Australian Government
Australian Institute of Health and Welfare

Australian Burden of Disease Study 2024

Web report | Last updated: **12 Dec 2024** | Topic: Burden of disease

About

Every year in Australia, millions of years of healthy life are lost because of injury, illness or premature deaths. This loss of healthy life is called the 'burden of disease'. Information on burden of disease and injuries is important for monitoring population health and provides an evidence base to inform health policy and service planning.

The Australian Burden of Disease Study 2024 includes national estimates for 220 diseases and injuries in 2024 based on projections using historical trends in data. It also includes estimates of the disease burden attributed to 20 individual risk factors in 2024.

Cat. no: BOD 40

- Summary
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Findings from this report:

- 36% of burden in Australia in 2024 could have been avoided or reduced, due to modifiable risk factors in the study
- The rate of total disease burden decreased by 10% between 2003 and 2024 after adjusting for age
- Overweight (including obesity) and tobacco use were the leading risk factors contributing to burden in 2024
- Coronary heart disease, dementia, back pain, anxiety disorders and COPD were the top 5 diseases causing burden in 2024

Summary

Burden of disease is an Australia's health topic

- Measures of health and health care for Australia and similar countries | 02 Jul 2024
- Health and wellbeing of First Nations people | 02 Jul 2024
- Life expectancy and causes of death | 06 Jun 2024

On this page:

Burden of disease measures the impact of diseases and injuries on a population. It combines the years of healthy life lost due to living with ill health (non-fatal burden) with the years of life lost due to dying prematurely (fatal burden). A portion of this burden is preventable, being due to modifiable risk factors. The Australian Burden of Disease Study (ABDS) 2024 includes estimates of disease burden due to 220 diseases and injuries in Australia in 2024, as well as the disease burden attributed to 20 individual risk factors.

This report presents findings from the ABDS 2024, with estimates for previous years (2003, 2011, 2015, 2018) for comparison.

About the ABDS 2024

In the ABDS 2024, disease burden estimates are projected to the publication year (2024). Projected estimates were done for the first time in ABDS 2022, and have been updated annually since. Burden estimates may be revised in the future as more data becomes available.

ABDS 2024 also includes updated estimates of attributable burden due to selected modifiable risk factors, which were last updated as part of ABDS 2018.

The latest progress against the burden of disease targets in the National Preventive Health Strategy 2021–2030 - external site opens in new window is also included.

For more information on methods used in the Study, refer to the Technical notes.

What is burden of disease?

Burden of disease analysis is a way of measuring the impact of diseases and injuries on a population (in this report, the population of Australia). It is the difference between a population's actual health and its ideal health, where ideal health is living to old age in good health (without disease or disability).

The disease burden due to risk factors is known as attributable burden. It is the amount by which disease burden would be reduced if exposure to the risk factor had been avoided or reduced to the lowest possible exposure.

Burden of disease is measured using the summary metric of disability-adjusted life years (DALY, also known as the total burden). One DALY is one year of healthy life lost to disease and injury. DALY caused by living in poor health (non-fatal burden) are the 'years lived with disability' (YLD). DALY caused by premature death (fatal burden) are the 'years of life lost' (YLL) and are measured against an ideal

life expectancy. DALY allows the impact of premature deaths and living with health impacts from disease or injury to be compared and reported in a consistent manner.

If a disease has a high number of DALY, it is considered to have a high burden on the population. Some diseases have high fatal burden due to the number of premature deaths they cause (for example, cancers) or they cause death at younger ages (for example, SIDS). Others have high non-fatal burden due to the number of people living with the condition and/or the severity of the illness (for example, musculoskeletal conditions). The underlying cause of death is used in this report to calculate fatal burden (consistent with most national mortality statistics). This may underestimate the health impact of some diseases which are commonly reported as associated causes of death such as diabetes and chronic kidney disease.

Burden estimates can be reported for diseases or injuries, which describe a specific health problem (for example, dementia). Reporting can also be for a disease group (for example, neurological conditions), which consists of a number of related diseases. There are 220 separate diseases and injuries, and 17 disease groups in the ABDS. Additionally, there are 40 risk factor components or exposures (for example, cannabis use) that combine into 20 individual risk factors (for example, illicit drug use). The risk factors are categorised into 4 groups: behavioural, dietary, metabolic/biomedical and environmental.

Living with illness or injury accounts for just over half of the overall disease burden

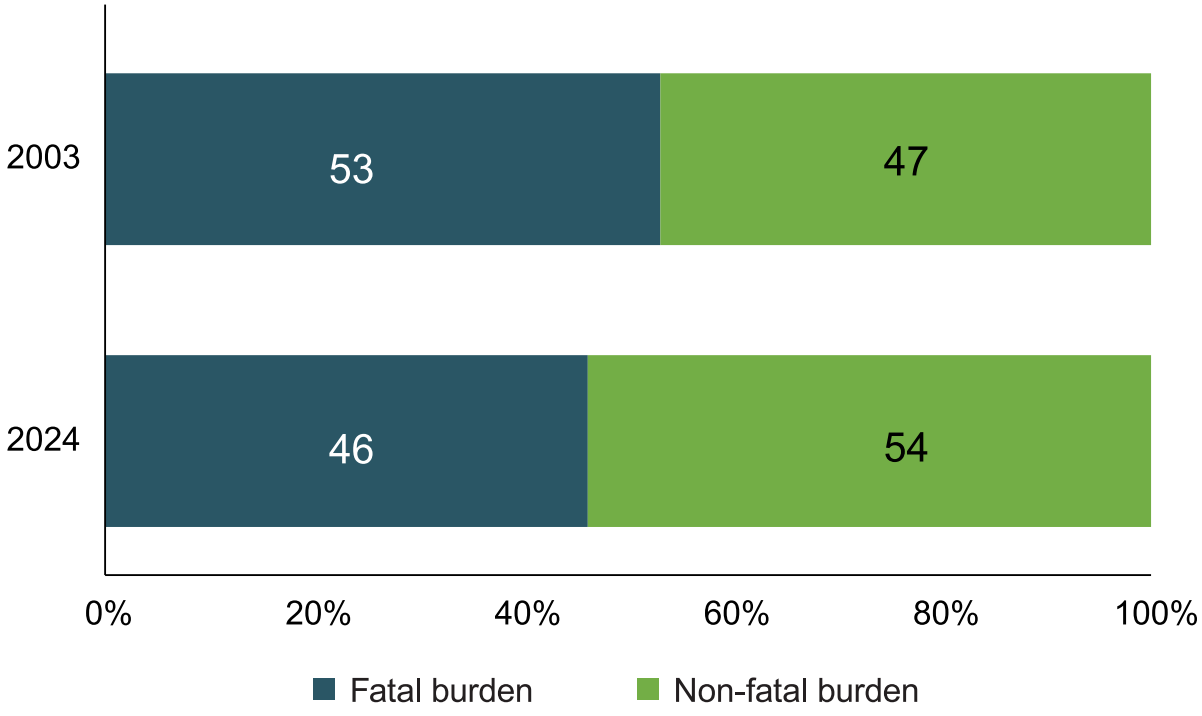
In 2024, Australians lost 5.8 million years of healthy life (total burden, DALY), or 0.2 DALY per person, due to:

Living with illness or injury (non-fatal): 54% of total burden

Dying prematurely (fatal): 46% of total burden

Living with illness or injury caused more disease burden than dying prematurely. Between 2003 and 2024, there has been a moderate shift from fatal burden to non-fatal burden being the biggest contributor to total burden (Figure 1.1). This is mostly driven by fewer premature deaths in recent years.

Figure 1.1: Proportion (%) of total burden due to fatal and non-fatal burden in 2003 and 2024



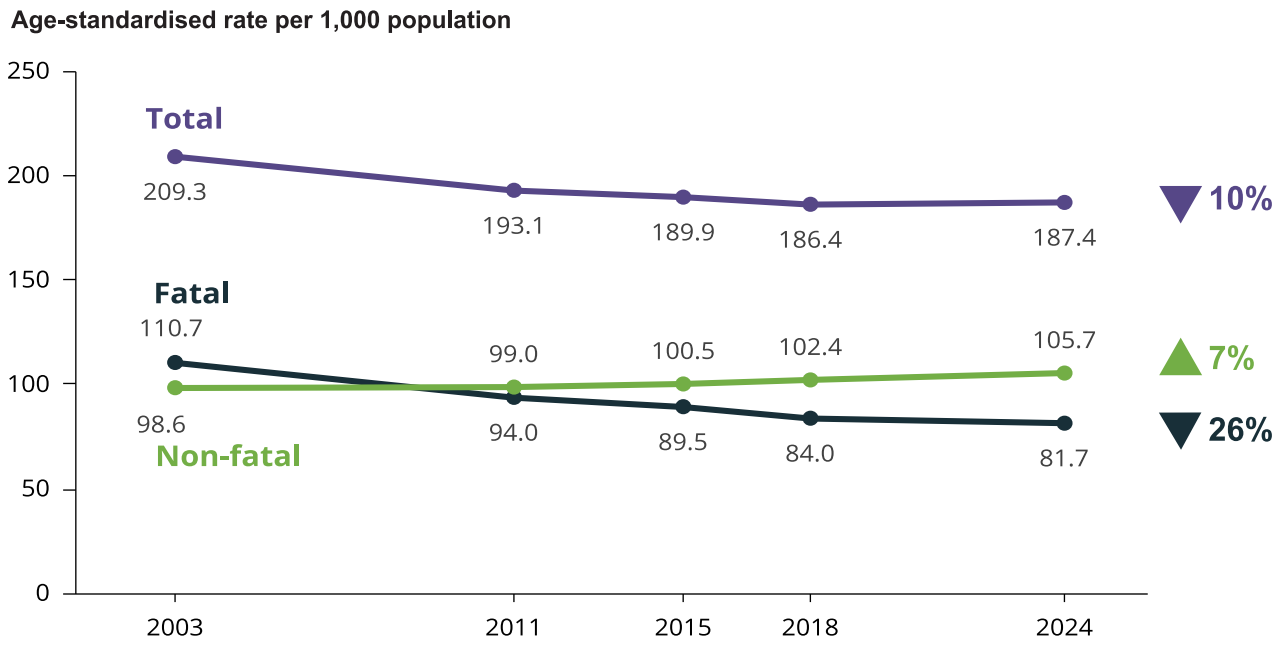
Source: AIHW Australian Burden of Disease Database, Data tables.

To further explore the contribution of fatal and non-fatal burden over time, see the interactive data visualisations: Burden of disease in Australia and Fatal vs. non-fatal burden.

Long-term improvements in fatal burden but recent increases in non-fatal burden

Between 2003 and 2024 there was a 39% increase in the total number of DALY (from 4.2 million to 5.8 million) which was mainly due to increases in population size. After adjusting for population ageing, there was a 10% decline in the rate of total burden between 2003 and 2024 (Figure 1.2). This was driven by a 26% decrease in the rate of fatal burden, as the non-fatal burden rate increased by 7%. Note that when compared with 2018, rates for 2024 were higher for non-fatal, lower for fatal burden and similar for total burden after adjusting for age.

Figure 1.2: Change in the age-standardised total burden (DALY), fatal burden (YLL) and non-fatal burden (YLD) rate (per 1,000 population) between 2003 and 2024



Source: AIHW Australian Burden of Disease Database, Data tables.

Chronic diseases cause the majority of health burden

In 2024, the 5 disease groups causing the most burden were cancer, mental health conditions & substance use disorders, musculoskeletal conditions, cardiovascular diseases and neurological conditions (Table 1.1).

Together these disease groups accounted for around two-thirds (64%) of the total burden. These disease groups include mostly chronic, or long-lasting, conditions.

Table 1.1: Summary of 5 leading disease groups causing burden in 2024

	Cancer	Mental health & substance use	Musculoskeletal	Cardiovascular	Neurological
% of total DALY	16.4	14.8	12.7	11.8	8.4
% of DALY that was fatal	91.3	1.8	2.9	75.0	49.8
Change between 2003 and 2024[(a)]	↓	↑	↓	↓	↑

(a) Based on the rate difference; that is, the absolute difference between the age-standardised rate of burden from 2003 to 2024.

Source: AIHW Australian Burden of Disease Database, Data tables.

To explore the contribution of fatal and non-fatal burden to total burden by disease group or by specific disease or injury, see the Fatal vs non-fatal burden interactive data visualisation.

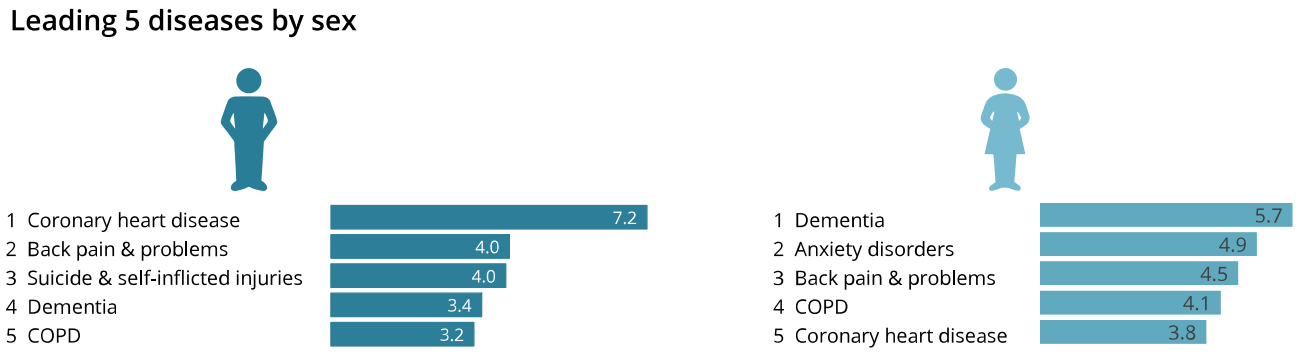
Males and females experience disease burden differently

Overall and for most age groups, males experienced more total disease burden than females. This was driven by males having higher rates of fatal burden.

In 2024, the leading specific causes of total burden among males were coronary heart disease, back pain & problems and suicide & self-inflicted injuries (Figure 1.3). Among females, the leading cause was dementia, followed by anxiety disorders and back pain & problems.

Males experienced 3 times the amount of burden due to suicide & self-inflicted injuries and 2 times the amount of burden from coronary heart disease than females. Females experienced more burden than males from dementia and anxiety disorders.

Figure 1.3: Leading causes of total burden and proportion (%) of total burden by sex, 2024



COPD = chronic obstructive pulmonary disease.

Source: AIHW Australian Burden of Disease Database, Data tables.

Changes in leading specific causes of burden over time

Between 2003 and 2024, the rate of total burden, after adjusting for age:

- decreased for coronary heart disease, stroke, rheumatoid arthritis, lung cancer and COPD.
- substantially increased for dementia, and its rank increased from the 12th leading cause of total burden in 2003 to the 5th leading cause in 2024. However, this increase is partly due to changes in practices of coding deaths due to dementia (see the Comparisons over time interactive data visualisation or refer to the Technical notes).
- increased for anxiety disorders, osteoarthritis, depressive disorders, suicide & self-inflicted injuries, back pain & problems and asthma.

Diseases that caused the most burden over the life course

Australians experience health loss from different diseases and injuries at various stages of life. Respiratory diseases caused burden throughout the life course, especially in children and older people. Mental health conditions & substance use disorders dominated the first half of the life course (ages 5–44), while musculoskeletal conditions, cardiovascular diseases and cancer feature more prominently in the latter part of the life course (ages 45 and over). Neurological conditions (namely dementia) are a leading cause of burden in older Australians (aged 65 and over).

For more information, see the interactive data visualisation: Leading causes of disease burden.

Australians living longer but no change in the proportion of life spent in full health

Australians are, on average, living longer and spending more years in full health (meaning no disease or injury). Years lived in full health is also referred to as health-adjusted life expectancy (HALE).

Males and females born in 2024 could expect to live an average of 88% and 86% of their lives in full health respectively (71.7 years of the 81.6 years of average life expectancy for males and 73.8 years of the 85.5 years of average life expectancy for females).

However, years lived in ill health are also increasing, resulting in no change in the proportion of life spent in full health between 2003 and 2024.

For further information about life expectancy, see: Life expectancy.

National Preventive Health Strategy 2021–2030: burden of disease targets

The National Preventive Health Strategy 2021–2030 (the 'Strategy') outlines the long-term approach to prevention in Australia. The Strategy aims to address the wider determinants of health, promote health equity and decrease the overall burden of disease through a whole-of-systems approach to prevention (Department of Health 2021).

There are 6 burden of disease specific targets in the Strategy. Data from the Australian Burden of Disease Study 2024 can be used to monitor 3 of these 6 targets which fall under the Strategy's aims of "all Australians have the best start in life", and "all Australians live in good health and wellbeing for as long as possible". An assessment of data reported for these 3 targets suggests there has been no change between 2018 (baseline year) and 2024 in the:

- proportion of the first 0–4 years lived in full health (around 92%)
- proportion of the first 25 years lived in full health (ranging between 91 and 92%)
- average number of years lived in full health (71 to 72 years for males and 74 years for females).

It should be noted that estimates for 2024 are projections so progress against the targets may change as 2024 data becomes available. COVID-19's impacts on burden and the health of the Australian population may also affect progress against these targets. More data points and further monitoring is required to determine if the targets set out in the Strategy can be achieved by 2030. For further information and data on the Strategy's aims, targets and assessment of progress, including baseline data, see: National Preventive Health Strategy Monitoring Dashboard.

A large proportion of burden could be prevented

Over one-third (36%) of the total burden of disease in Australia in 2024 could have been prevented by reducing exposure to all the modifiable risk factors included in the Australian Burden of Disease Study 2024. This estimate has taken into account the complex pathways and interactions between diseases and risk factors.

Overweight (including obesity) has overtaken tobacco use as the leading risk factor

Overweight (including obesity) was the leading risk factor contributing to total disease burden in 2024 (8.3%). Prior to 2024, tobacco use had been the leading risk factor; there has been a substantial fall (41%) in the total burden attributable to tobacco use between 2003 and 2024, after adjusting for age.

The leading risk factors following overweight (including obesity) in 2024 were tobacco use (7.6%, excluding nicotine vaping), all dietary risks (4.8%), high blood pressure (4.4%) and high blood plasma glucose (4.2%) (Table 1.2). Tobacco use contributed the greatest amount of fatal burden and deaths in Australia while overweight (including obesity) contributed the most non-fatal burden in both males and females.

Table 1.2: Proportion (%) of total burden (DALY), fatal burden (YLL) and non-fatal burden (YLD) attributable to the leading risk factors, 2024

Rank	Risk factor	% DALY	Risk factor	% YLL	Risk factor	% YLD
1	Overweight (including obesity)	8.3	Tobacco use[(a)]	11.7	Overweight (including obesity)	7.1
2	Tobacco use[(a)]	7.6	Overweight (including obesity)	9.6	Tobacco use[(a)]	4.1
3	Dietary risks	4.8	Dietary risks	7.9	High blood plasma glucose	3.6
4	High blood pressure	4.4	High blood pressure	7.2	Child abuse & neglect	3.1

5	High blood plasma glucose	4.2	Alcohol use	5.4	Alcohol use	3.0
	All risk factors (joint effect)[(b)]	**35.8**	**All risk factor (joint effect)[(b)]**	**45.9**	**All risk factors (joint effect) [(b)]**	**27.2**

(a) Excludes nicotine vaping.

(b) Includes all 20 risk factors.

Source: AIHW Australian Burden of Disease Database, Data tables.

The total burden attributable to the risk factors (the joint effect) included in this study was higher in males (38%) compared with females (33%). Risk factors with higher attributable burden in males compared with females included alcohol use, occupational exposures and hazards, illicit drug use and high cholesterol. Risk factors with higher attributable burden in females compared with males included iron deficiency, unsafe sex, bullying victimisation and intimate partner violence (only estimated in females).

To further explore leading risk factors, see the Burden attributable to risk factors interactive data visualisation.

After taking into account population growth and ageing, the rate of attributable burden due to overweight (including obesity) between 2003 and 2024 was similar. There was a large (41%) decline in the rate of attributable burden due to tobacco use over this period after adjusting for age.

There were also declines in the attributable DALY rate for some other risk factors including high blood pressure and high cholesterol (57% and 61% respectively between 2003 and 2024). The burden attributable to illicit drug use increased over this period (42% increase after adjusting for age).

To further explore changes in leading risk factors over time, see the Changes in risk factors over time interactive data visualisation.

Diseases and associated risk factors

Attributable burden reflects the direct link between a risk factor (for example, tobacco use) and a disease or injury outcome, referred to here as a linked disease (for example, lung cancer). Some risk factors had linked diseases across a large number of disease groups. Tobacco use, for example, contributed to the burden for 9 disease groups, including 36% of respiratory diseases, 15% of cancer, 5.1% of cardiovascular diseases, 2.6% of infectious diseases and 1.8% of endocrine disorders. All the risk factors combined (the joint effect) contributed substantially to the burden for endocrine disorders (96%), kidney & urinary diseases (73%), cardiovascular diseases (65%) and respiratory diseases (52%).

To further explore total burden for specific diseases attributable to risk factors, see the Diseases and associated risk factors interactive data visualisation.

Where do I go for more information?

For more information on the burden of disease in Australia, see:

- ABDS 2024 Supplementary data tables
- ABDS 2018 State and territory estimates, Remoteness areas, Socioeconomic groups interactive data visualisations
- ABDS 2018 Interactive data on risk factor burden
- Australian Burden of Disease Study: Impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018
- ABDS 2018: Interactive data on disease burden among Aboriginal and Torres Strait Islander people
- ABDS 2018: Interactive data on risk factor burden among Aboriginal and Torres Strait Islander people
- Australian Burden of Disease Study: Methods and supplementary material 2018

For more on this topic, see Burden of disease.

References

Department of Health (2021) *National Preventive Health Strategy 2021–2030* - external site opens in new window, Department of Health, Australian Government, accessed 11 September 2024.

Key findings

On this page:

Burden of disease measures the impact of diseases and injuries on a population. It combines the years of healthy life lost due to living with ill health (non-fatal burden) with the years of life lost due to dying prematurely (fatal burden). A portion of this burden is preventable, being due to modifiable risk factors. The Australian Burden of Disease Study (ABDS) 2024 includes estimates of disease burden due to 220 diseases and injuries in Australia in 2024, as well as the disease burden attributed to 20 individual risk factors.

This report presents findings from the ABDS 2024, with estimates for previous years (2003, 2011, 2015, 2018) for comparison. To explore burden of disease estimates in more detail see the Interactive data on disease burden and risk factor burden and the downloadable Data tables.

For the latest subnational burden of disease estimates, see the ABDS 2018 interactive data visualisations by State and territory, Remoteness areas and Socioeconomic groups. For the latest burden of disease estimates for the First Nations population, refer to the *Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018* report.

About the ABDS 2024

In the ABDS 2024, disease burden estimates are projected to the publication year (2024). Projected estimates were done for the first time in ABDS 2022, and have been updated annually since. Burden estimates may be revised in the future as more data becomes available.

ABDS 2024 also includes updated estimates of attributable burden due to selected risk factors, which were last updated as part of ABDS 2018.

The latest progress against the burden of disease targets in the National Preventive Health Strategy 2021–2030 is also included.

For more information on methods used in the Study, refer to the Technical notes.

What is burden of disease?

Burden of disease analysis is a way of measuring the impact of diseases and injuries on a population (in this report, the population of Australia). It is the difference between a population's actual health and its ideal health, where ideal health is living to old age in good health, without disease or disability.

Burden of disease is measured using the summary metric of disability-adjusted life years (DALY, also known as the total burden). One DALY is one year of healthy life lost to disease and injury. DALY caused by living in poor health (non-fatal burden) are the 'years lived with disability' (YLD). DALY caused by premature death (fatal burden) are the 'years of life lost' (YLL) and are measured against an ideal life expectancy. DALY allows the impact of premature deaths and living with health impacts from disease or injury to be compared and reported in a consistent manner.

If a disease has a high number of DALY, it is considered to have a high burden on the population. Some diseases have high fatal burden due to the number of premature deaths they cause (for example, cancers) or they cause death at younger ages (for example, SIDS). Others have high non-fatal burden due to the number of people living with the condition and/or the severity of the illness (for example, musculoskeletal conditions). The underlying cause of death is used in this report to calculate fatal burden (consistent with most national mortality statistics). This may underestimate the health impact of some diseases which are commonly reported as associated causes of death such as diabetes and chronic kidney disease.

Burden estimates can be reported for diseases or injuries, which describe a specific health problem (for example, dementia). Reporting can also be for a disease group (for example, neurological conditions), which consists of a number of related diseases. There are 220 separate diseases and injuries, and 17 disease groups, in the ABDS.

Which risk factors are included?

Risk factors are attributes, characteristics or exposures that increase the likelihood of a health disorder or other unwanted condition or event.

There are 40 risk factor components or exposures included in this report (such as cannabis and cocaine use) that combine into 20 individual risk factors (such as illicit drug use). The risk factors are categorised as behavioural, dietary, environmental and metabolic/biomedical risks. While this list is extensive, it does not cover all potential risk factors. The risk factors included needed to meet the following criteria:

- have strong evidence of causal association
- are modifiable
- can be measured in the Australian population
- are linked to diseases that occur in Australia, and are measured in the ABDS.

The same list of selected risk factors was used in 2024 as in the 2018 study. Further information on risk factor methods can be found in the Technical notes.

Gaps in the current risk factor list include more distal environmental factors such as climate change-related exposures and hazards, the built environment (including access to transport, open spaces, housing and level of walkability) and natural environment; access to health services and the social determinants of health (such as income, employment, education and housing). Evidence on the importance of these risk factors and their influence on health outcomes is growing (for example *Social determinants of health*). There is increasing work underway to measure the burden of disease attributable to climate change internationally and a number of climate-sensitive conditions (such as coronary heart disease and chronic respiratory diseases) are already captured in the ABDS. Assessing the evidence and developing methods suitable for Australia to include some of these risk factors in ABDS 2024 was outside the scope of this study. However, as part of the next major update of the ABDS (2026), a number of new risk factors will be assessed for inclusion, drawing on the latest evidence.

What is attributable burden?

Attributable burden is the amount of burden (morbidity and mortality) that could be reduced if exposure to the risk factor had been avoided. It uses evidence in the literature or direct evidence from Australian data sources on the links between a risk factor (for example, tobacco use) and a disease or injury outcome (for example, lung cancer), and the amount of increased risk of morbidity or mortality due to exposure to the risk factor. For most risk factors in this study, exposure to the risk factor was estimated using high-quality survey data. For information about the quality of data inputs, see *Australian Burden of Disease Study: Methods and supplementary material 2018*.

Issues with adding risk factor estimates together

For the majority of the analysis in this report, the risk factors are analysed independently. It is important to note that it is not possible to add or combine the separate estimates for different risk factors without further analysis, due to complex pathways and interactions between them. For example, if the burden of coronary heart disease attributable to physical inactivity and to high blood plasma glucose were added, the amount of coronary heart disease burden attributable would be an overestimate. This is because these risk factors can be found along the same causal pathway—for example, where low physical activity increases the risk of having high blood plasma glucose levels, which, in turn, increases the risk of coronary heart disease.

Further analysis is needed to combine risk factors. In this report, an analysis has been undertaken to estimate the attributable burden for 'all risk factors combined' (referred to as the 'joint effect' of all risk factors in this report) which adjusts estimates using mediation factors to account for risk factors on the same causal pathway and prevents the attributable burden due to multiple risk factors from exceeding the total burden for a given disease. Further detail on the methods used for this combined risk factor analysis is described in *Australian Burden of Disease Study: methods and supplementary material 2018*. Analysis has not been undertaken to adjust estimates in the same way (using the joint effect and mediation factors) for individual risk factors in this study. This will be explored further in the next major update of the ABDS.

Living with illness or injury accounts for just over half of the overall disease burden

In 2024, Australians lost 5.8 million years of healthy life (total burden, DALY), or 0.2 DALY per person, due to:

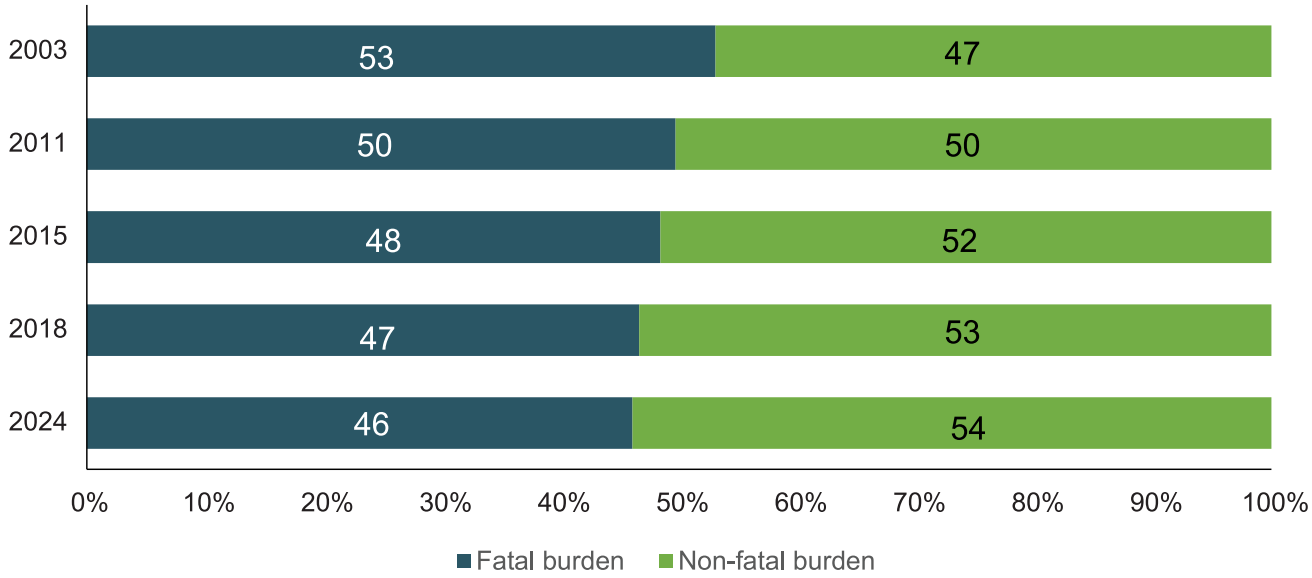
Living with illness or injury (non-fatal): 54% of total burden

Dying prematurely (fatal): 46% of total burden

Living with illness or injury (non-fatal burden, YLD) caused more disease burden than dying prematurely (fatal burden, YLL). Between 2003 and 2024, there has been a moderate shift from fatal burden to non-fatal burden being the biggest contributor to total burden (Figure 2.1). This is mostly driven by fewer premature deaths in recent years. The proportion of total burden that is due to fatal burden has decreased at a slower rate between 2018 and 2024 than between 2003 and 2018.

To further explore the contribution of fatal and non-fatal burden over time, see the interactive data visualisations: Burden of disease in Australia and Fatal vs. non-fatal burden.

Figure 2.1: Proportion (%) of total burden due to fatal and non-fatal burden between 2003 and 2024



Source: AIHW Australian Burden of Disease Database, Data tables.

Long-term improvements in fatal burden but recent increases in non-fatal burden

Between 2003 and 2024 there was a 39% increase in the total number of DALY (from 4.2 million to 5.8 million) which was mainly due to increases in population size. Over the same period, the crude rate of total disease burden was relatively similar (212 DALY per 1,000 population in 2003 compared with 216 DALY per 1,000 population in 2024). Underlying this was a 12% decrease in the rate of fatal burden while the rate of non-fatal burden increased by 17% over that period.

After adjusting for population ageing, there was an 10% decline in the rate of total burden between 2003 and 2024 (Figure 2.2). This was driven by a 26% decrease in the rate of fatal burden, as the non-fatal burden rate increased by 7%. Note that when compared with 2018, rates for 2024 were higher for non-fatal burden, lower for fatal burden and similar for total burden after adjusting for age (Figure 2.2).

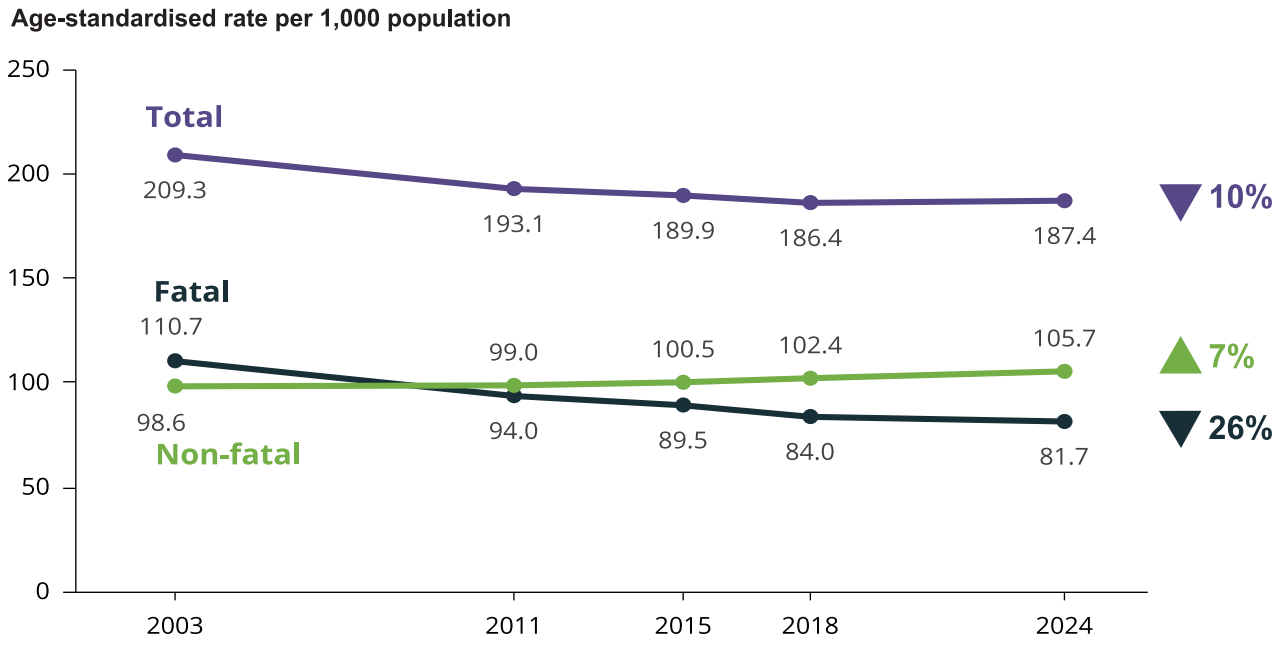
Some of this difference may be attributed to the COVID-19 pandemic which had both direct health effects (from the virus itself) and indirect health effects (from COVID-19 acting as a risk factor for other diseases and the public health measures and restrictions put in place) (AIHW 2022). Therefore, simply subtracting the estimated disease burden due to COVID-19 from the total burden does not necessarily reflect the true disease burden experienced had the COVID-19 pandemic not occurred. This is an area requiring further analysis and exploration.

Interpreting crude and age-standardised rates

Crude rates show the actual rate of disease burden in each year, whereas age-standardised rates show the rate of burden if the population age structure did not change over time. Given that Australia's population is ageing, and the incidence of most chronic diseases increases with age, considering both crude and age-standardised rates is important to determine whether or not changes in disease burden are largely a result of an ageing population.

To further explore changes over time, see the interactive data visualisation: Comparisons over time.

Figure 2.2: Change in the age-standardised total burden (DALY), fatal burden (YLL) and non-fatal burden (YLD) rate (per 1,000 population) between 2003 and 2024



Source: AIHW Australian Burden of Disease Database, Data tables.

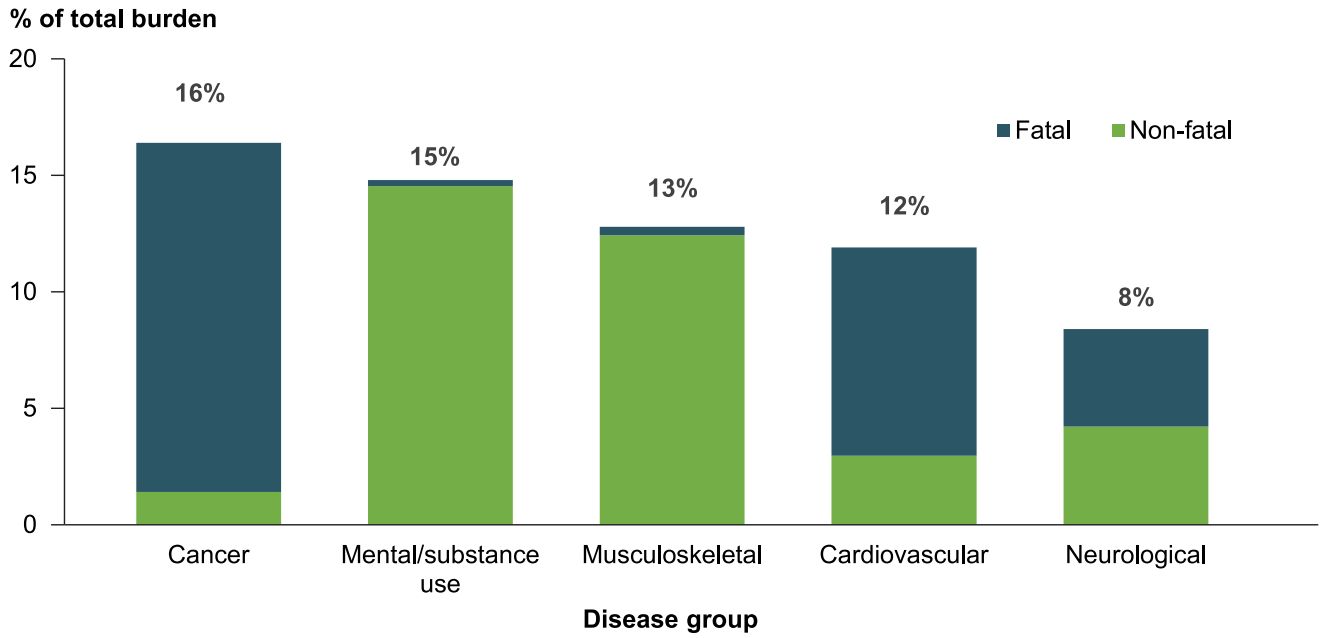
Chronic diseases cause the majority of health burden

In 2024, the 5 disease groups causing the most burden were cancer, mental health conditions & substance use disorders, musculoskeletal conditions, cardiovascular diseases and neurological conditions (Figure 2.3).

Together these disease groups accounted for around two-thirds (64%) of the total disease burden. These disease groups include mostly chronic, or long-lasting, conditions.

The contribution of fatal and non-fatal burden to the total burden varies by disease and injury. To explore the contribution of fatal and non-fatal burden to total burden by disease group or by specific disease or injury, see the interactive data visualisation: Fatal vs non-fatal burden.

Figure 2.3: Proportion (%) of total burden, and fatal and non-fatal composition of total burden, for the leading 5 disease groups in 2024



Source: AIHW Australian Burden of Disease Database, Data tables.

Coronary heart disease is the leading specific cause of burden

When considering individual diseases, coronary heart disease was the leading cause of burden for every reference year in the Study. However, the burden from coronary heart disease showed the largest absolute reduction over time and was mainly driven by large declines in fatal burden.

The leading 5 diseases that caused burden (% of total DALY) in 2024:

1. Coronary heart disease (5.5%)
2. Dementia (4.5%)
3. Back pain & problems (4.3%)
4. Anxiety disorders (3.9%)
5. Chronic obstructive pulmonary disease (COPD) (3.7%)

To explore burden for individual diseases and changes in disease burden over time, see the interactive data visualisation: Disease/injury-specific summary.

COVID-19 burden in 2024

An estimated 0.8% of total disease burden in 2024 was due to the direct effects of COVID-19. It ranked 36th among the specific diseases in 2024. The burden from COVID-19 was predominantly fatal (83%) and was higher in males. The burden was highest in those aged 80–89 years. The burden due to COVID-19 in 2024 was lower than that reported in 2023 (AIHW 2023) although estimates are not strictly comparable due to differences in methods and data quality.

COVID-19 was the 19th leading cause of fatal burden (contributing 1.4%) and 51st leading cause of non-fatal burden (contributing 0.2%) in 2024.

For information on how disease burden due to COVID-19 was estimated, refer to the Technical notes.

Males and females experience disease burden differently

Overall, and for most age groups, males experienced more total burden than females. This was driven by males having higher rates of fatal burden.

In 2024, after adjusting for different age structures, males experienced 1.2 times the rate of total burden and 1.6 times the rate of fatal burden of females, while females experienced 1.1 times the rate of non-fatal burden of males.

Mental health conditions & substance use disorders was the leading disease group causing burden for females (15%), while Cancer was the leading disease group causing burden for males (18%).

In 2024, the leading specific causes of total burden among males were coronary heart disease (7.2%), back pain & problems (4.0%) and suicide & self-inflicted injuries (4.0%). Among females, the leading specific cause was dementia (5.7%), followed by anxiety disorders (4.9%) and back pain & problems (4.5%). These rankings were the same as reported for 2023.

Males experienced 3 times the amount of burden due to suicide & self-inflicted injuries and 2 times the amount of burden from coronary heart disease than females. Females experienced more burden than males from dementia, anxiety disorders and osteoarthritis.

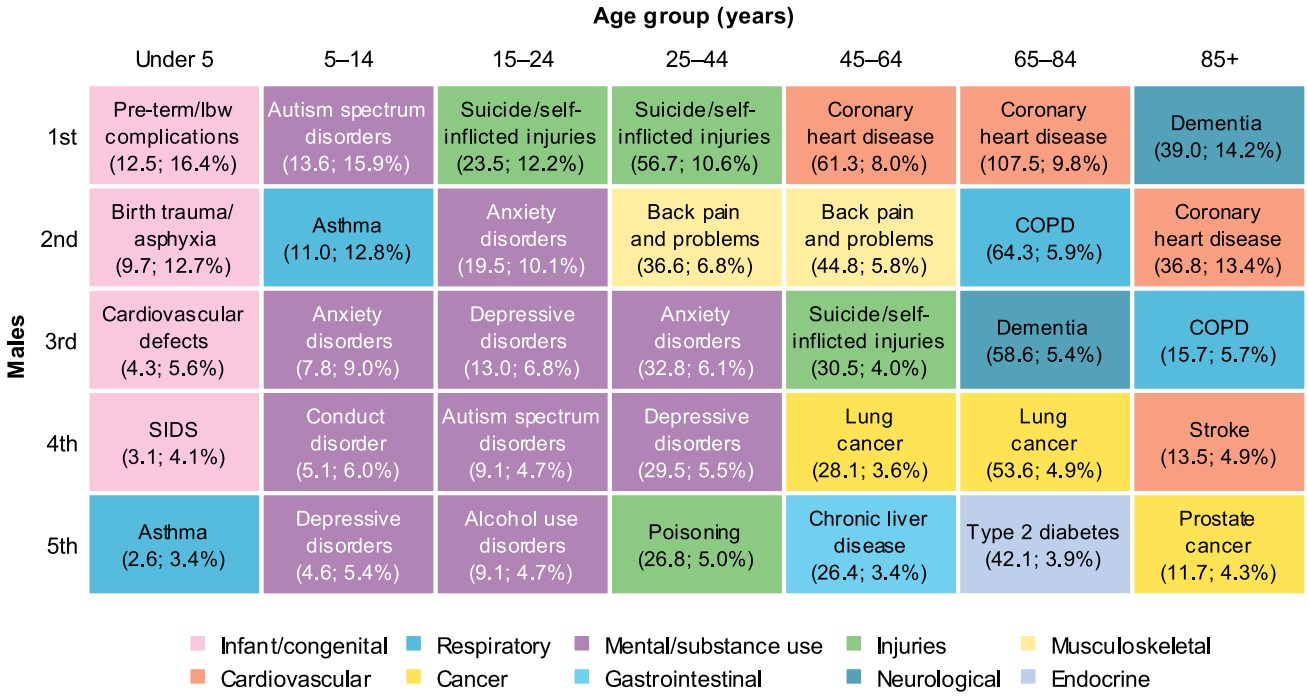
Diseases that caused the most burden over the life course

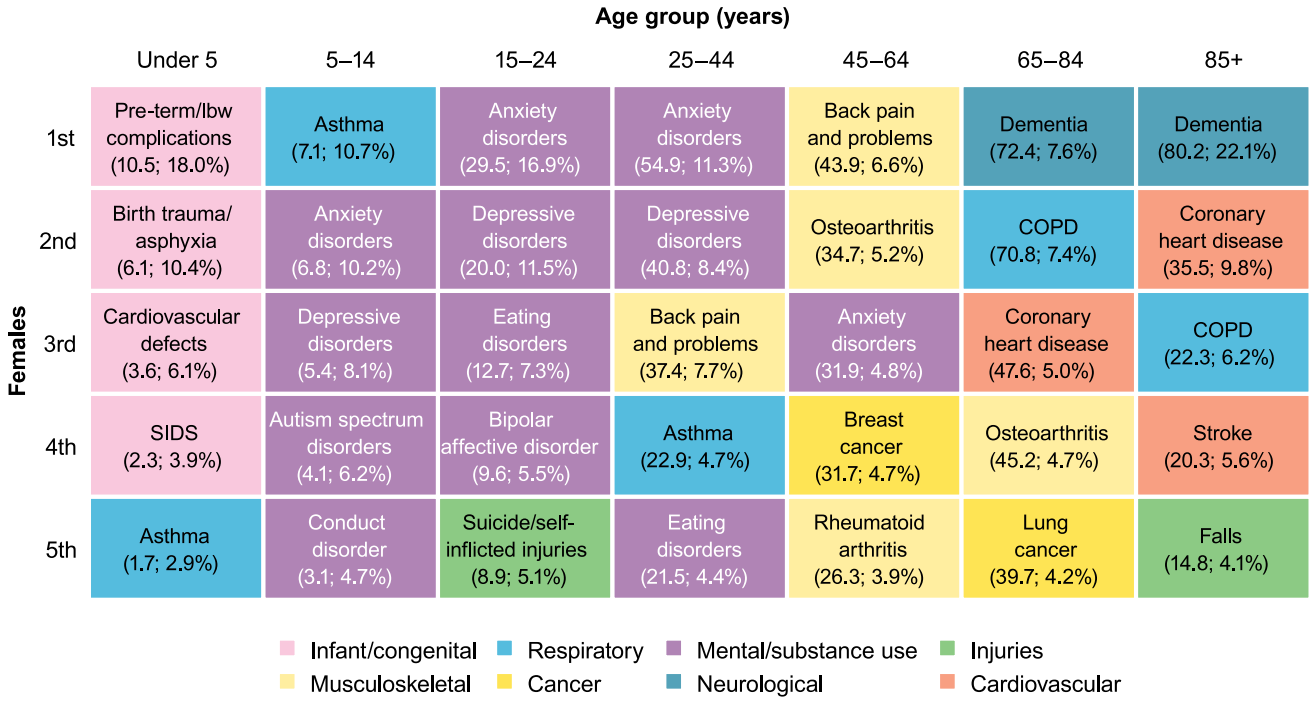
Australians experience health loss from different diseases and injuries at various stages of life. Respiratory diseases caused burden throughout the life course, especially in children and older people. Mental health conditions & substance use disorders dominated the first half of the life course, while musculoskeletal conditions, cardiovascular diseases and cancer feature more prominently in the latter part of the life course. Neurological conditions (namely dementia) are a leading cause of burden in older Australians (aged 65 and over).

Leading causes of burden at various ages can be different for females and males (Figure 2.4). For example:

- For those aged 15–44, anxiety disorders was the leading specific cause of burden in females, while for males it was suicide & self-inflicted injuries. Asthma and eating disorders also featured among the 5 leading causes of burden in females. Alcohol use disorders and poisoning featured among the leading 5 causes of burden for males.
- For women aged 45–64, back pain & problems, osteoarthritis, anxiety disorders, breast cancer and rheumatoid arthritis were the leading 5 specific causes of burden. For men it was coronary heart disease, back pain & problems, suicide & self-inflicted injuries, lung cancer and chronic liver disease.
- Osteoarthritis was among the 5 leading causes of burden for women aged 65–84, while type 2 diabetes mellitus was among the 5 leading causes of burden for men in this age group.
- Dementia and coronary heart disease were the leading causes of burden in both men and women aged 85 years and over.

Figure 2.4: Leading causes of total burden (DALY '000; proportion %), by sex and age group, 2024





COPD = chronic obstructive pulmonary disease; lbw = low birthweight; SIDS = sudden infant death syndrome.

Source: AIHW Australian Burden of Disease Database, Data tables.

For more information on the leading causes of total, fatal and non-fatal burden in Australia by sex and age and to explore how this has changed over time, see the interactive data visualisation: Leading causes of disease burden.

Changes in leading specific causes of disease burden over time

Age-standardised rates are often used to look at changes in health outcomes such as disease burden over time. They show the rate of burden if the population age structure did not change over time, which can indicate whether changes in disease burden are largely a result of an ageing population. This is important, as the rate of many of the leading causes of disease burden in Australia increase with age.

Over time, the leading individual causes of disease burden in Australia have changed (Figure 2.5). Between 2003 and 2024, the rate of total burden, after adjusting for age:

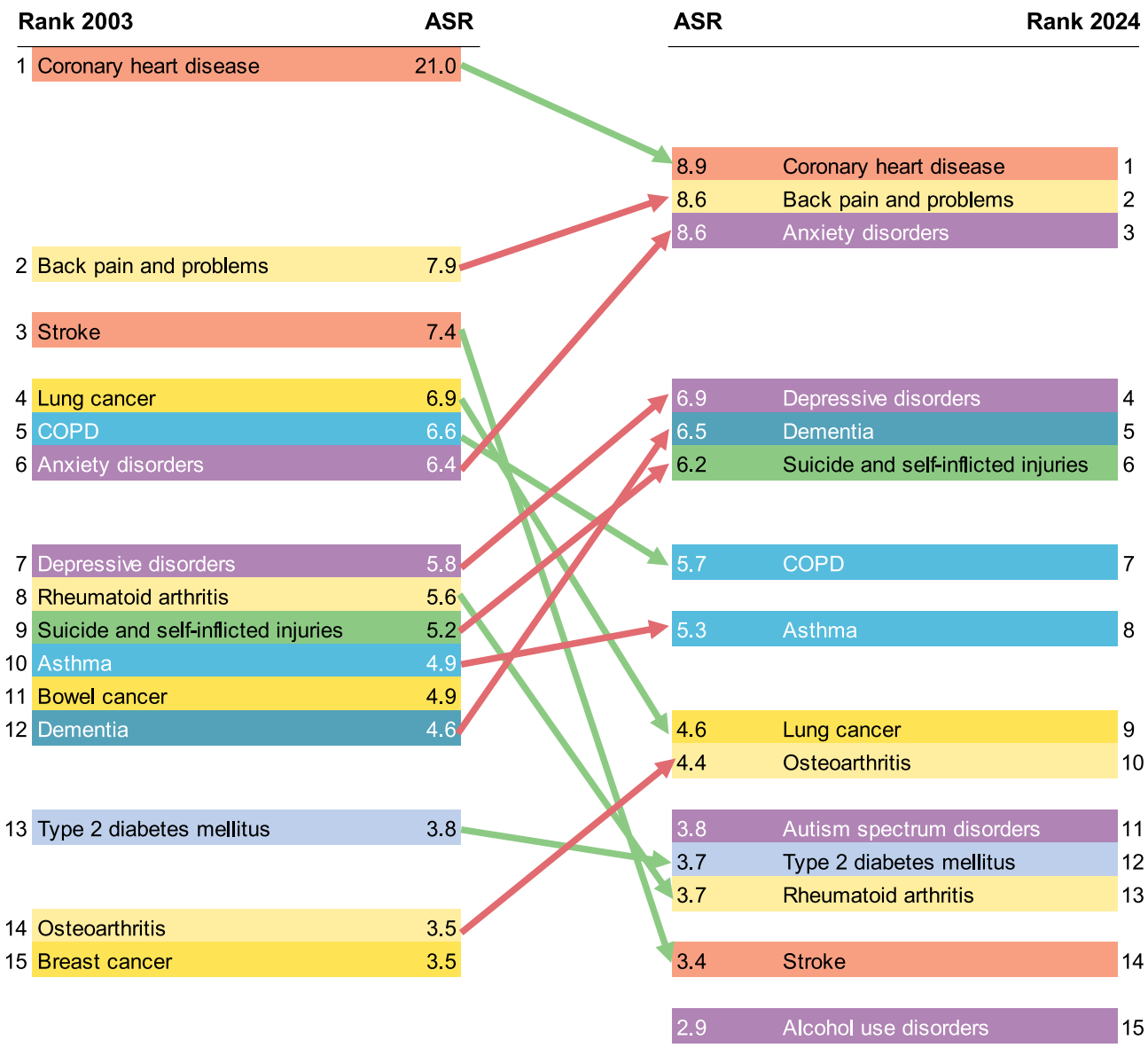
- decreased for coronary heart disease (by 58%), stroke (54%), rheumatoid arthritis (35%), lung cancer (33%) and COPD (13%).
- substantially increased for dementia (42%), and its rank increased from the 12th leading cause of total burden in 2003 to the 5th leading cause in 2024. However, this increase is partly due to changes in practices of coding deaths due to dementia (see the Comparisons over time interactive data visualisation or refer to the Technical notes).
- increased for anxiety disorders (34%), osteoarthritis (26%), suicide & self-inflicted injuries (19%), depressive disorders (18%), back pain & problems (8.7%) and asthma (8.5%).

Coronary heart disease and stroke were the leading causes of fatal burden in 2003, however, premature deaths from these causes have decreased over time. Back pain & problems was the leading cause of non-fatal burden in 2024.

There were differences in the leading causes of total burden, and therefore their ranking, when looking at age-standardised burden rates compared with crude rates (based on the number of DALY). The rankings of age-related conditions (such as dementia, COPD and osteoarthritis) were often lower in more recent years when ranking by age-standardised rates compared with crude rates. For example, dementia was ranked 5th based on the age-standardised rate, and ranked 2nd based on the crude rate. This indicates that an ageing population is one of the factors that influence changes to Australia's leading causes of disease burden.

To explore changes in the leading causes of disease burden over time (by number and age-standardised rate) for 2024 compared with each of the previous years (2003, 2011, 2015 and 2018) see the interactive data visualisation: Leading causes of disease burden.

Figure 2.5: Change in disease ranking and age-standardised DALY rate (DALY per 1,000 population) between 2003 and 2024



ASR = age-standardised rate; COPD = chronic obstructive pulmonary disease.

Notes

1. Diseases are presented in descending order, from highest ASR to lowest ASR, with arrows indicating either an increase (red) or decrease (green) in the ASR over time.
2. 'Other musculoskeletal conditions' are excluded from the rankings.
3. There were changes in practices of coding deaths due to dementia; therefore, caution is recommended when interpreting changes over time for dementia burden.
4. Since the ABDS 2018, the Intellectual Disability Exploring Answers (IDEA) data has been linked to the National Disability Insurance Scheme (NDIS), resulting in higher ascertainment of individuals with autism spectrum disorders. Estimates for 2018 were revised to allow comparisons with 2024 estimates, however, estimates for 2024 are not comparable to estimates for 2015 and earlier due to the addition of a new ascertainment source to the IDEA.

Source: AIHW Australian Burden of Disease Database, Data tables.

Australians living longer but no change in the proportion of life spent in full health

Australians are, on average, living longer and spending more years in full health (meaning no disease or injury), compared with 20 years ago. Years lived in full health is also referred to as health-adjusted life expectancy (HALE). However, years lived in ill health are also increasing, resulting in no change in the proportion of life spent in full health.

Interpreting changes in HALE over time

Whether or not the amount of ill health experienced by older Australians has increased has been the subject of ongoing debate. Assessment of how the relationship between life expectancy and HALE has changed over time (by analysing the ratio and difference between the 2 measures) provides an opportunity to examine which of the scenarios of healthy ageing – compression or expansion of morbidity, or equilibrium – provides the best insight into whether longer lives are healthier lives. These 3 health scenarios are described as follows:

Compression of morbidity

In this scenario, increasing life expectancy is accompanied by better health. As the population ages, there is also a delay in the age of onset of disease. As such, we can expect a reduction in the proportion of life spent in ill health (Fries 1980) as most morbidity occurs at the end of life.

Expansion of morbidity

In this scenario, increasing life expectancy is accompanied by more illness and injury before death. As chronically ill people survive for longer, we can expect an increase in the proportion of their lives spent with illness (Gruenberg 1977).

Dynamic equilibrium

In this scenario, the proportion of the lifetime spent living with illness remains relatively constant over time. As life expectancy increases, so does the onset and progression of disease. However, as diseases become more prevalent, they may also be less severe (Howse 2006). If the ratio of HALE to total life expectancy is constant, there is an equilibrium.

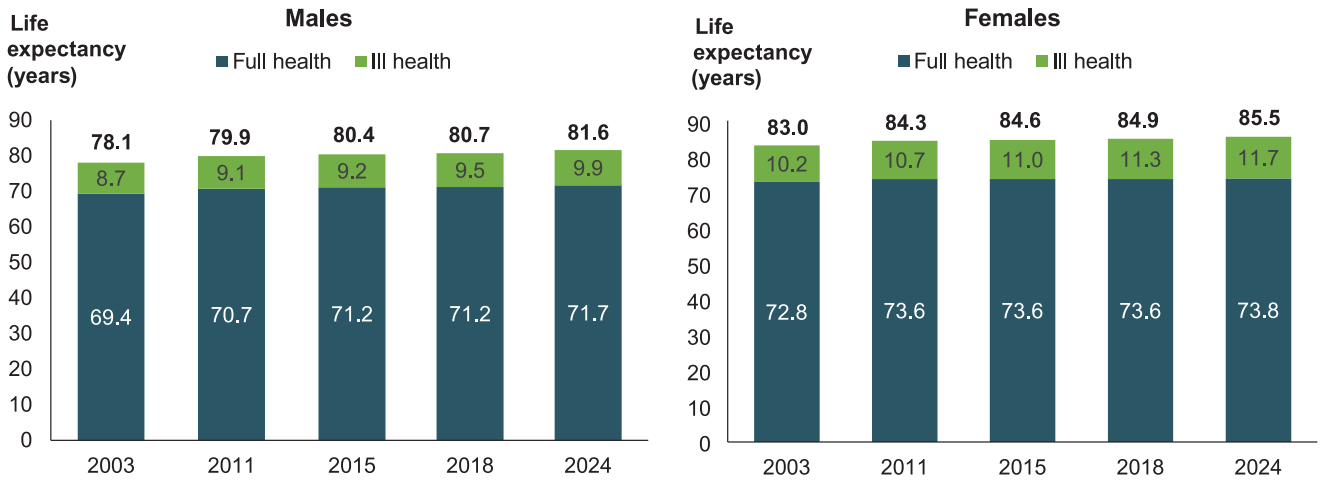
Findings from HALE analysis suggest a scenario of equilibrium between 2003 and 2024: the proportion of time spent living in ill health has remained relatively constant.

Males and females born in 2024 could expect to live an average of 88% and 86% of their lives in full health respectively (71.7 years of the 81.6 years of average life expectancy for males and 73.8 years of the 85.5 years of average life expectancy for females).

Between 2003 and 2024, males gained 3.5 years in life expectancy and 2.3 years in HALE (Figure 2.6). The corresponding gains for females were 2.5 years in life expectancy and 1.0 years in HALE. Despite these gains in life expectancy and healthy years (which were greater for males than females), the average time spent in ill health increased by 1.2 years for males and 1.5 years for females. The average proportion of life spent in full health over this period was relatively stable (ranging from 89% to 88% for males and from 88% to 86% for females).

These changes are illustrated in Figure 2.6, showing the split in life expectancy that is average number of healthy years (HALE) and average years in ill health. The results suggest that, at the national level, gains in healthy years at birth are largely comparable with gains in life expectancy at birth. It suggests an equilibrium of morbidity in Australia over this period.

Figure 2.6: Life expectancy at birth as years lived in full health (HALE) and years lived in ill health, by sex, between 2003 and 2024



Note: For more information on HALE and the life expectancies used, refer to Technical notes.

Source: ABS published life tables, AIHW derived life tables for 2024, AIHW Australian Burden of Disease Database, Data tables.

Changes over time in HALE and life expectancy at age 65 followed a similar pattern as at birth. Life expectancy and HALE at age 65 increased between 2003 and 2024 by 2.6 and 2.0 years, respectively, for males and by 1.8 and 1.1 years, respectively, for females.

For more detailed data on the proportion of life spent in full health by age and how this has changed over time, see the interactive data visualisation: Health-adjusted life expectancy.

National Preventive Health Strategy 2021–2030: burden of disease targets

The National Preventive Health Strategy 2021–2030 (the 'Strategy') outlines the long-term approach to prevention in Australia. The Strategy aims to address the wider determinants of health, promote health equity and decrease the overall burden of disease through a whole-of-systems approach to prevention (Department of Health 2021).

To assess progress over the 10-year period, the Strategy outlines several targets to achieve by the year 2030. There are 6 burden of disease specific targets in the Strategy and data from the Australian Burden of Disease Study 2024 can be used to monitor 3 of the 6 targets:

- the proportion of the first 25 years lived in full health will increase by at least 2 percentage points by 2030
- the proportion of the first 0–4 years of life lived in full health will increase by at least 3.5 percentage points by 2030
- Australians have at least an additional 2 years of life lived in full health by 2030.

The remaining 3 targets involve burden of disease estimates by socioeconomic group, remoteness and for Aboriginal and Torres Strait Islander (First Nations) people which was not in the scope of the current report (however, these will be reported in the next major ABDS study (2026) and First Nations study).

Australia's current performance against the targets

Table 2.1 shows how the burden of disease measures in 2024 compare with the baseline measures (the year 2018) for each reportable target. An assessment of data reported for these 3 targets suggests there has been no change between 2018 (baseline year) and 2024 in the:

- proportion of the first 0–4 years lived in full health (around 92%)
- proportion of the first 25 years lived in full health (ranging between 91 and 92%)
- average number of years lived in full health (71 to 72 years for males and 74 years for females).

Table 2.1: Selected aims and burden of disease targets in the National Preventive Health Strategy 2021–2030: number and proportion (%) of years lived in full health and the percentage point change between 2018 and 2024

Aim	Target	Sex	2018 (baseline)[(a)]	2024 estimate	Comparison to 2018

All Australians have the best start in life	The proportion of the first 25 years lived in full health will increase by at least 2 percentage points by 2030	Persons	92.1% of first 25 years were lived in full health	91.5% of first 25 years were lived in full health	–0.6[(b)]
All Australians have the best start in life	The proportion of the first 0–4 years of life lived in full health will increase by at least 3.5 percentage points by 2030	Persons	91.9% of first 5 years were lived in full health	91.3% of first 5 years were lived in full health	–0.6[(b)]
All Australians live in good health and wellbeing for as long as possible	Australians have at least an additional 2 years of life lived in full health by 2030	Males	71.2 years lived in full health	71.7 years lived in full health	0.5 years[(b)]
		Females	73.6 years lived in full health	73.8 years lived in full health	0.2 years[(b)]

(a) Baseline level data for the burden of disease targets have been revised to allow for comparability with 2024 estimates and are different to the published Strategy.

(b) Progress against these targets is currently assessed as no change based on factors such as quality and reliability of the data sources used and magnitude of the observed difference.

Source: AIHW Australian Burden of Disease Database, Data tables.

Estimates for 2024 are projections so progress against the targets may change as 2024 data becomes available. COVID-19's impacts on burden and the health of the Australian population may also affect progress against these targets. More data points and further monitoring is required to determine if the targets set out in the Strategy can be achieved by 2030.

For further information and data on the Strategy's aims, targets and progress, including baseline data, see: National Preventive Health Strategy Monitoring Dashboard.

A large proportion of burden could be prevented

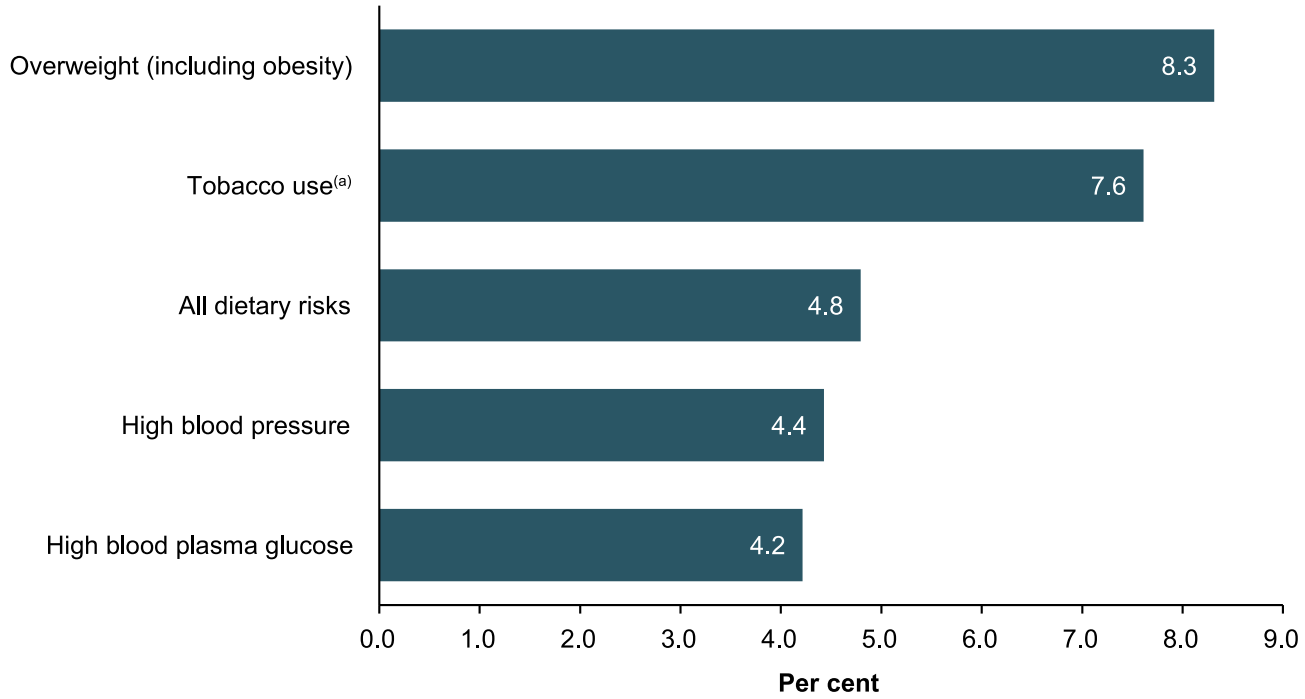
Of the total burden of disease and injury in Australia for 2024, over one-third (36%) was attributable to the risk factors included in this Study. This illustrates the potential for health gain in preventing disease and injury by avoiding or reducing exposure to these risk factors. Although it may not be feasible or achievable to prevent all health loss, it quantifies what is theoretically possible.

The amount of burden that could be attributed to the included risk factors was higher for fatal burden (46%) compared with non-fatal burden (27%). This is due to a high proportion of leading causes of fatal burden, such as cancer and cardiovascular disease, being attributable to these risk factors.

Leading risk factors

The 5 risk factors contributing the most to total disease burden in 2024 were overweight (including obesity) (8.3%), tobacco use (7.6%, excluding nicotine vaping), dietary risks (4.8%), high blood pressure (4.4%) and high blood plasma glucose (4.2%) (Figure 2.7). Among the dietary risk factors, a diet low in legumes contributed the most to disease burden. This was followed by a diet high in sodium, diet low in wholegrains & high fibre cereals and diet high in red meat.

Figure 2.7: Leading risk factors contributing to total disease burden (DALY), 2024



(a) Excludes nicotine vaping.

Source: AIHW Australian Burden of Disease Database, Data tables.

The contribution of risk factors to fatal and non-fatal burden was also calculated as part of this study (Table 2.2). Tobacco use contributed the most to fatal burden followed by overweight (including obesity), dietary risks and high blood pressure. The risk factors that contributed the most to non-fatal burden were overweight (including obesity), tobacco use, high blood plasma glucose, child abuse & neglect and alcohol use.

Table 2.2: Number and proportion (%) of fatal burden (YLL), non-fatal burden (YLD) and total burden (DALY) attributable to each risk factor, 2024

			Metabolic/biomedical				
Risk factor	**Number**	**% of total YLL**	**Number**	**% of total YLD**	**Number**	**% of total DALY**	**Rank**
Overweight (including obesity)	257,620	9.6	223,207	7.1	480,827	8.3	1
High blood pressure	193,719	7.2	62,513	2.0	256,232	4.4	4
High blood plasma glucose	130,403	4.9	112,806	3.6	243,209	4.2	5
High cholesterol	106,618	4.0	25,487	0.8	132,104	2.3	9
Impaired kidney function	85,004	3.2	33,848	1.1	118,852	2.0	11
Low birthweight & short gestation	43,740	1.6	6,592	0.2	50,331	0.9	14
Low bone mineral density	13,497	0.5	12,552	0.4	26,050	0.4	17
Iron deficiency	312	0.0	19,545	0.6	19,858	0.3	18
			Behavioural				

Risk factor	Number	% of total YLL	Number	% of total YLD	Number	% of total DALY	Rank
Tobacco use[(a)]	314,058	11.7	126,597	4.1	440,655	7.6	2
Dietary risks	211,583	7.9	65,843	2.1	277,426	4.8	3
Alcohol use	143,823	5.4	94,439	3.0	238,262	4.1	6
Illicit drug use	113,351	4.2	57,206	1.8	170,557	2.9	7
Child abuse & neglect	41,328	1.5	97,309	3.1	138,637	2.4	8
Physical inactivity	83,398	3.1	39,228	1.3	122,626	2.1	10
Intimate partner violence[(b)]	9,240	0.3	37,203	1.2	46,443	0.8	15
Unsafe sex	8,357	0.3	2,870	0.1	11,228	0.2	19
Bullying victimisation	0	0.0	8,814	0.3	8,814	0.2	20

Environmental

Risk factor	Number	% of total YLL	Number	% of total YLD	Number	% of total DALY	Rank
Air pollution	64,490	2.4	28,354	0.9	92,844	1.6	12
Occupational exposures & hazards	29,797	1.1	60,407	1.9	90,204	1.6	13
UV sun exposure	25,513	1.0	4,888	0.2	30,400	0.5	16
Joint effect[(c)]	**1,228,722**	**45.9**	**848,230**	**27.2**	**2,076,953**	**35.8**	

(a) Excludes nicotine vaping.

(b) Intimate partner violence is measured in females only.

(c) Includes all 20 risk factors.

Source: AIHW Australian Burden of Disease Database, Data tables.

Differences between males and females

The total burden attributable to risk factors included in the study was higher in males (38%) compared with females (33%). Overweight (including obesity) and tobacco use were the leading risk factors contributing to total disease burden in both males and females (although the proportion of total burden was higher for males than females).

Among females, high blood plasma glucose ranked 3rd, followed by high blood pressure and dietary risks. In males, dietary risks ranked 3rd, followed by alcohol use and high blood pressure. The proportion of attributable DALY due to alcohol use for males was more than 2 times that for females (5.5% compared to 2.6% respectively). Child abuse & neglect ranked much higher in females (6th; 2.9%) than for males (12th; 1.9%), while illicit drug use ranked higher for males (7th; 3.9%) than for females (10th, 1.9%). Intimate partner violence was estimated for females only (as sufficient evidence to identify the causally linked diseases is not currently available for men) and ranked 11th, contributing to 1.7% of total burden in 2024.

To further explore leading risk factors, see the Burden attributable to risk factors interactive data visualisation.

Changes in leading risk factors over time

Changes in burden over time from risk factors may be due to changes in population size, exposure to the risk factors, the age at which exposure occurs, or the overall burden for those diseases or injuries that are linked to these risk factors.

Not all risk factors have data for all years in the study. As a result, caution is recommended when comparing the joint effect of all risk factors over time. Where individual risk factors have data for multiple reference years, the data and methods used for each year in the study are assumed to be largely comparable.

Overweight (including obesity) has overtaken tobacco use as the leading risk factor

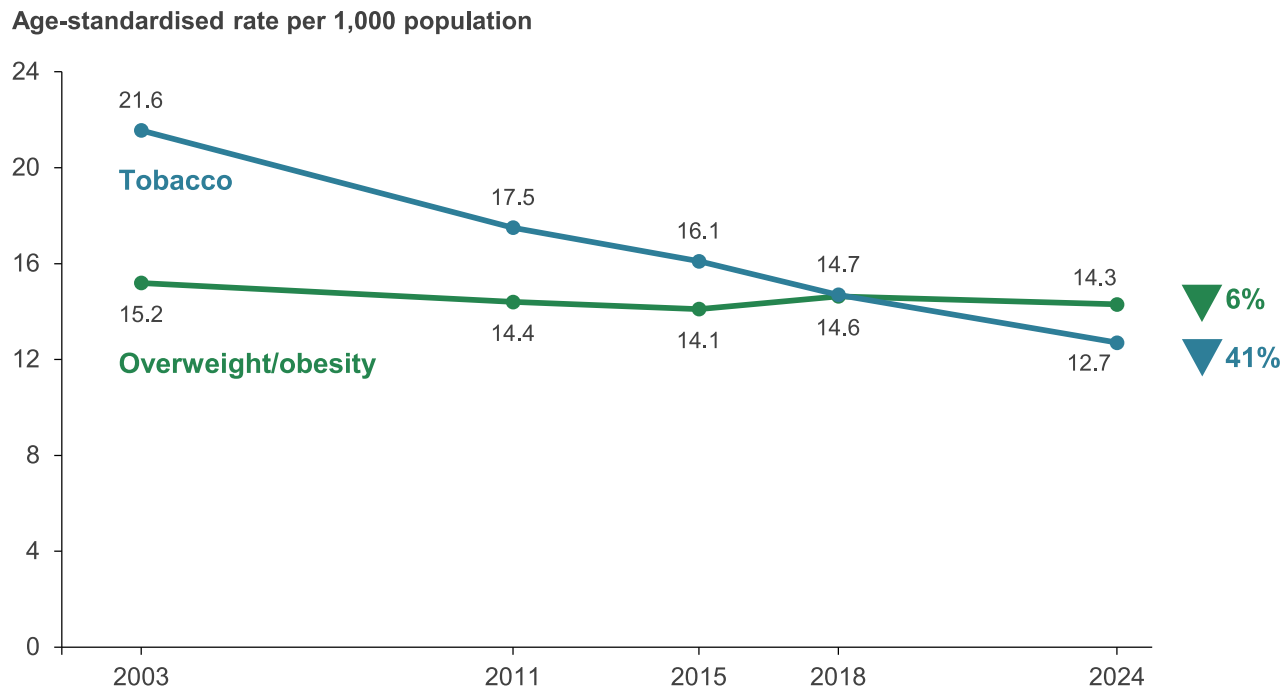
Overweight (including obesity) became the leading risk factor contributing to disease burden in 2024, overtaking tobacco use. It increased from the 4th highest risk factor in 2003 and the second highest risk factor in 2018. However, it should be noted that the rate of total burden attributable to overweight (including obesity) has been relatively stable over time. This trend is partly a result of increases in the rates of burden attributable to obesity and some linked diseases such as dementia, in combination with decreases in the rates of burden attributable to overweight (excluding obesity) and linked diseases such as cardiovascular diseases.

In contrast, there has been a substantial fall (41%) in the age-standardised rate of total burden attributable to tobacco use between 2003 and 2024 (Figure 2.8). This change is largely a result of declines in smoking prevalence and the major linked diseases.

While smoking prevalence has decreased in recent years, the burden attributable to tobacco use remains high due to the long lag times between smoking and developing diseases such as cancers and chronic respiratory conditions and the remaining risk of developing these diseases in people who have smoked in the past, although this risk continues to fall with prolonged abstinence.

It should be noted that the burden estimates for tobacco use presented here do not include nicotine vaping as this was outside the scope of the current study. However, as part of the next major update of the ABDS (2026), a number of new risk factors will be assessed for inclusion, including nicotine vaping and vaping illicit drugs.

Figure 2.8: Change between 2003 and 2024 in the age-standardised attributable DALY rate (per 1,000 population) for the leading 2 risk factors in 2024



Notes:

1. Rates were age-standardised to the 2001 Australian Standard Population.

2. Tobacco use excludes nicotine vaping.

Source: AIHW Australian Burden of Disease Database, Data tables.

Other risk factors which had notable changes in rankings and age-standardised attributable burden rates between 2003 and 2024 include:

- High blood pressure for which the rate decreased by 57% (and dropped from 2nd highest ranking to 5th highest ranking over this period);
- High cholesterol for which the rate decreased by 61% (and dropped from 5th to 9th ranking);

- All dietary risks for which the rate decreased by 49% (and dropped from 3rd to 4th ranking). Most of this decrease occurred between 2003 and 2011;
- Illicit drug use for which the rate increased by 42% (and increased from 8th to 7th ranking).

Changes in attributable burden can reflect changes in the linked disease burden and/or changes in exposure to the risk factor. For example, the large decreases observed in burden due to coronary heart disease is the main driver of the decreases observed for high cholesterol and dietary risks. This coupled with reduced exposure to high blood pressure in the population are the main drivers of the decline observed in attributable burden due to high blood pressure. An increase in burden due to drug use disorders is one of the drivers of the increase in attributable burden due to the illicit drug use risk factor.

Changes in attributable non-fatal burden

Between 2003 and 2024, there was an increase in the rate of non-fatal burden attributable to overweight (including obesity) (22% increase after adjusting for age). Other risk factors with notable increases in rates of attributable non-fatal burden include intimate partner violence (40% increase) which moved into the top 10 in 2024; illicit drug use (34% increase) and child abuse and neglect (29% increase).

Tobacco use, high blood pressure and all dietary risks saw a decrease in the rate of non-fatal attributable burden between 2003 and 2024 (27%, 44%, and 32%, respectively).

Changes in attributable fatal burden

Between 2003 and 2024, rates of fatal attributable burden decreased for a number of risk factors, the largest decline being for high cholesterol which decreased by 62% after adjusting for age, and from 5th ranking in 2003 to 8th in 2024. Over the same period, the rate of attributable fatal burden due to illicit drug use increased by 46% after adjusting for age, and increased from 9th ranking in 2003 to 6th ranking in 2024.

To further explore changes in leading risk factors over time, see the Changes in risk factors over time interactive data visualisation.

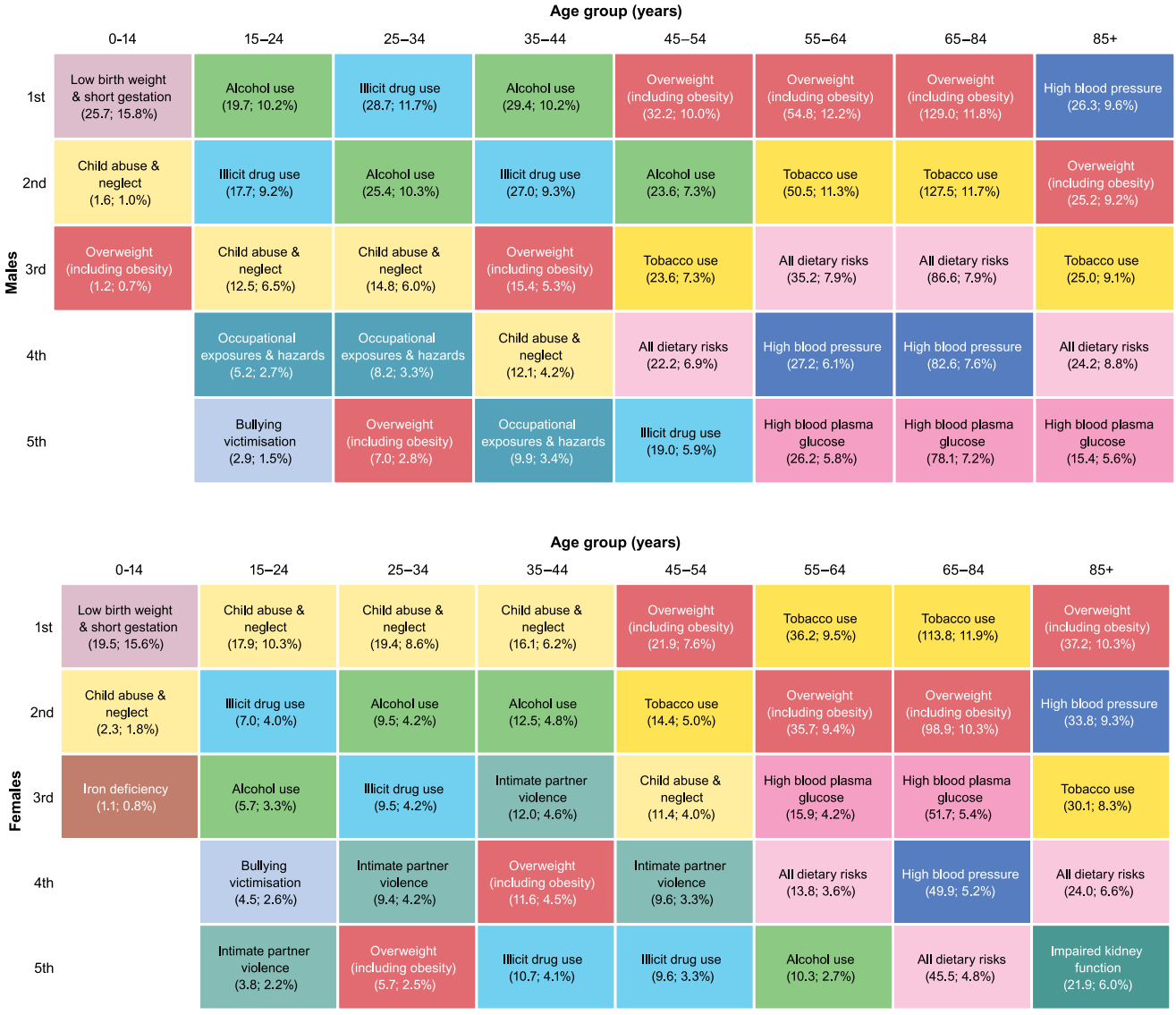
How does attributable burden differ across the life course?

The health impacts due to the modifiable risk factors included in this study varied by age and sex. It should be noted that exposure to risk factors in the past can influence the proportion of burden attributable in the reference year of the study or for a particular age group. This is because evidence of past exposure can be linked to current burden—for example, to take into account the lag time from exposure through to outcomes such as cancer.

Low birthweight & short gestation was the leading contributor to burden for males and females under 15. In males, alcohol use or illicit drug use was the leading contributor for ages 15–44, overweight (including obesity) for ages 45–84 and high blood pressure in the older ages (85 and over).

In females, child abuse & neglect was the leading contributor to burden for ages 15–44, overweight (including obesity) for ages 45–54, tobacco use followed by overweight (including obesity) for ages 55–84, and overweight (including obesity) in the older ages (85 and over) (Figure 2.9).

Figure 2.9: Leading risk factor contribution to total burden (DALY '000; proportion %), by sex and age group, 2024



Note: Tobacco use excludes nicotine vaping.

Source: AIHW Australian Burden of Disease Database, Data tables.

To further explore how attributable burden varies across the life course, see the Attributable burden across the life course interactive data visualisation.

Which diseases have the most burden attributable to risk factors?

All the risk factors combined (the joint effect) contributed greatly to the burden for a number of disease groups including endocrine disorders (96%), kidney & urinary diseases (73%), cardiovascular diseases (65%) and respiratory diseases (52%).

The contribution of individual risk factors to the total burden of different disease groups varied. For example:

- Tobacco use contributed to 36% of the total burden from respiratory diseases and 15% of the total burden from cancers.
- Overweight (including obesity) contributed to 28% of the total burden from endocrine disorders and 22% of the total burden from kidney & urinary diseases.

The contribution of individual risk factors to total disease burden also varied for specific diseases. For example:

- Multiple risk factors contributed to total burden from coronary heart disease including dietary risks (22%), high blood pressure (19%), high cholesterol (16%) and overweight (including obesity) (6.9%). Overall, all the risk factors combined (the joint effect) contributed to 87% of the total burden due to coronary heart disease.
- Tobacco use (65%), air pollution (6.9%) and occupational exposures and hazards (2.0%), contributed to the total burden from chronic obstructive pulmonary disease (COPD). Around three-quarters (74%) of the total burden due to COPD was attributable to all risk factors combined.

The above analyses account for the overlap between risk factors that share the same linked diseases. To further explore total burden for specific diseases attributable to risk factors, see the Diseases and associated risk factors interactive data visualisation.

Where do I go for more information?

For more information on the burden of disease in Australia, see:

- ABDS 2024 Supplementary data tables
- ABDS 2018 State and territory estimates, Remoteness areas, Socioeconomic groups interactive data visualisations
- ABDS 2018 Interactive data on risk factor burden
- Australian Burden of Disease Study: Impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018
- ABDS 2018: Interactive data on disease burden among Aboriginal and Torres Strait Islander people
- ABDS 2018: Interactive data on risk factor burden among Aboriginal and Torres Strait Islander people
- Australian Burden of Disease Study: Methods and supplementary material 2018

For more on this topic, see Burden of disease.

References

AIHW (Australian Institute of Health and Welfare) (2022) *Australia's health 2022: data insights*, AIHW, Australian Government, accessed 17 October 2024. doi:10.25816/ggvz-vr80.

AIHW (2023) *Australian Burden of Disease Study 2023*, AIHW, Australian Government, accessed 15 October 2024.

Department of Health (2021) *National Preventive Health Strategy 2021–2030* - external site opens in new window, Department of Health, Australian Government, accessed 11 September 2024.

Fries JF (1980) 'Aging, natural death, and the compression of morbidity', *The New England Journal of Medicine,* 303(3): 130–5.

Gruenberg EM (1977) 'The failures of success', *The Milbank Quarterly,* 55(1): 3–24.

Howse K (2006) *Increasing life expectancy and the compression of morbidity: a critical review of the debate* (Working paper 206), Oxford Institute of Ageing, Oxford University.

Australian Government
Australian Institute of Health and Welfare

Interactive data on disease burden

The following interactive data visualisations allow users to explore the data in more detail and filter/customise the data and figures to meet their information needs.

The AIHW aims to meet the Australian Government's web accessibility requirements. If any of the interactive burden of disease pages are inaccessible to you, or you are experiencing problems accessing content for any reason, please contact us at burdenofdisease@aihw.gov.au.

What is included in the Australian Burden of Disease Study 2024 data visualisations?

The interactive data visualisations present estimates of total burden (DALY), non-fatal burden (YLD), fatal burden (YLL) and health adjusted life-expectancy (HALE) in Australia for 2003, 2011, 2015, 2018 and 2024.

The following interactive data visualisations are included:

- Overview of disease burden, for all diseases and disease groups or for a specific disease/injury or disease group
- Contributions of fatal vs non-fatal burden to total burden for a specific disease/injury or disease group
- Comparison of disease burden over time for a specific disease/injury or disease group
- Changes in the ranking of leading causes (specific disease/injury) of disease burden over time by sex and age
- Summary of disease burden for a specific disease/injury
- Health-adjusted life expectancy by age, sex and over time.

Data visualisations from previous Australian Burden of Disease Studies

Previous Australian Burden of Disease Studies have estimated burden of disease at a subnational level (by state and territory, remoteness area and socioeconomic group). The latest subnational data were published in the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report. Data visualisations presenting these results can be found at the links below.

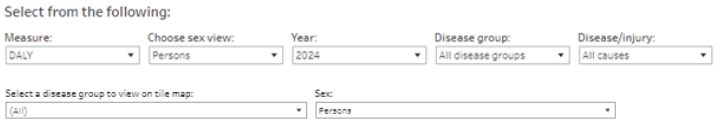
- Australian Burden of Disease Study 2018: Interactive data on disease burden, State and territory estimates
- Australian Burden of Disease Study 2018: Interactive data on disease burden, Remoteness areas
- Australian Burden of Disease Study 2018: Interactive data on disease burden, Socioeconomic groups.

Burden of disease in Australia

Use the interactive graphs to explore the number or rate of total burden (DALY), non-fatal burden (YLD) and fatal burden (YLL) in Australia by disease group, disease or injury for the most recent year (2024). Results for 2003, 2011, 2015 and 2018 are included for comparison.

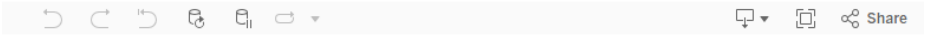
How to navigate the interactive visualisation

Use the drop-down list above each graph to view the data by measure of disease burden, year, sex, disease group and disease/injury (top graph) or by disease group and sex (bottom graph).



Hover over the bars, line or coloured tiles on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



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Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

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Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 3.1: National overview of the burden of disease in Australia

This interactive visualisation gives an overview of disease burden in Australia, by type of burden, year, sex, disease group and disease.

Australian Burden of Disease Study 2024

Select from the following:

Measure:	Choose sex view:	Year:	Disease group:	Disease/injury:
DALY	Persons	2024	All disease groups	All causes

In 2024, there were **5,798,423 DALY in Persons** from the disease/s selected, equivalent to **187.38 per 1,000 population** (age-standardised rate) and **100.0%** of the total burden in Australia.

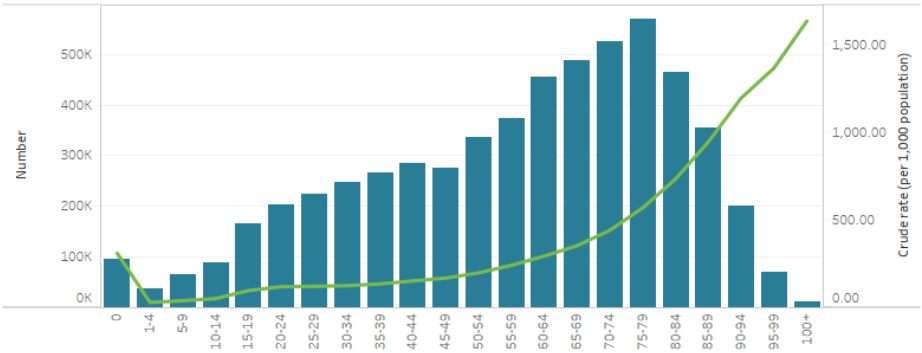
In 2024, there were **2,772,826 DALY in Females** from the disease/s selected, equivalent to **172.40 per 1,000 population** (age-standardised rate) and **100.0%** of the total burden in Australia.

In 2024, there were **3,025,597 DALY in Males** from the disease/s selected, equivalent to **203.47 per 1,000 population** (age-standardised rate) and **100.0%** of the total burden in Australia.

Note: Diseases displaying a rate of 0.00 per 1,000 population refer to a rate <0.005 per 1,000 population.

DALY= Disability-adjusted life years; **YLD**= Years lived with disability; **YLL**= Years of life lost

DALY in Persons by age, 2024



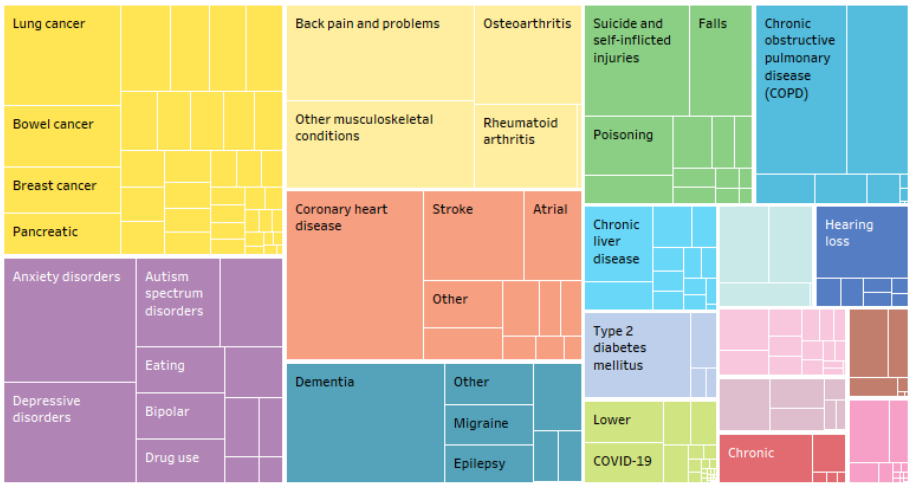
DALY in Persons by disease group, 2024

Select a disease group to view on tile map: All

Sex: Persons

Disease group

- All disease groups
- Blood and metabolic disorders
- Cancer and other neoplasms
- Cardiovascular diseases
- Endocrine disorders
- Gastrointestinal disorders
- Hearing and vision disorders
- Infant and congenital conditions
- Infectious diseases
- Injury (external cause)
- Kidney and urinary diseases
- Mental and substance use disorders
- Musculoskeletal disorders
- Neurological conditions
- Oral disorders
- Reproductive and maternal conditions
- Respiratory diseases
- Skin disorders



Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed as per 1,000 population.
2. Estimates for autism spectrum disorders in 2018 and 2024 are not comparable to earlier years due to changes in data source.
3. Refer to the technical notes for more information on data sources and methods used in the Study.

Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Fatal vs. non-fatal burden

Burden of disease estimates are one of the few population health measures which combine health loss from living with, and dying prematurely from illness and injury.

The contribution of fatal and non-fatal burden to the total burden experienced in Australia differs by age, sex and disease. Some disease groups such as cancers, contribute substantial fatal burden, whilst diseases which don't usually cause death, such as back pain, contribute substantial non-fatal burden.

Use the interactive graphs to explore the contribution of fatal burden (YLL) and non-fatal burden (YLD) to the total burden of disease (DALY) in Australia by sex, age group and disease or injury for the most recent year (2024). Results for 2003, 2011, 2015 and 2018 are included for comparison.

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by year, sex, disease group and disease/injury.

Hover over the bars on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:

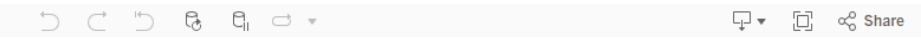


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Figure 3.2: Fatal and non-fatal burden in Australia

This interactive visualisation compares the amount and proportion of fatal vs. non-fatal burden, by year, sex, age, disease group and disease.

Australian Burden of Disease Study 2024

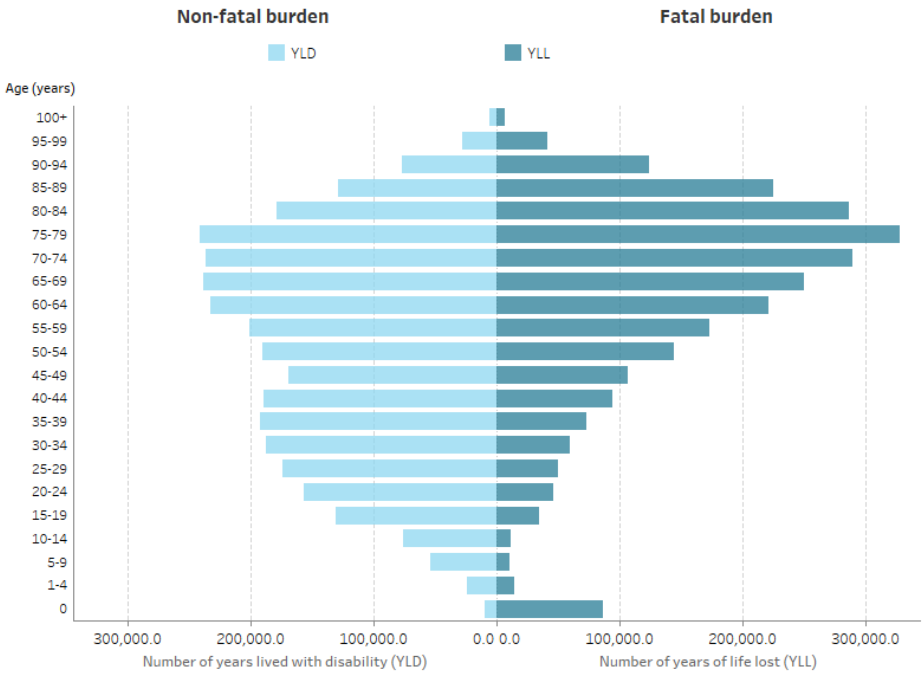
Select from the following:

Year:	Sex:	Disease group:	Disease or injury:
2024	Persons	All disease groups	All causes

Fatal vs. Non-fatal burden in Persons, 2024

53.9% non-fatal

46.1% fatal



Fatal vs. Non-fatal burden by age, Persons, 2024

Notes
1. Diseases displaying an estimate of 0.0 refer to an estimate <0.05.
2. Estimates for autism spectrum disorders in 2018 and 2024 are not comparable to earlier years due to changes in data source.
3. Refer to the technical notes for more information on data sources and methods used in the Study.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Comparisons over time

Changes in burden over time from specific diseases or injuries may be due to changes in population size, population ageing, changes in disease prevalence (including epidemics) or changes to how causes are reported or coded in health data.

For fatal burden (YLL) estimates, notable changes in cause of death coding practices occurred over time for dementia and accidental poisoning. For non-fatal burden (YLD) estimates, morbidity data were drawn from a wide variety of sources, with varying availability and data quality over time. Of note, changes in testing practices and diagnostic criteria occurred over time for gestational diabetes. Therefore, comparisons over time for some causes need to be interpreted with caution.

Use the interactive graphs to explore differences in age-standardised and age-specific rates of burden (DALY, YLD or YLL) in Australia. Estimates are displayed by sex and for disease groups or by specific disease or injury for the most recent year (2024) and for years 2003, 2011, 2015 and 2018 for comparison. Estimates for COVID-19 as an individual cause are not presented as these were not available for earlier reference years (though it is included in the total 'Infectious diseases' estimates).

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by measure of burden, sex, start and end year, disease group and disease/injury.

Hover over the bars or lines on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:

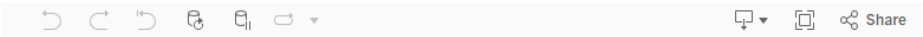


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Figure 3.3: Comparisons of disease burden in Australia over time

This interactive visualisation compares disease burden for each data year (2003, 11, 15, 18 & 24), by type of burden, sex, disease group and disease.

Australian Burden of Disease Study 2024

Select from the following:

Measure:	Choose sex view:	Start year:	End year:	Disease group:	Disease/injury:
DALY	Persons	2003	2024	All disease groups	All causes

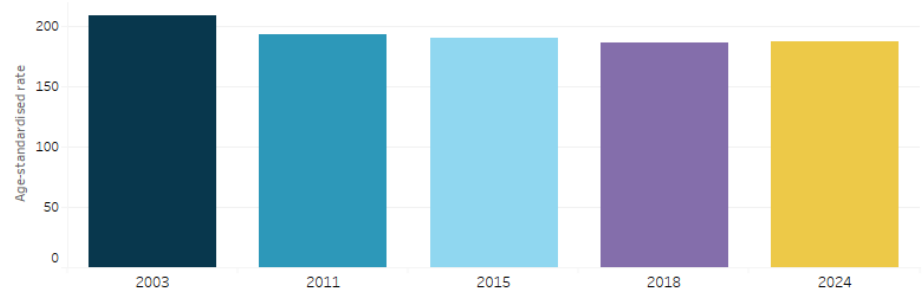
10.5% decrease
in the age-standardised DALY rate in **Persons** between 2003 and 2024 for the disease/s selected

6.2% decrease
in the age-standardised DALY rate in **Females** between 2003 and 2024 for the disease/s selected

14.5% decrease
in the age-standardised DALY rate in **Males** between 2003 and 2024 for the disease/s selected

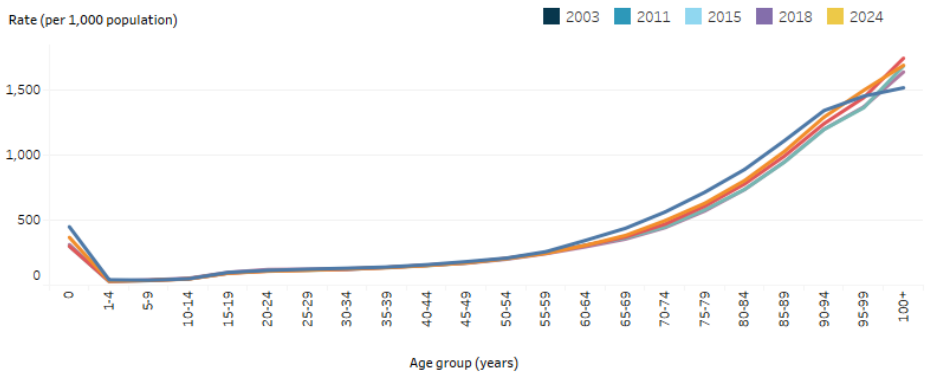
DALY= Disability-adjusted life years; **YLD**= Years lived with disability; **YLL**= Years of life lost

Comparison of age-standardised DALY rates, Persons



Comparison of age-specific crude DALY rates, Persons

Choose graph scale:
Linear



Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed as per 1,000 population.
2. The logarithmic scale allows a wider range of results to be presented on a more compact scale, as the intervals on the vertical axis change by a factor of 10. This differs to the linear scale where intervals on the vertical axis are equally spaced.
3. Diseases displaying a rate of 0.000 per 1,000 population refer to a rate <0.0005 per 1,000 population.
4. Estimates for autism spectrum disorders in 2018 and 2024 are not comparable to earlier years due to changes in data source. Refer to the technical notes for more information on data sources and methods used in the Study.
5. Estimates for COVID-19 as an individual cause are not presented as these were only available for 2024 (though it is included in the total 'Infectious diseases' estimates).
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Leading causes of disease burden

Ranking diseases by burden shows the leading causes of health loss in Australia. Changes in rankings over time may be due to changes in disease prevalence (including epidemics) or changes to how causes of data are collected, reported or coded.

This visualisation shows the leading 25 causes of disease burden (YLL, YLD or DALY) in Australia in 2024 compared with previous years (2003, 2011, 2015 and 2018) ranked by:

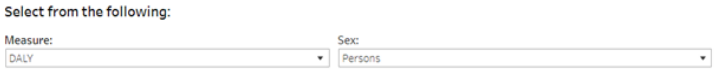
- age-standardised rate (ASR) of disease burden, which takes into account differences in population age structure and size between years. This graph can be filtered by sex.
- the number of YLL, YLD or DALY. This graph can be filtered by sex.

Note that rankings are a relative measure and changes in rank over time do not always mean the disease or injury has increased or decreased in the population. Leading causes of YLL are based on Australian Burden of Disease Study 2024 methods and will not be comparable to leading causes of death reported elsewhere due to modelling and cause of death alignment to diseases. Further, estimates for COVID-19 have no ranking in previous years which were prior to the pandemic (2003, 2011, 2015 and 2018). For a discussion of results related to leading causes of burden, refer to the Key findings.

How to navigate the interactive visualisation

Click on the tabs at the top of the visualisation to either view the disease rankings by age-standardised rate of burden or by number of burden.

Use the drop-down lists to filter the data by measure of burden, sex and age group (for Rank by number only).



Hover over the coloured squares or lines on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:

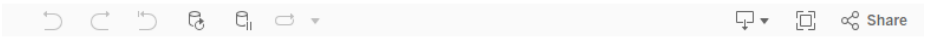


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Figure 3.4: Leading causes of disease burden in Australia

This interactive visualisation compares changes over time in Australia's leading cause of burden rankings by age-standardised rate and burden amount.

-
-
-

Australian Burden of Disease Study 2024

The dynamic data visualisation shows the leading causes of disease burden in Australia ranked by age-standardised rate.
The diseases listed on the right are the 25 leading causes in 2024. The connecting lines and numbered box shows what the rank of that disease was in 2018, 2015, 2011 and 2003. Selecting each disease group by clicking on its ranking or colour will highlight its change in ranking over time. A positive percent change reflects an increase in disease burden between 2003 and 2024; a negative percent change ..

Select from the following:

Measure: DALY

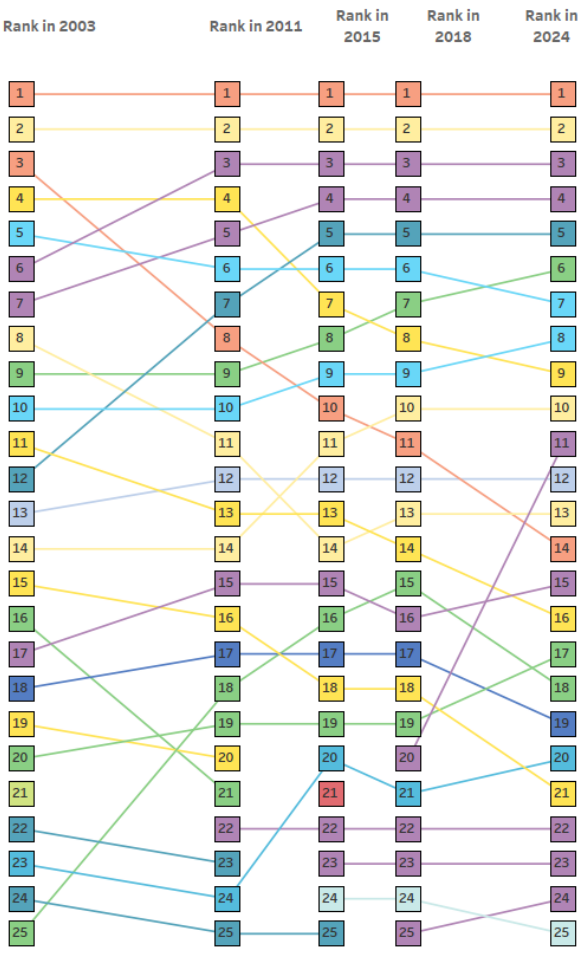
Sex: Persons

DALY= Disability-adjusted life years; **YLD**= Years lived with disability; **YLL**= Years of life lost

Ranking by age-standardised DALY rate: Persons

Disease groups

- Cancer and other neoplasms
- Cardiovascular diseases
- Endocrine disorders
- Gastrointestinal disorders
- Hearing and vision disorders
- Infectious diseases
- Injury (external cause)
- Kidney and urinary diseases
- Mental and substance use disor..
- Musculoskeletal disorders
- Neurological conditions
- Oral disorders
- Respiratory diseases



Leading disease in 2024	% change since 2003
Coronary heart disease	-57.6
Back pain and problems	8.7
Anxiety disorders	33.9
Depressive disorders	18.0
Dementia	42.5
Suicide and self-inflicted injuries	19.0
COPD	-12.6
Asthma	8.5
Lung cancer	-33.3
Osteoarthritis	26.0
Autism spectrum disorders	256.9
Type 2 diabetes mellitus	-3.7
Rheumatoid arthritis	-34.7
Stroke	-53.6
Alcohol use disorders	-4.3
Bowel cancer	-40.5
Falls	26.8
Poisoning	43.2
Hearing loss	14.1
Chronic liver disease	16.6
Breast cancer	-33.9
Eating disorders	22.7
Bipolar affective disorder	24.0
Drug use disorders (excluding alcohol)	17.3
Dental caries	15.8

Notes
1. Diseases ranked in the leading 25 in a single year, which are not in the leading 25 in any other year, will not have connecting lines and rankings. This includes COVID-19 which is only included for 2024.
2. Refer to the technical notes for more information on data sources and methods used in the Study.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

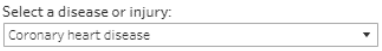
Disease/injury-specific summary

Use the interactive graphs to generate a summary of burden of disease in Australia in 2024 for a specific disease or injury.

For a discussion of results related to specific diseases, such as coronary heart disease (the leading cause of disease burden in 2024), refer to the Key findings.

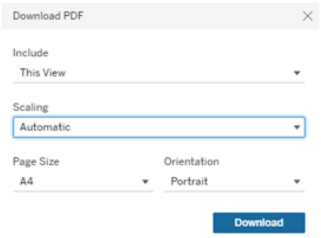
How to navigate the interactive visualisation

Use the drop-down list at the top right of the visualisation to view the data for a specific disease or injury.



Click on the 'Download PDF' button to download a 1-page PDF for the selected disease/injury.

Select A4 in the Page Size drop-down.



Hover over the bars or lines on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:

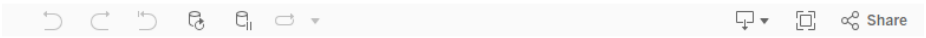


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Figure 3.5: Disease- or injury-specific summary of disease burden in Australia

This interactive visualisation reports a range of data on the burden of a specific disease or injury in Australia, which can be selected by the user.

Australian Burden of Disease Study 2024

Select a disease or injury:
Coronary heart disease

Coronary heart disease

Download PDF

DALY = Disability-adjusted life years; **YLD** = Years lived with disability; **YLL** = Years of life lost.

For Persons in Australia in 2024 there were:
317,105 DALY,
equivalent to **11.80 per 1,000 population**

Fatal burden
249,388 YLL,
equivalent to **9.28 per 1,000 population**

Non-fatal burden
67,717 YLD,
equivalent to **2.52 per 1,000 population**

Fatal vs. Non-fatal burden in Persons, 2024

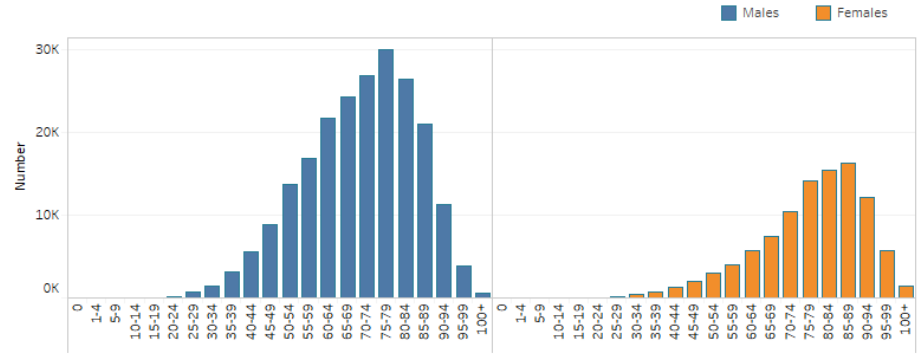
78.6% Fatal

21.4% Non-fatal

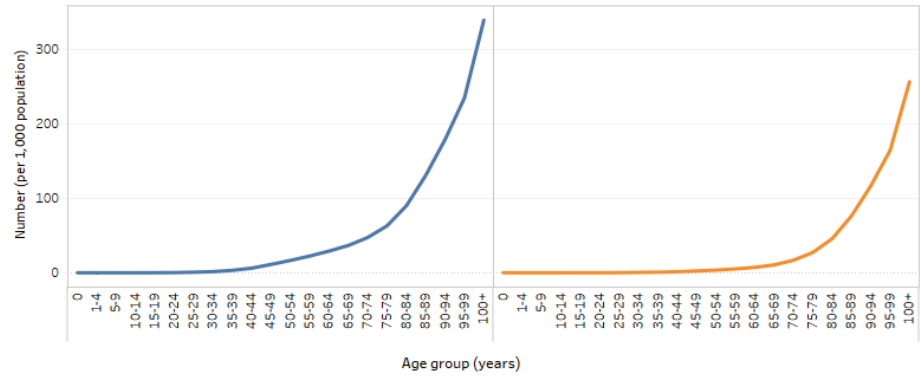
Age-standardised rates (ASRs) over time

	Males					Females				
	2003	2011	2015	2018	2024	2003	2011	2015	2018	2024
DALY ASR	29.56	20.32	17.17	15.36	13.32	13.49	8.57	7.00	6.08	4.89
YLL ASR	24.51	16.44	13.94	12.31	10.82	10.83	6.54	5.35	4.53	3.65
YLD ASR	5.05	3.89	3.23	3.05	2.50	2.66	2.02	1.65	1.55	1.24

Number of DALY by sex and age, 2024



DALY rates by sex and age, 2024



Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed as per 1,000 population.
2. Diseases displaying a rate of 0.00 per 1,000 population refer to a rate <0.005 per 1,000 population.
3. Estimates for autism spectrum disorders in 2018 and 2024 are not comparable to earlier years due to changes in data source. Refer to the technical notes for more information on data sources and methods used in the Study.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Health-adjusted life expectancy

Health-adjusted life expectancy (HALE) extends the concept of life expectancy (the number of years a person can expect to live) by considering the number of years a person of a particular age could expect to live in full health (without disease and/or injury) and in ill health (with disease and/or injury). For example, a 21-year old male can expect to live 52.2 years (85%) of their remaining life in full health and 9.0 years (15%) of their remaining life in ill health based on estimated age-specific morbidity and mortality rates in 2024. For detailed methods for the estimation of HALE, refer to the *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021b).

Life expectancy and HALE can be measured at any age but are typically reported from birth (which represents the average life expectancy in years for a baby born that year) and at age 65, describing health in an ageing population.

The ratio of HALE to life expectancy, expressed as a percentage, represents the proportion of life expectancy that is spent in full health. Comparing the ratio over time can highlight whether or not an increase in life expectancy is accompanied by an increase in time spent in full health or in ill health.

Use the interactive graphs below to explore the health-adjusted life expectancy of Australians, at various ages and by sex, for the most recent year (2024) compared with previous years (2003, 2011, 2015 and 2018). For a discussion of results related to HALE, refer to the Key findings.

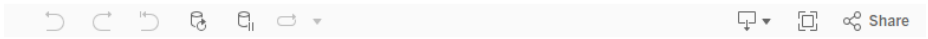
For ABDS 2024, a life table for 2024 derived from the ABS provisional deaths and projected 2024 YLD rates were used to calculate HALE. For more information on HALE and the life expectancies used, see Technical notes.

How to navigate the interactive visualisation

Use the drop-down list above each graph to view the data by age (top graph) or by year (bottom graph).

Hover over the bars on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



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Download = Allows a downloadable file as either an image (PNG), PDF or PowerPoint file. This is a useful way to save a snapshot of the visualisation to include in a document or presentation.

Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

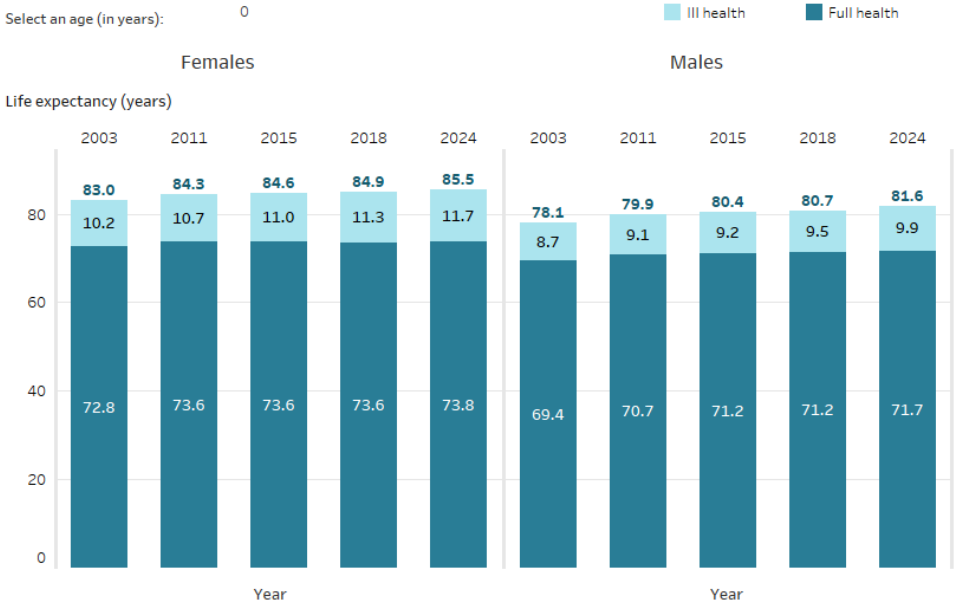
Figure 3.6: Health-adjusted life expectancy in Australia

This interactive visualisation shows life expectancy and health-adjusted life expectancy by age and sex for the years 2003, 2011, 2015, 2018 and 2023.

Australian Burden of Disease Study 2024

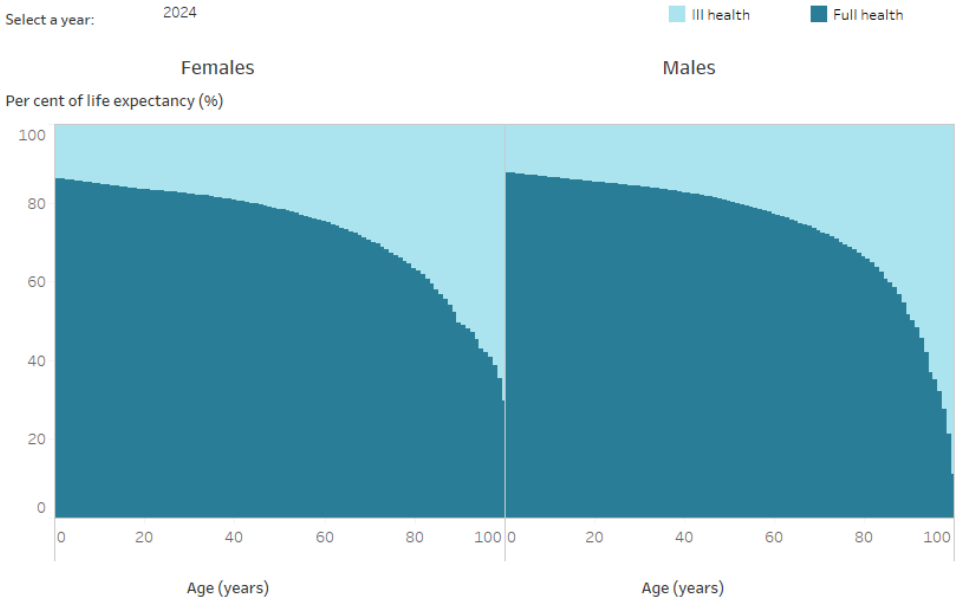
Life expectancy and health-adjusted life expectancy (HALE) over time, by sex, at selected age

Select an age (in years): 0



Per cent of remaining life expectancy spent in full health and ill health at each age, by sex, in selected year

Select a year: 2024



Notes
1. For ABDS 2024, a life table for 2024 derived from the ABS provisional deaths and projected 2024 YLD rates were used to calculate HALE.
2. For more information on HALE and the life expectancies used, see Technical notes.
Sources: ABS provisional mortality 2024 customised data, AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

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Interactive data on risk factor burden

The following interactive data visualisations allow users to explore the data in more detail and filter/customise the data and figures to meet their information needs.

The AIHW aims to meet the Australian Government's web accessibility requirements. If any of the interactive burden of disease pages are inaccessible to you, or you are experiencing problems accessing content for any reason, please contact us at burdenofdisease@aihw.gov.au.

What is included in the Australian Burden of Disease Study 2024 risk factor data visualisations?

The interactive data visualisations present estimates of attributable total burden (attributable DALY), non-fatal burden (attributable YLD), fatal burden (attributable YLL) and attributable deaths in Australia by age, sex and linked disease for 2024, and for most risk factors for 2003, 2011, 2015 and 2018.

There are five sections which explore:

- Leading risk factors
- Attributable burden across the life course
- Burden attributable to risk factors for linked diseases
- Changes in attributable burden over time
- Diseases/injuries and their associated risk factors.

Risk factor estimates for a particular disease cannot simply be added together as they are estimated independently, with some risk factors being on the same causal pathway. Further information on estimating PAFs and the data and methods used in the Australian Burden of Disease Study 2024 can be found in the Technical notes. Further information on how to interpret specific measures in the visualisations is shown when hovering over the information icons on available pages.

Leading risk factors

Ranking risk factors by attributable burden shows the leading causes of preventable health loss in Australia.

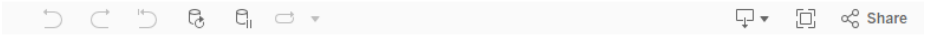
Use the interactive graph to explore the number or rate of total burden (DALY), non-fatal burden (YLD) and fatal burden (YLL) attributable to risk factors in Australia by sex for the most recent year (2024). Results for 2003, 2011, 2015 and 2018 are included for comparison.

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by measure, year and sex.

Hover over the bars on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

Pause = Stops the visualisation from updating each time a filter is changed, enabling multiple filters to be changed at once. Clicking ‘Resume’ will update the visualisation according to the selected filters.

Download = Allows a downloadable file as either an image (PNG), PDF or PowerPoint file. This is a useful way to save a snapshot of the visualisation to include in a document or presentation.

Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.1: Leading risk factors contributing to disease burden in Australia

This interactive visualisation ranks all 20 included risk factors in descending order by selected measure, data year and sex.

Australian Burden of Disease Study 2024

Select from the following:

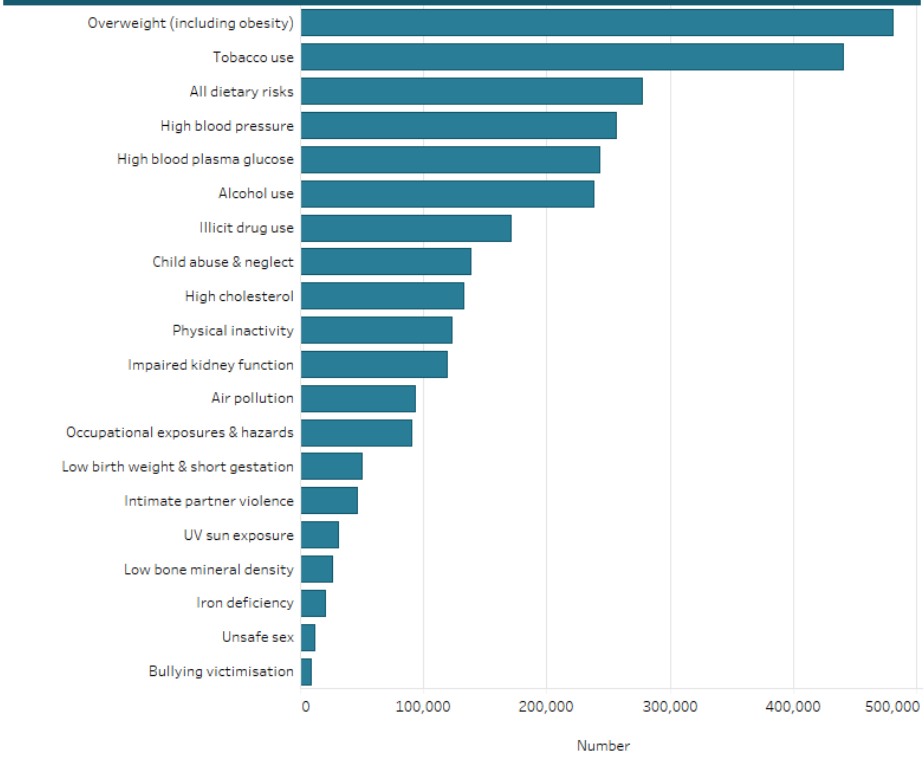
Measure: Attributable DALY

Year: 2024

Sex: Persons

DALY= Disability-adjusted life years; **YLD**= Years lived with disability; **YLL**= Years of life lost; **ASR**= Age-standardised rate per 1,000 population

Leading risk factors contributing to disease burden in Australia, persons, 2024



Notes:
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed as per 1,000 population.
2. The risk factors high blood plasma glucose, air pollution, and low birth weight & short gestation were not estimated for all reference years.
3. Attributable deaths are not available in 2024 and the percent attributable deaths is appoximate for 2024, as data on deaths in 2024 were not available at the time of analysis. See Technical notes for more information.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Attributable burden across the life course

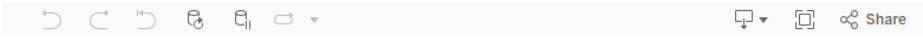
The health impacts due to risk factors vary by age and sex. Use the interactive graph to explore the contribution of leading risk factors to total burden (DALY), non-fatal burden (YLD) and fatal burden (YLL) in Australia by age and sex for the most recent year (2024).

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by measure, year and sex.

Hover over the coloured tiles on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

Pause = Stops the visualisation from updating each time a filter is changed, enabling multiple filters to be changed at once. Clicking 'Resume' will update the visualisation according to the selected filters.

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Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.2: Top 5 risk factors contributing to disease burden in Australia, by age group

This interactive visualisation shows the leading 5 risk factors for each age group by selected measure, data year and sex.

Australian Burden of Disease Study 2024

Select from the following:

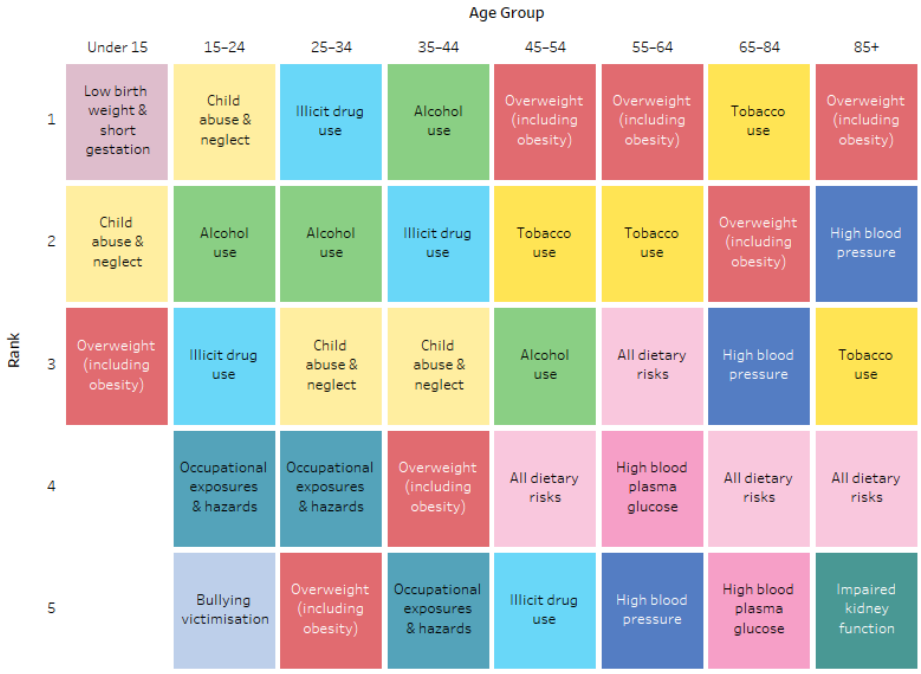
Measure: Percent of DALY

Year: 2024

Sex: Persons

DALY= Disability-adjusted life years; **YLD**= Years lived with disability; **YLL**= Years of life lost

Ranking of leading risk factors by age group, for persons in 2024



Notes:
1. The percent attributable deaths is approximate for 2024, as estimates of deaths in 2024 were not available at the time of analysis. See Technical notes for more information.
2. The risk factors high blood plasma glucose, air pollution, and low birth weight & short gestation were not estimated for all reference years.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Burden attributable to risk factors

On this page

The Australian Burden of Disease Study (ABDS) 2024 estimated the disease burden and deaths due to 40 risk factor components or exposures (such as cannabis use) that combine into 20 individual risk factors (such as illicit drug use).

These estimates reflect the amount of disease burden that could have been avoided if exposure to the risk factor had been avoided or reduced to the lowest possible exposure.

How much burden was attributable to individual risk factors?

Use the interactive graph to explore the top 10 linked diseases due to the selected risk factor (by the selected measure).

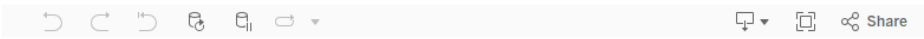
How to navigate the interactive visualisation

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by risk factor, measure, year and sex.

Hover over the bars on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

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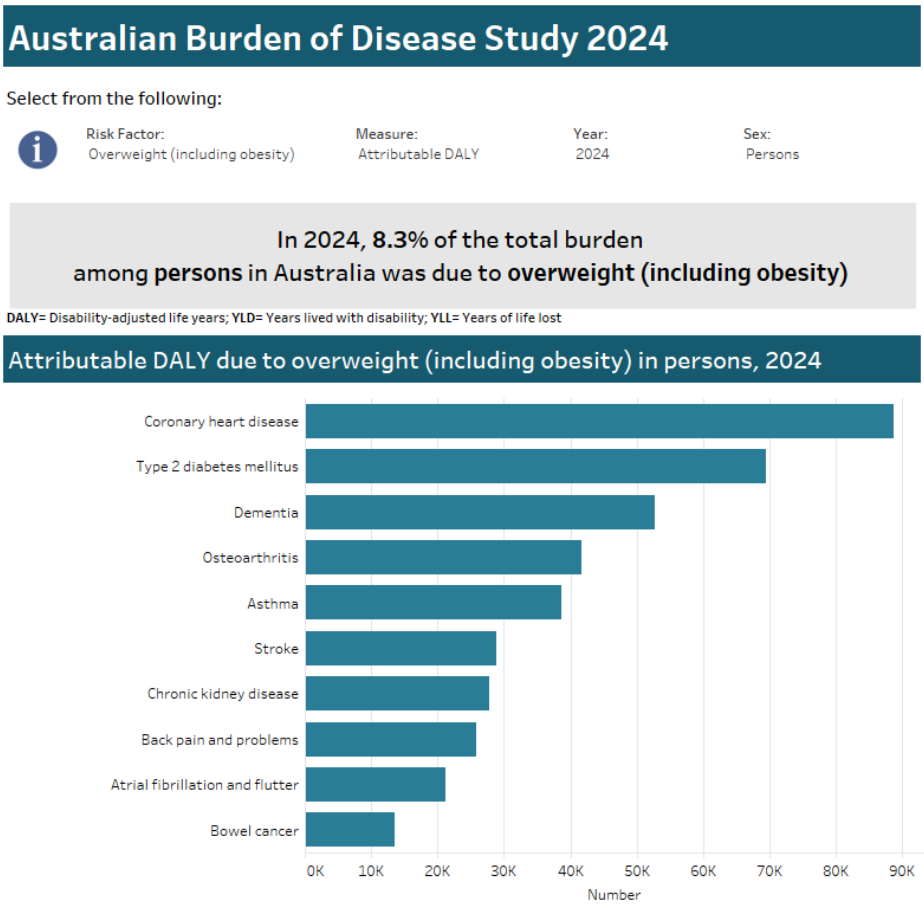
Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.3: Burden attributable to linked diseases in Australia, by risk factor

This interactive visualisation shows the burden from the top 10 linked diseases, by selected risk factor, measure, data year and sex.



How did burden attributable to individual risk factors vary by age and sex?

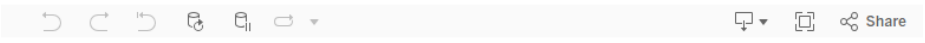
Use the interactive graphs to explore how the burden attributable to the selected risk factor (by the selected measure) varies by sex and age.

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by risk factor, measure, year, sex and disease group.

Hover over the bars on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

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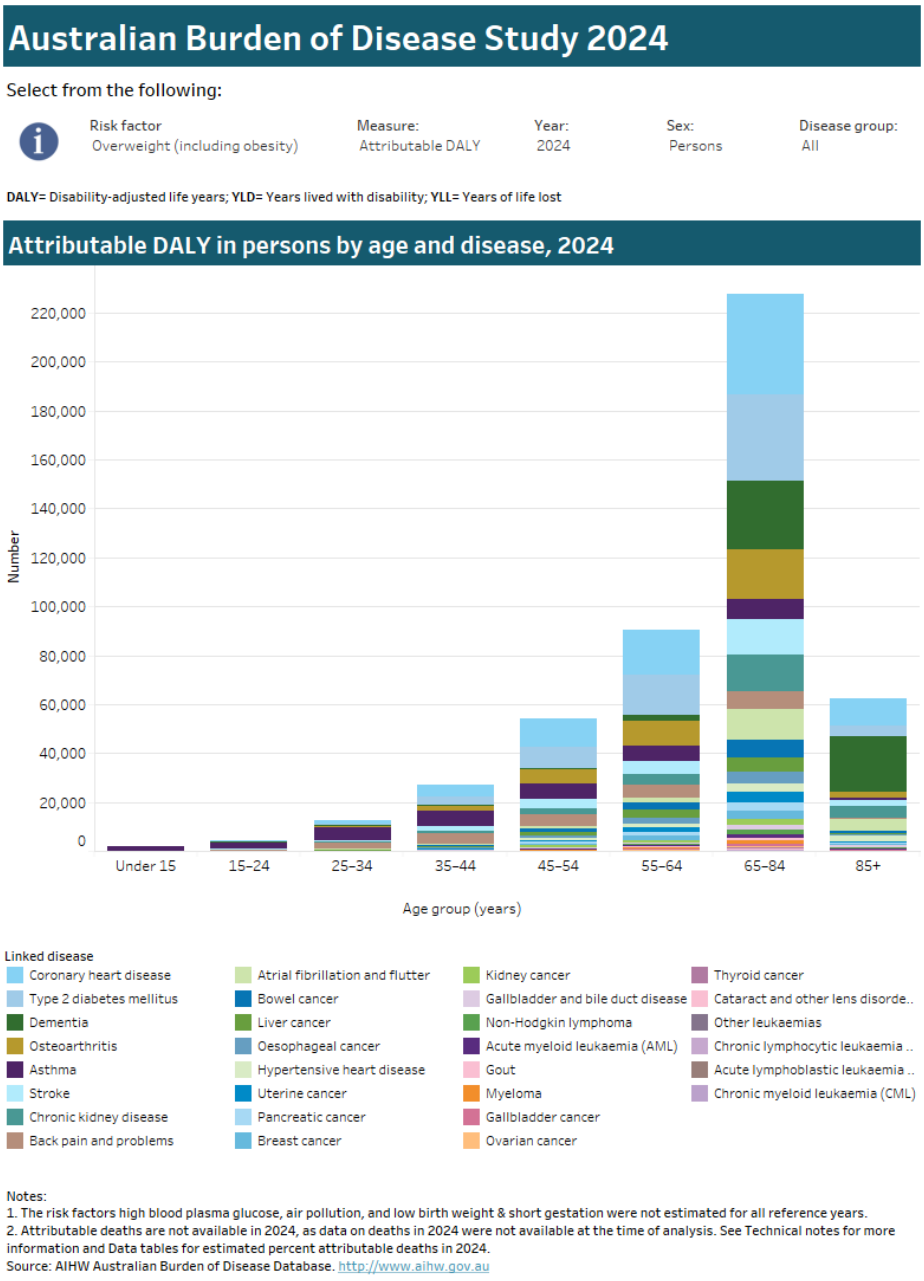
Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.4: Attributable burden in Australia, by risk factor, age and linked disease

This interactive visualisation shows the burden by age group from all linked diseases, by selected risk factor, measure, data year and sex.



Notes:
1. The risk factors high blood plasma glucose, air pollution, and low birth weight & short gestation were not estimated for all reference years.
2. Attributable deaths are not available in 2024, as data on deaths in 2024 were not available at the time of analysis. See Technical notes for more information and Data tables for estimated percent attributable deaths in 2024.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Changes in risk factors over time

On this page

Changes in burden over time from risk factors may be due to changes in population size, exposure to the risk factors, the age at which exposure occurs, or the overall burden for those diseases or injuries that are linked to these risk factors.

The following interactive data visualisations are included on this page:

- Changes in the ranking of leading risk factors over time by sex
- Changes in attributable burden over time by specific risk factors and sex.

Changes in leading risk factors over time

Ranking risk factors by attributable burden shows the leading causes of preventable health loss in Australia.

The interactive visualisation below shows the leading 10 risk factors for attributable burden (DALY, YLD or YLL) in Australia in 2024 compared with previous years (2003, 2011, 2015 and 2018) ranked by:

- age-standardised rate (ASR) of attributable burden, which takes into account differences in population age structure and size between years. This graph can be filtered by sex.
- the number of YLL, YLD or DALY. This graph can be filtered by sex and/or age group.

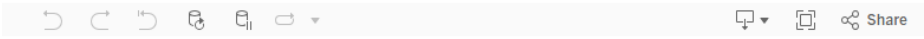
How to navigate the interactive visualisations

Click on the tabs at the top of the visualisation to either view the disease rankings by age-standardised rate or by number.

Use the drop-down lists at the top of the visualisation to filter the data by measure and sex.

Hover over the coloured squares or lines on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

Pause = Stops the visualisation from updating each time a filter is changed, enabling multiple filters to be changed at once. Clicking 'Resume' will update the visualisation according to the selected filters.

Download = Allows a downloadable file as either an image (PNG), PDF or PowerPoint file. This is a useful way to save a snapshot of the visualisation to include in a document or presentation.

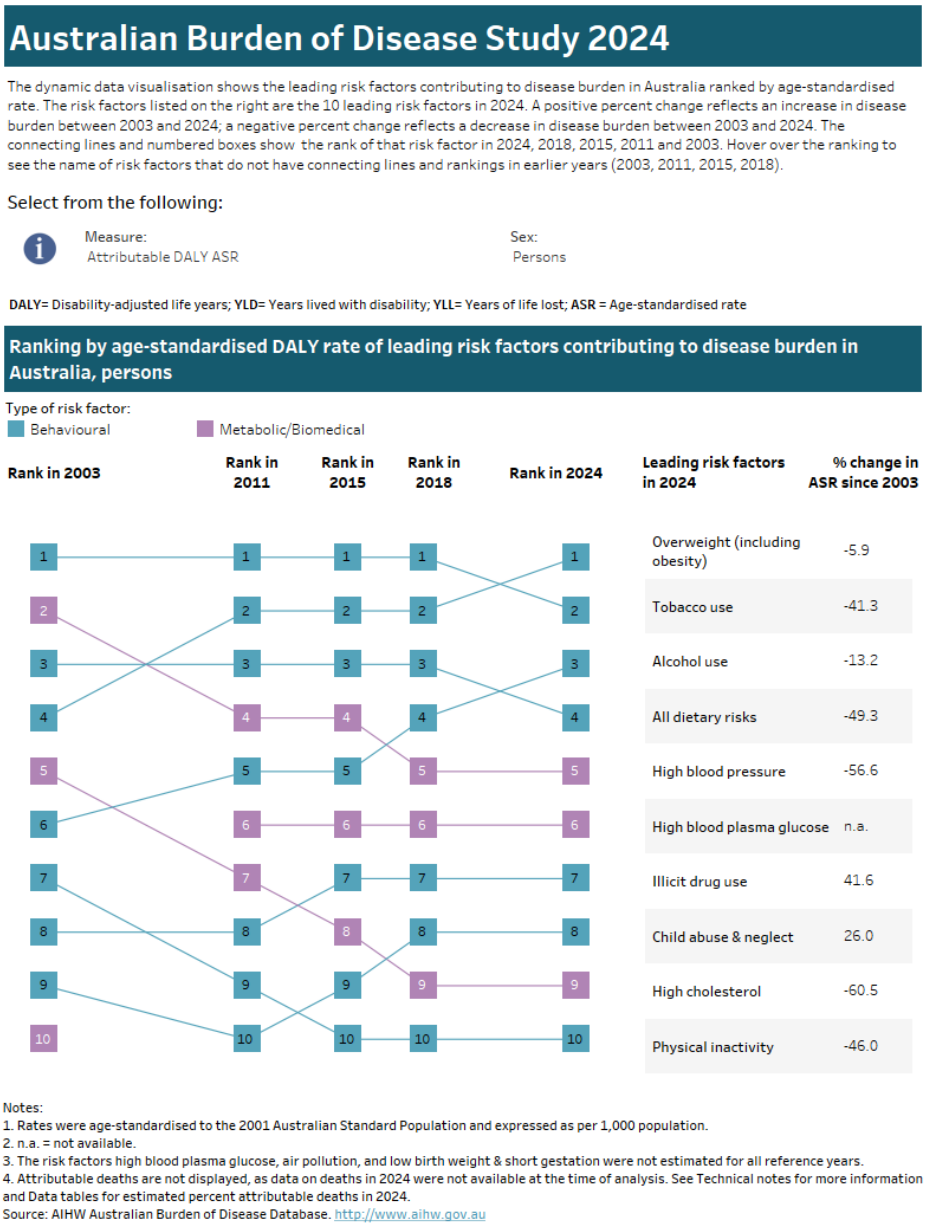
Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.5: Leading risk factors contributing to disease burden in Australia, ranking over time

This interactive visualisation compares changes over time in rankings of leading risk factors contributing to burden, by selected measure and sex.

-
-
-



Notes:
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed as per 1,000 population.
2. n.a. = not available.
3. The risk factors high blood plasma glucose, air pollution, and low birth weight & short gestation were not estimated for all reference years.
4. Attributable deaths are not displayed, as data on deaths in 2024 were not available at the time of analysis. See Technical notes for more information and Data tables for estimated percent attributable deaths in 2024.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Changes in attributable burden over time

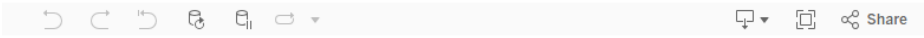
Use the interactive graph below to explore differences in attributable burden in Australia over time. Estimates are displayed by specific risk factor and sex for the most recent year (2024) and for year 2003, 2011, 2015 and 2018 for comparison.

How to navigate the interactive visualisation

Use the drop-down lists at the top of the visualisation to filter the data by risk factor, measure, sex, start year and end year.

Hover over the bars on the chart for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

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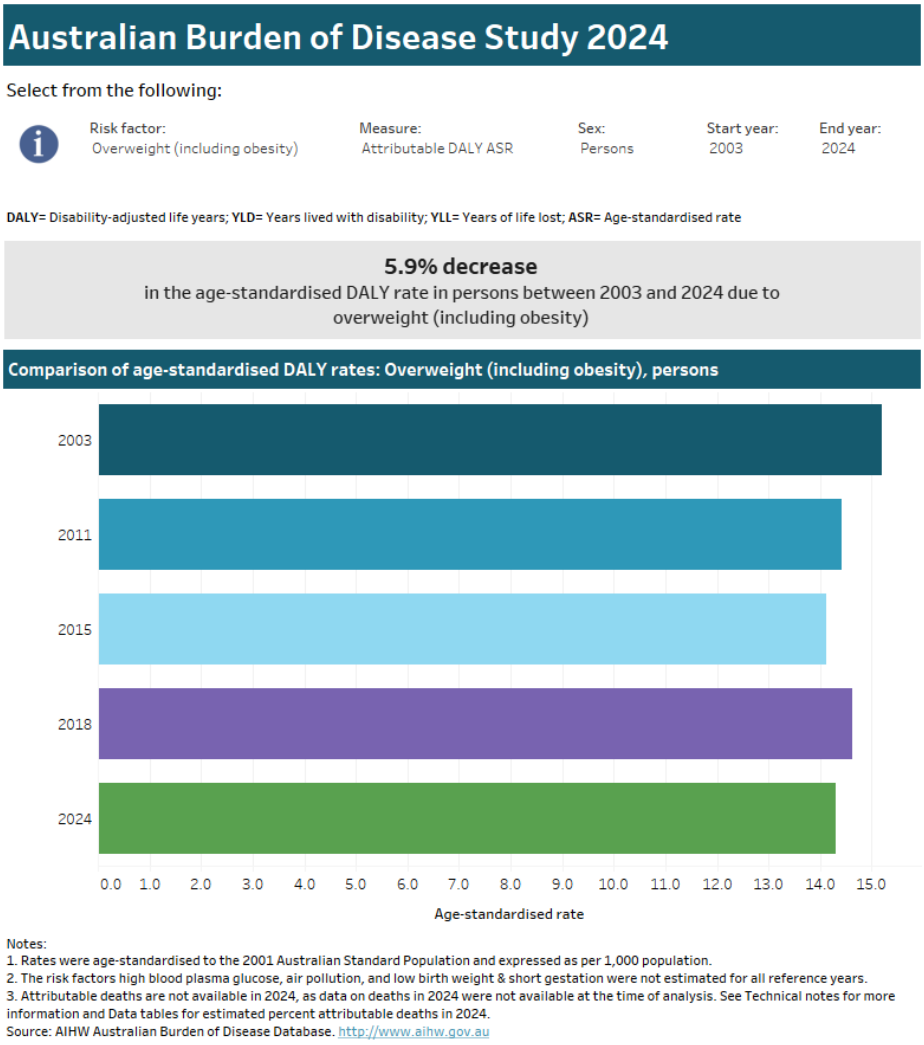
Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.6: Burden attributable to linked diseases in Australia over time, by risk factor

This interactive visualisation compares changes in burden due to a risk factor between selected years, by selected measure and sex.



Australian Government
Australian Institute of Health and Welfare

Diseases and associated risk factors

Use the interactive graph below to explore a disease or injury to find out their associated risk factors and the impact on burden in Australia in 2024.

By selecting a disease group and a specific disease or injury, the risk factors that contribute to the development of the disease or injury, the proportion of disease burden each risk factor contributes to and the number of total burden in 2024 (DALY) are displayed.

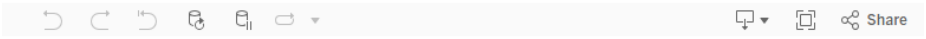
Note that attributable burden estimates by risk factor here may differ to the estimates provided in the risk factor-specific visualisations provided elsewhere. This is due to a proportional scaling applied to each risk factor's estimates to account for the relative impact of the joint effect calculation and mediation occurring between interrelated risk factors. It is not appropriate to sum the proportion of disease burden contributed by each risk factor for all forms of diabetes and chronic kidney disease, as these are considered entirely attributable to the risk factors high blood plasma glucose and impaired kidney function, respectively.

How to navigate the interactive visualisation

To filter the data, select a disease group by clicking on an icon in section 1, a disease in section 2, and then select a measure.

Hover over the bars on the charts for additional information.

The toolbar at the bottom of the visualisation enables users to interact with the data in different ways:



Undo = Undo the latest filter applied.

Redo = Redo the latest filter applied.

Revert = Clears all filters applied and reverts visualisation to default filters.

Refresh = Connects to the underlying data source and updates the visualisation with any changes in the data (not applicable to this visualisation).

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Full screen = Displays the dashboard in full screen mode (press Esc to return to original view).

Share = Generates a link that can be shared (note that filters will not be applied when link is shared).

Figure 4.7: Burden of linked diseases due to risk factors in Australia

This interactive visualisation reports the burden from related risk factors for a selected disease or injury, by selected measure.

Australian Burden of Disease Study 2024

Impact of risk factors on disease burden in Australia 2024

1. Select a disease group


Blood and metabolic disorders


Cancer and other neoplasms


Cardiovascular diseases


Endocrine disorders


Gastrointestinal disorders


Hearing and vision disorders


Infant and congenital conditions


Infectious diseases


Injury (external cause)


Kidney and urinary diseases


Mental and substance use disorders


Musculoskeletal disorders


Neurological conditions


Reproductive and maternal conditions


Respiratory diseases

2. Select a disease to explore its related risk factor(s)

Related risk factor(s)

Select measure:
Attributable DALY

DALY = Disability-adjusted life years
YLD = Years lived with disability
YLL = Years of life lost

Proportion of None None due to risk factors by sex, 2024

Amount of None attributable None by sex and risk factor, 2024

Notes:
1. All forms of diabetes and chronic kidney disease are considered entirely attributable to the risk factors high blood plasma glucose and impaired kidney function, respectively.
2. Intimate partner violence attributable burden was estimated for females only.
3. Attributable deaths are not displayed, as data on deaths in 2024 were not available at the time of analysis. See Technical notes for more information and Data tables for estimated percent attributable deaths in 2024.
Source: AIHW Australian Burden of Disease Database. http://www.aihw.gov.au

Technical notes

Overarching methods

General methods for estimation of burden of disease can be found in *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021b). This includes descriptions for years of life lost (YLL), years lived with disability (YLD), disability-adjusted life years (DALY) and health-adjusted life expectancy (HALE).

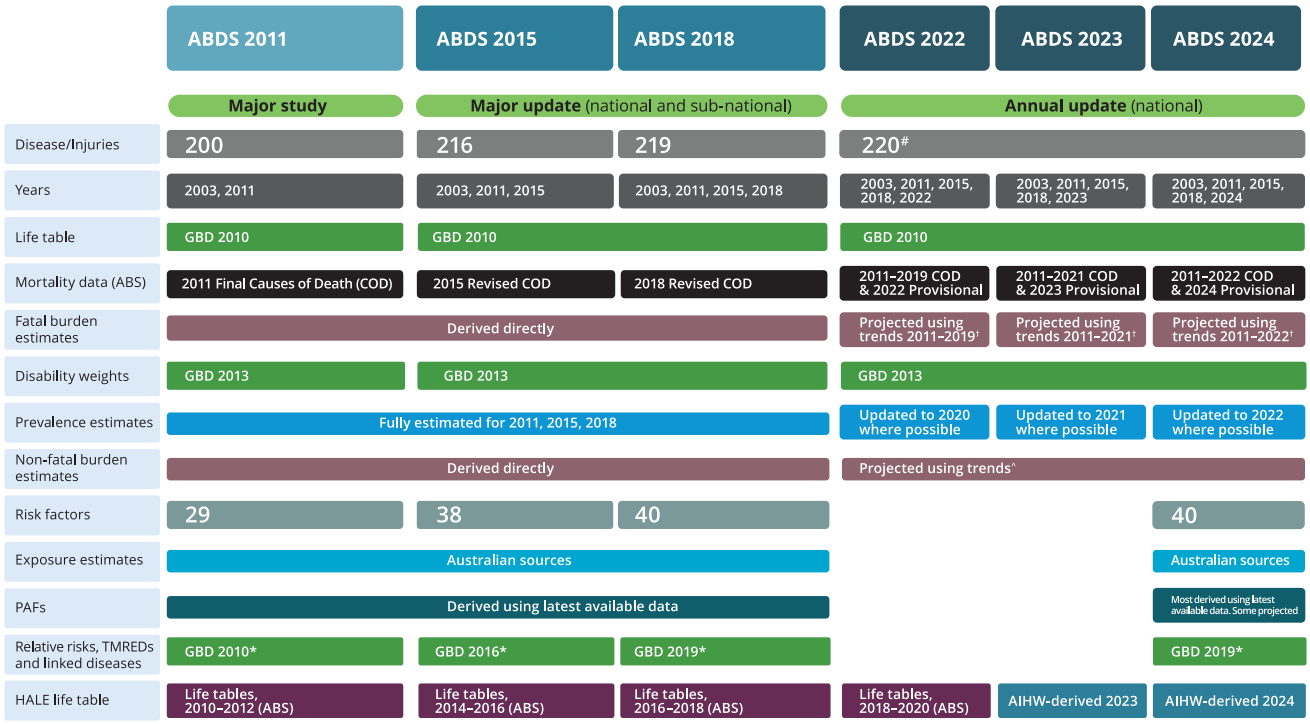
How the Australian Burden of Disease Study 2024 differs from previous studies

The 2003, 2011, 2015 and 2018 Australian Burden of Disease Studies (referred to as 'major studies') produced estimates for an agreed 'reference year'. Due to the complex methods for deriving estimates and availability of key data sources there was a 3–4 year lag between the reference year and the year of publication of results. Following ABDS 2018, the AIHW has produced annual updates of national disease burden estimates projected to the year of publication (referred to as 'nowcasting') utilising the most recent updates for major data sources. This has enhanced the frequency and timeliness of the data and maximised the use of these estimates for policy development. ABDS 2022 and ABDS 2023 (referred to as 'annual updates') published estimates of disease burden for the nowcast years of 2022 and 2023 respectively.

The ABDS 2024 builds on work from the ABDS 2022 and ABDS 2023 to produce national disease burden estimates for the year of publication (2024) for 220 diseases and injuries. ABDS 2024 also includes estimates of attributable burden for 20 risk factors (last updated as part of ABDS 2018) in 2024 using a nowcast methodology for the first time for selected risk factors. This Study provides burden of disease and risk factor estimates best matched to the public health context for the Australian population for 2024.

Figure 5.1 shows some of the key methodological differences between previous studies and ABDS 2024. Each iteration of the ABDS (both major and annual updates) contains a full set of burden estimates regenerated for each cause for each major study year (2011, 2015 and 2018) using any updated input estimates and/or reference inputs. Estimates for 2003 have not been regenerated since the 2018 major update.

Figure 5.1: Australian Burden of Disease Studies: changes over time



ABDS 2024 reports estimates for 2003, 2011, 2015, 2018 and 2024 for comparisons over time. Estimates for years prior to 2024 are either sourced from ABDS 2018 or have been revised to reflect updates in major data sources. The years included in trend analyses for projection models to estimate burden in 2024 may differ to these reporting years. Table S4 presents information about the years of data included in trend analyses for each disease or injury in ABDS 2024, as well as the type of projection model used.

Sex and gender data in ABDS

The ABDS presents results by male or female as this is what is currently recorded in the majority of the data collections used in the estimates. In some instances, male or female may refer to either sex or gender, depending on the data source. Due to small numbers, where sex or gender is included in datasets as a term other than male or female, this is not reported separately.

Population data

All Australian population-based rates for 2018 were calculated using populations rebased to the 2016 Census (ABS 2022).

Population-based rates for 2003, 2011 and 2015 were calculated using the latest available population estimates from the ABS.

Population data for 2024 were sourced from population projections by the Centre for Population (2022). The population under the 'central scenario' was used for this Study, which assumed overseas migration to Australia was significantly affected by the COVID–19 pandemic.

The 2001 Australian Standard Population was used for all age-standardisation, as per AIHW and ABS standards (ABS 2016).

References

ABS (Australian Bureau of Statistics) (2016) *Australian demographic statistics, Jun 2016* - external site opens in new window, ABS, Australian Government, accessed 8 September 2022.

ABS (2022) *National, state and territory population, December 2022* - external site opens in new window [Data Explorer], ABS, Australian Government, accessed 16 June 2023.

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: methods and supplementary material 2018*, AIHW, Australian Government, accessed 19 September 2024.

Centre for Population (2022) *Population Statement: national projections, 2021–22 to 2032–33* - external site opens in new window, Australian Government, accessed 1 July 2022.

Disease burden estimates

On this page:

2024 estimates

Estimates for years of life lost (YLL) for 2024 were largely based on trend analyses of annual deaths occurring between 2011 to 2022, projected to 2024. A 12-year time period was considered sufficient for producing reliable trends in mortality. Trend analyses were supplemented with ABS provisional deaths for available months (January to June) in 2024 which was used to validate and adjust projected deaths where appropriate. Provisional deaths to September 2024 were also used in the estimation of COVID-19 and lower respiratory infections (LRI) (see sections on COVID and LRI for more detail).

Estimates for years lived with disability (YLD) for 2024 used trend analysis based on YLD estimates for previous ABDS reference years (2003, 2011, 2015, 2018), 2019 (calculated as part of ABDS 2022), 2020 (calculated as part of ABDS 2023), and 2022 prevalence data where available (for example, hospitalisation data and data from National Survey of Mental Health and Wellbeing - external site opens in new window (NSMHW)).

For some diseases, the reference period used to inform the trend was restricted (see Table S4 for information about the models used and years included in YLL and YLD estimates for each disease and injury in ABDS 2024). For example, for diseases that were largely impacted by the lockdowns and restrictions put in place during the early part of the COVID-19 pandemic (for example, road traffic injuries), estimates for 2020 were not included in the projection models for YLD estimates. The year 2020 was also excluded from trend analyses for YLL as this did not resemble a typical mortality year (ABS 2020). Other years were excluded where data were considered inappropriate for use in trend analysis, such as due to coding changes, or where data in early years (that is, 2003 for some causes) were not considered robust. See Box 5.1 for examples of coding changes for selected diseases and how this affected trend analyses.

Box 5.1: Examples of changes to disease coding and guidelines over time

Substance use disorders and accidental poisoning

From 2013, the ABS implemented new software for coding causes of death, applied International Classification of Diseases 10th revision (ICD-10) - external site opens in new window updates and reviewed coding practices. These processes impacted the cause of death output from 2013 onwards for some diseases and conditions. Specifically, for substance use disorders, where a death was due to an accidental drug overdose for a person with a known addiction to the drug, the addiction was reported as the underlying cause of death (that is, ICD-10 codes F10–F19 Mental and behavioural disorders due to psychoactive substance use). Since the coding changes, the drug overdose is captured as the underlying cause of death (X40–X49 Accidental poisoning) and the addiction is retained as an associated cause of death. The result was an increase in deaths due to Accidental poisoning, and a decrease in the number of deaths due to Mental and behavioural disorders due to psychoactive substance use. These changes caused a break in the fatal burden series for these conditions. Comparisons of fatal burden between study years prior to 2013 (that is, 2003 or 2011) and those after (that is, 2015, 2018 or 2024) should take this into consideration. It does not affect comparisons between 2003 and 2011, or between 2015 and 2018 or 2024.

To account for the change in 2013, the 2024 projected estimates of fatal burden (YLL) of substance use disorders were based on trend analysis starting from 2013.

Dementia and stroke

There was a change in the trend for deaths due to dementia in 2006. The number of deaths due to dementia has increased when comparing data before 2006 with data from 2006 onwards. This increase can be attributed to:

- changes in ICD-10 instructions for coding deaths data, which have resulted in assigning some deaths to vascular dementia (F01) that may previously have been coded to cerebrovascular diseases (stroke) (I60–I69)
- the increase in reporting dementia as the underlying cause of death accompanied by the decrease in reporting of dementia as an associated cause (Buckley et al. 2019)
- legal changes allowing veterans and members of the defence forces to relate death from vascular dementia to relevant service
- a promotional campaign targeted at health professionals, which is thought to have increased the reported number of dementia deaths among this group (ABS 2014).

These changes will have an impact on comparisons made between 2003 and study years after 2006.

To account for these changes, the 2024 burden estimates (both YLL and YLD) for dementia and stroke were based on trend analysis starting from 2011.

Gestational diabetes

The International Association of the Diabetes and Pregnancy Study Groups (IADPSG) developed a new consensus guideline for the testing and diagnosis of gestational diabetes in 2010. In 2014, the endorsement of the IADPSG guidelines by the Australasian Diabetes in Pregnancy Society (ADIPS) resulted in a significant change to the practice of testing and diagnosing gestational diabetes in Australia (AIHW 2019). Reflecting international trends, Australian studies found increases in the number of women diagnosed with gestational diabetes following the introduction of the IADPSG guidelines between about 2010 and 2014, of 20% (Laafira et al. 2015), 35% (Moses et al. 2011) and 74% (Cade et al. 2019). A steep increase of the incidence of gestational diabetes was recorded from 2012–13 (AIHW 2019). These changes will have an impact on comparisons made between study years before 2014 (that is, 2003 or 2011) and those after (that is, 2015, 2018 or 2024). It does not affect comparisons between 2003 and 2011, or between 2015 and 2018 or 2024.

To address this change, the 2024 non-fatal burden (YLD) estimates of gestational diabetes were based on trend analysis starting from 2015, which was the closest starting point amongst available ABDS estimates.

For each disease, one of the following projection methods was used to estimate YLL or YLD burden in 2024:

- log-linear regression (also called Poisson regression or Poisson linear regression) which assumes that rates change at a constant per cent annually (for example, increases by 1% every year);
- ordinary least-squares regression (also called simple linear regression) which assumes a constant fixed amount of change (for example, 10 YLD) every year (NCI 2022);
- sex- and age-specific crude rates assumed to be the same between the year with the latest available data (for example, 2022) and 2024, and applied to 2024 population data.

The COVID-19 pandemic presents an important consideration for the selection of appropriate models given its impacts on the input data sources available, the health system or the disease/injury itself. For example, disease estimates that would otherwise rely on health surveys or screening data sources were likely to be impacted due to restrictions and lockdowns in reference years following the onset of the pandemic. Therefore, selected regression models take into account factors beyond indicators of best fit and incorporate an assessment of appropriateness in consideration of the pandemic data environment. Projections of burden using model inputs only up to and including the year 2019 (that is, prior to the pandemic), are available upon request.

COVID-19 was added to the ABDS 2022 as a new disease, and has since been included in the ABDS. COVID-19 and lower respiratory infections (including influenza and pneumonia) estimates were derived using the most recent available data for 2024. While burden of disease estimates report on lower respiratory infections (including influenza and pneumonia), attributable burden estimates report on lower respiratory infections and influenza separately, consistent with the approach used for ABDS 2018. Further details on these diseases, including caveats and assumptions, are presented below.

Earlier reference years

For YLL, estimates reported for earlier ABDS reference years (2003, 2011, 2015, 2018) have been revised to incorporate changes in mortality coding under the ABS revisions process. Once a year, the ABS revises mortality information for coroner-certified deaths to improve the accuracy of the coding of these deaths. These revisions do not increase the overall number of deaths in any year but may change the distribution of the causes of death. Further information on the ABS mortality revisions process is available on the ABS website - external site opens in new window.

For YLD, estimates for earlier ABDS reference years were largely sourced from published estimates from ABDS 2018 (AIHW 2021a). Estimates for 2011, 2015 and 2018 were revised for the mental health conditions sourced from the NSMHW (depressive disorders, anxiety disorders, bipolar affective disorder and alcohol use disorder) to account for changes in prevalence between the 2007 and 2020–22 surveys. YLD estimates for autism spectrum disorders for 2018 were also updated following a revision to WA Intellectual Disability Exploring Answers (IDEA) data which has been linked to the National Disability Insurance Scheme (NDIS), resulting in higher

ascertainment of individuals with autism spectrum disorders. YLD estimates for 2018 were revised to allow comparisons with 2024 estimates, however, it should be noted that estimates for 2018 and 2024 are not strictly comparable to estimates for 2015 and earlier years due to this addition of a new ascertainment source in the IDEA.

Estimation of COVID-19 for 2024

Fatal burden

Methods for calculating fatal burden (expressed as YLL) of COVID-19 used the number of deaths directly due to COVID-19, the ages at which these deaths occurred, and the Global Burden of Disease Study (GBD) 2010 standard reference life table.

Definition and coding of COVID-19 deaths

In the International Classification of Diseases 10th revision (ICD-10), COVID-19 deaths are coded to:

- ICD-10 code U07.1 – COVID-19 virus identified is used when COVID-19 is confirmed by laboratory testing.
- ICD-10 code U07.2 – COVID-19 virus not identified is used for suspected or clinical diagnoses of COVID-19 where testing is not completed or inconclusive.
- ICD-10 code U10.9 – Multisystem inflammatory syndrome associated with COVID-19. This code is used to identify people who have died from a multi-inflammatory response syndrome associated with COVID-19.
- ICD-10 code U09.9 – Post COVID-19 condition. This code is used to link long term conditions including chronic lung conditions that are the result of the virus. These deaths are included as associated cause of death.

In ABDS 2024, deaths coded to U07.1, U07.2 and U10.9 as the underlying cause of death (death directly due to COVID-19) were included in estimating fatal burden.

Data sources

COVID-19 deaths for 2024 were sourced from the ABS death registration data, which is the official Australian deaths data collected via the state/territory Registrars of Births, Deaths and Marriages. It includes death registration data and medical cause of death information completed by a certifying medical practitioner and is considered a high-quality data source. In early-mid 2020, the ABS started releasing provisional deaths data to monitor the impact of the COVID-19 pandemic. Further information about the completeness and timeliness of the ABS provisional deaths data is available on the ABS website - external site opens in new window.

Estimating fatal burden in 2024

At the time of analysis, COVID-19 deaths up to September 2024 were available from the ABS provisional deaths report, released on 29 October 2024 (ABS 2024). These data were incomplete for August and September 2024 due to late registrations, and as such data for these months were inflated to account for incompleteness. To estimate the number of COVID deaths for the remaining months of 2024, the monthly changes of COVID-19 mortality rates were modelled from COVID-19 deaths in the previous year (2023) using the percentage change in rates from month-to-month to December.

The estimated COVID-19 deaths for 2024 were then disaggregated by single year of age and sex, using the age and sex distributions from a customised data request of 2024 provisional deaths (January to June) provided by the ABS. The standard reference life table was then applied to the estimates to derive the YLL at each age.

Non-fatal burden

The input data needed to calculate COVID-19 non-fatal burden estimates should ideally reflect the full coverage of cases, with any under-ascertainment adjusted for with appropriate data, if available. This was the method used for 2022 estimates, however over time, procedures for testing COVID-19 have changed (that is, the move from strict requirements for PCR-based testing to rapid antigen testing and self-reporting), making it difficult to determine the number of COVID-19 cases each year and the level of under-ascertainment.

Estimating non-fatal burden in 2024

The potential of high under-ascertainment of COVID-19 cases in 2024 and limited data availability at the time of analysis on hospitalised and Intensive Care Unit (ICU) cases nationally, COVID-19 YLL-to-YLD ratios for 2023 (from ABDS 2023) were applied to the COVID-19 YLL estimated for 2024 (which used Provisional deaths) to estimate COVID-19 YLD in 2024 for each age-sex group. This approach was deemed reasonable considering mortality data for COVID-19 is of reasonable quality and the burden due to COVID-19 is predominantly fatal (83% in 2023). The underlying assumption using this method is that the COVID-19 YLL-to-YLD ratio for 2023 will be similar for 2024.

This method was applied to all age-sex groups where the YLL in 2024 was predicted to be greater than 0. For age groups where there was no predicted YLL (Female 0–34 and 40–44; Male 0–34), a ratio of YLD in 2023 to YLD in 2024 was calculated for each age group and the median value applied to each 5-year age sex group. The median was used to limit the impact of outliers.

Details on the methods and conceptual model for COVID-19 used in ABDS 2023 (which underpins the non-fatal burden estimates for ABDS 2024) can be found in the ABDS 2023 Technical notes.

Estimation of lower respiratory infections (including influenza and pneumonia) for 2024

Fatal burden

Deaths due to lower respiratory infections (LRIs), including influenza and pneumonia, were sourced from ABS provisional death registration data for 2024 and validated using the Australian Influenza Surveillance Reports. The Australian Influenza Surveillance Reports are compiled from a number of data sources, including laboratory-confirmed notifications to the National Notifiable Diseases Surveillance System (NNDSS); sentinel hospital admissions with confirmed influenza; sentinel influenza-like illness (ILI) reporting from general practitioners; ILI-related community level surveys; and sentinel laboratory testing results. See Department of Health and Aged Care (2024) - external site opens in new window for more information.

Deaths for 2024 were derived separately for influenza and other LRIs (including pneumonia). For influenza, a similar method to estimating deaths from COVID-19 was used. Doctor and coroner-certified influenza deaths up to September 2024 were available from the ABS provisional deaths report, released on 29 October 2024 (ABS 2024a). Deaths for August and September 2024 were inflated to account for incompleteness due to late registrations. To estimate deaths from influenza in October to December, the monthly changes of influenza mortality rates were modelled from deaths in the previous year (2023) using the percentage change in rates from month-to-month to December. Monthly deaths from the Australian Influenza Surveillance Reports were compared with the ABS provisional deaths to validate the trend predicted.

For other LRI (excluding influenza), only doctor-certified deaths up to June 2024 were available to the AIHW at the time of analyses (customised data request supplied by the ABS). Pneumonia deaths make up the large majority of these deaths and thus were first estimated using the same methods as described above for influenza. An inflation factor based on the previous 5 years was applied to the doctor-certified pneumonia deaths for 2024 to account for the missing coroner-certified deaths. To estimate the remaining number of LRI deaths in 2024, the ratio of pneumonia to total LRI deaths between 2018 and 2022 from the National Mortality Database (NMD) (0.89), was applied to the estimated number of pneumonia deaths in 2024 to derive the number of LRI deaths for 2024.

The single year age and sex distribution for influenza and other LRI from the provisional deaths data provided by the ABS for available months in 2024 was applied to the total number of deaths estimated for influenza and other LRIs in 2024. The standard reference life table was then applied to the estimates to derive the YLL at each age. YLL estimates for influenza and other LRI (including pneumonia) have been combined for reporting purposes.

Non-fatal burden

There was no national data available on the incidence of LRIs in 2024 at the time of analysis. As such, the same approach for estimating COVID-19 YLD in 2024 was used for LRI. This was to apply YLL-to-YLD ratios for 2023 (from ABDS 2023) to the YLL estimated for 2024 (based on ABS provisional deaths) to estimate YLD in 2024 for each age-sex group. This method was applied to all age-sex groups where the YLL in 2024 was predicted to be greater than 0. For the age-sex groups where there was no predicted YLL (Female 0–34 and 40–44; Male 0–4 and 10–34), a ratio of YLD in 2023 to YLD in 2024 was calculated and the median value applied to each 5 year age-sex group. The median was used to limit the impact of outliers. The underlying assumption using this method is that the LRI YLL-to-YLD ratio for 2023 will be similar for 2024.

Details on the methods and conceptual model for LRIs used in ABDS 2023 (which underpins the non-fatal burden estimates in ABDS 2024) can be found in detail in the ABDS 2023 Technical notes.

YLL and YLD data quality

To provide information on the quality of estimates, a quality index was developed for the ABDS to rate estimates according to the relevance and quality of source data, and methods used to transform data into a form required for analysis. Generally, the higher the rating, the more relevant and accurate the estimate.

To report on the reliability of projected burden of disease measures, the inclusion of confidence intervals associated with regression estimates was explored. However, these were not presented as these relate to the uncertainty of the regression models and do not reflect the underlying uncertainty associated with data inputs that inform prevalence estimates.

The burden estimates for ABDS 2024 were largely based on trend analyses using the most recent data for major data sources. The quality of input estimates in the ABDS 2024 for earlier reference years (2003, 2011, 2015 and 2018) are the same as the quality presented in the ABDS 2018. The ABDS 2018 estimates were produced using the best available data within the scope and time frame of the study.

Fatal burden (YLL) estimates were considered to have the highest quality rating for both data and methods used, as they used administrative data from the National Mortality Database, or the ABS provisional deaths supplied. The projections for 2024 were largely based on previous mortality trends. The non-fatal burden (YLD) estimates varied depending on the disease or injury, and the data sources used.

Information about the quality of the YLD 2018 estimates and the data and methods used can be found in Appendix B in the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report (AIHW 2021a) and in the *Australian Burden of Disease Study: methods and supplementary material 2018* report (AIHW 2021b).

An assessment of the quality of YLD estimates for COVID-19 were not available in the ABDS 2018. Lower respiratory infections (including influenza and pneumonia) were adjusted using recent data due to available evidence that these diseases were impacted by COVID-19. To help users understand the potential sources of uncertainty associated with the estimates, the 2-dimensional index developed for the burden estimates was used for these 2 diseases. This index was derived based on:

- the relevance of the underlying epidemiological data
- the methods used to transform that data into a form required by this analysis.

The index is scored on a scale from A (highest) to E (lowest). The quality of COVID-19 and lower respiratory infections (including influenza and pneumonia) are discussed below.

COVID-19

Non-fatal burden estimates for COVID-19 should be used with caution. Due to lack of robust data that captured all or most cases of COVID-19, non-fatal burden due to COVID-19 in 2024 was estimated using the ratio of non-fatal to fatal burden from 2023. This assumes that this ratio is the same between 2023 and 2024. Fatal burden estimates are considered more robust as they were calculated using available mortality data for the first half of 2024, with some assumptions made about the second half. Therefore, modelling non-fatal burden estimates using fatal burden was considered reasonable.

Data score = D

Method score = D

Lower respiratory infections (including influenza and pneumonia)

Non-fatal burden estimates for LRIs should be used with caution. Due to lack of data that captured all or most cases of LRIs, non-fatal burden was estimated using the ratio of non-fatal to fatal burden from 2023. This assumes that the ratio between 2023 and 2024 are the same. Fatal burden estimates are considered more robust as they were calculated using available mortality data for the first half of 2024, with some assumptions made about the second half. Therefore, modelling non-fatal burden estimates using fatal burden was considered reasonable.

Data score = D

Method score = D

References

ABS (Australian Bureau of Statistics) (2014) *Causes of death, Australia, 2012* - external site opens in new window, ABS, Australian Government, accessed 8 September 2022.

ABS (2020) *Causes of Death, Australia* - external site opens in new window, ABS, Australian Government, accessed 28 August 2023.

ABS (2024) *Deaths due to COVID-19, influenza and RSV* - external site opens in new window *in Australia – 2022 – September 2024*, ABS, Australian Government, accessed 31 October 2024.

AIHW (Australian Institute of Health and Welfare) (2019) *Incidence of gestational diabetes in Australia*, AIHW, Australian Government, accessed 8 September 2022.

AIHW (2021a) *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018*, AIHW, Australian Government, accessed 29 August 2022, doi:10.25816/5ps1-j259.

AIHW (2021b) *Australian Burden of Disease Study: methods and supplementary material 2018*, AIHW, Australian Government, accessed 19 September 2024.

Buckley RF, Waller M, Masters CL and Dobson A (2019) 'To what extent does age at death account for sex differences in rates of mortality from Alzheimer disease? - external site opens in new window', *American Journal of Epidemiology* 188(7):1213–1223. doi:10.1093/aje/kwz048.

Cade TJ, Polyakov A and Brennecke SP (2019) 'Implications of the introduction of new criteria for the diagnosis of gestational diabetes: a health outcome and cost of care analysis - external site opens in new window', *BMJ Open* 9:e023293, doi:10.1136/bmjopen-2018–023293.

Department of Health and Aged Care (2024) *Australian Respiratory Surveillance Reports – 2024* - external site opens in new window, Department of Health and Aged Care, Australian Government, accessed 19 September 2024.

Laafira A, White SW, Griffin CJ and Graham D (2016) 'Impact of the new IADPSG gestational diabetes diagnostic criteria on pregnancy outcomes in Western Australia - external site opens in new window', *Australian and New Zealand Journal of Obstetrics and Gynaecology* 56(1):36–41, doi:10.1111/ajo.12394.

Moses RG, Morris GJ, Petocz P, San Gil F and Garg D (2011) 'The impact of potential new diagnostic criteria on the prevalence of gestational diabetes mellitus in Australia - external site opens in new window', *Medical Journal of Australia* 194(7):338–40, doi:10.5694/j.1326-5377.2011.tb03001.x.

NCI (National Cancer Institute) (2022) *Linear or log-linear model* - external site opens in new window, NCI, accessed 8 September 2022.

Health-adjusted life expectancy

For ABDS 2024, the estimation of health-adjusted life expectancy (HALE) uses a three-step process:

1. Estimate the number of deaths in 2024. These estimates are used to calculate the mortality rates which underpin estimates of life expectancy.
2. Calculate life expectancy in 2024 by constructing a life table based on the above mortality rates. For ABDS 2024, AIHW calculated its own life table for 2024.
3. Estimate HALE in the usual manner using Sullivan's method (see Jagger et al. 2014). Here the estimated life expectancies in 2024 by sex and age are applied to the estimated YLD rates for 2024. Further information can be found in *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Estimation of the number of deaths in 2024

Deaths for 2024 were estimated using a log-linear (Poisson) regression model. Deaths were modelled by sex and single year of age. The model included historical time series of quarterly (all cause) deaths from 2011 to 2022 (excluding 2020), provisional deaths for 2023 and 2 quarters of 2024 (January to June) (ABS 2024b), estimated resident populations for 2011 to 2023 and for the first quarter for 2024 (ABS 2024a). In this time series, the 2022 deaths were adjusted for the undercount which occurs when using the latest year of deaths data (ABS 2022) by using the year of registration of death rather than the year the death occurred for 2022.

The method described above for estimating deaths in 2024 differed to that used in ABDS 2023 where the estimated number of deaths was the sum of provisional deaths in the first half of 2023 and the estimated deaths in the second half of the year based on linear trends of monthly deaths. The log-linear methodology was preferred because the log-linear model is widely used to estimate counts and the projection approach is consistent with the nowcasting approach used for projecting burden rates in ABDS.

AIHW validated the estimated number of deaths in 2024 using a number of different methods. Firstly, the age and sex-specific trends in deaths over the period 2011 to 2024 were assessed. Secondly, projected deaths estimated for 2023 derived from the above log-linear (Poisson) regression model were compared to published ABS provisional deaths for 2023 and the estimates were within 1% difference. Thirdly, the total number of deaths estimated for 2024 was considered reasonable based on ABS provisional deaths for available months in 2024 and predicted deaths for the remaining months in 2024 (if assuming similar monthly trends to those observed in the latter part of 2023).

Calculation of life expectancy in 2024

A full life table (by sex and single year ages from 0 to 100 years or more) was constructed using the mortality rates as estimated above. Other components of the life table that required estimation of inputs for 2024 were:

- The probability of dying before the first birthday. This was estimated by applying the latest available (2023) crude birth rate and sex-ratio at birth from birth registrations collated by the ABS (ABS 2023).
- The average period lived for infants dying before their first birthday. This was estimated for 2024 using the latest available deaths data (2022) from the National Mortality Database (NMD). The average period lived by infants is calculated from the NMD and the methodology is comparable to estimates used elsewhere (for example, Office for National Statistics (ONS) 2019).
- The amount of time lived past 100 years for centenarian deaths. This was estimated using a standard approach of assuming that the probability of death in the age group 100+ is 1.0 and the amount of time lived is estimated as the ratio of the number of survivors to age 100 divided by the death rate for the age group 100+.

The remaining life table calculations are derived from the predicted deaths rates in 2024 and the above estimated inputs.

Calculation of HALE

HALE for 2024 was calculated using the same method (Sullivan's) as in previous studies: by applying the projected 2024 YLD rates by age and sex to the projected 2024 life expectancy estimates by age and sex. For other ABDS reference years, the 2016–2018 life table (ABS 2019) was used for 2018 HALE estimates, the 2013–2015 life table (ABS 2016) for 2015 HALE estimates, the 2010–2012 life table (ABS 2013) for 2011 HALE estimates and the 2002–2004 life table (ABS 2005) for 2003 HALE estimates.

References

ABS (Australian Bureau of Statistics) (2005) *Life tables, 2002–2004* - external site opens in new window, ABS, Australian Government, accessed 1 July 2022.

ABS (2013) *Life tables, 2010–2012* - external site opens in new window, ABS, Australian Government, accessed 1 July 2022.

ABS (2016) *Life tables, 2013–2015* - external site opens in new window, ABS, Australian Government, accessed 1 July 2022.

ABS (2019) *Life tables, 2016–2018* - external site opens in new window, ABS, Australian Government, accessed 1 July 2022.

ABS (2022) *Causes of Death, Australia methodology* - external site opens in new window, ABS, Australian Government, accessed 18 September 2024.

ABS (2023) *Births, Australia* - external site opens in new window, ABS, Australian Government, accessed 31 October 2024.

ABS (2024a) *National, state and territory population, March 2024* - external site opens in new window, ABS, Australian Government, accessed 31 October 2024.

ABS (2024b) *Provisional mortality statistics, Jan–Jun 2024* - external site opens in new window, ABS, Australian Government, accessed 15 October 2024.

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: methods and supplementary material 2018*, AIHW, Australian Government, accessed 19 September 2024.

Jagger C, Van Oyen H and Robine J (2014) *Health expectancy calculation by the Sullivan method: a practical guide (4th edition),* Newcastle University, accessed 12 September 2022.

ONS (Office for National Statistics) (2019) *Guide to calculating national life tables: Explanation of the methodology used to create the national life tables* - external site opens in new window, ONS, accessed 7 November 2024.

Risk factor attributable burden

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Overarching methods and choices for risk factors

Most of the risk factors methods used in the Australian Burden of Disease Study (ABDS) 2024 were the same as those used in the ABDS 2018 (AIHW 2021a). General methods and choices for risk factors can be found in *Overarching methods and choices for risk factors* and *Risk factor attributable burden* (AIHW 2021b). This includes descriptions of the methods used to calculate the population attributable fractions (PAFs) and attributable burden, including the selection of linked diseases, estimation of effect sizes (relative risks), combined risk factor analysis and assumptions for theoretical minimum risk exposure distributions (TMREDs).

The basic steps for estimating attributable burden are described as follows:

- Select linked diseases for which there is convincing or probable evidence in the literature that the risk factor has a causal association.
- Define the exposure to the risk factor that is not associated with increased risk of the linked disease (the theoretical minimum risk exposure distribution or TMRED).
- Estimate the PAFs by either the comparative risk assessment method or the direct method:
  - Comparative risk assessment involves using the amount of increased risk (relative risk) of linked disease morbidity or mortality due to exposure to the risk factor and an estimate of exposure to each risk factor in the population. For most risk factors, exposure to the risk factor was estimated using high-quality survey data. For information about the quality of data inputs, see *Australian Burden of Disease Study: Methods and supplementary material 2018*.
  - The direct method uses comprehensive data sources such as registries to estimate the amount of the linked disease due to the risk factor.
  - Estimate the attributable burden by multiplying the PAFs by the disease burden (fatal and non-fatal) for each linked disease.

The linked diseases and relative risks were sourced from the GBD 2019 or an AIHW review of the literature. Most TMREDs were also sourced from the GBD 2019, with the exceptions described in Risk factor specific methods.

Exposure to risk factors in the lifetime of the individuals in the population can influence the proportion of burden in the reference year. For risk factors such as tobacco use, occupational risks, alcohol use, child abuse and neglect, illicit drug use, and unsafe sex, the burden can continue to exist from past exposure levels. Where evidence of ever being exposed to a risk factor can be linked to current burden, this is included in the analyses and described under the individual risk factor.

For some risk factors, such as overweight (including obesity), current exposure can have an impact on future burden. This is not accounted for in this study as the burden pertains to each reference year (2003, 2011, 2015, 2018 or 2024).

Not all risk factors are relevant to all population (age and sex) groups. For example, the bulk of the burden from high blood pressure occurs for people aged 25 and over. The choices for population groups and type of burden (fatal or non-fatal) were informed by the GBD 2019 (GBD 2019 Risk Factor Collaborators 2020). The population group for which attributable burden from a given risk factor has been estimated is described in each section.

Both fatal and non-fatal burden are relevant for most linked diseases in the study. For others, such as back pain & problems linked to occupational risks, only non-fatal burden has been estimated.

Note that for the majority of the analysis in this report, the burden from different risk factors for a particular disease cannot simply be added together, because:

- some risk factors are on the same causal pathway – for example, a diet high in sodium increases the likelihood of high blood pressure
- the PAFs are estimated independently – the burden due to each risk factor for a given disease might exceed the total burden of that disease.

Combined risk factor analysis was undertaken to measure the combined effect of multiple risk factors and account for the bias introduced by the complex pathways and interactions between many risk factors.

Firstly, to account for risk factors on the same causal pathway, mediation factors were used to attenuate the relative risk for the first risk factor in the pathway which mediates through the second risk factor in the same causal pathway for the relevant linked disease. The attenuation factors were sourced from the GBD 2019 (GBD 2019 Risk Factors Collaborators 2020).

Following mediation, the combined burden of more than 1 risk factor was adjusted to prevent the combined disease burden exceeding the total burden for a given disease (the 'joint effect').

The use of both the joint effect and mediation formulae therefore adjusts for the interrelatedness between risk factors in the same causal pathway as well as the combined impact of all risk factors and all dietary risks included in the study. Detailed examples of this approach, also used for ABDS 2018, are further described in *Risk factor attributable burden* (AIHW 2021b).

A supplementary table contains detailed definitions, data sources and linked diseases for all risk factors .

Calculating attributable deaths for 2024

Attributable deaths provide an estimate of the number of deaths attributable to each risk factor. Attributable deaths are estimated in the same way that disease burden attributable to risk factors is calculated, by applying estimated fatal PAFs to the redistributed number of deaths for that year.

An estimate of attributable deaths is not provided for 2024, as data on deaths in 2024 were not available at the time of analysis. However, an approximate percentage of attributable deaths for 2024 is provided in order to provide some information on attributable deaths in 2024. The percentage of attributable deaths is considered to be less sensitive to unpredictable fluctuations in deaths that occur over time. The percentage of attributable deaths for 2024 were estimated based on the projected YLL in 2024 divided by the mean remaining life expectancy for each age group.

Where attributable deaths are reported (for 2003, 2011, 2015 and 2018), attributable deaths are based on deaths that have been redistributed for fatal burden analysis. As such the number of deaths may not align with other reporting of causes of death. Information on the redistribution of deaths can be found in the *Australian Burden of Disease Study: methods and supplementary material 2018* report.

Nowcasting population attributable fractions

For the first time, ABDS 2024 used nowcasting to project estimates of population attributable fractions (PAFs) where possible using available data. These are applied to burden of disease estimates, where nowcasting has also been used to project estimates of disease burden to the current year based on available data.

For ABDS 2024, PAFs were nowcast to the current year of 2024 using a beta regression model. Beta regression was chosen as it can be used to model proportion data, making it an appropriate choice for nowcasting PAFs.

The nowcast model is based on trends in PAFs estimated for earlier reference years, as well as PAFs based on the latest available exposure data. PAFs were nowcast by each sex, age group, risk factor and disease/injury group.

For example, updated body mass index (BMI) data from the National Health Survey (NHS) 2022 was used to estimate a new 2022 PAF for the overweight (including obesity) risk factor. This 2022 estimate was incorporated alongside earlier estimates from 2003, 2011, 2015 and 2018 to nowcast a PAF for 2024.

The ability to nowcast PAFs was assessed on a case-by-case basis. The risk factors with PAFs in-scope for nowcasting include:

- Overweight and obesity
- High blood pressure.

Nowcasting PAFs was not possible or considered necessary for risk factors where:

- The latest exposure data is considered up to date, with minimal benefit from nowcasting, such as alcohol use based on National Drug Strategy Household Survey (NDSHS) data 2022–2023.
- There is no trend information available or the same PAF for a risk factor is applied to all ABDS years, such as for bullying victimisation and child abuse and neglect.
- PAFs are stable and there will be little benefit gained from nowcasting.
- PAFs are volatile and subject to unpredictable changes, as for environmental risk factors such as air pollution.

Where there was no new trend data available, PAFs from ABDS 2018 were carried forward to ABDS 2024.

Attributable burden data quality

Survey and administrative data sets were primary sources of risk factor exposure data. In the absence of good-quality survey or administrative data, epidemiological studies were used to determine exposure distributions.

The quality of input estimates in the ABDS 2024 for earlier reference years (2003, 2011, 2015 and 2018) are generally the same as the quality presented in the ABDS 2018. Refer to Appendix B in the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report (AIHW 2021a) and the *Australian Burden of Disease Study: methods and supplementary material 2018* report (AIHW 2021b) for more detail on the quality of the risk factor exposure data, including details on the criteria used to assess risk factor exposure data selection.

Data sources that were changed in ABDS 2024 (such as the epidemiological study used to estimate attributable burden due to UV sun exposure) are described in detail below and the quality is expected to be similar to ABDS 2018.

Risk factor specific methods

This section describes in detail the methods unique to each risk factor included in the ABDS 2024. It is focused on the calculation of exposure estimates, as this was the aspect of risk estimation most influenced by Australia-specific data, and methods used to nowcast estimates to the 2024 reference year.

Behavioural risk factors

Alcohol use

The impact of alcohol use is presented for people of all ages. In people aged under 15, burden is only attributed to the linked disease alcohol use disorders. The burden attributable to the remaining linked diseases was estimated in people aged 15 and over. Note that the risk factor is alcohol *use* while alcohol *use disorders* is a linked disease. The burden attributable to this risk factor was calculated as described in detail in the AIHW publication *Impact of alcohol and illicit drug use on the burden of disease and injury in Australia: Australian Burden of Disease Study 2011* (AIHW 2018).

Population attributable fractions calculated with direct evidence

In ABDS 2024, the PAFs for chronic liver disease were estimated from the proportion represented by chronic liver disease due to alcohol of all chronic liver disease burden, as estimated for Australia by the GBD 2021 (GBD 2021 Risk Factor Collaborators 2024). The same method was used to estimate the PAFs for liver cancer. The burden of alcohol dependence (the linked disease) was entirely attributed to alcohol use (the risk factor).

Direct evidence was used to derive the PAFs for accidental poisoning linked to alcohol use, using the mention of specific drugs recorded in the National Mortality Database (NMD) 2022 as described by the AIHW (2018).

Population attributable fractions estimated using comparative risk assessment

The proportions of the Australian population who are current drinkers, former drinkers or never drank alcohol were sourced from self-reported data in the National Drug Strategy Household Survey (NDSHS) 2022–2023. However, the amount of alcohol self-reported to be consumed by current drinkers in this and other surveys is known to be an underestimate of actual consumption (Rehm et al. 2010).

To overcome this, alcohol sales data were used to inflate the survey estimates. The total volume of alcohol sold in Australia was sourced from the apparent consumption of alcohol (ABS 2019). Self-reported daily consumption from the NDSHS, by age and sex, was inflated to match alcohol sales data in each reference year, based on the methods described by Rehm et al. (2010). The inflation factors used for the 2018, 2015, 2011 and 2003 reference years were the same as those used in ABDS 2018. In ABDS 2024, self-reported daily consumption from the NDSHS was inflated by the same rate as used for 2018, as sales data was not available for 2022–2023 to match data from the NDSHS 2022–2023.

Among current drinkers, the mean number of standard drinks self-reported per day was converted into litres of self-reported alcohol consumption for that year. In 2024, the inflation factor was estimated to be 1.46. The proportion of self-reported lifetime abstainers and ex-drinkers from the NDSHS was assumed to be accurate.

Following methods used in Rehm et al. (2010) and in the GBD 2010, 80% of the alcohol available nationally was assumed to have been consumed (Lim et al. 2012). Only a proportion (80%) of alcohol sold in Australia was used, because the total figure includes alcohol discarded due to changes in stocks, alcohol consumed by overseas travellers, alcohol that has been stored or cellared, and alcohol that has been used to prepare food or discarded as waste.

The adjusted litres of alcohol consumed nationally were distributed among self-reported current drinkers using a 2-parameter gamma distribution, which has been found to be the best model to shift the distribution of survey data to fit sales data (Rehm et al. 2010). While this approach brings self-reported alcohol consumption in line with known alcohol sales, a limitation is that it assumes the degree of under-reporting of alcohol consumption is uniform across all age and sex groups. This distribution was used to estimate the proportion of the population who consumed alcohol in categories relevant to the relative risks.

Table 5.1: Alcohol use risk model parameters

Risk factor	Alcohol use – former drinkers
Disease outcome	Atrial fibrillation & flutter, bowel cancer, breast cancer, coronary heart disease, epilepsy, hypertensive heart disease, laryngeal cancer, lower respiratory infections, lip & oral cavity cancer, nasopharynx cancer, oesophageal cancer, other oral cavity & pharynx cancers, pancreatitis, stroke
TMRED	No alcohol use
National data source	NDSHS 2022–2023
Units for effect size calculation	Former drinker

Risk factor	Alcohol use – Average daily alcohol consumption by current drinkers
Disease outcome	Atrial fibrillation & flutter, bowel cancer, breast cancer, coronary heart disease, drowning, epilepsy, falls, fire, burns and scalds, homicide and violence, hypertensive heart disease, laryngeal cancer, lip & oral cavity cancer, lower respiratory infections, nasopharynx cancer, oesophageal cancer, other land transport injuries, other oral cavity & pharynx cancers, other unintentional injuries, pancreatitis, road traffic injuries (RTI)—motor vehicle occupants, RTI—motorcyclists, RTI—pedal cyclists, RTI—pedestrians, stroke
TMRED	No alcohol use
National data source	NDSHS 2022–2023
Units for effect size calculation	Average consumption of pure alcohol (g per day)

Risk factor	Alcohol use – Alcohol use and dependence
Disease outcome	Alcohol use disorders, accidental poisoning, liver cancer, chronic liver disease
TMRED	No alcohol use
National data source	NMD; GBD 2021
Units for effect size calculation	Direct evidence

Risk factor	Alcohol use – Alcohol dependence
Disease outcome	Suicide & self-inflicted injuries
TMRED	No alcohol use
National data source	ABDS 2024
Units for effect size calculation	Prevalence of alcohol use disorders

2018, 2015, 2011 and 2003 estimates

Exposure estimates for 2018 were calculated from the NDSHS 2019 and alcohol sales data for 2018, while exposure for 2015, 2011 and 2003 were calculated using data from the NDSHS 2016, 2010 and 2004 and alcohol sales data for 2015, 2011 and 2003, respectively. These followed the method for estimating exposure used for 2024. Direct PAFs were calculated using the method for 2024, which were based on the GBD 2021 estimates for 2018, 2015, 2011 and 2003.

References

ABS (Australian Bureau of Statistics) (2019) *Apparent alcohol consumption, Australia, 2017–18* - external site opens in new window, ABS, Australian Government, accessed 10 October 2020.

AIHW (Australian Institute of Health and Welfare) (2018). *Impact of alcohol and illicit drug use on the burden of disease and injury in Australia: Australian Burden of Disease Study 2011*, AIHW, Australian Government, accessed 12 November 2024.

GBD 2021 Risk Factors Collaborators (2024) 'Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021 - external site opens in new window', *The Lancet*, 403:2162–2203. doi:10.1016/S0140-6736(24)00933-4.

Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H et al. (2012) 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010 - external site opens in new window', *Lancet*, 380(9859):2224–60.

Rehm J, Kehoe T, Gmel G, Stinson F, Grant B and Gmel G (2010) 'Statistical modelling of volume of alcohol exposure for epidemiological studies of population health: the US example - external site opens in new window', *Population Health Metrics*, 8(3):1–12, doi:10.1186/1478-7954-8-3.

Bullying victimisation

The burden for bullying victimisation was estimated in people aged 10 to 24. The methods used for ABDS 2024 are the same as those described in detail in *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Population attributable fractions estimated by comparative risk assessment

Prevalence and relative risks were taken from a recent systematic review and meta-analysis of bullying victimisation among Australian children and adolescents (Jadambaa et al. 2019a, 2019b) using the comparative risk assessment methodology to estimate PAFs for anxiety disorders and depressive disorders. As no data were available to inform trends, the same PAFs were applied to each reference year of this study.

Table 5.2: Bullying victimisation risk model parameters

Risk factor	Bullying victimisation - Exposure to bullying within the past 12 months
Disease outcome	Anxiety disorders, depressive disorders
TMRED	No bullying victimisation
National data source	Jadambaa et al. 2019a, Jadambaa et al. 2019b
Units for effect size calculation	Prevalence of bullying victimisation

References

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

Jadambaa A, Thomas HJ, Scott JG, Graves N, Brain D and Pacella R (2019a) 'Prevalence of traditional bullying and cyberbullying among children and adolescents in Australia: A systematic review and meta-analysis - external site opens in new window', *Australian & New Zealand Journal of Psychiatry*, 53:878–888, doi: 10.1177/000486741984639.

Jadambaa A, Thomas HJ, Scott JG, Graves N, Brain D and Pacella R (2019b), 'The contribution of bullying victimisation to the burden of anxiety and depressive disorders in Australia' - external site opens in new window, *Epidemiology and Psychiatric Sciences*, 29:1–23, doi: 10.1017/S2045796019000489.

Child abuse and neglect

Child abuse & neglect included emotional, physical, sexual abuse and neglect. The burden of child abuse & neglect was estimated in people aged 5 and over.

Exposure and population attributable fractions estimates

Exposure and PAFs were estimated by Moore et al. (2015) by age and sex. As no data were available to inform trends, the same PAFs were applied to each reference year of this study: 2003, 2011, 2015, 2018 and 2024. Additional detail can be found in *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Table 5.3: Child abuse & neglect risk model parameters

Risk factor	Child abuse & neglect – Physical, sexual and emotional abuse and neglect
Disease outcome	Anxiety disorders, depressive disorders, suicide & self-inflicted injuries
TMRED	No child abuse and neglect
National data source	Moore et al. 2015
Units for effect size calculation	Prevalence of childhood abuse and neglect

References

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

Moore SE, Scott JG, Ferrari AJ, Mills R, Dunne MP, Erskine HE, Devries KM, Degenhardt L, Vos T, Whiteford HA, McCarthy M and Norman RE (2015) 'Burden attributable to child maltreatment in Australia - external site opens in new window', *Child Abuse & Neglect*, 48:208–20, doi:10.1016/j.chiabu.2015.05.006.

Dietary risk factors

The burden attributable to dietary risk factors was estimated in people aged 25 and over.

It should be noted that the methods used in the ABDS 2024 to calculate attributable burden due to dietary risk factors do not align with current Australian dietary guidelines. This is because the methods are designed to align with TMREDs and relative risks sourced from the Global Burden of Disease Study (GBD 2019 Risk Factors Collaborators 2020, see Dietary risk model parameters in the table below). For information on recommended food choices, see the Australian Dietary Guidelines (NHMRC 2021).

The risk factors included were based on the AIHW review of evidence from the GBD 2019 (which included 15 dietary risk factors) and other systematic reviews from authoritative sources that have also assessed the impact of dietary risk factors on health.

Due to methodological differences, methods for diet high in sodium are discussed in a separate sub-section.

Dietary risks included

The same dietary risk factors were included as in the ABDS 2018.

Population attributable fractions estimated using comparative risk assessment

The risk factors estimated using the comparative risk assessment were diet low in fruit, vegetables, wholegrains, legumes, nuts and seeds, milk, fish and seafood, and polyunsaturated fats; and diet high in red meat, processed meat and sugar-sweetened beverages.

Exposure estimate

There was no new data available to update exposure estimates for ABDS 2024. As such PAFs from ABDS 2018 were carried forward to ABDS 2024 and applied to updated estimates of disease burden.

Exposure estimates and PAFs for ABDS 2018 were based on the National Nutrition and Physical Activity Survey (NNPAS) part of the AHS 2011–12 (ABS 2013), which collected food intake data (through a 24-hour recall) from participants for 2 days. For details on the methods used to estimate exposure and PAFs for the dietary risk factors in ABDS 2018 see: *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Table 5.4: Dietary risk model parameters

Risk factor	Diet low in fruit – Average daily consumption of fresh, frozen, cooked, canned, or dried fruits (excluding fruit juices)
Disease outcome	Coronary heart disease, lung cancer, oesophageal cancer, stroke, type 2 diabetes
TMRED	Consumption of at least 300 g of fruit per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 100 g per day intake decrease

Risk factor	Diet low in legumes – Average daily consumption of fresh, frozen, cooked, canned, or dried legumes
Disease outcome	Coronary heart disease
TMRED	Consumption of at least 150 g of legumes per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 50 g per day intake decrease

Risk factor	Diet low in milk – Average daily consumption of milk including non-fat, low-fat and full-fat milk, excluding soy milk and other plant derivatives
Disease outcome	Bowel cancer
TMRED	Consumption of at least 240 g of milk per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 60 g per day intake decrease

Risk factor	Diet low in nuts and seeds – Average daily consumption of nut and seed foods
Disease outcome	Coronary heart disease, type 2 diabetes
TMRED	Consumption of at least 14 g of nuts and seeds per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 7 g per day intake decrease

Risk factor	Diet low in polyunsaturated fats – Average daily consumption of polyunsaturated fats
Disease outcome	Coronary heart disease
TMRED	Consumption of polyunsaturated fatty acids at least 8% of total daily energy
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 2% energy from polyunsaturated fat decrease

Risk factor	Diet high in processed meats – Average daily consumption of meat preserved by smoking, curing, salting, or addition of chemical preservatives
Disease outcome	Bowel cancer, coronary heart disease, type 2 diabetes
TMRED	Consumption of less than 24 g of processed meat per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 25 g per day intake increase

Risk factor	Diet high in red meat – Average daily consumption of red meat (beef, pork, lamb, and goat) (excluding poultry, fish, eggs and all processed meats)
Disease outcome	Bowel cancer, breast cancer, coronary heart disease, stroke, type 2 diabetes
TMRED	Consumption of less than 50 g of red meat per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 50 g per day intake increase

Risk factor	Diet low in vegetables – Average daily consumption of fresh, frozen, cooked, canned, or dried vegetables, (excluding vegetable juices, legumes and starchy vegetables such as potatoes or corn)
Disease outcome	Coronary heart disease, oesophageal cancer, stroke
TMRED	Consumption of at least 300 g of vegetables per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 100 g per day of vegetable intake decrease

Risk factor	Diet low in whole grains (including high fibre cereals) – Average daily consumption of wholegrain or higher fibre breads, cereals, rice, pasta, crumpets, muffins, crispbreads, relevant fortified cereals with 1 g of fibre per 10 g of carbohydrate
Disease outcome	Bowel cancer, coronary heart disease, stroke, type 2 diabetes
TMRED	Consumption of at least 150 g of wholegrains per day
National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 50 g per day intake decrease

Risk factor	Diet high in sugar sweetened beverages – Consumption of beverages with ≥50 kcal per 226.8 g serving, including carbonated beverages, sodas, energy drinks and fruit drinks (excluding 100% fruit and vegetable juices)
Disease outcome	Coronary heart disease, type 2 diabetes
TMRED	Consumption of less than 60 g of sugar-sweetened beverages per day

National data source	Self-reported from AHS 2011–12
Units for effect size calculation	Per 60 g per day intake increase

Risk factor	Diet low in fish and seafood - Average daily consumption of fish and seafood
Disease outcome	Coronary heart disease
TMRED	Consumption of fish or seafood 100 g per week
National data source	Self-reported from AHS 2011–12 (day 1 only)
Units for effect size calculation	Per 15g per day intake decrease

2018, 2015, 2011 and 2003 estimates

Estimates for 2018 were based on the methods using the AHS 2011–12 data as described above.

Exposure to these dietary risk factors over time was calculated by comparing the mean exposure from the NHS 1995 and the mean exposure from the AHS 2011–12 by age. Unit record level data from the AHS 2011–12 were adjusted by the percentage change from 2011 to 2003 and 2011 to 2015 in these data sources to estimate the distribution of dietary intake in those reference years.

Dietary risks mediated through other risk factors - Diet high in sodium

Diet high in sodium was measured by the amount it mediated blood pressure. The methods for this risk factor use comparative risk assessment and are based on the GBD 2019.

The attributable burden for diet high in sodium was calculated from a model of the impact of current sodium consumption on blood pressure levels in Australia. The model estimates the blood pressure distribution of Australians if no sodium above the TMRED was consumed. The main data source used was the AHS 2011–12.

As there were no new data available for ABDS 2024, PAFs from ABDS 2018 were carried forward to ABDS 2024 and applied to updated estimates of disease burden.

For detail on the methods used to calculate PAFs for 2018 for this risk factor see *Australian Burden of Disease Study: methods and supplementary material 2018*.

Table 5.5: Diet high in sodium risk model parameters

Risk factor	Diet high in sodium – Consumption of sodium
Disease outcome	High blood pressure-linked diseases, excluding dementia: Aortic aneurysm, atrial fibrillation and flutter, cardiomyopathy, chronic kidney disease, coronary heart disease, hypertensive heart disease, inflammatory heart disease, non-rheumatic valvular disease, peripheral vascular disease, rheumatic heart disease, stroke
TMRED	24 hr urinary sodium of 2 g per day
National data source	Self-reported from AHS 2011–12; adjusted based on urinary sodium estimate (Powles et al. 2013)
Units for effect size calculation	Per 2.3g per day intake increase

2018, 2015, 2011 and 2003 estimates

Estimates from 2018 and 2011 were based on the methods using the AHS 2011–12 data as described above.

Estimates for 2003 and 2015 were calculated using the average adjustment factors estimated for sodium intake and blood pressure for 2011 applied to the distribution of blood pressure prevalence in the NHS 2004–05 (for 2003 estimates) and the NHS 2014–15 (for 2015 estimates).

References

ABS (Australian Bureau of Statistics) (2013) Microdata: Australian Health Survey, National Health Survey, 2011-12 - external site opens in new window [DataLab], accessed 28 January 2021.

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

GBD 2019 Risk Factors Collaborators 2020. 'Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019 - external site opens in new window', *The Lancet*, 396:1223–249.

NHMRC (National Health and Medical Research Council) (2021) *Australian Dietary Guidelines 1–5* - external site opens in new window [website], accessed 12 November 2024.

Powles J, Fahimi S, Micha R, Khatibzadeh S, Shi P, Ezzati M, Engell RE, Lim SS, Danaei G and Mozaffarian D (2013) 'Global, regional and national sodium intakes in 1990 and 2010: a systematic analysis of 24 h urinary sodium excretion and dietary surveys worldwide - external site opens in new window', *BMJ Open*, 3:e003733, doi: 10.1136/bmjopen-2013-003733.

Illicit drug use

The impact of illicit drug use was estimated in people aged 15 and over. The burden attributable to this risk factor was calculated as described in detail in the AIHW publication *Impact of alcohol and illicit drug use on the burden of disease and injury in Australia: Australian Burden of Disease Study 2011* (AIHW 2018).

Population attributable fractions estimated using direct evidence

There was limited new data available to update direct PAFs for illicit drug use for ABDS 2024 (with the exception of accidental poisoning). As such, PAFs from ABDS 2018 were largely carried forward to ABDS 2024 and applied to updated estimates of burden of disease. A summary of the methods used for ABDS 2018 is provided below. For further detail see *Australian Burden of Disease Study: methods and supplementary material 2018*.

Unsafe injecting practices

PAFs for the linked diseases for unsafe injecting practices (chronic liver disease, hepatitis B hepatitis C, HIV/AIDS and liver cancer) were calculated from the National Notifiable Diseases Surveillance System (NNDSS) data published in the annual surveillance reports by The Kirby Institute (The Kirby Institute 2018).

HIV/AIDS

For HIV/AIDS, direct PAFs were calculated from the estimated proportion of diagnosed HIV cases in 2018 who were exposed to unsafe injecting practices regardless of sexual behaviour.

Acute hepatitis B and C

For acute hepatitis B and hepatitis C, the direct PAFs were calculated from the estimated proportion of newly acquired hepatitis B or hepatitis C infections in 2018 who were exposed to unsafe injecting practices regardless of sexual behaviour.

Chronic liver disease and liver cancer

Chronic hepatitis C infection

The rates of decompensated cirrhosis (chronic liver disease), hepatocellular carcinoma (liver cancer) and liver transplants due to hepatitis C are published by The Kirby Institute. These were multiplied by the earliest year of exposure data estimates available to determine the proportion of hepatitis C related morbidity due to unsafe injecting practices.

The proportion of chronic liver disease and liver cancer due to unsafe injecting practices was then estimated by quantifying the rate of hepatitis C related morbidity from the total prevalence for liver cancer and chronic liver disease in 2018.

Chronic hepatitis B infection

The Kirby Institute reported that 5.7% of people living with chronic hepatitis B in 2017 and 2015 had acquired this condition through unsafe injecting practices (The Kirby Institute 2016, 2018). This is similar to Australian estimates reported by other published studies for the years 2011 (5.7%) and the year 2000 (4.7%) (MacLachlan et al. 2013; O'Sullivan et al. 2004).

The proportion of these chronic outcomes being chronic liver disease or liver cancer was then estimated using total disease prevalence data from the ABDS 2018.

Accidental poisoning

The direct PAFs for accidental poisoning linked to specific illicit drugs were estimated using the number of deaths due to accidental poisoning with a mention of each drug type compared with the total number of accidental poisoning deaths in 2022 (latest year available) in the National Mortality Database (NMD). These methods are described in more detail in the section on alcohol use. The PAFs were also applied to non-fatal burden due to accidental poisoning.

Illicit drug dependence

All of the burden due to drug use disorders (including amphetamine, cannabis, cocaine, opioid and other illicit drug use disorders) was attributable to illicit drug use (a PAF of 1).

Population attributable fractions estimated using comparative risk assessment

There are 2 types of exposure to drug use estimated for the risk factor illicit drug use: drug dependence and driving under the influence of illicit drugs. Estimates of the exposure to drug dependence are sourced from prevalence estimates for the relevant drug use disorder from the ABDS 2024. Exposure to drug dependence—not drug use—was used in this study.

Exposure to driving under the influence of illicit drugs was estimated from the National Drug Strategy Household Survey (NDSHS) 2022–2023—specifically, the proportion of the population that responded yes to the question: 'In the last 12 months did you undertake the activity—drove a motor vehicle—while under the influence of or affected by illicit drugs?' Data were further provided by the type of drug used while driving.

Including drug driving by drug type is an improvement from the methods used for ABDS 2018, where the type of drug used while driving was estimated based on the relative prevalence of the use of different drugs self-reported in the NDSHS. Drug driving by drug type, and broad age group, in NDSHS 2022–2023 was applied to all years in the ABDS 2024 (2003, 2011, 2015, 2018 and 2024). Data from NDSHS 2022–2023 were applied to all years as this year of data was the most complete. While expected patterns of driving under the influence of different types of illicit drugs may be expected to change over time, estimates from NDSHS 2022–2023 were considered conservative as self-reported driving under the influence of illicit drugs appears to have been decreasing over time (where time series data is available) (AIHW 2024). The type of drug used while driving was measured independently, and no adjustment was made for those who may have driven under the influence of multiple drug types.

Table 5.6: Illicit drug use risk model parameters

Risk factor	Cannabis use – Cannabis dependence
Disease outcome	Anxiety disorders, depressive disorders, schizophrenia
TMRED	No illicit drug use
National data source	ABDS 2024
Units for effect size calculation	Prevalence of illicit drug use disorders

Risk factor	Cannabis use – Driving under the influence of cannabis
Disease outcome	Road traffic injuries—motorcyclists and road traffic injuries—motor vehicle occupants
TMRED	No illicit drug use
National data source	NDSHS 2022–2023
Units for effect size calculation	Prevalence of driving under the influence of illicit drugs

Risk factor	Cannabis use – Cannabis use and dependence
Disease outcome	Accidental poisoning
TMRED	No illicit drug use
National data source	NMD

Units for effect size calculation	Direct evidence

Risk factor	Amphetamine, cocaine and opioid use – Amphetamine, cocaine and opioid use or dependence
Disease outcome	Suicide & self-inflicted injuries
TMRED	No illicit drug use
National data source	ABDS 2024
Units for effect size calculation	Prevalence of illicit drug use disorders

Risk factor	Amphetamine, cocaine and opioid use – Driving under the influence of amphetamine, cocaine or opioids
Disease outcome	Road traffic injuries—motorcyclists and road traffic injuries—motor vehicle occupants
TMRED	No illicit drug use
National data source	NDSHS 2022–2023
Units for effect size calculation	Prevalence of driving under the influence of illicit drugs

Risk factor	Amphetamine, cocaine and opioid use – Amphetamine or opioid use and dependence
Disease outcome	Accidental poisoning
TMRED	No illicit drug use
National data source	NMD
Units for effect size calculation	Direct evidence

Risk factor	Amphetamine, cannabis cocaine, opioid and other illicit drug use – Illicit drug dependence
Disease outcome	Drug use disorders (excluding alcohol)
TMRED	No illicit drug use
National data source	ABDS 2024
Units for effect size calculation	Direct evidence

Risk factor	Unsafe injecting practices – Unsafe injecting practices
Disease outcome	Chronic liver disease, hepatitis B, hepatitis C, HIV/AIDS, liver cancer
TMRED	No unsafe injecting practices
National data source	National notifiable disease annual surveillance reports (The Kirby Institute)
Units for effect size calculation	Direct evidence

2018, 2015, 2011 and 2003 estimates

The burden attributable to illicit drug use from drug driving for 2018, 2015, 2011 and 2003 used the NDSHS 2022–2023, described above.

The burden attributable to illicit drug use in 2015, 2011 and 2003 was further estimated using the Kirby Institute data, using the same methods as for 2018 and 2024 (described above).

References

AIHW (Australian Institute of Health and Welfare) (2018) *Impact of alcohol and illicit drug use on the burden of disease and injury in Australia: Australian Burden of Disease Study 2011*, AIHW, Australian Government, accessed 12 November 2024.

AIHW (2024) *National Drug Strategy Household Survey 2022–2023*, AIHW, Australian Government, accessed 12 November 2024.

MacLachlan JH, Allard N, Towell V and Cowie BC (2013) 'The burden of chronic hepatitis B virus infection in Australia, 2011 - external site opens in new window', *Australian and New Zealand Journal of Public Health*, 37(5):416–22, doi:10.1111/1753-6405.12049.

O'Sullivan BG, Gidding HF, Law M, Kaldor JM, Gilbert GL and Dore GJ (2004) 'Estimates of chronic hepatitis B virus infection in Australia, 2000 - external site opens in new window', *Australian and New Zealand Journal of Public Health*, 28(3):212–16, doi: 10.1111/j.1467-842x.2004.tb00697.x.

The Kirby Institute (2016) *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report 2016 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

The Kirby Institute (2018) *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report 2018 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

Intimate partner violence

The burden of intimate partner violence was estimated in women aged 15 and over.

The burden was estimated as described further in the report *Examination of the burden of disease of intimate partner violence against women in 2011: Final report* (Ayre et al. 2016).

This risk factor was estimated in women only as the evidence in the literature used to inform the linked diseases and relative risks was not available for men (AIHW unpublished; Ayre et al. 2016; GBD 2019 Risk Factor Collaborators 2020). Available data on male victims of violence can be found in *Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2018*.

Population attributable fractions estimated with direct evidence

Homicide and violence linked to intimate partner violence was estimated using direct evidence from the National Homicide Monitoring Program (NHMP; Miles & Bricknell 2024) for fatal burden, which estimated that 57% of homicides in females were due to an intimate partner in 2022–23. NHMP data on victim-offender relationship is collected for cleared incidents only. NHMP data for 2022–23 on victim-offender relationship exclude Western Australia, but this is expected to have minimal impact on the results.

Non-fatal burden from homicide and violence due to an intimate partner was estimated directly from the National Hospital Morbidity Database (NHMD), using the proportion of hospitalisations (with any principal diagnosis) with an external cause related to assault by an intimate partner (ICD-10-AM codes X85–Y09 with a fifth digit of 0).

Population attributable fractions estimated with comparative risk assessment

Exposure to intimate partner violence data were sourced from the ABS Personal Safety Survey (PSS) 2021–22 (ABS 2023). It was based on survey respondents aged 18 and over who self-reported intimate partner violence from a cohabiting partner from the age of 15 onwards (ABS 2024). PSS 2021–22 data were used to estimate a PAF which was applied to 2024 burden of disease estimates.

Multiple definitions of exposure to intimate partner violence exist to reflect the complexity of violence against women. This study has been able to include emotional, physical and sexual intimate partner violence by a cohabiting current or previous intimate partner. It was not possible to estimate violence by a non-cohabiting current or previous intimate partner. This is because the PSS 2021–22 did not include an estimate of emotional abuse by non-cohabiting partners (ABS 2023).

While the PSS 2021–22 is comparable to previous surveys, no nowcasting was applied to this risk factor. This is because the PAF for physical and sexual intimate partner violence was stable with little benefit from nowcasting, while a conservative approach was taken for emotional partner violence, taking into consideration the expanded definition of partner emotional abuse compared with previous surveys (ABDS 2023).

Table 5.7: Intimate partner violence risk model parameters

Risk factor	Intimate partner violence – Physical, sexual, emotional abuse from a cohabitating partner
Disease outcome	Anxiety disorders, alcohol use disorders, early pregnancy loss, depressive disorders, homicide and violence, suicide and self-inflicted injuries
TMRED	No exposure to intimate partner violence
National data source	ABS Personal Safety Survey 2021–22; National Homicide Monitoring Program
Units for effect size calculation	Ever been exposed to intimate partner violence since the age of 15 years (prevalence)

2018, 2015, 2011 and 2003 estimates

The burden due to intimate partner violence in 2018 was estimated using data from the PSS 2016 (ABS 2017), NHMD hospitalisations in 2018 and the NHMP 2018. Estimates for ABDS 2024 were updated with the latest NHMP data available for 2018.

The burden due to intimate partner violence in 2015 was estimated using data also from the PSS 2016 (ABS 2017), NHMD hospitalisations in 2015 and the NHMP 2012–2014 (Bryant & Bricknell 2017).

Intimate partner violence burden in 2011 was estimated using data from the PSS 2012 (ABS 2013), NHMD hospitalisations in 2011 and the National Homicide Monitoring Program 2010–2012 (Bryant & Cussen 2015).

Burden due to intimate partner violence in 2003 was estimated using data from the PSS 2005 (ABS 2006), NHMD hospitalisations in 2003 and the *National Homicide Monitoring Program annual report 2003–04* (Mouzos 2005). Prevalence of emotional abuse in 2003 was based on the PSS 2012, assuming no trends, as it was not estimated in the PSS 2005 (ABS 2006).

References

ABS (Australian Bureau of Statistics) (2006) *Personal safety, Australia, 2005 (reissue) - external site opens in new window*, ABS, Australian Government, accessed 22 March 2018.

ABS (2013) *Personal safety, Australia, 2012 - external site opens in new window*, ABS, Australian Government, accessed 15 August 2015.

ABS (2017) *Personal Safety Survey, Australia: user guide, 2016 - external site opens in new window*, ABS, Australian Government, accessed 15 March 2018.

ABS (2023) *Personal Safety Survey, Australia: user guide, 2021-22 - external site opens in new window*, ABS, Australian Government, accessed 30 May 2024.

ABS (2024). Customised report.

AIHW unpublished. Health outcomes of violence: A review of data sources and evidence. Report to the Australian Government Department of Social Services.

Ayre J, Lum On M, Webster K and Moon L (2016) *Examination of the burden of disease of intimate partner violence against women in 2011: final report - external site opens in new window*, Australian National Research Organisation for Women's Safety, accessed 30 May 2024.

Bryant W and Bricknell S (2017) *Homicide in Australia, 2012–13 to 2013–14: National Homicide Monitoring Program report - external site opens in new window*, Australian Institute of Criminology, Australian Government, accessed 19 September 2018.

Bryant W and Cussen T (2015) *Homicide in Australia, 2010–11 to 2011–12: National Homicide Monitoring Program report - external site opens in new window*, Australian Institute of Criminology, Australian Government, accessed 22 June 2016.

Dearden J and Jones W (2008) *Homicide in Australia: 2006-07 National Homicide Monitoring Program annual report (monitoring reports no. 1) - external site opens in new window*, Australian Institute of Criminology, Australian Government, accessed 17 November 2020.

GBD 2019 Risk Factors Collaborators (2020) 'Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019 - external site opens in new window', *The Lancet*, 396:1223–249, doi: 10.1016/S0140-6736(20)30752-2.

Miles H and Bricknell S (2024) *Homicide in Australia 2022–23 - external site opens in new window*, Australian Institute of Criminology, Australian Government, accessed 1 May 2024.

Mouzos J (2005) *Homicide in Australia: 2003–2004 National Homicide Monitoring Program (NHMP) annual report* - external site opens in new window, Australian Institute of Criminology, Australian Government, accessed 23 August 2016.

Physical inactivity

Burden due to physical inactivity was estimated in people aged 20 and over.

Population attributable fractions estimated by comparative risk assessment

Population exposure to physical inactivity was treated as a categorical variable. The categories describe the range of total activity per week, as measured by the total metabolic equivalent of tasks (METs). This measure encompasses the rate of energy expenditure, with one (1) MET equivalent to 1 kcal/kg/hr, which is about the energy expended in sitting. The higher the MET, the greater the energy expended. The calculation of METs requires the input of:

- time spent undertaking the activity in 1 week (*T*)
- intensity score for that specific activity (*I*).

The total MET for each activity is calculated as:

MET = *T* x *I*

In this study, the total MET score describes the total rate of energy expended across 4 activity domains: leisure, transportation, occupational, and household. The categories included:

- Fewer than 600 METs per week
- 600–1,199 METs per week
- 1,200–1,799 METs per week
- 1,800–2,399 METs per week
- 2,400–2,999 METs per week
- 3,000–3,599 METs per week
- 3,600–4,199 METs per week
- 4,200 METs and over per week.

These categories align with relative risks provided by the GBD 2019.

For ABDS 2024, the METs for leisure, walking for transport and occupational activity were estimated from the number of self-reported minutes spent in each activity per week, multiplied by the intensity scores as provided by the AHS 2011–12, using the National Health Survey 2022 (ABS 2023). Estimates from the NHS 2022 were used directly for 2024, rather than nowcast to 2024 using trend information from previous surveys as in ABDS 2018. This is because while the NHS 2022 is generally comparable to NHS 17–18, there were major updates to the physical inactivity module (ABS 2022) and a conversative approach (using NHS 2022 estimates directly) was taken.

The METs for household chores, gardening and strengthening and toning were calculated in the same way as ABDS 2018, as no new appropriate data were available. For further detail see: *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Prevalence was estimated from the proportion of people within each activity category once the METs from each domain were summed.

Table 5.8: Physical inactivity risk model parameters

Risk factor	Physical inactivity – Metabolic equivalent of task (METs)
Disease outcome	Breast cancer, bowel cancer, coronary heart disease, dementia, type 2 diabetes, stroke, uterine cancer
TMRED	All adults experience average 4200 metabolic equivalent of task (METs) per week (highly physically active)
National data source	AHS 2011–12; NHS 2022
Units for effect size calculation	METs of less than 600, 600–1,999, 1,200–1,799, 1,800–2,399, 2,400–2,999, 3,000–3,599, 3,600–4,199

2018, 2015, 2011 and 2003 estimates

As the relevant NHS data had not changed for earlier reference years, the estimated PAFs for 2018, 2015, 2011 and 2003 were the same as those estimated for ABDS 2018, for further detail see *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

References

ABS (Australian Bureau of Statistics) (2022) *National Health Survey methodology* - external site opens in new window, ABS, Australian Government, accessed 17 September 2024.

ABS (2023) *Microdata: National Health Survey, 2022* - external site opens in new window [DataLab], accessed 26 April 2024.

Australian Institute of Health and Welfare (2021) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

Tobacco use

The impact of tobacco use captures the burden attributable to current smoking, past smoking (in people aged 30 and over) and exposure to second-hand smoke in the home (in people of all ages). Note that due to a current lack of input data appropriate for burden of disease analysis, the ABDS 2024 does not include vaping in the tobacco use risk factor. These estimates may be revised in the future, as more data becomes available.

Population attributable fractions estimated using comparative risk assessment

Linked diseases and relative risks

Linked diseases and relative risks were sourced from the GBD 2016 (GBD 2016 Risk Factor Collaborators 2017). More detail on the methods are described further in the report *Burden of tobacco use in Australia: Australian Burden of Disease Study 2015* (AIHW 2019).

Exposure estimates

The National Drug Strategy Household Survey (NDSHS) 2019 was used to estimate the proportion of the population who currently smoke (5-year lagged). Using these data for current smoking allows for a 5-year lag between exposure and these disease outcomes. Current smoking (5-year lagged) was linked to cardiovascular diseases, diabetes, asthma and respiratory infections. Exposure to current tobacco smoking (5-year lagged) was calculated from the proportion of individuals in the NDSHS 2019 who reported smoking daily, weekly or less than weekly.

The NDSHS 2022–2023 was used to estimate the proportion of non-smokers exposed to environmental tobacco in the home (second-hand smoke).

Due to the much longer lag between smoking and the incidence of cancers and chronic respiratory conditions, as well as consistent reductions in smoking rates over recent decades, the tobacco attributable burden for those disease outcomes cannot be estimated from data on the current or recent prevalence. For these conditions, the 'smoking impact ratio' (described by Peto et al. 1992) was used as an indirect method to estimate the accumulated risk from tobacco smoking. Lung cancer mortality in 2022 (by age and sex) from the National Mortality Database (NMD) was compared with lung cancer mortality rates among a cohort of people who smoke tobacco and never-smokers in the United States (Peto et al. 1992). The excess mortality seen in the Australian population, compared with this cohort of non-smokers, is used to determine the proportion of the population living with accumulated tobacco risk. The burden attributable to past smoking was estimated in people aged 40 and over because the small number of lung cancer deaths observed in those aged 30–39 resulted in unreliable PAFs.

Table 5.9: Tobacco risk model parameters

Risk factor	Tobacco use – Second-hand smoke
Disease outcome	Breast cancer, coronary heart disease, influenza, lower respiratory infections, lung cancer, otitis media, stroke, type 2 diabetes
TMRED	No tobacco use
National data source	NDSHS 2022–2023
Units for effect size calculation	Proportion of the population exposed to second-hand smoke

Risk factor	Tobacco use – Current smoking (5-year lagged)
Disease outcome	Age-related macular degeneration, aortic aneurysm, asthma, atrial fibrillation & flutter, back pain & problems, cataract & other lens disorders, coronary heart disease, dementia, gallbladder & biliary diseases, gastroduodenal disorders, hypertensive heart disease, lower respiratory infections, multiple sclerosis, other cardiovascular diseases, peripheral vascular disease, rheumatoid arthritis, stroke, type 2 diabetes
TMRED	No tobacco use
National data source	NDSHS 2019
Units for effect size calculation	Proportion of the population who smoked 5 years ago

Risk factor	Tobacco use – Smoking impact ratio
Disease outcome	Acute lymphoblastic leukaemia, acute myeloid leukaemia, bladder cancer, bowel cancer, breast cancer, cervical cancer, chronic lymphocytic leukaemia, chronic myeloid leukaemia, COPD, kidney cancer, laryngeal cancer, lip & oral cavity cancer, liver cancer, lung cancer, nasopharynx cancer, oesophageal cancer, other leukaemias, other respiratory diseases, pancreatic cancer, prostate cancer, stomach cancer
TMRED	No tobacco use
National data source	NMD
Units for effect size calculation	Lung cancer mortality rate; Peto et al. 1992

2018, 2015, 2011 and 2003 estimates

The NDSHS 2013 was used to estimate the proportion of the population who smoke tobacco (5-year lagged) for 2018. The NDSHS 2019 was used to estimate the proportion of non-smokers exposed to second-hand smoke. The NMD 2018 was used to estimate lung cancer mortality.

National exposure estimates for 2015, 2011 and 2003 were calculated from the earlier iterations of the same surveys used for the 2018 estimates and followed the same method.

References

AIHW (Australian Institute of Health and Welfare) (2019) *Burden of tobacco use in Australia: Australian Burden of Disease Study 2015*, AIHW, Australian Government, accessed 12 November 2024.

GBD 2016 Risk Factors Collaborators (2017) 'Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016 - external site opens in new window', *The Lancet*, 390:1345–422, doi: 10.1016/S0140-6736(17)32366-8.

Peto R, Boreham J, Lopez AD, Thun M and Heath C (1992) 'Mortality from tobacco in developed countries: indirect estimation from national vital statistics - external site opens in new window', *The Lancet*, 339(8804):1268–78, doi: 10.1016/0140-6736(92)91600-d.

Unsafe sex

This risk factor was estimated in people aged 15 and over using direct evidence.

Population attributable fractions estimated using direct evidence

The entire burden of cervical cancer, chlamydia, gonorrhoea, syphilis and other sexually transmitted infections was attributed to unsafe sex; therefore, a PAF of 1 was used.

PAFs were estimated directly for chronic liver disease, hepatitis B, hepatitis C, HIV/AIDS, and liver cancer from the National Notifiable Diseases Surveillance Scheme (NNDSS) data published in annual surveillance reports by The Kirby Institute (The Kirby Institute 2018). There was no new data available to update exposure estimates for ABDS 2024, and PAFs from ABDS 2018 were carried forward to ABDS 2024 and applied to updated estimates of burden of disease. The methods for calculating these direct PAFs are described in more detail in *Australian Burden of Disease Study: methods and supplementary material 2018* (AIHW 2021).

Table 5.10: Unsafe sex risk model parameters

Risk factor	Unsafe sex – Unsafe sex
Disease outcome	Cervical cancer, chlamydia, chronic liver disease, gonorrhoea, hepatitis B, hepatitis C, HIV/AIDS, liver cancer, syphilis, other sexually transmitted infections
TMRED	No unsafe sex
National data source	National notifiable disease annual surveillance reports (The Kirby Institute)
Units for effect size calculation	All sexually transmitted infections and cervical cancer attributed to unsafe sex HIV/AIDS, hepatitis B and hepatitis C from direct evidence

2018, 2015, 2011 and 2003 estimates

Methods for estimating exposure and calculating the PAFs in 2018 were used to produce 2015, 2011 and 2003 estimates. Data from the NNDSS published in the annual surveillance reports by The Kirby Institute were used to calculate PAFs for unsafe sex (The Kirby Institute 2004, 2012, 2013, 2016).

References

AIHW (Australian Institute of Health and Welfare) (2021) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

GBD 2021 Risk Factors Collaborators (2024) 'Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021 - external site opens in new window', *The Lancet*, 403:2162–2203. doi:10.1016/S0140-6736(24)00933-4.

The Kirby Institute (2004) *HIV, viral hepatitis and sexually transmitted infections in Australia: annual surveillance report 2004 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

The Kirby Institute (2012) *HIV, viral hepatitis and sexually transmitted infections in Australia: annual surveillance report 2012 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

The Kirby Institute (2013) *National blood-borne virus and sexually transmissible infections surveillance and monitoring report 2013 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

The Kirby Institute (2016) *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report 2016 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

The Kirby Institute (2018) *HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report 2018 - external site opens in new window*, The Kirby Institute, UNSW, accessed 19 November 2024.

Metabolic/biomedical risk factors

High blood plasma glucose

The burden attributable to high blood plasma glucose was estimated in people of all ages. The risk factor includes estimates of the burden due to intermediate hyperglycaemia and diabetes.

Burden due to this risk factor was not estimated for the 2003 reference year as there were no data on trends of blood plasma glucose between 2003 and 2011.

Population attributable fractions using direct evidence

All types of diabetes were entirely attributable to high blood plasma glucose (PAF of 1) as high blood plasma glucose is a diagnostic criteria for all types of diabetes.

Chronic kidney disease due to high blood plasma glucose

The method for attributing the amount of chronic kidney disease due to diabetes is based on the GBD 2021 and involves a 2-step approach:

1. The proportion of the GBD cause 'chronic kidney disease due to diabetes' of the total GBD cause 'chronic kidney disease' in the GBD 2021 (13% in males and 12% in females) was used to estimate the direct PAF of chronic kidney disease due to high blood plasma glucose (GBD 2021 Risk Factors Collaborators 2024).
2. Exposure to high blood plasma glucose is linked to the remaining amount of chronic kidney disease burden not attributed in step 1 as described later in this section. Part of this remaining proportion is attributed to high blood plasma glucose, using the comparative risk assessment method.

Population attributable fractions using comparative risk assessment

Exposure estimates

Exposure to high plasma glucose included 2 parts: the population distribution of blood plasma glucose levels (continuous risk model) and the proportion of the population with diabetes (categorical risk model). Each of these exposures was linked to different diseases (see High blood plasma glucose risk model parameters below).

To estimate and report the burden attributable by intermediate hyperglycaemia and diabetes, the continuous distribution of high blood plasma glucose was divided into the following categories:

- exposure to 4.9 to 6.9 mmol/L high plasma glucose was attributable to intermediate hyperglycaemia. This range was defined by the GBD TMRED of 4.9 mmol/L and expert advice for the 6.9 mmol/L cut-off.
- burden due to blood plasma glucose of 7 mmol/L or more was attributable to diabetes in addition to the attributable burden estimated from exposure to diabetes.

High blood plasma glucose

Age- and sex-specific data were extracted in the finest possible increments from a continuous fasting blood plasma glucose distribution for the Australian population from the Australian Health Survey (AHS) 2011–12 (ABS 2013). As no data were available to inform trends, this estimate was also applied in 2015, 2018 and 2024.

Diabetes

The prevalence of diabetes was based on the prevalence of type 1, type 2 and other diabetes in from ABDS 2024. All types of diabetes are included because people exposed to all types of diabetes are at risk of the disease outcomes identified, and the risk factor is modifiable.

Table 5.11: High blood plasma glucose risk model parameters

Risk factor	Intermediate hyperglycaemia; diabetes – High fasting plasma glucose
Disease outcome	Chronic kidney disease, coronary heart disease, stroke
TMRED	Blood plasma glucose 4.8–5.4 mmol/L
National data source	AHS 2011–12
Units for effect size calculation	Per 1 mmol/L of fasting plasma glucose increase

Risk factor	Diabetes – Diabetes prevalence
Disease outcome	Bladder cancer, bowel cancer, breast cancer, cataract & other lens disorders, chronic kidney disease, coronary heart disease, dementia, glaucoma, liver cancer, lung cancer, ovarian cancer, pancreatic cancer, peripheral vascular disease
TMRED	No diabetes
National data source	ABDS 2024

Units for effect size calculation	Prevalence of type 1, type 2 and other diabetes

Risk factor	Diabetes – Direct PAFs
Disease outcome	Chronic kidney disease, type 2 diabetes, type 1 diabetes, other diabetes
TMRED	No diabetes
National data source	GBD 2021
Units for effect size calculation	Direct evidence

2018, 2015, 2011 estimates

The prevalence of high blood plasma glucose in 2011 was estimated using measured data from the AHS 2011–12. These estimates were also applied for 2015, 2018 and 2024.

It was not possible to estimate this risk factor in 2003 because there were no data available to estimate the trend in high blood plasma glucose.

References

ABS (Australian Bureau of Statistics) (2013) *Microdata: Australian Health Survey, National Health Survey, 2011–12* - external site opens in new window [DataLab], accessed 13 April 2021.

GBD 2021 Risk Factors Collaborators (2024) 'Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021 - external site opens in new window', *The Lancet* 403:2162–2203. doi:10.1016/S0140-6736(24)00933-4.

High blood pressure

The burden attributable to high blood pressure was estimated in people aged 25 and over.

Population attributable fractions estimated with comparative risk assessment

Age- and sex-specific data were extracted in the finest possible increments from a continuous systolic blood pressure distribution for the Australian population based on blood pressure measurements from the National Health Survey (NHS) 2022 (ABS 2023).

The burden of dementia attributable to high blood pressure was calculated as described in detail in the AIHW publication *Contribution of vascular diseases and risk factors to the burden of dementia in Australia: Australian Burden of Disease Study 2011* (AIHW 2016), based on exposure to high blood pressure in midlife (defined for this analysis as aged 35–64).

The 2022 estimates were incorporated alongside earlier estimates (2003, 2011, 2015 and 2018) to nowcast a PAF for 2024.

Table 5.12: High blood pressure risk model parameters

Risk factor	High blood pressure – Systolic blood pressure
Disease outcome	Aortic aneurysm, atrial fibrillation & flutter, cardiomyopathy, chronic kidney disease, coronary heart disease, hypertensive heart disease, inflammatory heart disease, non-rheumatic valvular disease , peripheral vascular disease, rheumatic heart disease, stroke
TMRED	Systolic blood pressure between 110–115 mmHg
National data source	NHS 2022
Units for effect size calculation	Per 10 mmHg of systolic blood pressure increase

Risk factor	High blood pressure – high blood pressure in midlife
Disease outcome	Dementia
TMRED	Systolic blood pressure over 140 mmHg
National data source	NHS 2022
Units for effect size calculation	Prevalence of high blood pressure in midlife

2018, 2015, 2011 and 2003 estimates

Exposure data for 2015 and 2018 was sourced from the NHS 2014–15 and NHS 2017–18 (ABS 2016, 2018), respectively, using the same method as for 2024. For 2011, data were sourced directly from the AHS 2011–12 (ABS 2013).

For 2003 estimates, the exposure to high blood pressure in 2003 was calculated by comparing the mean exposure from the Australian Diabetes, Obesity and Lifestyle Study (AusDiab) 1999–2000 and the mean exposure from the AHS 2011–12 by age and sex (Begg et al. 2007). Record level data from the AHS 2011–12 were adjusted by the percentage change in the mean from 2011 to 2003. The adjusted unit record data were used to estimate the distribution of exposure to high blood pressure in 2003.

References

ABS (Australian Bureau of Statistics) (2013) Microdata: Australian Health Survey, National Health Survey, 2011-12 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2016) Microdata: National Health Survey, 2014-15 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2018) Microdata: National Health Survey, 2017-18 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2023) Microdata: National Health Survey, 2022 - external site opens in new window [DataLab], accessed 26 April 2024.

AIHW (Australian Institute of Health and Welfare) (2016) *Contribution of vascular diseases and risk factors to the burden of dementia in Australia: Australian Burden of Disease Study 2011*, AIHW, Australian Government, accessed 9 September 2024.

Begg S, Vos T, Barker B, Stevenson C, Stanley L & Lopez AD (2007) *The burden of disease and injury in Australia 2003* - external site opens in new window, AIHW, Australian Government, accessed 30 September 2024.

High cholesterol

The burden attributable to high cholesterol was estimated in people aged 25 and over.

Population attributable fractions

There was no new trend data available to update exposure estimates for ABDS 2024. PAFs from ABDS 2018 were carried forward to ABDS 2024 and applied to updated estimates of burden of disease.

Age- and sex-specific data were extracted in the finest possible increments from a continuous measured low-density lipoprotein (LDL) cholesterol distribution for the Australian population from the Australian Health Survey (AHS) 2011–12 (ABS 2013).

The exposure to high cholesterol in 2018 (also used for 2024) was calculated by comparing the mean exposure of total cholesterol from the AusDiab 1999–2000 and the mean exposure from the AHS 2011–12 by age and sex (Begg et al. 2007). Record level data from the AHS 2011–12 were adjusted by the percentage change in the mean that would be expected between the years 2011 to 2018. The adjusted unit record data were used to estimate the distribution of exposure to high cholesterol in 2018 and 2024.

Table 5.13: High cholesterol risk model parameters

Risk factor	High cholesterol – Low-density lipoprotein (LDL) cholesterol
Disease outcome	Coronary heart disease, stroke
TMRED	LDL cholesterol between 0.7–1.3 mmol/L
National data source	AHS 2011–12

Units for effect size calculation	Per 1 mmol/L of LDL cholesterol increase

2018, 2015, 2011 and 2003 estimates

The prevalence of total cholesterol for 2011 was estimated using data from the AHS 2011–12.

The same trend described here for 2018 was used to estimate prevalence in total cholesterol in 2015 and 2003.

References

ABS (Australian Bureau of Statistics) (2013) *Microdata: Australian Health Survey, National Health Survey, 2011–12* - external site opens in new window [DataLab], accessed 19 May 2020.

Begg S, Vos T, Barker B, Stevenson C, Stanley L & Lopez AD (2007) *The burden of disease and injury in Australia 2003* - external site opens in new window, AIHW, Australian Government, accessed 30 September 2024.

Impaired kidney function

The burden attributable to impaired kidney function is presented for people of all ages. In people under 25, attributable burden is only attributed to chronic kidney disease. Attributable burden for all other linked diseases was estimated in people aged 25 and over.

Population attributable fractions

Exposure estimates

Chronic kidney disease stages 1–3

There was no new trend data available to update exposure estimates for ABDS 2024. PAFs from ABDS 2018 were carried forward to ABDS 2024 and applied to updated estimates of burden of disease.

PAFs from ABDS 2018 were calculated by extracting age- and sex-specific data in the finest possible increments from the estimate of stages 1, 2 and 3 chronic kidney disease for the Australian population from the Australian Health Survey (AHS) 2011–12 (ABS 2013).

To estimate prevalence in the year 2018 (also used for 2024), the AIHW analysis of trends in stages 3–5 chronic kidney disease prevalence from the 1999–2000 AusDiab compared with the AHS 2011–12 in the broad age groups was used (AIHW 2018). The age and sex distribution for stage 3 chronic kidney disease were further refined using the age and sex of people who were hospitalised for stage 3 chronic kidney disease (N18.3) in 2018.

Chronic kidney disease stages 4–5

The prevalence of stage 4 and 5 (end-stage) chronic kidney disease was estimated as the prevalence for the relevant sequelae (stage 4 chronic kidney disease, end-stage chronic kidney disease treated with dialysis or transplant) for the cause chronic kidney disease in the ABDS 2024. The methods for these sequelae are described for the cause chronic kidney disease.

Table 5.14: Impaired kidney function risk model parameters

Risk factor	Chronic kidney disease stages 1–2
Disease outcome	Coronary heart disease, dementia, gout, peripheral vascular disease, stroke
TMRED	No chronic kidney disease
National data source	AHS 2011–12
Units for effect size calculation	Prevalence of chronic kidney disease stages 1–2

Risk factor	Chronic kidney disease stage 3
Disease outcome	Coronary heart disease, dementia, gout, peripheral vascular disease, stroke, chronic kidney disease
TMRED	No chronic kidney disease

National data source	AHS 2011–12
Units for effect size calculation	Prevalence of chronic kidney disease stage 3

Risk factor	Chronic kidney disease stage 4–5
Disease outcome	Coronary heart disease, dementia, gout, peripheral vascular disease, stroke, chronic kidney disease
TMRED	No chronic kidney disease
National data source	AHS 2011–12; ABDS 2024
Units for effect size calculation	Prevalence of chronic kidney disease stage 4–5

2018, 2015, 2011 and 2003 estimates

Chronic kidney disease stages 1–3

The prevalence of stages 1, 2 and 3 chronic kidney disease for 2011 was estimated using data from the AHS 2011–12. To estimate prevalence in the years 2003 and 2015, the AIHW analysis of trends in stages 3–5 chronic kidney disease prevalence from the 1999–2000 AusDiab compared with the AHS 2011–12 in the broad age groups was used (AIHW 2018). The same PAFs were used for 2018 and 2024 (described above).

Chronic kidney disease stages 4–5

The prevalence of stages 4–5 chronic kidney disease was sourced as described for the cause chronic kidney disease for the ABDS 2018 (see Disease-specific methods - morbidity).

References

ABS (Australian Bureau of Statistics) (2013) Microdata: Australian Health Survey, National Health Survey, 2011–12 - external site opens in new window [DataLab], accessed 25 February 2021.

AIHW (Australian Institute of Health and Welfare) (2018) *Chronic kidney disease prevalence among Australian adults over time*, AIHW, Australian Government, accessed 30 September 2024.

Iron deficiency

The burden attributable to iron deficiency was estimated for people of all ages. Iron deficiency anaemia is the only disease linked to iron deficiency and was 100% attributable to this risk factor (PAF of 1). The method was the same for all years in the study.

Table 5.15: Iron deficiency risk model parameters

Risk factor	Iron deficiency
Disease outcome	Iron deficiency anaemia
TMRED	No Iron deficiency anaemia
National data source	n.a.
Units for effect size calculation	All of iron deficiency anaemia is attributable

Low birthweight and short gestation

Burden due to low birth weight & short gestation was estimated in people of all ages. This risk factor represents the combined impact of being born of low weight and/or prematurely and not as separate risk factors. It should be noted that the methods, including the TMREDs, used in the ABDS 2024 to calculate attributable burden due to low birthweight and short gestation do not align with other definitions of low birthweight (usually <2500g) or premature birth (usually <37 weeks gestation). Due to data limitations, this risk factor was only estimated for the 2018 and 2024 reference years.

Population attributable fractions estimated by comparative risk assessment

Exposure estimates

Exposure estimates were obtained using the National Perinatal Data Collection (NPDC), which contains data on all live births and stillbirths of at least 20 weeks gestation or 400 grams birthweight, and the National Perinatal Mortality Data Collection (NPMDC) which contains data on all stillbirths and neonatal deaths of at least 20 weeks gestation or 400 grams birthweight. For more information please read the latest NPDC data quality statement - external site opens in new window.

The number of live births within each category of birthweight and gestational age (to represent the early neonatal period, 0–6 days), and the number of living babies within each category of birthweight and gestation age at 7 days (to represent the late neonatal period, 7–28 days), was calculated so as to correspond with relative risks provided by the GBD 2021 (see Table 5.16).

Table 5.16: Categories of exposure to gestation and birthweight and TMREDs from GBD 2021 study

Gestation (weeks)	Birthweight (grams)
<24	0–499, 500–999
24–25	500–999
26–27	500–999, 1000–1499
28–29	500–999, 1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499
30–31	500–999, 1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999
32–33	1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999
34–35	1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999, 4000–4499
36	1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999, 4000–4499
37	1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999, 4000–4499
38–39	1000–1499, 1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999, 4000–4499
40–41	1500–1999, 2000–2499, 2500–2999, 3000–3499, 3500–3999, 4000–4499
TMRED	
[38, 40]	3000–3499, 3500–3999, 4000–4499
[40–42]	3000–3499, 3500–3999, 4000–4499

Source: GBD 2021.

PAFs were estimated using the comparative risk assessment method using NPDC and NPMDC exposure data from 2016–2018 (for 2018 reference year) and 2019–2021 (the latest available at the time of analysis, for 2024 reference year). PAFs were scaled down using the proportion of deaths in the early and late neonatal period out of all deaths among children less than one year old, to match the age groups used in burden of disease estimates.

Relative risks

Relative risks and linked diseases were obtained from the GBD 2021 though, following expert advice, not all were deemed appropriate within the Australian context. Pre-term birth and low birthweight complications was the only linked disease that was attributed entirely to the risk factor and applied to people of all ages.

Table 5.17: Low birthweight & short gestation risk model parameters

Risk factor	Low birthweight & short gestation – Birthweight, gestational age
Disease outcome	Birth trauma & asphyxia, haemophilus influenza type-B, lower respiratory infections, meningococcal disease, neonatal infections, other disorders of infancy, other gastrointestinal diseases, other meningitis and encephalitis, otitis media, pneumococcal disease, pre-term birth & low birthweight complications, rotavirus, salmonellosis, sudden infant death syndrome, upper respiratory infections

TMRED	Birthweight ≥ 3000 g and gestational age ≥ 38 weeks
National data source	NPDC and NPMDC 2016–21
Units for effect size calculation	Prevalence of birthweight and gestational age categories

References

GBD 2021 Risk Factors Collaborators (2024) 'Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021 - external site opens in new window', *The Lancet* 403:2162–2203. doi:10.1016/S0140-6736(24)00933-4.

Low bone mineral density

The burden attributable to low bone mineral density was measured in people aged 40 and over.

Population attributable fractions

Self-reported prevalence of osteoporosis underestimates the true community prevalence of the condition, as many individuals with low bone mineral density display no overt symptoms and are therefore undiagnosed.

The PAFs from ABDS 2018 (and earlier years) were also used for ABDS 2024 as there was no new data available. Exposure data on measured bone mineral density (the gold standard for measuring osteoporosis) were sourced from the 2001–06 wave of the Geelong Osteoporosis Study (Henry et al. 2010). Mean bone mineral density at the femoral neck, by age and sex, was used to model exposure distributions, assuming a normal distribution and following methods described by Sànchez-Riera et al. (2014).

Table 5.18: Low bone mineral density risk model parameters

Risk factor	Low bone mineral density
Disease outcome	Falls
TMRED	95th percentile of femoral neck bone mineral density fromthe Third National Health and Nutrition Examination Survey (NHANES-III) cohort by age and sex (Looker et al. 2012)
National data source	Geelong Osteoporosis Study (Barwon Health)
Units for effect size calculation	Standardised bone mineral density at the femoral neck

2018, 2015, 2011 and 2003 estimates

Methods for estimating exposure and calculating the PAFs for the 2018, 2015, 2011 and 2003 reference year were the same as those used for 2024.

References

Henry MJ, Pasco JA, Korn S, Gibson JE, Kotowicz MA and Nicholson GC (2010) 'Bone mineral density reference ranges for Australian men: Geelong Osteoporosis Study - external site opens in new window', *Osteoporosis International* 21(6):909–17. doi:10.1007/s00198-009-1042-7.

Looker AC, Borrud LG, Hughes JP, Fan B, Shepherd JA and Melton LJ (2012) 'Lumbar spine and proximal femur bone mineral density, bone mineral content, and bone area: United States 2005–2008 - external site opens in new window', *Vital Health Statistics* 11(251):1-132.

Sànchez-Riera L, Carnahan E, Vos T, Veerman L, Norman R, Lim SS, Hoy D, Smith E, Wilson N, Nolla JM, Chen JS, Macara M, Kamalaraj N, Li Y, Kok C, Santos-Hernandez C and March L (2014) 'The global burden attributable to low bone mineral density - external site opens in new window', *Annals of the Rheumatic Diseases* 73:1635–45. doi:10.1136/annrheumdis-2013-204320.

Overweight (including obesity)

The burden due to overweight (including obesity) was estimated in people aged 5 and over. The methods used for this risk factor are described in detail in the AIHW publication *Impact of overweight and obesity as a risk factor for chronic conditions: Australian Burden of Disease Study* (AIHW 2017).

Population attributable fractions estimated with comparative risk assessment

Exposure estimates

Age- and sex-specific data were extracted in the finest possible increments from a continuous high body mass distribution for the Australian population based on measurements of height and weight from the National Health Survey (NHS) 2022 (ABS 2023). For children and adolescents aged 5–14, age- and sex-specific BMI cut-off levels indicating overweight (including obesity) were derived from the study by Cole et al. (2000).

Relative risks

The relative risks used were largely based on those published by the GBD 2019, including atrial fibrillation & flutter, cataract, non-Hodgkin lymphoma and multiple myeloma. Other relative risks were based on work by the AIHW (AIHW 2017). For dementia and gallbladder and bile duct disease, relative risks from the GBD 2019 were used instead of relative risks from the AIHW as they were based on a more recent meta-analysis.

Population attributable fractions

Updated body mass index (BMI) data from the National Health Survey (NHS) 2022 was used to estimate a PAF for 2022. This 2022 estimate was incorporated alongside earlier estimates (2003, 2011, 2015 and 2018) to nowcast a PAF for 2024. Mediated PAFs were also nowcast, where relevant.

Table 5.19: Overweight (including obesity) risk model parameters

Risk factor	Overweight, obese – Body mass index BMI
Disease outcome	Acute lymphoblastic leukaemia, acute myeloid leukaemia, asthma, atrial fibrillation & flutter, back pain & problems, bowel cancer, breast cancer, cataract & other lens disorders, chronic kidney disease, chronic lymphocytic leukaemia, chronic myeloid leukaemia, coronary heart disease, dementia, gallbladder and bile duct disease, gallbladder cancer, gout, hypertensive heart disease, kidney cancer, liver cancer, myeloma, non-Hodgkin lymphoma, oesophageal cancer, osteoarthritis, other leukaemias, ovarian cancer, pancreatic cancer, stroke, thyroid cancer, type 2 diabetes, uterine cancer
TMRED	Body mass index between 20 and 25 BMI
National data source	NHS 2022
Units for effect size calculation	Per 5 BMI increments

2018, 2015, 2011 and 2003 estimates

Exposure for 2011, 2015 and 2018 were estimated as described above, using data from the AHS 2011–12, NHS 2014–15 and NHS 2017–18, respectively (ABS 2013, 2016, 2018).

For people aged 20 and over, prevalence by BMI category, age and sex was estimated for the time-point 2003 by using the trends in the prevalence of the distribution of BMI from the 3 successive health surveys (the NHS 2007–08, the AHS 2011–12 and the NHS 2014–15) as described in AIHW 2017.

For people aged 5–19, prevalence by BMI category, age and sex was estimated for the time-point 2003 using the NHS 2007–08.

References

ABS (Australian Bureau of Statistics) (2013) Microdata: Australian Health Survey, National Health Survey, 2011–12 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2016) Microdata: National Health Survey, 2014–15 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2018) Microdata: National Health Survey, 2017–18 - external site opens in new window [DataLab], accessed 26 April 2024.

ABS (2023) Microdata: National Health Survey, 2022 - external site opens in new window [DataLab], accessed 26 April 2024.

AIHW (2017) *Impact of overweight and obesity as a risk factor for chronic conditions: Australian Burden of Disease Study*, AIHW, Australian Government, accessed 30 September 2024.

Cole TJ, Bellizzi MC, Flegal KM & Dietz WH (2000) 'Establishing a standard definition for child overweight and obesity worldwide: international survey - external site opens in new window', *British Medical Journal,* 320:1240–3. doi:10.1136/bmj.320.7244.1240.

Environmental risk factors

Air pollution

The burden attributable to air pollution in Australia was estimated by considering the annual average concentration of particulate matter of aerodynamic diameter <2.5 μg ($PM_{2.5}$). Burden attributable to coronary heart disease and stroke is only estimated for people aged 25 and over, while burden attributable to the remaining linked diseases (COPD, lower respiratory infections, lung cancer and type 2 diabetes) is estimated for all ages. Estimates are provided for 2015, 2018 and 2024 only.

The analysis for this risk factor was undertaken using estimates obtained directly from the University of Sydney (L Knibbs, personal communication, 2024), as the most recent update of the validated $PM_{2.5}$ predictions described by Knibbs et al. (2018). Note that these are gridded as approximately 100 m raster cells for all of Australia, and incorporate minor technical improvements related to the underlying predictor data sets, as needed.

The development of the original mesh block-based exposure estimates described by Knibbs et al. (2018) were supported by the Centre for Air Quality and Health Research and Evaluation (CAR), an NHMRC Centre of Research Excellence (APP1030259).

The estimates are presently available with thanks to the successor Centres of Research Excellence (CRE) for Safe Air (CSA) via the Clean Air Research Data and Analysis Tools (CARDAT) platform (https://cardat.github.io). It is anticipated that the $PM_{2.5}$ rasters used in ABDS 2024 will be available on CARDAT in the near future.

CARDAT is supported by The Centre for Safe Air (https://safeair.org.au/) which is currently supported by the National Health and Medical Research Council (2015584) and the Australian Research Data Commons (ARDC) AirHealth Data Bridges project (https://doi.org/10.47486/PS022 - external site opens in new window).

Population attributable fractions estimated using comparative risk assessment

$PM_{2.5}$ are particles suspended in the air with a diameter in a specified size range, 0–2.5 microns. Average annual $PM_{2.5}$ raster data from the Centre for Safe Air was estimated using satellite data, calibrated by ground monitoring stations, for 2015, 2018 and 2021 (latest available data, applied to 2024 reference year).

These raster data were used to estimate average $PM_{2.5}$ levels for mesh blocks, then geographic correspondence files were used to convert the mesh block data to SA2 geography. The SA2 data were aggregated using population weights for each age and sex cohort to estimate national exposure to air pollution by age and sex.

Air pollution modelling, including satellite-based modelling used here, as well as fixed site ground based measurement networks, are limited in that they reflect air pollution concentrations, rather than actual personal exposures to air pollution. However, satellite-based modelling has advantages over previous methods using monitoring stations in that estimates are based on measurements which sample the geographic extent of Australia much more comprehensively and are calibrated using ground monitoring stations. There may still be variation in estimated levels of air pollution and actual levels realised. There is also likely to be a substantial amount of variation between sites in the amount of time that people generally spend outside, being exposed to air pollution. While outside air pollution can move into indoor spaces, contributing to exposure, indoor air pollution is not currently captured in this study. This will be considered for inclusion in future studies if available input data is available.

Table 5.20: Air pollution risk model parameters

Risk factor	Air pollution – Fine particulate matter (2.5 μm)
Disease outcome	COPD, coronary heart disease, lower respiratory infections, lung cancer, stroke, type 2 diabetes
TMRED	2.4–5.9 μm (PM2.5)
National data source	Satellite-based model data
Units for effect size calculation	Annual average of particulate matter (PM2.5)

References

Knibbs LD, Van Donkelaar A, Martin RV, Bechle MJ, Brauer M, Cohen DD, Cowie CT, Dirgawati M, Guo Y, Hanigan IC and Johnston FH (2018) 'Satellite-based land-use regression for continental-scale long-term ambient PM2.5 exposure assessment in Australia - external site opens in new window', *Environmental science & technology*, 52(21):12445–12455, doi:10.1021/acs.est.8b02328.

Occupational exposures and hazards

The impact of occupational exposures and hazards was estimated in people aged 15 and over. Occupational exposures and hazards captured the impact of exposure to 12 carcinogens (asbestos, arsenic, benzene, beryllium, cadmium, chromium, diesel engine exhaust, formaldehyde, nickel, polycyclic aromatic hydrocarbons, silica and sulphuric acid), asthmagens, noise, ergonomic stressors, injury, particulate matter, and gases and fumes in the workplace.

Population attributable fractions from direct evidence

The PAFs for injuries were estimated directly from data collected by Safe Work Australia. For all other disease outcomes, the PAFs were estimated from exposure to working in various industries or occupations.

All pneumoconiosis was attributable to occupational exposure as informed by expert advice (T Driscoll, personal communication, 24 June 2016). As per the disease group methods, pneumoconiosis was split into its component sequelae of silicosis, asbestosis and other pneumoconiosis for ABDS 2024.

For injuries, direct evidence was sourced from Safe Work Australia, including data on the number of deaths occurring at work in 2022 (Safe Work Australia 2024a) and the number of workers' compensation injury claims annually in 2022–23 (preliminary data, Safe Work Australia 2024b). Counts of deaths and injuries, with disaggregation by age, sex and nature or external cause of injury, were used to directly calculate PAFs. Where the full distribution of counts by age and sex were not available due to small numbers, the disaggregation was estimated using the age and sex distribution of available occupational injuries in that year.

The PAFs for fatal burden were estimated by the number of deaths occurring at work compared with the total number of deaths due to injuries in the broader population in the same year.

The data for non-fatal burden are limited in that serious workers' compensation claims will capture only injuries that require more than 1 week away from work, by definition. This means that some work-related injuries or illnesses that have a significant and ongoing impact on workers, such as permanent impairment, are not captured in this data. They will also not include people who are self-employed. These PAFs were estimated for people aged 15 and over.

The PAFs for non-fatal burden were estimated by the number of injuries reported at work in 2022–23 preliminary data from Safe Work Australia divided by the incidence of admitted and non-admitted injury hospitalisations and emergency department presentations in the National Hospital Morbidity Database (NHMD) in 2022.

Population attributable fractions by comparative risk assessment

Exposure estimates

The number of people working in Australia—the economically active population—by age, sex and industry or occupation, was estimated from the Labour Force Survey (ABS 2024).

Industry

Exposure to working in certain types of industry was linked to various cancers, hearing loss and COPD (see Occupational exposure risk model parameters below). This is because working in these industries is known to expose a proportion of the workforce to carcinogens, noise, particulate matter, gases and fumes as estimated by the Carcinogen Exposure (CAREX) research project (Kauppinen et al. 2000).

The working population was distributed across 9 broad industry types (agriculture, hunting, forestry and fishing; mining and quarrying; wholesale, retail trade, restaurants and hotels; manufacturing; electricity, gas and water; transport, storage and communication; construction; finance, insurance, real estate and business services; community, social and personal services) based on the 2021 Census of Population and Housing.

A severity distribution from the GBD 2010 was applied to obtain the proportion of people working in these industries exposed to high and low levels of noise, and to high and low levels of particulate matter, gases and fumes. The PAFs were calculated for people aged 15–74.

To account for the latency period between exposure and the symptoms of cancer, an 'occupational turnover rate' was applied to the number of people working in these industries. The occupational turnover rate adjusts for annual worker turnover, mortality rates and past trends by industry, to estimate past exposure to carcinogens in each industry. These factors are based on trends observed in the United Kingdom.

Data from the Carcinogen Exposure (CAREX) research project produces estimates of the proportion of workers in each industry who will be exposed to specific carcinogens (Kauppinen et al. 2000). These proportions, which are based on data from the European Union and Canada, are then applied for each of the industries described earlier. The PAFs for carcinogens were calculated for people aged

over 15.

Occupation

Exposure to types of occupations was linked to asthma and low back pain (see occupational exposure risk model parameters below). This is because working in these occupations is known to expose a proportion of the workforce to asthmagens and ergonomic stressors.

The number of working people was apportioned by 8 broad occupational groups (professional, technical and related workers; administrative and managerial workers; clerical and related workers; sales workers; service workers; agricultural, animal husbandry and forestry workers; fishermen and hunters; production and related workers; transport equipment operators and labourers) based on the 2021 Census of Population and Housing (ABS 2022).

Exposure to working in these occupations was used to estimate the PAFs in people aged 15–64 and no severity distribution was applied.

Table 5.21: Occupational exposure risk model parameters

Risk factor	Occupational exposures and hazards – Occupational injuries
Disease outcome	Drowning; falls; fire, burns and scalds; homicide and violence; road traffic injuries—motor vehicle occupants; road traffic injuries—motorcyclists; other unintentional injuries; other land transport injuries
TMRED	No occupational injuries
National data source	Work-related Traumatic Injury Fatalities, Australia 2022; Workers Compensation Statistics 2022–23 preliminary
Units for effect size calculation	Direct evidence: number of workplace fatalities and the number of workers compensation claims for injuries

Risk factor	Occupational exposures and hazards – Occupational exposure to benzene or formaldehyde
Disease outcome	Acute lymphoblastic leukaemia, acute myeloid leukaemia, chronic lymphocytic leukaemia, chronic myeloid leukaemia, other leukaemias, nasopharyngeal cancer
TMRED	No occupational exposure to benzene or formaldehyde
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to arsenic, beryllium, cadmium, chromium, diesel engine exhaust, polycyclic aromatic hydrocarbons, nickel, silica
Disease outcome	Lung cancer
TMRED	No occupational exposure to arsenic, beryllium, cadmium chromium, diesel engine exhaust, polycyclic aromatic hydrocarbons, nickel, silica
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to asbestos, silicone and other particulate matter

Disease outcome	Asbestosis, silicosis, other pneumoconiosis
TMRED	No occupational exposure to asbestos, silicone and other particulate matter
National data source	GBD 2019
Units for effect size calculation	Direct evidence

Risk factor	Occupational exposures and hazards – Occupational exposure to sulphuric acid
Disease outcome	Laryngeal cancer
TMRED	No occupational exposure to sulphuric acid
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to trichloroethylene
Disease outcome	Kidney cancer
TMRED	No occupational exposure to trichloroethylene
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to particulate matter, gas and fumes
Disease outcome	COPD
TMRED	No occupational exposure to particulate matter, gas and fumes
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to asbestos
Disease outcome	Laryngeal cancer, lung cancer, mesothelioma, ovarian cancer
TMRED	No occupational exposure to asbestos
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to noise
Disease outcome	Hearing loss

TMRED	Background noise exposure
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational exposure to asthmagens
Disease outcome	Asthma
TMRED	Background asthmagen exposure
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

Risk factor	Occupational exposures and hazards – Occupational ergonomic factors
Disease outcome	Back pain and problems
TMRED	No occupational exposure to ergonomic factors causing back pain and problems
National data source	Census of Population and Housing 2021; ABS Labour force survey, July 2024
Units for effect size calculation	Distribution of the labour force by broad industry type

2018, 2015, 2011 and 2003 estimates

Methods for estimating exposure and calculating the PAFs in 2024 were followed for 2018, 2015 and 2011 estimates. Due to data availability, exposure estimates from 2011 were applied to 2003 population data for all occupational exposures except fatal injuries. The working population was estimated from the Labour Force Survey (ABS 2024) and disaggregated by occupation and industry using the 2016 and 2011 Census of Population and Housing (ABS 2017; ABS 2013).

References

ABS (Australian Bureau of Statistics) (2013) Census of Population and Housing 2011 - external site opens in new window [Census TableBuilder], accessed March 2024.

ABS (2017) Census of Population and Housing 2016 - external site opens in new window [Census TableBuilder], accessed March 2024.

ABS (2022) Census of Population and Housing 2021 - external site opens in new window [Census TableBuilder], accessed March 2024.

ABS (2024) *Labour force, Australia, July 2024* - external site opens in new window [website], accessed 17 September 2024.

Kauppinen T, Toikkanen J, Pedersen D, Young R, Ahrens W, Boffetta P, Hansen J, Kromhout H, Maqueda Blasco J, Mirabelli D, de la Orden-Rivera V, Pannett B, Plato N, Savela A, Vincent R and Kogevinas M (2000) 'Occupational exposure to carcinogens in the European Union - external site opens in new window', *Occupational and Environmental Medicine*, 57(1):10–18, doi:10.1136/oem.57.1.10.

Safe Work Australia (2024a) *Work-related traumatic injury fatalities, Australia 2022* - external site opens in new window, Safe Work Australia, Australian Government, accessed 18 October 2024.

Safe Work Australia (2024b) *Australian Workers' Compensation Statistics 2022–23 (preliminary)* - external site opens in new window, Safe Work Australia, Australian Government, accessed 18 October 2024.

UV sun exposure

The burden attributable to ultraviolet (UV) radiation exposure was estimated in people of all ages using direct evidence. The main source of UV exposure is the sun. The direct PAFs used here represent a proportion of current burden due to past and current UV exposure in the population.

Population attributable fractions using direct evidence

Direct PAFs sourced from Olsen et al. (2015) were used to estimate burden attributable to high UV exposure. Olsen et al. (2015) estimated the PAFs for melanoma (0.633) and non-melanoma skin cancer (0.994) due to ambient UV exposure in Australia by comparing the incidence of these linked diseases in Australian residents compared with minimally sun exposed populations (the UK for melanoma, Scandinavia for non-melanoma skin cancers).

Note that the PAFs used for ABDS 2024 are based on a more recent study compared with the PAFs used for ABDS 2018 (see *Australian Burden of Disease Study: methods and supplementary material 2018*).

Table 5.22: UV sun exposure risk model parameters

Risk factor	UV sun exposure
Disease outcome	Melanoma, non-melanoma skin cancer
TMRED	Minimal UV exposure (based on residence in the UK or Scandinavia)
National data source	Olsen et al. 2015
Units for effect size calculation	Direct evidence

2018, 2015, 2011 and 2003 estimates

The same PAFs were used in 2018, 2015, 2011 and 2003.

References

Olsen CM, Wilson LF, Green AC, Bain CJ, Fritschi L, Neale RE and Whiteman DC (2015) 'Cancers in Australia attributable to exposure to solar ultraviolet radiation and prevented by regular sunscreen use - external site opens in new window', *Australia and New Zealand Journal Public Health*, 39:471–476, doi:10.1111/1753-6405.12470.

References

AIHW (Australian Institute of Health and Welfare) (2021a) *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018*, AIHW, Australian Government, accessed 11 October 2024, doi:10.25816/5ps1-j259.

AIHW (2021b) *Australian Burden of Disease Study: Methods and supplementary material 2018*, AIHW, Australian Government, accessed 11 October 2024.

GBD 2019 Risk Factors Collaborators (2020) 'Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019 - external site opens in new window', *The Lancet*, 396:1223–249, doi: 10.1016/S0140-6736(20)30752-2.

Abbreviations

Table: Abbreviations

Term	Description
ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ADIPS	Australasian Diabetes in Pregnancy Society
AHS	Australian Health Survey
AIHW	Australian Institute of Health and Welfare
ASR	age-standardised rate
AusDiab	Australian Diabetes, Obesity and Lifestyle Study
BMI	body mass index
COPD	chronic obstructive pulmonary disease
COVID-19	coronavirus disease 2019
DALY	disability-adjusted life years
g	gram
GBD	Global Burden of Disease Study
HALE	health-adjusted life expectancy
IADPSG	International Association of the Diabetes and Pregnancy Study Groups
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th Revision
ICU	intensive care unit
ILI	influenza-like illness
lbw	low birthweight
LDL	low-density lipoprotein cholesterol
LE	life expectancy
LRI	lower respiratory infection
MET	metabolic equivalent of tasks
µg/m3	micrograms per cubic metre
mmHg	millimetre of mercury
mmol/L	millimole per litre
NDSHS	National Drug Strategy Household Survey
NHMD	National Hospital Morbidity Database
NHMP	National Homicide Monitoring Program

NHS	National Health Survey
NMD	National Mortality Database
NNDSS	National Notifiable Diseases Surveillance System
NSMHW	National Survey of Mental Health and Wellbeing
PAF	population attributable fraction
PM	particulate matter
PSS	Personal Safety Survey
RTI	road traffic injuries
SIDS	sudden infant death syndrome
TMRED	theoretical minimum risk exposure distribution
UV	ultraviolet radiation
WHO	World Health Organization
YLD	years lived with disability
YLL	years of life lost

Frequently asked questions

On this page:

What is burden of disease?

Burden of disease analysis measures the impact of disease and injury in a population by estimating the years of life lost (YLL, fatal burden) and years lived with disability (YLD, non-fatal burden). The sum of non-fatal and fatal burden equates to the total burden (disability-adjusted life year, DALY).

> 1 DALY is equivalent to 1 year of healthy life lost.

Burden of disease studies allow the impact of both deaths and living with illness to be compared and reported in a consistent manner. The health impacts and distribution of diseases and injuries contribute to the evidence base to inform health policy and programs, and service delivery.

How are burden of disease estimates (DALY, YLD, YLL) calculated?

Disability-adjusted life years (DALY) are estimated by combining the years of life lost (YLL) with the years lived with disability (YLD) in a single reference year for each sex, age group and disease or injury.

> DALY = YLL + YLD

YLL equals the sum of the number of deaths due to the disease at each age multiplied by the number of remaining years that a person would on average expected to have lived according to an aspirational life expectancy.

YLD is estimated by multiplying the point prevalence of all sequelae (that is, consequences of a disease) by a disability weight which reflects the severity of the health state. A health state reflects a combination of signs and symptoms that result in health loss (for example, end stage of chronic liver disease). The disability weights used in ABDS 2024 were sourced from the Global Burden of Disease Study 2013 - external site opens in new window (GBD 2013 Collaborators 2015). Point prevalence is defined as the number of people with a condition at a particular point in time, for a reference year.

For 2024, burden estimates were mostly based on trends from previous ABDS reference years, and subsequent years up to 2022 where data were available and appropriate. Further detail about the trend analyses can be found in the Technical notes.

How is health-adjusted life expectancy calculated?

Health-adjusted life expectancy (HALE) extends the concept of life expectancy by considering the time spent living with ill health from disease and injury. HALE is measured using the morbidity and mortality experienced by the population for a particular reference year.

In the ABDS, Sullivan's method was used to calculate HALE (see Jagger et al. 2014). Further information can be found in the *Australian Burden of Disease Study 2018: methods and supplementary material* report.

Sullivan's method requires a current life table. For ABDS 2024, a life table for 2024 was derived by the AIHW using a log-linear regression model including the latest ABS provisional deaths. HALE was then calculated using the projected 2024 life expectancy and projected 2024 YLD rates. For more information see HALE in the Technical notes.

Which diseases are included in the Australian Burden of Disease Study?

Burden of disease analysis provides estimates for an extensive list of diseases and injuries, and the list of diseases has been devised to be mutually exclusive (non-overlapping).

The ABDS 2024 disease list comprises 220 specific diseases or conditions (such as coronary heart disease, stroke, lung cancer or bowel cancer), grouped into 17 disease groups of related diseases or conditions (such as cardiovascular diseases or cancer). Estimates for injuries are calculated from two perspectives—external cause of injury (such as road traffic accident) and nature of injury (such as traumatic brain injury).

Conditions that could not be individually specified are included in a residual category for each disease group (such as 'other cardiovascular conditions').

COVID-19 is a disease under the Infectious diseases group in the ABDS 2024. Further information on the data and methods used for COVID-19 is provided in the Technical notes.

More information on the diseases included in the Australian Burden of Disease studies can be found in the *Australian Burden of Disease Study: methods and supplementary material 2018* report.

Are risk factors included in the Australian Burden of Disease Study 2024?

The ABDS 2024 includes updated data on burden attributable to risk factors. Updated estimates are included for the reference years 2003, 2011, 2015, 2018 and 2024. The 20 risk factors included are the same as those in the *Australian Burden of Disease Study: impact and causes of illness and death in Australian 2018* report.

Which risk factors are included in the Australian Burden of Disease Study?

There are 40 risk factor components or exposures included in this report (such as cannabis and cocaine use) that combine into 20 individual risk factors (such as illicit drug use). The risk factors are categorised as behavioural, dietary, environmental and metabolic/biomedical risks. While this list is extensive, it does not cover all potential risk factors.

Behavioural risks

- Alcohol use
- Bullying victimisation
- Child abuse & neglect
- Illicit drug use
- Opioid use
- Amphetamine use
- Cocaine use
- Cannabis use
- Other illicit drug use
- Unsafe injecting practices
- Intimate partner violence
- Physical inactivity
- Tobacco use
- Unsafe sex

Metabolic/Biomedical risks

- High blood plasma glucose (including diabetes)

- High blood pressure
- High cholesterol
- Impaired kidney function (including chronic kidney disease)
- Iron deficiency
- Low bone mineral density
- Low birth weight & short gestation
- Overweight (including obesity)

Dietary risks

- Diet high in processed meat
- Diet high in red meat
- Diet high in sodium
- Diet high in sugar sweetened beverages
- Diet low in fish & seafood
- Diet low in fruit
- Diet low in legumes
- Diet low in milk
- Diet low in nuts and seeds
- Diet low in polyunsaturated fat
- Diet low in vegetables
- Diet low in whole grains & high fibre cereals

Environmental risks

- Air pollution
- UV sun exposure
- Occupational exposures & hazards.

How is attributable burden calculated?

The basic steps for estimating attributable burden are described as follows:

- Select linked diseases for which there is convincing or probable evidence in the literature that the risk factor has a causal association.
- Define the exposure to the risk factor that is not associated with increased risk of the linked disease (the theoretical minimum risk exposure distribution or TMRED).
- Estimate the population attributable fractions (PAFs) by either the comparative risk assessment method or the direct method:
  - Comparative risk assessment involves using the amount of increased risk (relative risk) of linked disease morbidity or mortality due to exposure to the risk factor and an estimate of exposure to each risk factor in the population. For most risk factors, exposure to the risk factor was estimated using high-quality survey data. For information about the quality of data inputs, see *Australian Burden of Disease Study: Methods and supplementary material 2018*.
  - The direct method uses comprehensive data sources such as registries to estimate the amount of the linked disease due to the risk factor.
  - Estimate the attributable burden by multiplying the PAFs by the disease burden (fatal and non-fatal) for each linked disease.

The risk factors where past exposure or any exposure during the life course contributes to the calculation of attributable burden are tobacco use, child abuse & neglect, intimate partner violence, high UV exposure, occupational exposures & hazards, alcohol use, illicit drug use, unsafe sex and low birthweight & short gestation. For these risk factors, the onset of linked diseases may not occur until years after initial exposure. For example, the methods for tobacco use incorporated a measure of current smoking where the onset of linked diseases are given a 5-year lag from the time of exposure. Similarly for other risk factors, burden over the lifetime of certain linked diseases is said to be attributable to past exposure, such as depression and anxiety for childhood experiences of abuse and neglect.

See Supplementary data tables and Calculation of risk factor specific estimates for information on the data sources used to estimate attributable burden.

What are attributable deaths and why aren't they estimated in 2024?

Attributable deaths are estimated in the same way that disease burden attributable to risk factors is calculated.

An estimate of the number of attributable deaths is not provided for 2024, as data on deaths in 2024 were not available at the time of analysis. However, an approximate percentage of attributable deaths is provided for 2024, estimated based on projected YLL for 2024 and the mean remaining life expectancy for each age group.

Where attributable deaths are reported (for 2003, 2011, 2015 and 2018), attributable deaths are based on deaths that have been redistributed, as such the number of deaths may not align with other reporting of causes of death. Information on the redistribution of deaths can be found in the *Australian Burden of Disease Study: methods and supplementary material 2018 report*.

How does the Australian Burden of Disease Study 2024 differ from previous studies?

To provide burden of disease estimates best matched to the public health context for the Australian population, previous Australian Burden of Disease Studies started when the key data resources became available for most included diseases. The complexity of the process (including reviewing and improving disease-specific methods and resources, data extraction, analysis and checking) results in a 3–year to 4–year delay between the reference period and release of results.

To address challenges such as timeliness and completeness of available data, the burden estimates for the ABDS 2024 are projections largely based on historical trends rather than gathering data for a specific reference period, as was done for previous studies. Trend analysis is a method used to evaluate the pattern of burden estimates over time and to predict burden estimates for the period of interest. It allows for burden to be estimated for the current year (2024), based on the assumption that past trends have continued. The ABDS 2022 was the first study where burden was estimated for the year of release (AIHW 2022). The years of data included in the trend analyses for ABDS 2024 was dependent on data availability as well as other considerations (such as data quality, changes in disease coding over time and the impact of the COVID-19 pandemic) which varied to some extent for fatal and non-fatal burden and by disease and injury. Table S4 presents information about the years of data included in trend analyses for each disease or injury, as well as the type of projection model used. Estimates from the trend analysis should be interpreted with caution, as the changes in burden due to factors outside disease epidemiology, such as new public health interventions, were not accounted for in this analysis.

This Study includes estimates for COVID-19. Burden from COVID-19 and lower respiratory infections (including influenza and pneumonia) were estimated from 2024 data available at the time of analysis (further detail is provided in the Technical notes). These estimates may be revised in the future, as more data become available. Note that burden from COVID-19 is not attributed to any of the risk factors included in ABDS 2024.

The ABDS 2024 does not include subnational estimates. The most recent estimates are presented in the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report and interactive data for disease burden and risk factors.

Further information on the data and methods used in ABDS 2024 can be found in the Technical notes.

Which data sources are used in the Australian Burden of Disease Study 2024?

Mortality data to calculate YLL estimates for 2024 were sourced from the AIHW National Mortality Database (NMD) (deaths occurring from 2011 to 2022 (excluding 2020) were used in trend analysis) and the ABS provisional death registration data for January to June in 2024 (used to validate projected deaths for 2024 and make adjustments where required).

Deaths due to COVID-19 and lower respiratory infections (including influenza and pneumonia) were mainly sourced from the ABS provisional deaths for available months in 2024, with deaths for the remainder of 2024 modelled based on monthly trends (see Technical notes for further detail).

The YLL estimates for 2024 should be interpreted with caution. Some cause of death information used in the analysis is subject to change pending the status of coroner investigation. The ABS revisions process is described in detail elsewhere (ABS 2023). The YLL estimates presented may be revised for the next Study when more information becomes available for 2024.

For YLD estimates, there is no single comprehensive and reliable source of data for the incidence, prevalence, severity and duration of all non-fatal health conditions. Morbidity estimates were drawn from a wide variety of data sources, and generally based on the best single source. This included administrative data, national surveys, disease registers and epidemiological studies. Potential sources for disease-specific morbidity data were required to:

- have case definitions appropriate to the disease being analysed
- be relevant to the Australian population
- be timely, accurate, reliable and credible.

YLD estimates for 2024 were calculated using trend analysis based on YLD data for previous ABDS reference years (2003, 2011, 2015, 2018), 2019 (calculated as part of ABDS 2022), 2020 (calculated as part of ABDS 2023) and prevalence data for 2022 where available (for example, hospitalisation and cancer incidence data and data from the National Survey of Mental Health and Wellbeing) and

appropriate (for example, for diseases that were not largely impacted by COVID-19 and the pandemic restrictions such as the pause on non-essential surgeries).

Data inputs for the risk factor component of ABDS 2024, such as relative risks, linked diseases and theoretical minimum risk exposure distribution (TMRED), are largely sourced from GBD 2019. Estimates of population distributions of risk factor exposure have been based on a variety of data sources. Risk factor exposure estimates have been updated where possible for ABDS 2024 using the latest data from sources such as:

- ABS National Health Survey 2022
- National Drug Strategy Household Survey 2022–2023
- Work-related Traumatic Injury Fatalities 2022
- Workers Compensation Statistics 2022–23 preliminary
- ABS Census of Population and Housing 2021
- ABS Personal Safety Survey 2021–22.

Most risk factors had updated data available for some, or all, of their components in ABDS 2024. See Supplementary data tables and Calculation of risk factor specific estimates for more information on the data sources used to estimate attributable burden. Further information on the data and methods used in ABDS 2024, as well as differences between the ABDS 2024 and the ABDS 2018, can be found in the Technical notes. The overarching methods used for previous studies, and more information on the redistribution of deaths, can be found in the *Australian Burden of Disease Study: methods and supplementary material 2018* report.

Why use estimates from the Australian Burden of Disease Study 2024 instead of the Australian Burden of Disease Study 2018?

The ABDS 2024 was undertaken to build on the AIHW's previous burden of disease studies and current disease monitoring work. The ABDS 2024 provides an update of burden of disease estimates using the infrastructure developed as part of ABDS 2011, 2015 and 2018.

The ABDS 2024 provides national burden of disease and attributable burden estimates relevant to the public health context for the Australian population for 2024. It includes estimates for the year of release (2024) and burden estimates for COVID-19.

Due to different methods used in the ABDS 2024 compared to previous studies, estimates from the ABDS 2024 are not directly comparable, and may differ from, published estimates in previous Australian burden of disease studies.

For further information on the differences between ABDS 2024 and previous studies see 'How does the Australian Burden of Disease Study 2024 differ from previous studies?'

Why use estimates from the Australian Burden of Disease Study 2024 instead of the Australian Burden of Disease Study 2023?

The ABDS 2024 builds on work from the ABDS 2022 and ABDS 2023. The ABDS 2022 was the first ABDS to estimate burden for the year of release based on historical trends and to include burden due to COVID-19. Since the ABDS 2022, methods for estimating burden due to COVID-19 have been refined and some estimates from previous years were revised due to updates in key data sources, such as the National Survey of Mental Health and Wellbeing 2020–21. Therefore, estimates from the ABDS 2024 are not directly comparable, and may differ from, published estimates in previous Australian burden of disease studies. However, estimates for different reference years within the ABDS 2024 are comparable.

For further information on the differences between ABDS 2024 and previous studies see 'How does the Australian Burden of Disease Study 2024 differ from previous studies?'

Where do I find subnational estimates, such as by state/territory?

The ABDS 2024 includes national estimates only. For subnational (state/territory, remoteness area, socio-economic group) estimates, see the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report. Subnational estimates may not add up to the national estimates. Updated subnational estimates are expected to be included in the next major update of the Australian Burden of Disease Study in late 2026.

How does Australia compare to other countries?

International comparisons are important and can provide a useful perspective of global disease burden. The Global Burden of Disease (GBD) studies and the WHO's Global Health Estimates help to inform comparisons that show how health challenges differ globally and regionally. Comparisons are best made with data that are based on consistent definitions and that have similar collection methods and

population coverage. In practice, this means that results are comparable within a study but not between studies. Hence, the GBD and WHO results for Australia cannot be compared with results produced in this study.

Australian estimates can be compared with those for other countries and regions using data from the GBD (see visualisations - external site opens in new window of country comparisons from the GBD 2021).

Why do some diseases have no fatal or non-fatal estimates?

Some diseases do not have YLL or YLD estimates as either mortality does not occur from that disease (such as hearing loss disorders), or the disease is only fatal and as such there is no morbidity (such as sudden infant death syndrome). For some rare infections, there were no deaths or morbidity associated with the disease in certain reference years.

What population data were used?

All Australian population-based rates for 2018 were calculated using populations rebased to the 2016 Census (ABS 2022).

Population-based rates for 2015, 2011 and 2003 were calculated using the latest available population estimates from the ABS.

Population data for 2024 were sourced from population projections by the Centre for Population (2022).

The 2001 Australian Standard Population was used for all age-standardisation, as per AIHW and ABS standards (ABS 2016).

What information is available about the quality of estimates in the Australian Burden of Disease Study 2024?

The ABDS 2024 estimates were produced using the best data available in the scope and time frame of the Study.

Disease burden estimates for 2024 were largely based on projecting historical trends. Uncertainty assessments were also conducted alongside trend analysis. To provide information on the quality of input estimates from previous reference years (2003, 2011, 2015 and 2018), a quality index was developed to rate estimates according to the relevance and quality of source data, and methods used to transform data into a form required for this analysis. Generally, the higher the rating, the more relevant and accurate the estimate. For disease burden due to COVID-19 and lower respiratory infections (including influenza and pneumonia), this approach to rating data quality was used to reflect uncertainty.

To report on the reliability of projected burden of disease measures, the inclusion of confidence intervals associated with regression estimates was explored. However, these were not presented as these relate to the regression models and do not reflect the underlying uncertainty associated with data inputs that inform prevalence estimates. Other outputs of the regression models may indicate the best fit projection based on the set of YLL and YLD crude rates available for each age-sex-cause group. However, these do not necessarily represent the most appropriate projections in the context of the overall epidemiology of a given disease or injury, especially when considering impacts of the COVID-19 pandemic.

Fatal burden (YLL) estimates were considered to have the highest rating for both data and methods used, whilst non-fatal burden (YLD) estimates varied depending on the disease or injury and the data sources used.

Survey and administrative data sets were primary sources of risk factor exposure data. In the absence of good-quality survey or administrative data, epidemiological studies were used to determine exposures distributions. The quality of the attributable burden estimates in 2024 vary depending on the exposure data source used.

The quality of input estimates in the ABDS 2024 for earlier reference years (2003, 2011, 2015 and 2018) are the same as the quality presented in the ABDS 2018. Therefore, refer to Appendix B in the *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* report (AIHW 2021a) and the *Australian Burden of Disease Study: methods and supplementary material 2018* report (AIHW 2021b) for more detail on the quality of the YLD estimates, attributable burden estimates and the data and methods used for the earlier reference years. The quality statements for COVID-19 and lower respiratory infections (including influenza and pneumonia) for 2024 are presented in the Technical notes.

Where can I get more information on methods used in Australian Burden of Disease Study 2024?

Information about the methods used for 2024 burden of disease estimates are presented in the Technical notes. Aside from COVID-19 and lower respiratory infections (including influenza and pneumonia), the methods used for the earlier reference years to inform the trend for 2024 are the same as methods used in the ABDS 2018. For information about methods used for specific diseases and risk factors for earlier reference years (2003, 2011, 2015 and 2018), refer to the *Australian Burden of Disease Study: methods and supplementary material 2018* report.

Where can I find information about disease burden in relation to disease expenditure?

Information about disease expenditure for 2022–23 has been published in the *Health system spending on disease and injury in Australia 2022–23* report (AIHW 2024). This report uses the same disease groupings as the ABDS and includes a section comparing disease burden to disease expenditure.

Where can I find more information about the Australian Burden of Disease Studies?

Information and reports about burden of disease in Australia, including for First Nations people, are available on the AIHW website.

For further information or for customised data requests please contact the AIHW Burden of Disease team (burdenofdisease@aihw.gov.au).

References

ABS (Australian Bureau of Statistics) (2016) *Australian demographic statistics, Jun 2016* - external site opens in new window, ABS, Australian Government, accessed 8 September 2022.

ABS (2022) *National, state and territory population, December 2022* - external site opens in new window [Data Explorer], ABS, Australian Government, accessed 16 June 2023.

ABS (2023) *Causes of death, Australia methodology, 2022* - external site opens in new window, ABS, Australian Government, accessed 11 September 2024.

AIHW (Australian Institute of Health and Welfare) (2021a) *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018*, AIHW, Australian Government, accessed 29 August 2022, doi:10.25816/5ps1-j259.

AIHW (2021b) *Australian Burden of Disease Study: methods and supplementary material 2018*, AIHW, Australian Government, accessed 29 August 2022.

AIHW (2022) *Australian Burden of Disease Study 2022*, AIHW, Australian Government, accessed 31 October 2024.

AIHW (2023) *Australian Burden of Disease Study 2023*, AIHW, Australian Government, accessed 31 October 2024.

AIHW (2024) *Health system spending on disease and injury in Australia 2022–23*, AIHW, Australian Government, accessed 20 November 2024.

Centre for Population (2022) *Population Statement: national projections, 2021–22 to 2032–33* - external site opens in new window, Australian Government, accessed 1 July 2022.

GBD (Global Burden of Disease Study) 2013 Collaborators (2015) Supplement to: 'Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013' - external site opens in new window, *The Lancet* 386(10010): S1–1868. doi:10.1016/S0140-6736(15)60692-4.

Jagger C, Van Oyen H and Robine J (2014) *Health expectancy calculation by the Sullivan method: a practical guide (4th edition),* Newcastle University, accessed 12 September 2022.

Notes

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Data

Data tables: ABDS 2024 National estimates for Australia

Data
XLSX 20.5MB

Report editions

This release

Australian Burden of Disease Study 2024 | 12 Dec 2024

Previous releases

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- Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2018 |
  Publication | 24 Nov 2021
- Australian Burden of Disease Study: impact and causes of illness and death in Australia 2015 |
  Publication | 13 Jun 2019
- Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011 |
  Publication | 10 May 2016
- The burden of disease and injury in Australia 2003 |
  Publication | 25 May 2007
- The burden of disease and injury in Australia (1996) |
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Related material

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In focus: Australian Burden of Disease Study 2024

Educational resource

5.8 million years of healthy life were lost in 2024. Australians experienced more burden from living with illness or injury (54%) than from premature death (46%). Overweight (including obesity) and tobacco use were the leading risk factors contributing to burden in 2024. Coronary heart disease, dementia, back pain, anxiety disorders and COPD were the top 5 diseases causing burden in 2024.
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