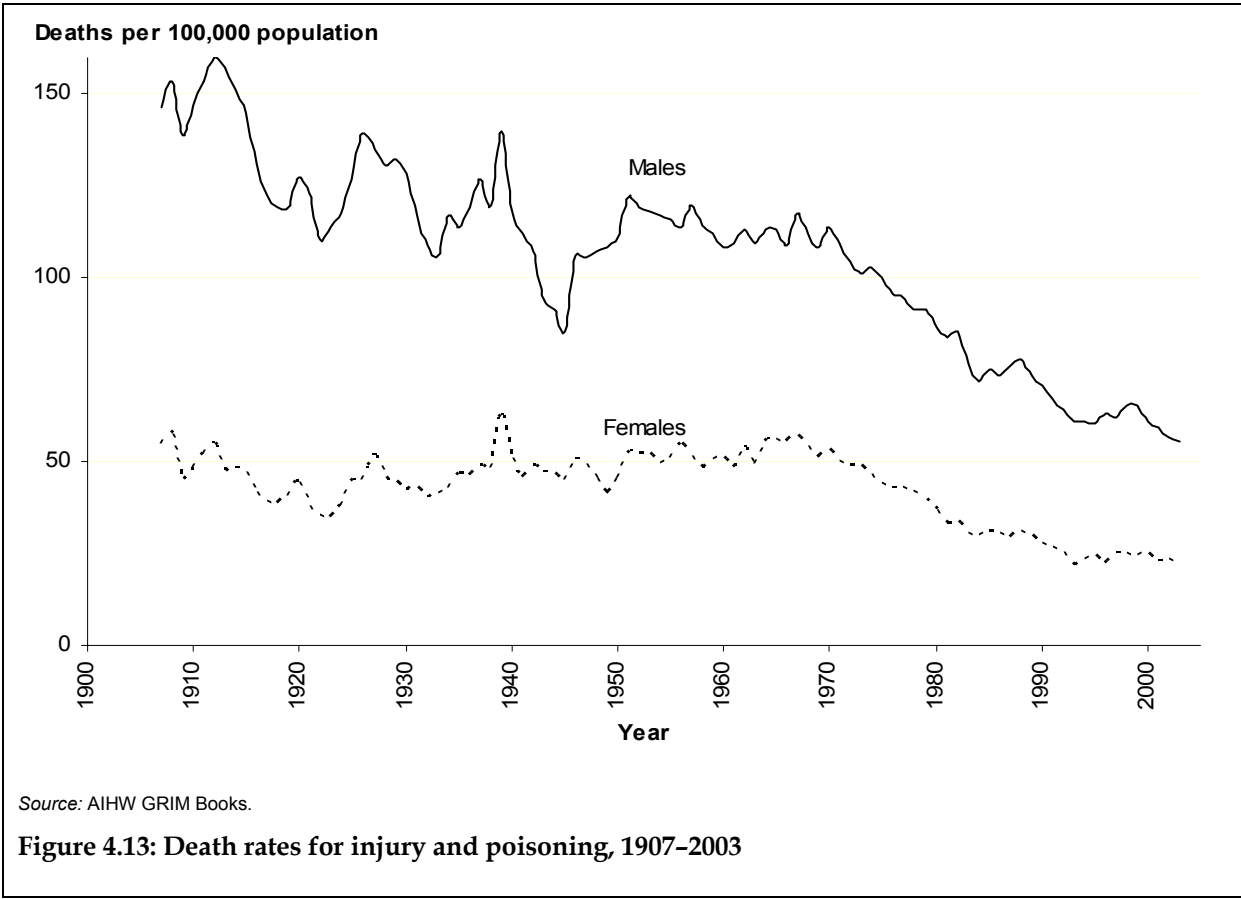


# Injury and poisoning

Deaths from injury and poisoning (also known as external causes) include those from motor vehicle and other accidents, suicide, assault, poisoning, drowning, burns and falls, and complications from medical and surgical care.

Across the century, the death rates for injury and poisoning more than halved for both males and females. Male rates were up to three times those of females early in the century, but the difference narrowed (Figure 4.13). For both males and females there was a clear, mostly continuous fall in death rates from injury and poisoning over the last three decades of the century. For females there was no clear trend before about 1970, whereas for males before 1970 there was an overall fall but with large fluctuations.

In 1907, the death rates were 147 for males and 55 for females per 100,000 population; by 2000, they had fallen to 61 and 25 respectively (Figure 4.13; tables B13 and B14).



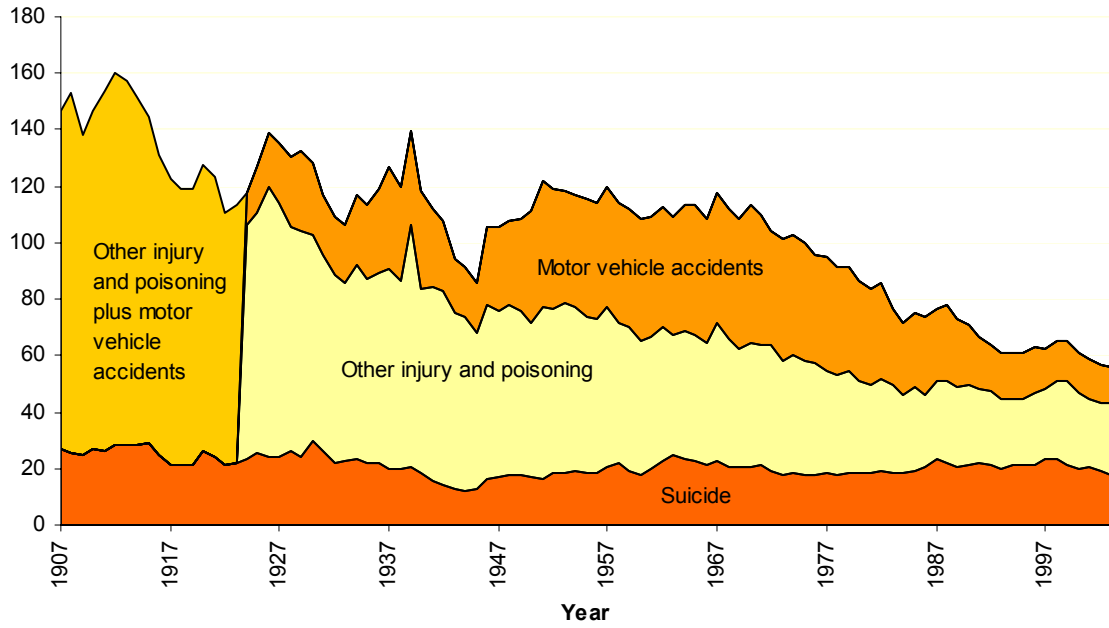
Male death rates from injury and poisoning were affected by war deaths. During World War I and World War II, many Australian males were overseas and deaths that occurred overseas were not counted as part of Australian official mortality statistics (see Box 1.5).

Figures 4.14 and 4.15 show the patterns over the century for suicide and motor vehicle accidents, the major causes in this broad group. It can be seen that suicide rates for both males and females were fairly constant throughout the century, but with male rates about four times those for females. The exception to the constant female rate was during the 1960s and early 1970s (see Chapter 5).

From the first recording of deaths due to motor vehicle accidents in 1924, the rates were substantial for both sexes throughout the twentieth century, especially in the second half. In 1970, deaths from motor vehicle accidents peaked at 49 deaths for males per 100,000 population and 18 for females, then fell to 14 and 6 respectively by 2000 (tables B13 and B14).

Rates for other injuries and poisoning combined declined throughout the century for males, and from around 1965 for females. At the end of the century, for both sexes death rates from motor vehicle accidents had fallen below those of suicide.

Deaths per 100,000 population

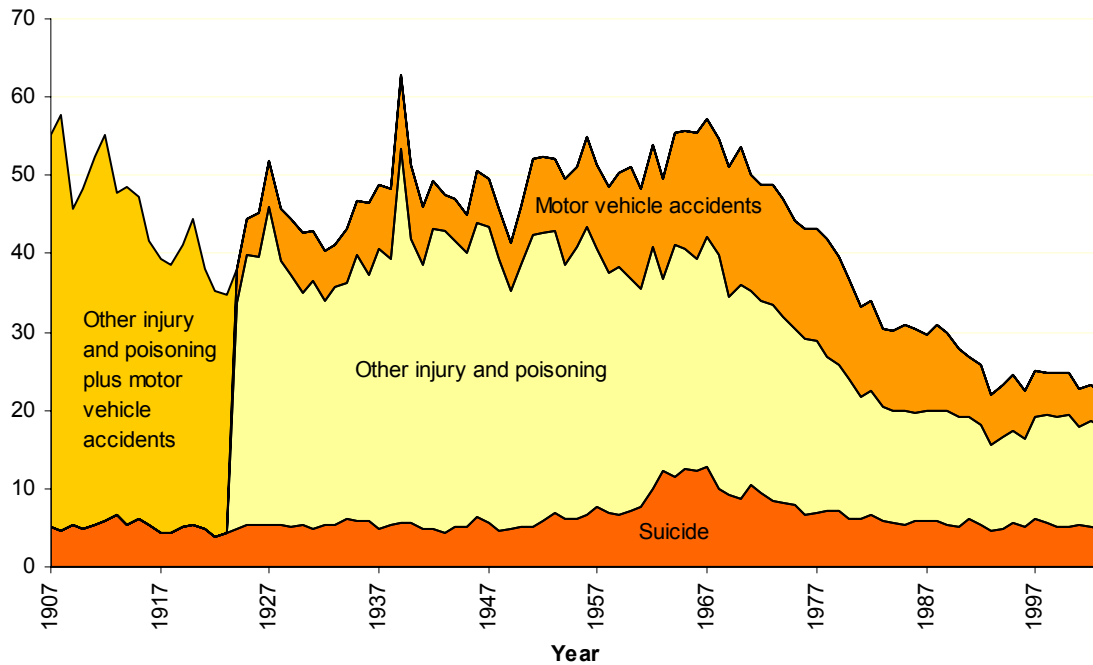


Note: Motor vehicle accidents not separately identified before 1924.

Source: AIHW GRIM Books.

Figure 4.14: Death rates for injury and poisoning, males, 1907-2003

Deaths per 100,000 population



Note: Motor vehicle accidents not separately identified before 1924.

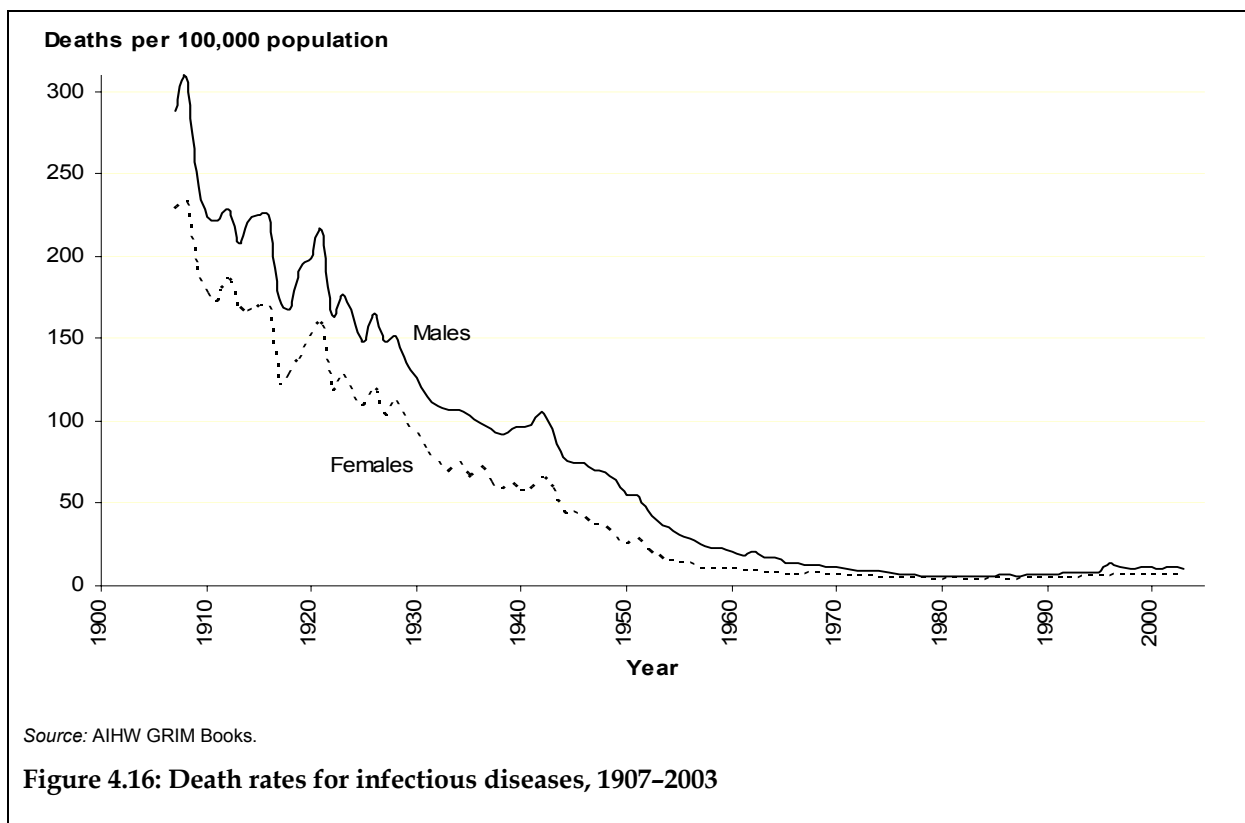
Source: AIHW GRIM Books.

Figure 4.15: Death rates for injury and poisoning, females, 1907-2003

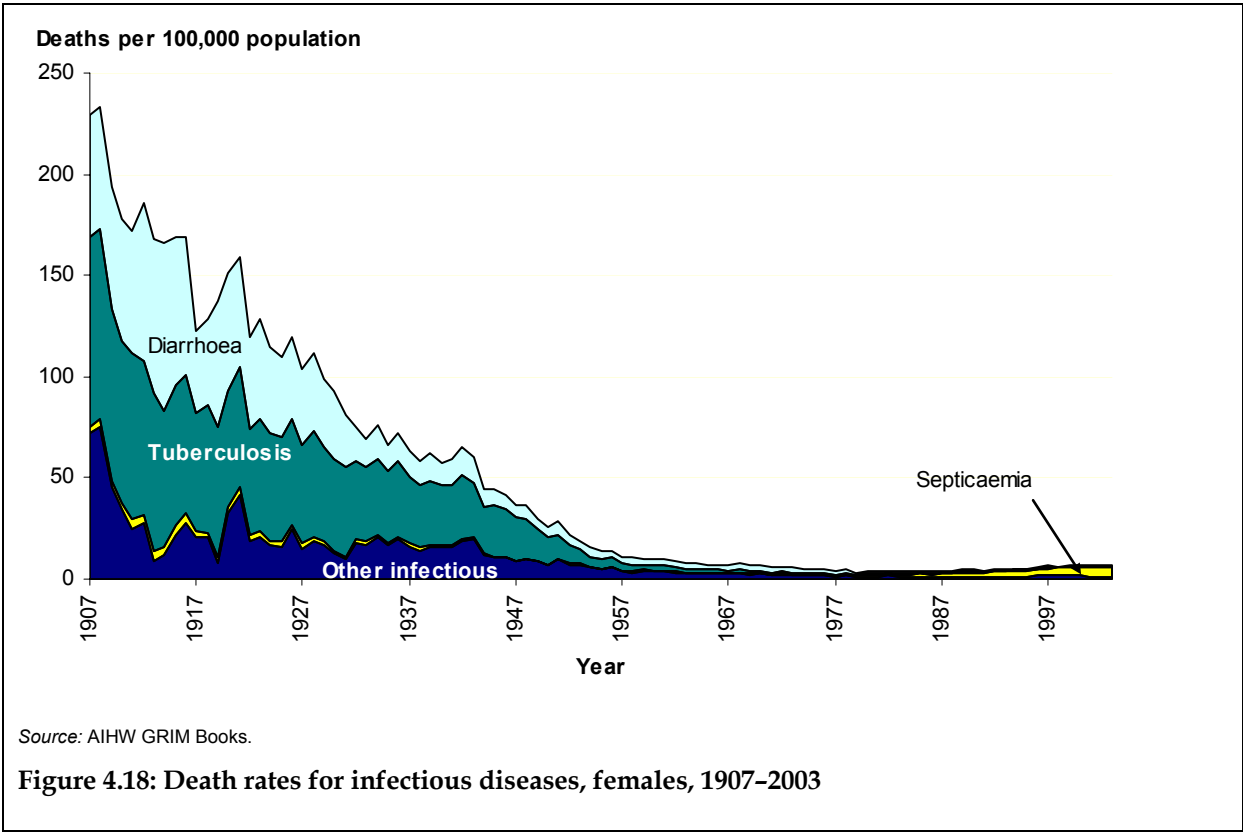
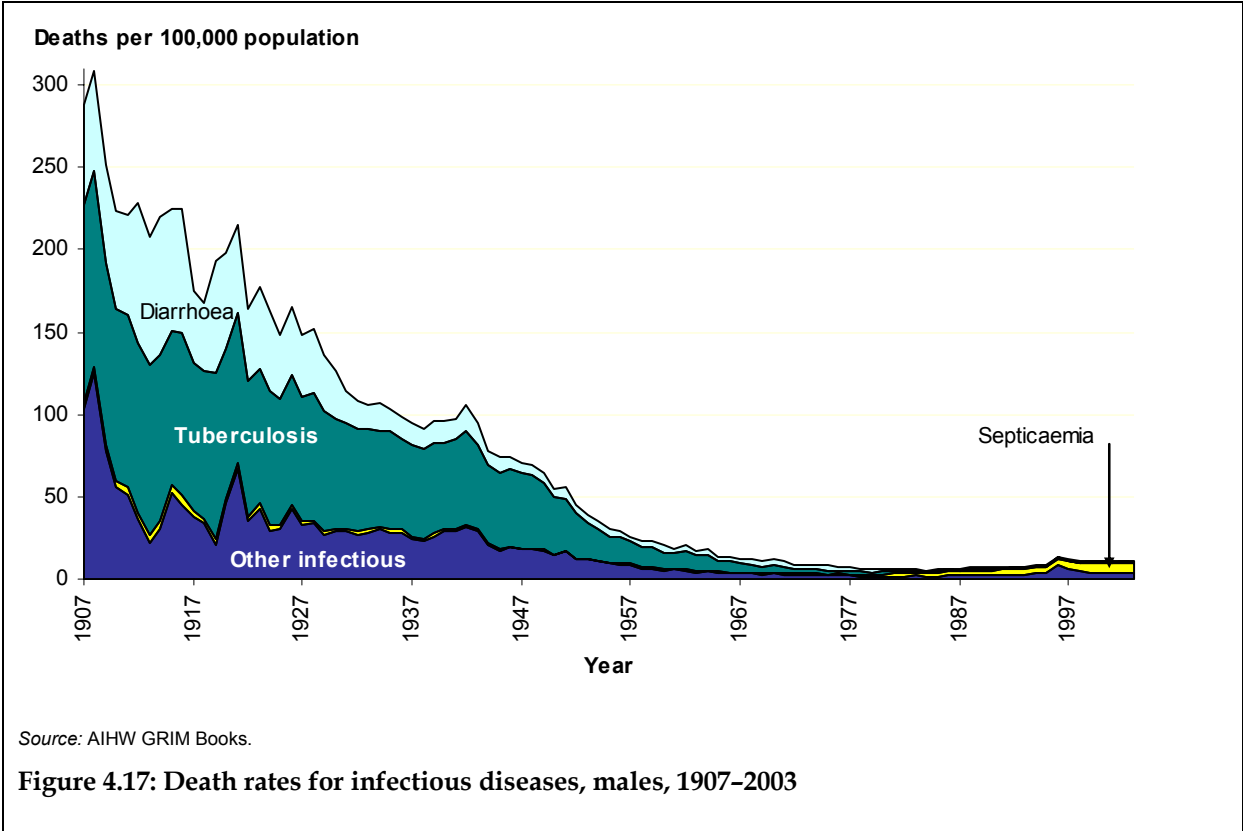
## Infectious diseases

Infectious diseases include conditions such as tuberculosis, polio, smallpox, hepatitis, and sexually transmitted diseases such as syphilis and HIV/AIDS. The category does not include influenza and pneumonia, which are listed in the section on respiratory diseases.

At the beginning of the twentieth century, the age-standardised death rates from infectious diseases accounted for around 13% of all deaths (tables B5 and B6), with rates in 1907 of 283 deaths for males and 230 deaths for females per 100,000 population. Death rates markedly reduced to the 1980s, to around 6 and 4 deaths per 100,000 population respectively, representing a more than 98% fall. However, during the final decade the respective rates increased to 11 and 7 deaths per 100,000 population by 2000 (Figure 4.16; tables B5 and B6). This is due to increases in the death rates from septicaemia, HIV/AIDS and hepatitis, which are discussed in Chapter 5.



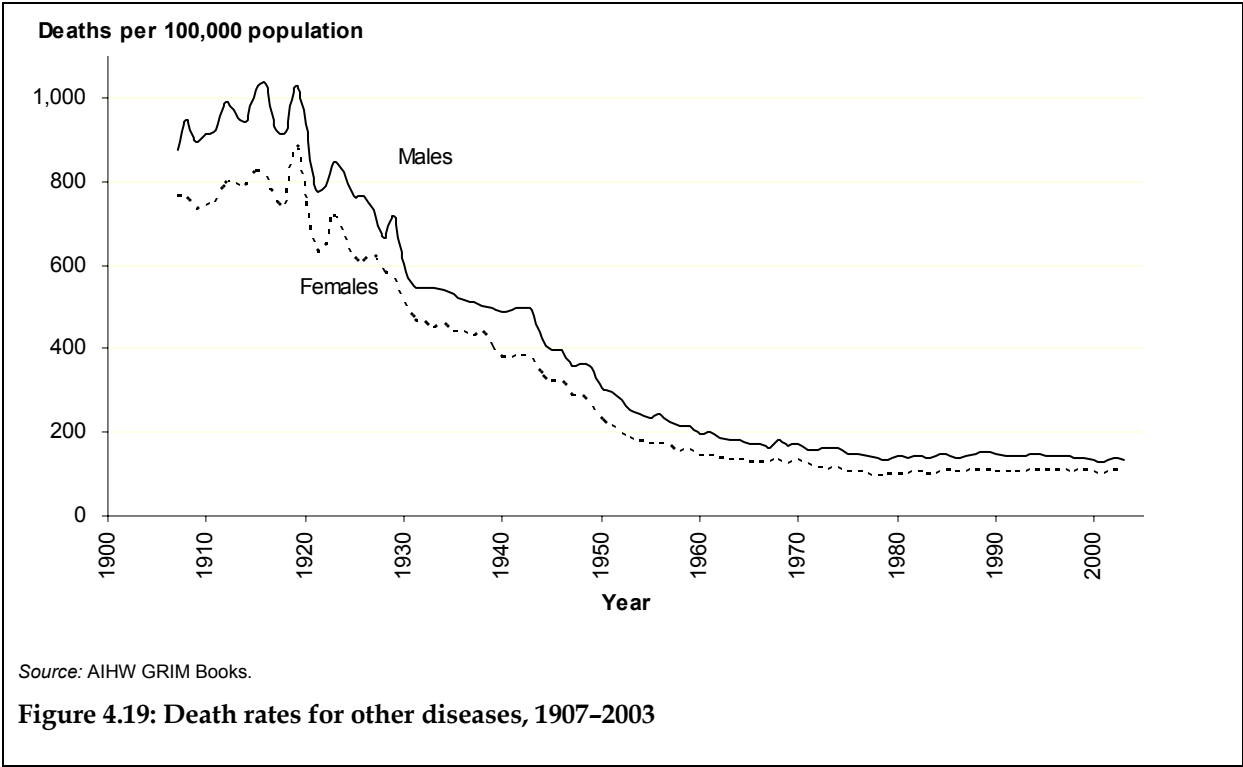
The changing components of mortality from infectious diseases are shown in figures 4.17 and 4.18. Consistent with the overall pattern of infectious diseases mortality, death rates for both diarrhoea and tuberculosis fell dramatically over the twentieth century for both males and females (tables B15 and B16). The same is true for the 'other' category. However, some conditions such as HIV/AIDS, septicaemia and hepatitis C have emerged or increased in recent times.



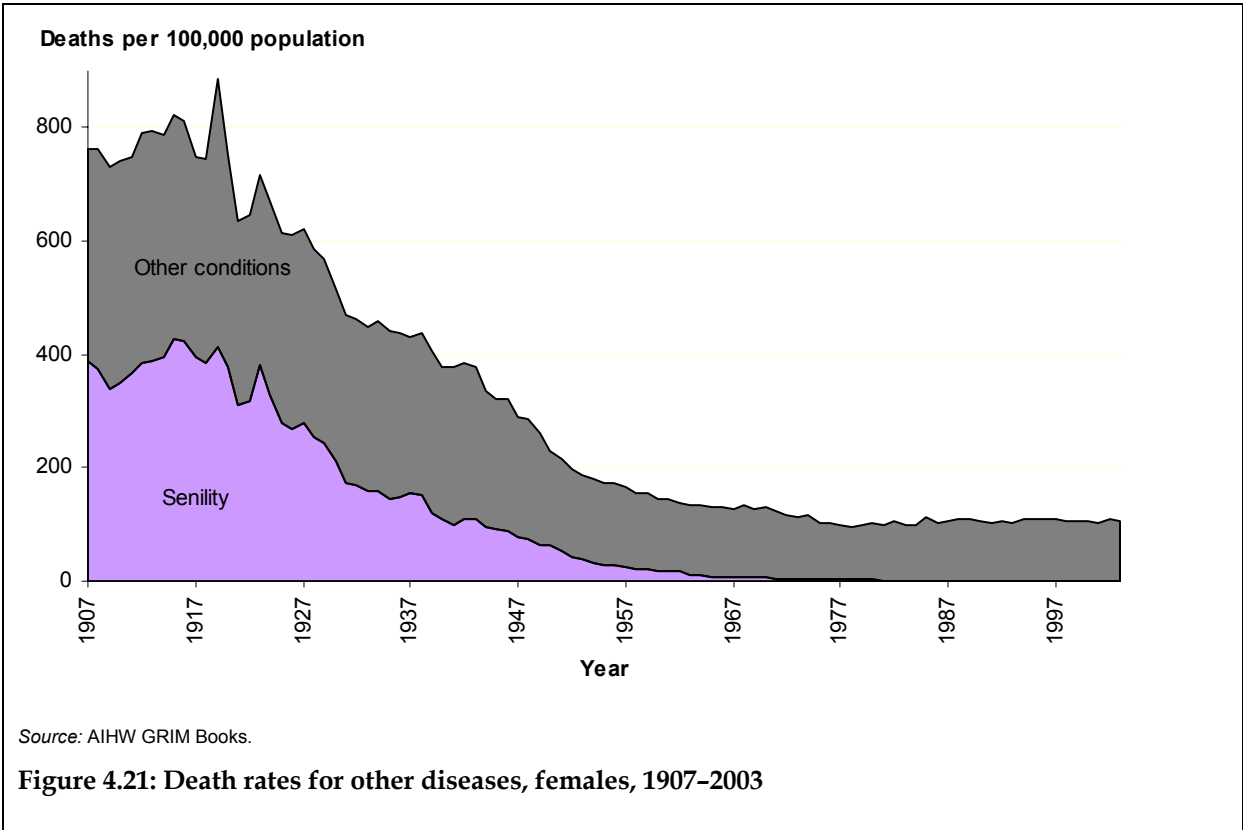
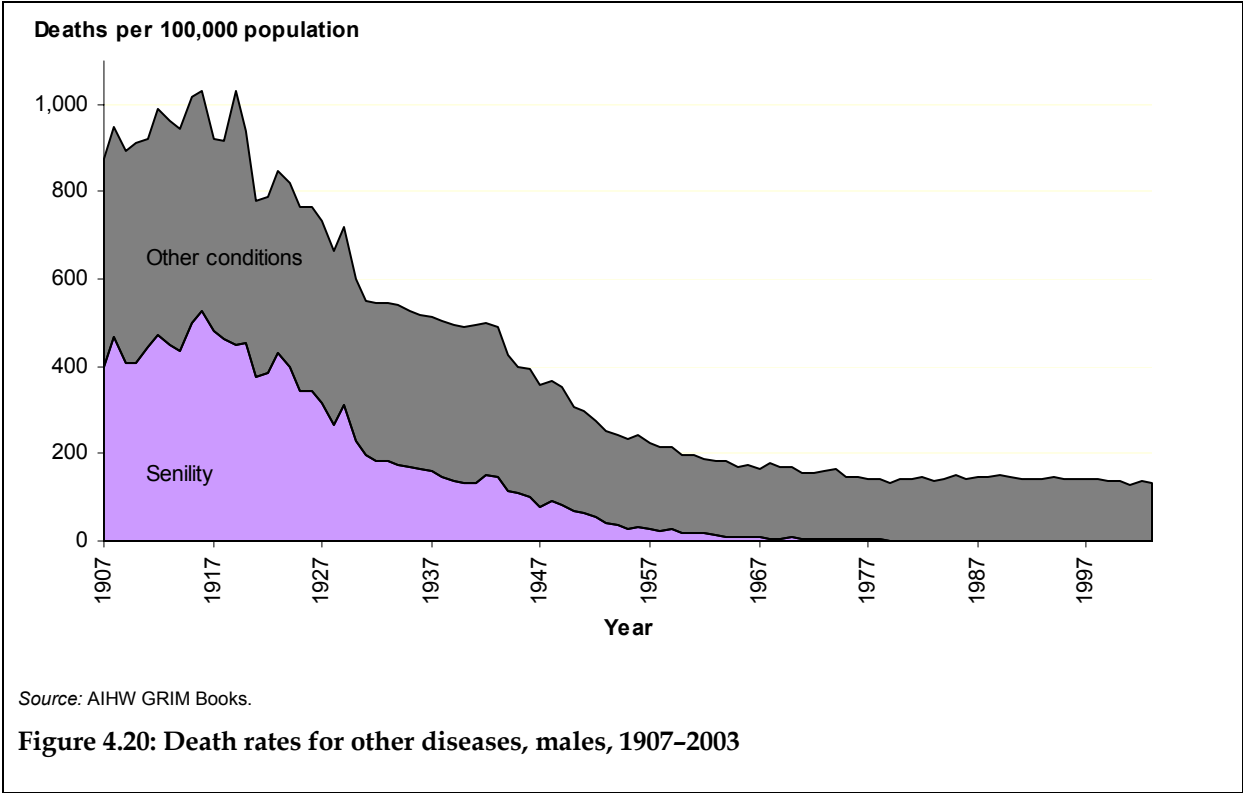
### Other diseases

In this report 'other diseases' includes broad causes such as diseases of the digestive system; muscle and skeletal systems; urinary system and genitalia; and pregnancy, childbirth and the puerperium. It also includes congenital conditions and conditions originating in the perinatal period, which are discussed separately in Chapter 6. Two important 'other' conditions include mental and behavioural conditions and nervous system conditions. While they are included in this 'other' category, these two broad conditions are also discussed separately later in this chapter.

At the beginning of the century, the death rates from 'other diseases' were around 880 deaths for males and 760 for females per 100,000 population, claiming about 40% of the total deaths (Figure 4.19; tables 4.1, B5 and B6). From around 1920 the rates fell progressively over the century, reaching 136 and 105 respectively in 2000.



Figures 4.20 and 4.21 show that in the first half of the twentieth century, a category defined as 'senility' was prominent and a major contributor to this 'other' group (tables B17 and B18). It is possible that this cause was later reclassified into other broad groups as medical knowledge increased. Nevertheless, the death rates attributed to senility fell sharply for both males and females from around the 1920s to low levels in the late 1960s.



## **Nervous system diseases**

### **Background**

Nervous system diseases are diverse and include epilepsy and cerebral palsy, inflammatory diseases of the nervous system such as meningitis and encephalitis, degenerative diseases such as Parkinson's and Alzheimer's diseases, and motor neurone disease and multiple sclerosis. Although neither this group of diseases nor mental health diseases (see over page) contributes as many deaths as the other broad causes profiled above, they are included here because their age-standardised death rates increased significantly for both males and females over the last two decades of the century.

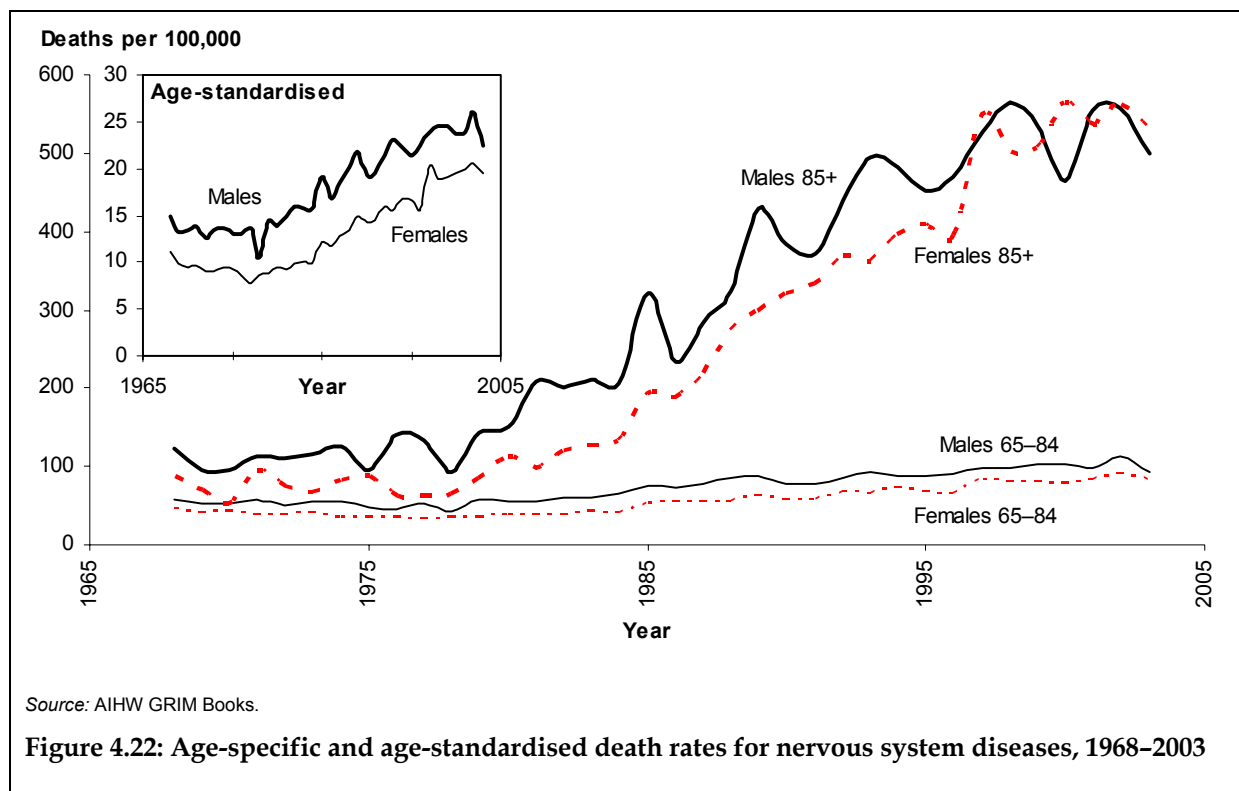
Although deaths from nervous system diseases were recorded before 1968, at the time of preparing this report no adjustments had been made to earlier data to make them as comparable as possible over different ICD versions; hence the years covered here are restricted to 1968–2003.

The age-standardised death rates for nervous system diseases were stable at around 13 and 9 per 100,000 persons for males and females respectively during 1968–1980. From 1980, however, the death rates doubled to 24 and 20 deaths per 100,000 in 2000 (Figure 4.22, inset; tables B17 and B18).

These increases were mainly due to a rise in death rates for Alzheimer's disease and to a lesser extent motor neurone disease. Between 1980 and 2000, the age-standardised Alzheimer rates rose from 0.8 deaths per 100,000 for males to 6.6 for males and from 0.4 to 9.2 for females (AIHW GRIM Books).

### **Age-specific death rates**

From 1980, the death rates from nervous system diseases for males and females aged 85 and over experienced a fourfold rise, increasing from 150 and 113 deaths per 100,000 males and females respectively to around 500 for both sexes in 2000. For males and females in the 65–84 age range, death rates doubled from 56 and 38 deaths per 100,000 respectively to 103 and 78 in 2000 (Figure 4.22). Death rates for the younger age groups did not change during the period, with rates for males and females aged 45–64 remaining at 11 and 9 deaths per 100,000 respectively.



## Mental health diseases

### Background

Mental health diseases make up another diverse class that includes schizophrenia and mood disorders, anxiety conditions and personality disorders. It also includes mental and behavioural disorders from senile and presenile dementia, and conditions that have arisen because of some organic disorder or disorders brought about by use of psychoactive substances such as alcohol or other drugs. This broad group does not include suicide deaths, which are counted under injury and poisoning.

Although deaths from mental health diseases were recorded before 1968, at the time of preparing this report no adjustments had been made to earlier data to make them as comparable as possible over different ICD versions; hence the years covered here are restricted to 1968–2003.

Death rates were reasonably constant between 1968–1980, being around 11 deaths per 100,000 for males and around 7 deaths per 100,000 for females. The pattern from 1980 suggests a marked increase, with rates rising to 23 and 20 in 1996. The classification change to ICD-10 in 1997 was mainly responsible for the fall in respective rates to 18 and 15 deaths per 100,000 persons in 2000 (Figure 4.23, inset; tables B17 and B18).

### Age-specific death rates

In 1980, death rates from mental health conditions for males and females aged 85 years or over were 238 and 227 deaths per 100,000, peaking in 1996 at 698 and 882 deaths per 100,000, before falling to 450 and 585 deaths per 100,000 respectively in 2000. For males and females aged 65–84, the death rates in 1980 were 40 and 28 deaths per 100,000 respectively, again peaking in 1996 at 64 and 61 deaths per 100,000 before falling to 46 and 44 in 2000 (Figure 4.23). Death rates for younger ages remained low and relatively constant, with rates around 7 for males and 3 for females (AIHW GRIM Books). As can be noted from the figure, some discontinuity in the rates occurred in the mid-1990s after the change from ICD-9 to ICD-10.

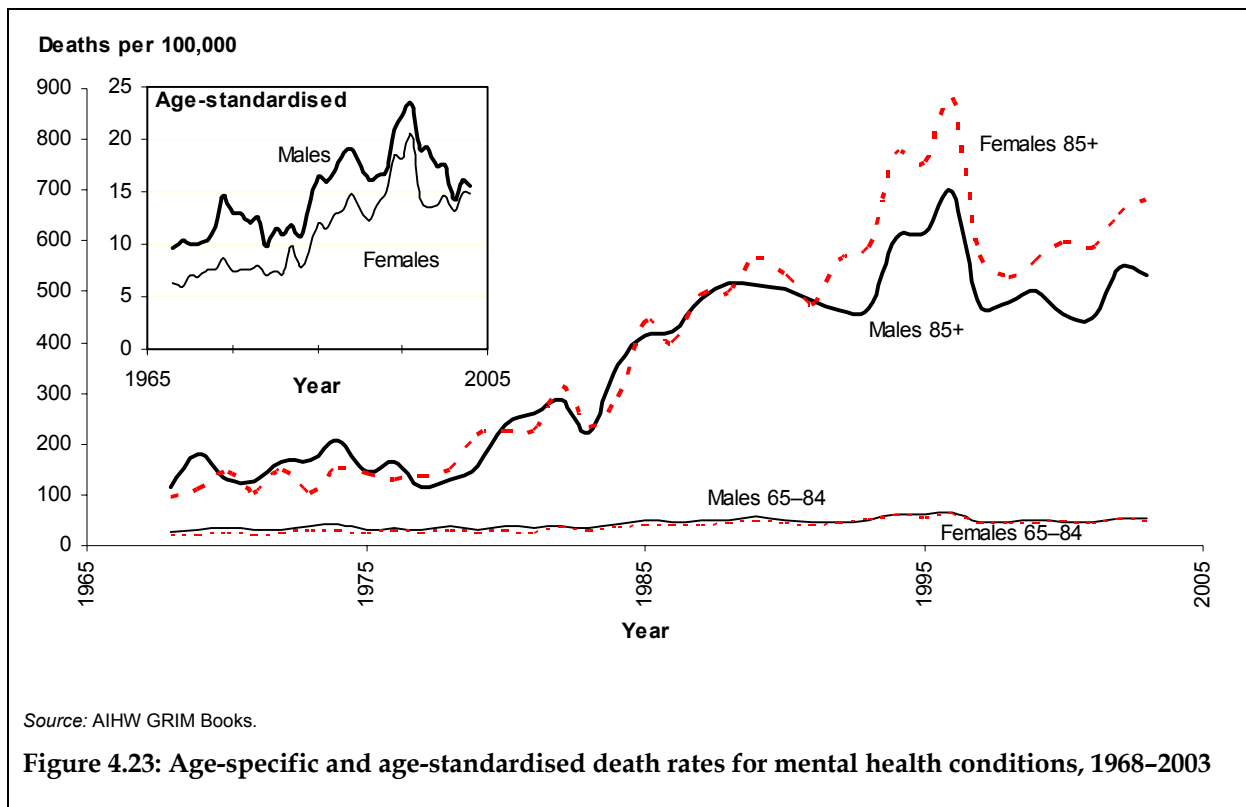


Figure 4.23: Age-specific and age-standardised death rates for mental health conditions, 1968–2003