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Impact of falling cardiovascular disease death rates: deaths delayed and years of life extended

Highlights

- Cardiovascular disease (CVD) continues to have a major impact on the health of Australians in terms of prevalence, mortality, morbidity, burden of disease and expenditure. An estimated 3.7 million Australians, 19% of the population, have a long-term cardiovascular condition and around 1.4 million Australians have a disability associated with the disease. CVD remains our biggest cause of death, accounting for 45,670 deaths (34% of all deaths) in Australia in 2006. In 2003, it accounted for 18% of the total Australian burden of disease.
- The number and rate of deaths from CVD have fallen considerably from the peak levels experienced in the late 1960s and early 1970s when CVD was responsible for around 60,000 deaths annually, or roughly 55% of all deaths each year. These major gains have been attributed to a combination of research, improvements in prevention and detection of cardiovascular disease, and better clinical management of people with the disease.
- From 1968 to 2006, the age-standardised death rate (ASR) fell 76% for both CVD overall and its most common form, coronary heart disease (CHD). For CVD, the fall was from 830.6 to 201.9 deaths per 100,000 population, while the CHD ASR declined from 428.3 to 101.8 deaths per 100,000.

(highlights continued overleaf)

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- The decline in death rates has resulted both in substantial savings of lives and gains in years of life for the Australian population.
- If the age- and sex-specific death rates for CVD and CHD had remained at their 1968 peak, the number of deaths due to these diseases would have been around 4 times as high as the actual number in 2006.
- In 2006, 187,000 Australian lives would have been lost to CVD, rather than the 45,670 actual deaths, representing a saving of over 140,000 lives in that year. More than half of the savings (73,000 lives) are due to declines in the CHD death rate.
- Potential years of life lost (PYLL) is an indicator of premature mortality. The actual PYLL due to CVD in 2006 was 191,600 person-years (assuming an arbitrary life expectancy of 80 years from birth). It is estimated that this figure would have been over 6 times as high, around 1.2 million person-years, if the CVD death rate had remained at its 1968 peak. Similarly, if the CHD death rate had prevailed at the 1968 level, the CHD PYLL would have been 7 times the estimated actual figure of 104,300 person-years.
- It is estimated that, in 2006, the Australian population gained over a million person-years due to the decline in the CVD death rate. Almost two-thirds of this gain (around 656,000 person-years) can be attributed to the fall in the CHD death rate.
- Australians aged 55–64 years may have gained the most from the reduction in CVD and CHD death rates in terms of lives 'saved', while those aged 55–69 years may have benefited most in 'years of life extended' (assuming an arbitrary life expectancy of 80 years).

Introduction

Cardiovascular disease (CVD) is a leading and serious disease in Australia. In 2006, it was recorded as the primary cause of death for 45,670 Australians, accounting for just over a third of all deaths in that year. CVD is one of the seven areas identified for attention under the National Health Priority Area (NHPA) initiative. Coronary heart disease (CHD), the most common form of CVD, is the largest single cause of death and the most common cause of sudden death in Australia.

Over the past few decades, however, Australia has achieved major gains in dealing with CVD and CHD, due to a combination of research and improvements in prevention, detection and clinical management of people who have CVD. Death rates have fallen considerably from the peak levels experienced in the late 1960s and early 1970s, when CVD was responsible for around 60,000 deaths annually, or roughly 55% of all deaths each year. The age-standardised death rate (ASR) from CVD declined from 830.6 per 100,000 population in 1968 to 201.9 per 100,000 in 2006.

This bulletin provides some estimates of the impact of the decline in CVD and CHD death rates from their peak in 1968 until 2006, measured in the number of deaths 'delayed' and 'years of life extended'. The aim is to provide an indication of the extent

to which the lives of Australians have potentially been 'saved' and 'extended' due to the decline in CVD and CHD death rates.

It should be noted that, while accurate, the approach taken to obtain the measures in this report is simple in its scope and methodology. It does not attempt to take account of factors other than the declines in CVD and CHD death rates and changes in population size and structure. The impact of CVD on loss of healthy life and quality of life are not quantified, unlike with the burden of disease (BOD) estimates (NHFA 2006). In addition, for the purposes of this bulletin, only those deaths where CVD or CHD was the 'underlying' (or primary) cause are considered (see Appendix).

Background

What is cardiovascular disease?

CVD covers all diseases and conditions of the heart and blood vessels. Other terms used to describe this group of diseases are 'circulatory disease' and 'heart, stroke and vascular diseases'. CHD, stroke, heart failure, peripheral vascular disease, rheumatic fever and rheumatic heart disease are types of CVD. In this bulletin, all diseases covered by International Classification of Disease, Tenth Revision (ICD-10) codes I00–I99 are included as CVD.

The main underlying causal mechanism of CVD is atherosclerosis, a process marked by build-up of fat, cholesterol and other substances in the inner lining of the arteries. It is most serious when it affects the blood supply to the heart (causing angina or heart attack) or to the brain (causing a stroke).

CHD, also known as ischaemic heart disease, is the most common form of CVD. There are two major clinical forms of CHD—heart attack (also known as acute myocardial infarction or AMI) and angina. In 2006, CHD accounted for around half of CVD deaths and just over a third of hospitalisations where the principal diagnosis was a cardiovascular condition. Diseases categorised under ICD-10 codes I20–I25 are included as CHD in this report.

The impact of CVD on Australia's health

CVD has a major impact on the health of Australians in terms of prevalence, mortality, morbidity, burden of disease and expenditure.

Despite major gains in fighting the disease since the late 1960s, as outlined briefly above, CVD remains our biggest cause of death. In 2006, 45,670 Australians died from CVD. Half of these deaths (22,983) were due to CHD, and 8,484 to stroke. Over 78% of the CVD deaths were of people aged over 74 years and slightly more than half were women.

Cardiovascular conditions were also the primary diagnosis in 469,817 hospital separations (6% of all separations) in 2006–07. CVD is one of the leading causes of disability,

with around 1.4 million Australians estimated to have a disability associated with cardiovascular conditions. In 2004–05, an estimated 3.7 million Australians (19% of the population) had one or more long-term diseases of the circulatory system (AIHW 2008a).

Taking fatal and non-fatal disease into account, in 2003 CVD was estimated to account for 18% of the total burden of disease in Australia for both males and females (measured in disability-adjusted life years or DALYs). CHD and stroke were the leading causes of CVD burden at all ages for both sexes (NHFA 2006).

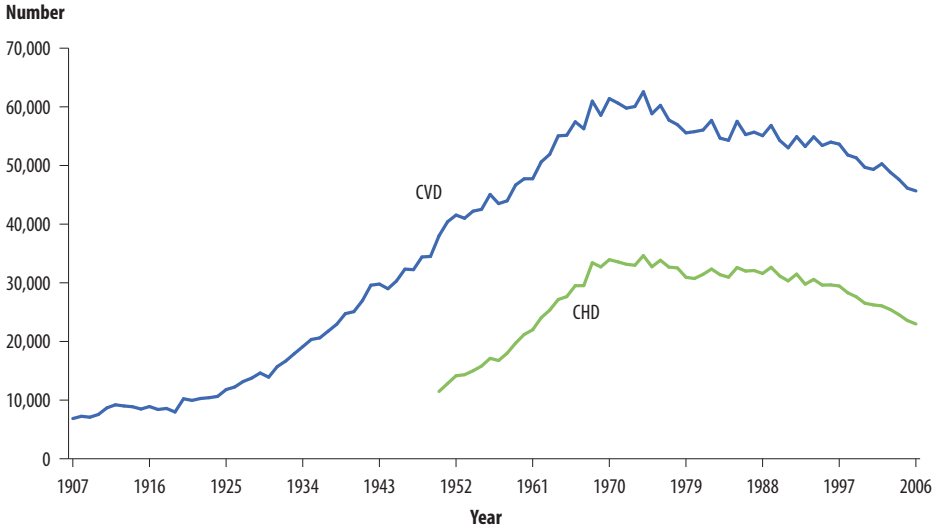
Cardiovascular diseases are the most expensive in Australia in terms of health expenditure. In 2004–05, they cost $5.94 billion—11% of overall allocated recurrent health system expenditure (AIHW 2008b).

Declining CVD and CHD deaths and death rates

Since the late 1960s, both the number of deaths and the rates of death from CVD and CHD have markedly declined (Figures 1 and 2).

The number of CVD deaths rose quickly over the 20th century to a peak of 62,570 in 1974, before declining gradually to 45,670 in 2006 (a decline of 27%). The pattern was similar for CHD deaths, which reached 34,629 in 1974 before declining to 22,983 in 2006 (a decline of 34%) (Figure 1).

These crude numbers underestimate the extent of the impact of the declines on the Australian population, however, as they do not take into account the growth in size, and the ageing, of the Australian population over that time. Age-standardised mortality (death) rates per 100,000 population (ASRs) are a better measure as they take both these factors into account (AIHW 2008c).



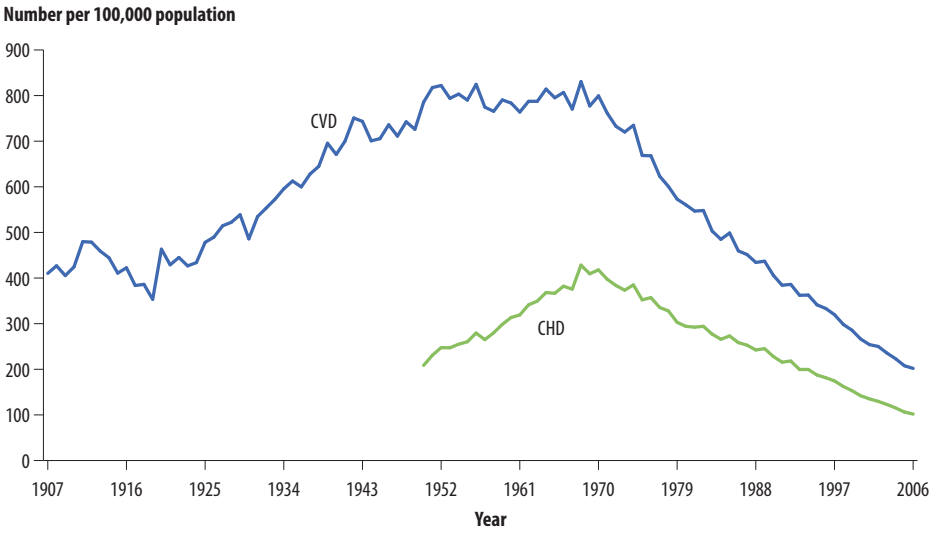
Source: AIHW 2008c.

Figure 1: Number of deaths with an underlying cause of CVD and CHD, 1907 to 2006

The ASR for CVD rose gradually over the first half of the 1900s. Between the early 1950s and the late 1960s it levelled, reaching a peak in 1968 at 830.6 deaths per 100,000 population (Figure 2). From 1968, the ASR fell by 76%, to 201.9 per 100,000 in 2006. Compared to females, the CVD ASR for males was higher (in 2006, 236.8 compared to 171.5), reached a higher peak (1,020.1 compared to 717.8) and began to decline later (in the late 1960s compared to the early 1950s) (AIHW 2008c).

The trend in the CHD ASR is slightly different to that for CVD as the rate rose sharply over the 1950s and 1960s to 428.3 deaths per 100,000 in 1968. As with the CVD death rate, however, the CHD ASR fell by 76% from 1968, to 101.8 deaths per 100,000 in 2006 (Figure 2).

At its peak in 1968, the CHD ASR for males was 589.2 per 100,000 population, compared to 304.0 for females. In 2006, the respective rates were 132.6 and 76.6 (AIHW 2008c).



Note: Standardised directly to the 2001 Australian population.
Source: AIHW 2008c.

Figure 2: Age-standardised death rates (ASRs), CVD and CHD, 1907 to 2006

Why have the death rates declined?

The declines in deaths and death rates from CVD and CHD have been attributed to a combination of research, improvements in detection, prevention and major advances in treatment and care, leading to higher survival rates (AIHW 2004).

Advances in diagnosis and treatment of heart disease and stroke, development of effective medications for treatment of high blood pressure and abnormal blood lipid levels,

greater numbers of specialists and other health-care providers focusing on CVD, better emergency medical services for heart attack and stroke, and an increase in specialised coronary care and stroke units have contributed to lower case fatality rates and lengthened survival times.

It should be noted that, while there have been improvements in some of the risk factors associated with CVD over the past 40 years, around 90% of Australian adults still have at least one modifiable risk factor and 16% have four or more risk factors (AIHW: O'Brien 2005). Many Australians remain at high risk of CVD as a result of tobacco smoking, physical inactivity, obesity, poor diet, psychosocial factors and higher levels of blood pressure, cholesterol and intake of alcohol than recommended. This indicates that there remains potential for further declines in CVD death rates in the future.

Measures of the impact

As outlined above, the aim of this bulletin is to provide a meaningful measure of the impact of the decline in CVD and CHD death rates on the health of the Australian population. Two approaches, briefly outlined below and in more detail in the Appendix, have been used.

Estimating the number of deaths 'delayed'

One simple approach is to compare the estimated number of deaths that would have occurred each year from 1969 to 2006 if age- and sex-specific CVD/CHD death rates had remained at their peak 1968 level ('expected deaths') with the actual number of deaths attributable to CVD/CHD ('actual deaths') in each year. The difference between expected and actual deaths provides an estimate of the number of deaths delayed in each year. It provides an indication of the number of people who potentially would have died from CVD/CHD each year if gains had not been made in reducing the death rates.

By applying the 1968 age- and sex-specific death rates to actual population estimates for each year, changes in the population structure and ageing of the population are taken into account.

Estimating 'years of life extended'

Another approach is to estimate the extent to which the lives of Australians have potentially been 'extended' due to the major declines in CVD and CHD death rates since their peaks in 1968. This is based on the concept of potential years of life lost (PYLL) (AIHW 2008a).

The PYLL measure is an indicator of premature mortality, based on an arbitrary notion of life expectancy. For example, if it is assumed that, at birth, an average expected age of death for a population is 80 years, and a person dies at 45, then it can be said that they have lost a potential 35 years of life. Their individual PYLL is estimated to be 35 years. By

summing this across the population, the PYLL measure can provide an indication of the extent of premature mortality attributable to a particular disease.

In this bulletin, the PYLL concept is used in a slightly different way. 'Expected PYLL' are calculated for males and females in 5-year age groups for each year from 1969 to 2006, based on the CVD/CHD age- and sex-specific death rates in 1968 (the peak). The arbitrary life expectancy limit of 80 years was chosen for the calculations as the average life expectancy at birth for a boy born in 2004–06 is estimated to be 78.7 years, while for a girl it is 83.5 years. It should be noted, however, that life expectancy has been increasing over time. In 1965–67, the life expectancy at birth for a boy was 67.6 years and for a girl 74.2 years (ABS 2008). As a result of choosing the 80 years life limit in the calculations, the actual and expected PYLL for the years before 2004 will be overestimates.

The expected PYLL were compared with the actual PYLL, with the difference being the additional or 'extended' years of life that could be attributed to the decline in CVD/CHD death rates in each year since 1968. These were summed across the age and sex groups to provide estimates of the total impact on the Australian population of the decline in CVD/CHD death rates since their peak in 1968.

In interpreting the results, it is important to note that the PYLL concept only takes account of deaths and not loss of healthy life due to disability.

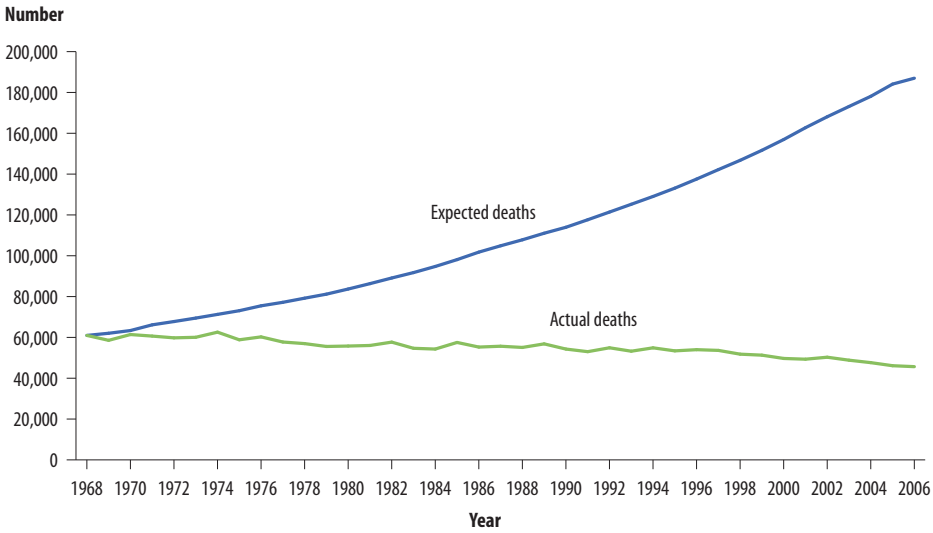
Estimated impact of the decline in CVD and CHD death rates

Deaths delayed

Cardiovascular disease

In 2006, CVD was the underlying cause of death for 45,670 Australians. However, had the same age- and sex-specific CVD death rates applied as in 1968, when CVD death rates were at their peak, the estimated number of deaths would have been 4 times as high (approximately 187,000) (Table 1 and Figure 3). Potentially, over 141,300 extra Australian lives would have been lost to CVD in 2006 if the 1968 CVD death rate had prevailed. This 'saving' is greater than the total number of deaths in Australia due to any cause in 2006 (133,739).

It should be kept in mind that, of the 141,300 or so people whose deaths were potentially averted in 2006, some may still have been affected by the disease and/or may have died in a later year from CVD or another disease. Despite this, the difference between the number of expected and actual deaths due to CVD in 2006 indicates a substantial impact on Australia's health as a result of the reduced CVD death rate.



Source: AIHW 2008c.

Figure 3: Actual and expected deaths from CVD, 1968 to 2006

Table 1: Actual and expected deaths from CVD, and deaths delayed, by sex and age group, 2006

	Age group (years)								
	0–24	25–34	35–44	45–54	55–64	65–74	75–84	85+	Total[(a)]
	Number								Per cent
Actual deaths									
Males	49	112	410	991	1,921	3,446	7,821	6,811	21,562	47.2
Females	54	65	133	365	659	1,792	7,122	13,918	24,108	52.8
Persons	**103**	**177**	**543**	**1,356**	**2,580**	**5,238**	**14,943**	**20,729**	**45,670**	**100.0**
Expected deaths									
Males	131	230	1,596	5,926	14,719	22,830	33,421	18,412	97,267	52.0
Females	94	178	787	2,352	6,213	13,386	32,319	34,392	89,721	48.0
Persons	**226**	**408**	**2,384**	**8,277**	**20,932**	**36,216**	**65,740**	**52,805**	**186,987**	**100.0**
Deaths delayed									
Males	82	118	1,186	4,935	12,798	19,384	25,600	11,601	75,706	53.6
Females	40	113	654	1,987	5,554	11,594	25,197	20,474	65,613	46.4
Persons	**123**	**231**	**1,841**	**6,921**	**18,352**	**30,978**	**50,797**	**32,076**	**141,318**	**100.0**
Ratio of expected to actual CVD deaths									
Males	2.7	2.1	3.9	6.0	7.7	6.6	4.3	2.7	4.5	
Females	1.7	2.7	5.9	6.4	9.4	7.5	4.5	2.5	3.7	
Persons	**2.2**	**2.3**	**4.4**	**6.1**	**8.1**	**6.9**	**4.4**	**2.5**	**4.1**	

(a) Actual total includes 1 male of missing age.
Note: Numbers may not add to totals due to rounding.

Source: AIHW 2008c.

As would be expected given the distribution of CVD deaths by age (that is, concentrated in the older age groups), around 80% of the expected deaths that were 'delayed' in 2006 were of people aged over 65 years and almost 60% aged over 75 years (Table 1).

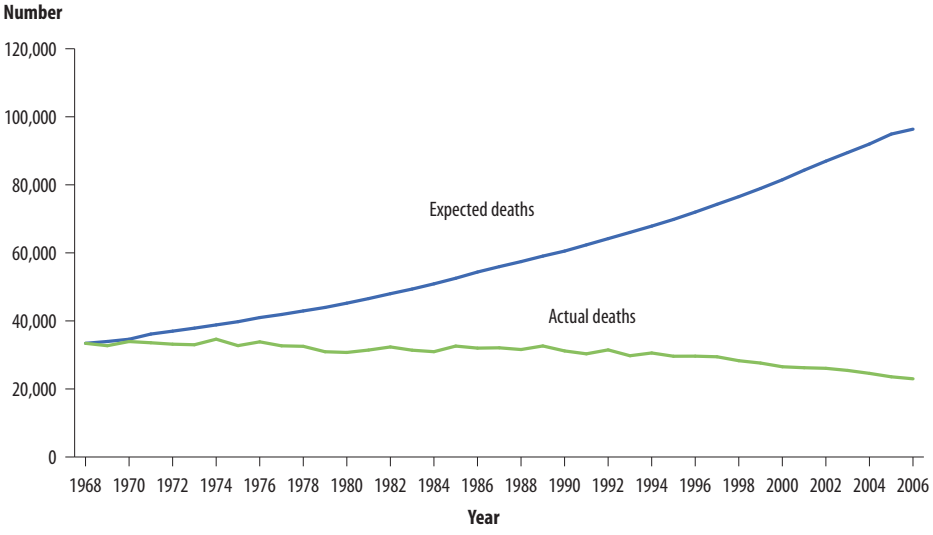
However, the greatest relative savings appear to have been for people aged 45–74 years of age, and in particular those aged 55–64 years (Table 1). Had the same CVD death rates applied as in 1968, the estimated number of deaths from CVD in the 2006 population aged 55–64 years would have been over 8 times as high. For women in this age group, it would have been 9.4 times as high. In contrast, for those aged 85 and over, the number of expected deaths was 2.5 times as high as actual deaths.

In 2006 the ratio of expected deaths to actual deaths due to CVD was higher for males than females (4.5 compared to 3.7). This indicates that, using this measure, the impact on declining CVD death rates may have been greater for males than females.

Coronary heart disease

While the number of deaths attributable to CHD did not peak until 1974 (34,629 deaths), 1968 marked the peak in the CHD age-standardised death rate (that is, the proportion of the population dying from the disease) as it did with the CVD death rate. In 1968, the CHD ASR was 428.3 per 100,000 population. This had fallen to 384.9 in 1974 and to 101.8 in 2006 (Figure 2).

The number of actual deaths attributable to CHD in 2006 was 22,983. The number of expected deaths in that year was 96,361 (Table 2 and Figure 4). Thus, if the age- and sex-specific CHD death rates had remained as they were in 1968, the number of Australians dying from CHD could have been over 4 times as high as they actually were. Potentially, over 73,000 extra lives would have been lost to CHD in 2006 if the death rate from this disease had remained at its peak 1968 level.



Source: AIHW 2008c.

Figure 4: Actual and expected deaths from CHD, 1968 to 2006

As with CVD, using this measure, the impact appears to have been slightly greater on males than females. In 2006, the number of expected CHD deaths for males was 4.7 times the actual number of deaths (57,462 compared to 12,186) (Table 2). For females, the number of expected deaths was 3.6 times the actual (38,898 and 10,797 respectively). While it would have been expected that almost 60% of CHD deaths in 2006 would have been males, the actual proportion was 53%.

As with all CVD, the biggest impact in 2006 of the decline in CHD death rates appears to have been on the 55–64 year age group (Table 2). The number of expected deaths attributable to CHD for females in this age group was 11.5 times the actual deaths. For males, it was 8.5 times, and for all people aged 55–64 years, the number of expected deaths from CHD was 9 times as high as the actual.

Table 2: Actual and expected deaths from CHD, by sex and age group, 2006

	Age group (years)									
	0–24	25–34	35–44	45–54	55–64	65–74	75–84	85+	Total[(a)]	
					Number					Per cent
Actual										
Males	6	51	236	672	1,274	2,095	4,269	3,582	12,186	53.0
Females	2	11	37	124	309	841	3,228	6,245	10,797	47.0
Persons	**8**	**62**	**273**	**796**	**1,583**	**2,936**	**7,497**	**9,827**	**22,983**	**100.0**
Expected										
Males	12	78	1,045	4,486	10,872	15,001	17,871	8,097	57,462	59.6
Females	0	39	247	1,073	3,545	7,297	14,215	12,481	38,898	40.4
Persons	**12**	**118**	**1,292**	**5,560**	**14,417**	**22,298**	**32,086**	**20,578**	**96,361**	**100.0**
Expected minus actual deaths										
Males	6	27	809	3,814	9,598	12,906	13,602	4,515	45,276	61.7
Females	–2	28	210	949	3,236	6,456	10,987	6,236	28,101	38.3
Persons	**4**	**56**	**1,019**	**4,764**	**12,834**	**19,362**	**24,589**	**10,751**	**73,378**	**100.0**
Ratio of expected to actual CHD deaths										
Males	2.0	1.5	4.4	6.7	8.5	7.2	4.2	2.3	4.7	
Females	0.0	3.6	6.7	8.7	11.5	8.7	4.4	2.0	3.6	
Persons	**1.5**	**1.9**	**4.7**	**7.0**	**9.1**	**7.6**	**4.3**	**2.1**	**4.2**	

(a) Actual total includes 1 male of missing age.
Note: Numbers may not add to totals due to rounding.

Source: AIHW 2008c.

Years of life extended

Whereas the previous measure provides an estimate of the impact of the decline in CVD and CHD death rates from the late 1960s in terms of the number of lives potentially saved in 2006, the 'years of life extended' measure provides an estimate of the total number of additional years of life that the Australian population may have gained. It is based on the 'potential years of life lost' (PYLL) concept.

The years of life extended estimates are calculated by comparing the expected PYLL due to CVD/CHD (derived by applying the age- and sex-specific CVD/CHD death rates in 1968 to the population in the years from 1969 to 2006) with actual PYLL. The arbitrary upper limit to life used in the estimation of the expected and actual PYLL is 80 years of age. PYLL and the years of life extended are measured in person-years, rather than in individual lives.

Further details on the method used to calculate this measure are provided in the Appendix.

Cardiovascular disease

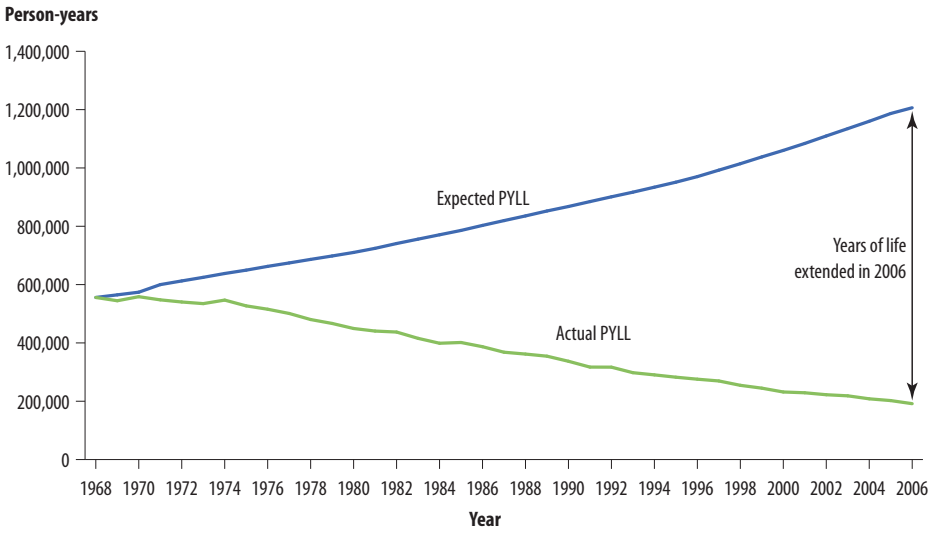
As would be expected given the decline in the CVD death rates described above, and the higher survival rates when people have an acute cardiovascular event, there was a marked decline in premature mortality as a result of CVD (the actual PYLL) from 1968 to 2006. In 1968, the actual PYLL due to CVD mortality was estimated to be 555,840 person-years. By 2006, it had fallen to 191,648 person-years (Table 3 and Figure 5). That is, from 1968 to 2006, there was a decline of 66% in the actual PYLL due to CVD.

Table 3: Actual and expected potential years of life lost (PYLL) and years of life extended due to the decline in CVD/CHD death rates, 1968 and 2006

	CVD			CHD			
	Actual PYLL	Expected PYLL	Years of life extended	Actual PYLL	Expected PYLL	Years of life extended	Australian population
	Person-years						Number
1968	555,840	555,840	..	347,423	347,423	..	12,008,635
2006	191,648	1,206,413	1,014,766	104,280	760,285	656,005	20,701,488

Notes
Actual and expected PYLL for both 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.
Expected PYLL minus Actual PYLL may not exactly equal Years of life extended due to rounding.

Source: AIHW 2008c.



Note: Actual and expected PYLL for all years from 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.
Source: AIHW 2008c.

Figure 5: Actual and expected PYLL due to CVD, and years of life extended due to decline in CVD death rates, 1968 to 2006

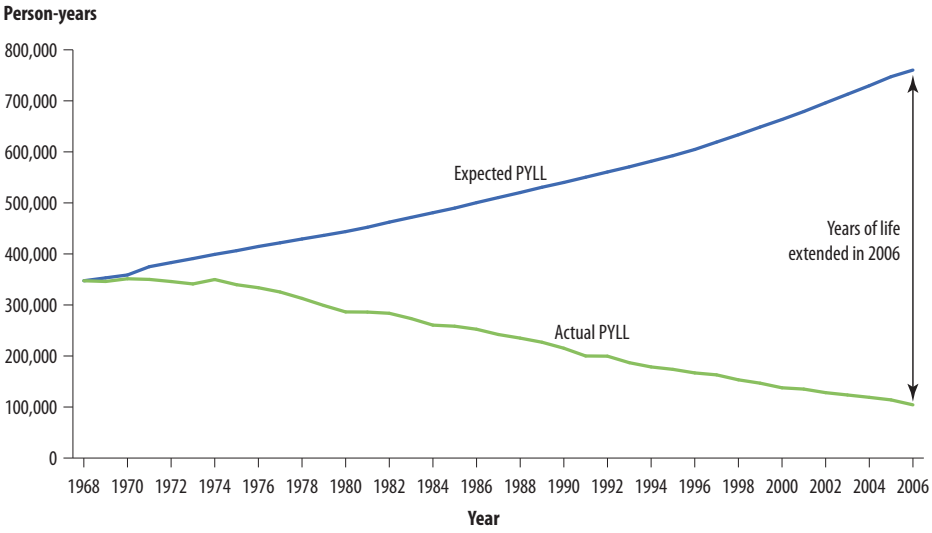
Factoring in the growth and ageing of the Australian population between 1968 and 2006, the effect is even greater.

It is estimated that, if CVD age- and sex-specific death rates had remained at the same level as in 1968, the expected PYLL would have been over 1.2 million person-years in 2006 (Table 3 and Figure 5). This is over 6 times as high as the actual PYLL. Using this measure, the effect of the decline in the CVD death rate from its peak in 1968 is estimated to be the extension of life by over 1 million person-years for the Australian population in 2006.

Coronary heart disease

In 2006, almost two-thirds of the estimated years of life extended as a result of the decline in CVD death rates can be attributed to declines in the rate of death from CHD. Of the estimated one million person-years gained by the Australian population, around 656,000 person-years were attributable to the drop in CHD death rates (Table 3).

The actual PYLL due to CHD in 2006 is estimated to be 104,280 person-years (Table 3 and Figure 6). If the age- and sex-specific death rates from CHD had remained as they were in 1968, the expected PYLL would have been more than 7 times as high, at 760,285 person-years.



Note: Actual and expected PYLL for all years from 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.
Source: AIHW 2008c.

Figure 6: Actual and expected PYLL due to CHD, and years of life extended due to decline in CHD death rates, 1968 to 2006

Who has benefited in extended years of life?

Males or females?

In 2006, for CVD, males accounted for 70% of the actual PYLL, 67% of the expected PYLL and 67% of the estimated years of life extended due the decline in CVD death rates (Table 4).

Table 4: Actual and expected potential years of life lost (PYLL) and estimated years of life extended due to the decline in CVD/CHD death rates, 2006

	CVD			CHD		
	Actual PYLL	Expected PYLL	Years of life extended	Actual PYLL	Expected PYLL	Years of life extended
	Person-years					
Males	133,245	808,827	675,582	81,820	562,046	480,226
Females	58,403	397,586	339,184	22,460	198,239	175,779
Persons	191,648	1,206,413	1,014,766	104,280	760,285	656,005
% male	70	67	67	78	74	73

Note: Actual and expected PYLL for both 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.

Source: AIHW 2008c.

Males account for an even higher proportion of the years of life lost due to CHD (Table 4). In 2006, 78% of the actual PYLL due to CHD were lost by males. In the same year, males accounted for 74% of the expected PYLL and 73% of the total years of life extended.

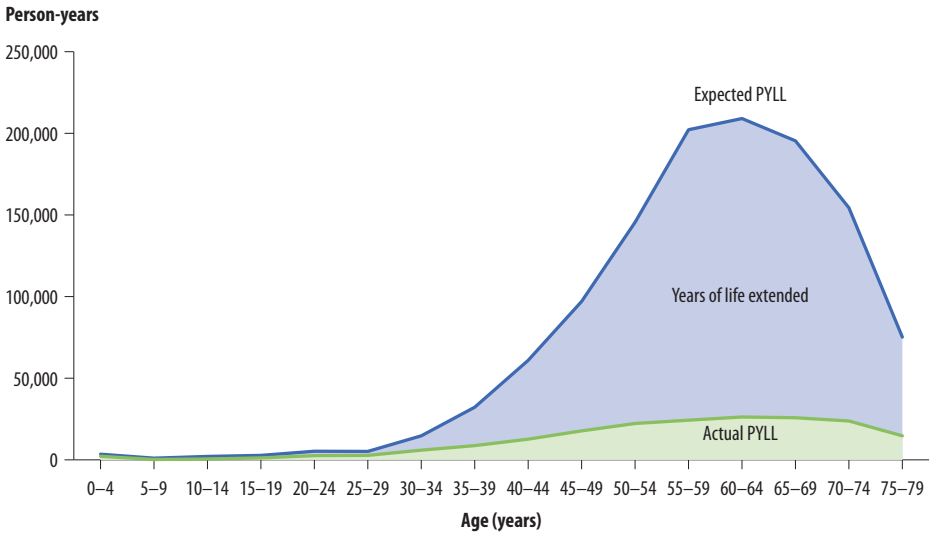
For both CVD and CHD, males had a lower ratio of expected PYLL to actual PYLL than females (that is, the share of actual PYLL for males was higher than their share of expected PYLL). This indicates that, relatively, using the years of life extended measure, females may have benefited to a greater extent than males from the decline in CVD and CHD death rates since 1968. This is in contrast to the measure based on the difference between the number of actual and expected deaths due to CVD and CHD, discussed above, which found that males may have benefited to a slightly greater extent than females.

Age group

In 2006, around 64% of the actual PYLL due to CVD and 70% of the actual PYLL due to CHD were lost by people aged between 50 and 74 years (Table 5, and figures 7 and 8). Consistent with this, most of the extended years of life gained by the Australian population in 2006 due to the decline in CVD and CHD death rates were in this age group.

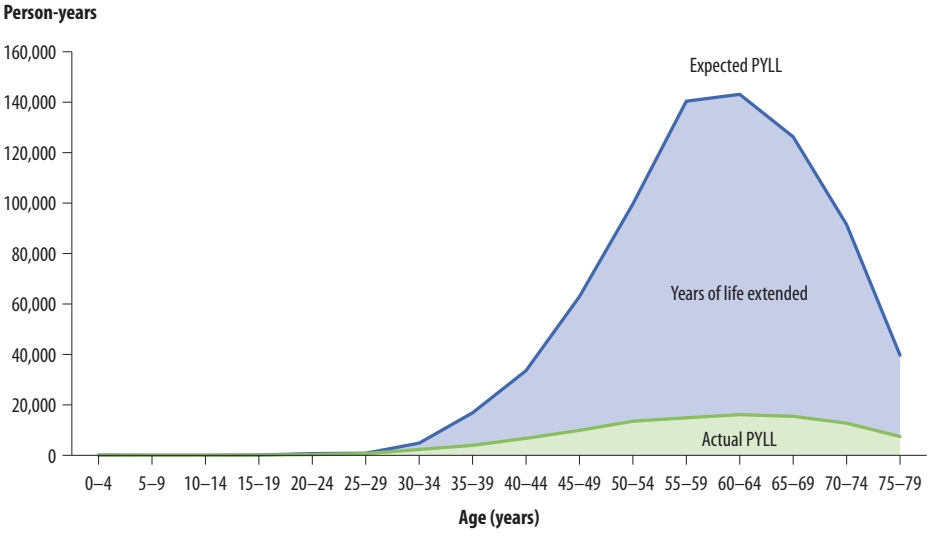
Of the estimated additional one million person-years gained by declines in CVD death rates, over three-quarters were gained by people aged between 50 and 74 years, with over half gained by people aged 55–69 years. For CHD, the concentration of savings was even greater, with 56% of years of life extended gained by people aged 55–69 years and 81% gained by people aged between 50 and 74 years.

In terms of the years of life extended, Australians aged 55–59 years appear to have experienced the greatest relative benefit, with the ratio of expected PYLL to actual PYLL being highest for this age group for both CVD and CHD (Table 5). Without the declines in CVD death rates, the PYLL due to CVD deaths for people in this age group in 2006 would have been 8.3 times as high. For CHD, the PYLL would have been 9.4 times as high as the actual for those aged 55–59 years.



Note: Actual and expected PYLL for all years from 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.
Source: AIHW 2008c.

Figure 7: Years of life extended due to the decline in CVD death rates, by age, 2006



Note: Actual and expected PYLL for all years from 1968 to 2006 are calculated assuming an upper life limit of 80 years of age.
Source: AIHW 2008c.

Figure 8: Years of life extended due to the decline in CHD death rates, by age, 2006

Table 5: Actual and expected potential years of life lost (PYLL) and years of life extended due to the decline in CVD and CHD death rates, by age group, 2006

	Age (years)									
	<25	25–39	40–49	50–54	55–59	60–64	65–69	70–74	75–79	Total
	Person-years									
CVD										
Actual PYLL	6,703	17,380	30,420	22,275	24,300	26,250	25,788	23,813	14,720	191,648
Expected PYLL	14,609	52,119	157,976	145,522	202,198	209,047	195,384	154,389	75,170	1,206,413
Ratio of expected to actual PYLL	2.2	3.0	5.2	6.5	8.3	8.0	7.6	6.5	5.1	6.3
Years of life extended	7,906	34,739	127,556	123,247	177,898	182,797	169,597	130,576	60,450	1,014,766
Years of life extended (%)	0.8	3.4	12.6	12.1	17.5	18.0	16.7	12.9	6.0	100.0
CHD										
Actual PYLL	490	6,963	16,630	13,530	14,873	16,135	15,463	12,743	7,455	104,280
Expected PYLL	678	22,530	96,503	99,644	140,397	143,106	126,264	91,478	39,684	760,285
Ratio of expected to actual PYLL	1.4	3.2	5.8	7.4	9.4	8.9	8.2	7.2	5.3	7.3
Years of life extended	188	15,567	79,873	86,114	125,524	126,971	110,802	78,736	32,229	656,005
Years of life extended (%)	—	2.4	12.2	13.1	19.1	19.4	16.9	12.0	4.9	100.0

Notes
Actual and expected PYLL are calculated assuming an upper life limit of 80 years of age.
Numbers may not add to totals due to rounding.

Source: AIHW 2008c.

Aboriginal and Torres Strait Islander peoples

While it is known that Aboriginal and Torres Strait Islander peoples are more likely to experience ill health and to die at younger ages than other Australians, the exact magnitude of the differences between the Indigenous and non-Indigenous populations is difficult to establish. Incomplete recording of Aboriginal and Torres Strait Islander status in death records and the experimental nature of population estimates prevent the precise measurement of current death rates for Indigenous Australians and the monitoring of mortality trends over time. Currently, only mortality data for Queensland, South Australia, Western Australia and the Northern Territory (where approximately 60% of the Indigenous population reside) are deemed to be of sufficient coverage and quality to provide a reliable, representative picture of Indigenous mortality (AIHW & ABS 2006). As a result, it is not possible to derive the measures of deaths delayed or years of life extended for the Aboriginal and Torres Strait Islander population.

However, comparative death rates are available based on mortality data for the four jurisdictions for the four years, 2002 to 2005. After adjusting for differences in the age

structure of the populations, Aboriginal and Torres Strait Islander peoples were 2.9 times as likely to die from cardiovascular disease as other Australians in the years 2002 to 2005 (AIHW: Penm 2008). The higher CVD death rates in Indigenous Australians were observed in every age group and in both sexes.

It is clear that this is a very important population with respect to CVD. Prevention, detection and treatment work in this area will be enhanced with the availability of higher-quality data.

Conclusions

Since the late 1960s, Australia has had major gains in the fight against CVD and CHD, with marked declines in both the number of deaths and the death rates from these diseases. The gains have been attributed to a combination of research, improvements in prevention and detection and better clinical treatment of patients who have the diseases.

The aim of this paper is to present some estimates of the impact of these gains on the health of the Australian population, using two relatively simple measures. The first measure provides an estimate of the number of additional lives that would have been lost to CVD and CHD in 2006, if age- and sex-specific death rates from these diseases had stayed at their 1968 peak levels. The second provides an estimate for 2006 of the potential years of life gained ('years of life extended') by the Australian population due to declines in the CVD and CHD death rates. While both measures take into account the declining death rates as a result of CVD and CHD, and changes in the Australian population in terms of size, age and sex, no account is taken of other changes. For example, neither measure takes into account the loss of healthy life through disability from CVD or CHD or death from other diseases.

Estimates using both measures indicate that the gains to the Australian population from the efforts to reduce deaths from CVD and CHD have been substantial. It is estimated that, in 2006, the number of deaths due to these diseases would have been 4 times as high, and the potential years of life lost over 6 times as high, if the 1968 age- and sex-specific death rates had prevailed.

In 2006, the Australian population gained an estimated one million person-years due to the decline in the CVD death rate. Almost two-thirds of this gain can be attributed to the fall in the CHD death rate.

It appears that, relatively, Australians aged 55–64 years have experienced the most benefit from the reduction in death rates in terms of lives 'saved' (or deaths delayed), while those aged 55–69 years may have benefited most in terms of years of life extended (assuming an arbitrary life expectancy of 80 years). While the sex differences are small, using the measure of deaths delayed it appears that males may have benefited slightly more than females in 2006. On the other hand, females appear to have benefited more than males using the 'years of life extended' measure.

Despite these major gains, CVD and CHD continue to have a major impact on the health of Australians in terms of prevalence, mortality, morbidity, burden of disease and expenditure. The number of people with one or more of the modifiable risk factors for CVD remains very high. This implies that there may be considerable room for further gains through continued research and advances in prevention, treatment and care.

Appendix: Methodology and data sources

Expected and actual deaths

'Expected deaths' is the number of deaths that would have occurred due to CVD/CHD annually if the age- and sex-specific CVD/CHD death rates had remained as they were in 1968. It is calculated by applying the age-specific (5-year age groups) and sex-specific death rates for 1968 to the population in each year from 1969 to 2006. Death rates and population data were sourced from the General Record of Incidence of Mortality (GRIM) books (AIHW 2008c).

'Actual deaths' is the actual number of deaths attributable to CVD/CHD in each year. The number of deaths is sourced from the GRIM books (AIHW 2008c).

Only those deaths where the underlying cause was CVD or CHD were considered CVD/CHD deaths.

Deaths delayed

'Deaths delayed' or 'lives saved' is calculated as the difference between the expected and actual deaths in a year. A comparison of 'expected' and 'actual' deaths due to CVD/CHD provides an indication of the number of people who potentially would have died from CVD/CHD in each year from 1969 to 2006, if age- and sex-specific death rates from these diseases had remained at their 1968 level.

Deaths delayed = expected deaths – actual deaths

Years of life extended

'Potential years of life lost' (PYLL) is an indicator of premature death. It attempts to measure the number of years of life lost per year due to death as a result of a specific cause. It assumes an arbitrary life expectancy. If an individual dies before that age they have potentially lost years of life. For example, if one assumes that an average expected age of death for a population is 80 years, then if a person dies at 45 they have lost a potential 35 years (that is, their individual PYLL is 35 years). It should be noted that the PYLL only takes account of deaths and not loss of healthy life due to disability.

Years of life extended = expected PYLL – actual PYLL

The 'actual PYLL' due to CVD/CHD for the Australian population was calculated for males and females, for each 5-year age group, annually from 1968 to 2006, using the same methodology as in the GRIM books (AIHW 2008c). PYLL for each 5-year age and sex group, assuming an upper life limit of 80 years (for example), was calculated by:

> Actual deaths due to CVD/CHD in each 5-year age group for males and females x (80 – mean age for that age group)

For example, for males aged 50–54, the PYLL due to CVD in 1968 is estimated to be:

> 1,800 x (80 – 52.5) = 49,500 person-years

The PYLL for each age/sex group were summed to provide an estimate of actual PYLL for the population in each year.

The 'expected PYLL' due to CVD/CHD for the Australian population was calculated in the same way for each year from 1969 to 2006, using expected deaths rather than actual deaths. Expected and actual deaths were derived as outlined above.

Data sources

The estimates provided in this bulletin are based on mortality data compiled by the AIHW in the GRIM books (AIHW 2008c). The GRIM books are interactive Excel workbooks that provide compilations of long-term mortality data on selected causes of death by age and sex for each year from the beginning of the 20th century. They are updated annually. From 1963, deaths information has been sourced electronically from the Registries of Births, Deaths and Marriages via the Australian Bureau of Statistics.

The deaths have been coded to reflect the underlying cause of death—that is 'the disease or injury which initiated the train of events leading directly to death or the circumstances of the accident or violence which produced the fatal injury'.

Deaths information has been assembled based on the year of registration and not the year of death. While for the most part, year of death and its registration coincide, deaths at the end of each calendar year may be held over until the following year, as will deaths in which the cause requires further examination by a coroner. In recent years, less than 5% of deaths were held over from one year to the next for processing.

The GRIM book on CVD is available at <http://www.aihw.gov.au/mortality/data/grim_books_national.cfm>.

The GRIM books also include population data for Australia. The population data used for the period 1900–70 have been interpolated (using a linear method) between the census population estimates of 1901, 1911, 1921, 1933, 1947, 1954, 1961 and 1966. Since 1971, annual mid-year estimated resident populations have been used.

The age-standardised death rates (ASRs) presented in this bulletin are also sourced from the GRIM books. They are based on the direct method of standardisation, using the 2001 Standard Australian Population.

ICD codes

The underlying cause of death in the mortality data has been coded according to rules set forward in various versions of the International Classification of Diseases (ICD), published by the World Health Organization (WHO). The relevant codes are shown in Table A1.

Table A1: ICD codes for cardiovascular disease (CVD) and coronary heart disease (CHD)

Version	Period	Codes for CVD	Codes for CHD
ICD-8	1968–1978	390–458,782	410–414
ICD-9	1979–1996	390–459	410–414
ICD-10	1997–	I00–I99	I20–25

In processing deaths registered from 1 January 1997, Australia adopted the use of the automated coding system (ACS) and introduced ICD-10 codes. As a result, there is a break in the underlying causes of death series between 1996 and 1997. Comparability factors close to 1.0 indicate there were no significant coding differences between automated ICD-10 and manual ICD-9 coding. As the comparability factor for CVD was 1.00 and for CHD 1.01, no adjustment was made to death rates.

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