Australian Government
Australian Institute of Health and Welfare

Health system spending per case of disease and for certain risk factors

Web report | Last updated: **05 Apr 2022** | Topic: Health & welfare expenditure

About

This report presents estimates of how much was spent through the health system in 2018–19 for each case of a disease or condition that was known to be prevalent in the community in that year. It also presents spending attributable to potentially avoidable risk factors such as being overweight, physical inactivity and tobacco use in that year.

Information is presented on the web pages using interactive visualisations, and downloadable Microsoft Excel workbooks.

Cat. no: HWE 88

- Health system spending per case
- Risk factors
- Data

Findings from this report:

- Total health system spending attributable to potentially avoidable risk factors in 2018–19 was $24 billion
- The cancer and other neoplasms group attracted the most spending per case on average in 2018–19 ($10,000)
- Chronic myeloid leukaemia attracted the most spending per case of all diseases in 2018–19 ($0.2 million)
- One third ($8 billion) of all potentially avoidable risk factor spending was due to being overweight and tobacco use

Summary

This report uses the expenditure estimates published in Disease expenditure in Australia 2018–19, along with the Australian Burden of Disease Study (ABDS) prevalence estimates for 2018, to estimate how much on average, was spent through the health system for each case of disease and condition in the community in that year. It also estimates the health system spending in 2018–19 that could be attributed to particular, potentially avoidable, risk factors, such as being overweight, physical inactivity and tobacco use.

Of all disease groups, cancers and other neoplasms was the most expensive at around $10,000 per case in 2018–19

Schizophrenia was the most expensive mental health and substance use disorder in 2018–19 with spending around $22,000 per case

Of the cancer group, chronic myeloid leukaemia had the highest spending per case at $0.2 million in 2018–19

Being overweight was the top risk factor with 18% of health spending on diseases attributable to risk factors in 2018–19

Half (50%) of the estimated spending for bowel cancer could be attributed to potentially preventable risk factors

Two-thirds (66%) of the estimated spending on chronic obstructive pulmonary disease (COPD) was due to tobacco use

Information on the spending per case of disease is useful to provide context to overall health spending on conditions. Disease spending may be high if the spending per case is high but case numbers are relatively low, or because there are many people with a condition in the community receiving a relatively low-spend treatment. The analysis combines information from the disease expenditure estimates on total spending for a condition, and information from the ABDS on the number of cases in the community each year, to estimate the average health system spending per case in that year. This does not necessarily reflect total spending across the course of a disease for an individual, such as diagnosis, acute treatment, and ongoing management or monitoring.

The burden of disease due to potentially preventable (modifiable) risk factors has been reported for several years by the AIHW as part of the ABDS. This analysis expands previous risk factor attribution methods to estimate the health spending related to the conditions caused by risk factors and quantify the impact to the health system due to potentially avoidable health risks. Health spending information complements burden information by providing another lens to view the spending associated with risk factors and disease burden experienced in the community.

The health spending estimates presented in this report include the following areas of expenditure:

- private and public hospital admitted patients
- public hospital emergency department
- public hospital outpatient clinic
- dental
- Pharmaceutical Benefits Scheme (PBS) pharmaceuticals
- services provided through the Medicare Benefits Schedule (MBS), including diagnostic imaging, general practice, pathology, allied health, and specialist services.

It does not include some out-of-pocket spending, such as privately provided physiotherapy or psychology services, or spending through the aged care system (where some management of conditions such as dementia or stroke may occur).

This web report provides the most recent data available at the national level. The spending per case estimates are presented for each burden of disease condition for which prevalence counts were available at the national level by sex. The disease spending that can be attributed to different risk factors is presented at the national level.

This is the first time that the AIHW has presented estimates of this nature and represents an ongoing body of work to improve and refine these estimates. Refer to the Technical notes section for further information on the data sources and methods used, and the fact sheet How do we measure the cost of disease? (PDF 240kB) for information on comparisons of total spending and disease burden.

Health system spending per case

Total spending across the health system on a particular disease or condition group is one measure of the financial burden due to disease and ill health. However, this does not give an indication of the relative number of people experiencing disease, or the amount spent on treating a single case. Total health spending for a condition may be high because treatments are expensive, or because the number of cases in the community is high. By estimating the health spending per case for a particular disease or condition, we can try to understand the drivers of total spending on disease, and where that spending is occurring in the health system. This information can also be used in health economic modelling to estimate what might happen to health spending if disease burden decreases over time or to assess the potential impact of new treatments and programs.

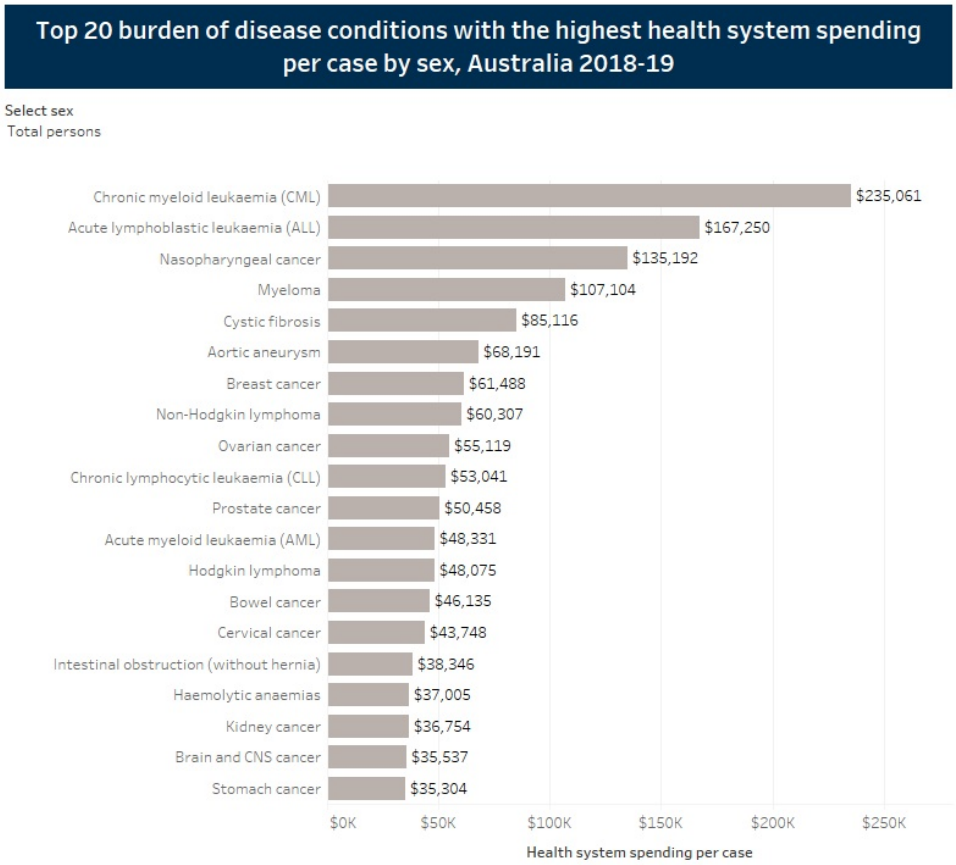
The expenditure estimates used to derive the spending per case estimates come from *Disease expenditure in Australia 2018-19* and include spending on public and private hospitals, PBS pharmaceuticals, MBS services, and dental. This does not include some spending through private providers, or the aged care system. For information on the methods used to derive prevalence and spending per case, refer to the Technical notes of this report and the *Australian Burden of Disease Study: Methods and Supplementary material 2018*.

Key findings

- The 5 specific conditions with the highest spending per case in 2018–19 were: chronic myeloid leukemia ($0.24 million), acute lymphoblastic leukaemia ($0.17 million), nasopharyngeal cancer ($0.14 million), myeloma ($0.11 million) and cystic fibrosis ($0.85 million).
- In 2018–19, 16 of the top 20 conditions (80%) on a spending per case basis, came from the cancer and other neoplasms disease group.
- Breast cancer spending was an estimated $61,000 per case, prostate cancer $50,000, cervical cancer $44,000 and lung cancer $29,000.
- Among cardiovascular diseases, spending per case of aortic aneurysm was highest at around $68,000, followed by hypertensive heart disease ($22,000).
- For mental health and substance use disorders, schizophrenia was the most expensive with spending of around $22,000 per case.
- Multiple sclerosis was the most expensive neurological condition per case ($21,000) followed by Guillain-Barre syndrome at around $11,000.

Conditions with a prevalence count less than or equal to 4 for either males, females or total persons are not included in this analysis. In addition, benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain ‘other’, ‘unknown’ or ‘uncertain’ in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.

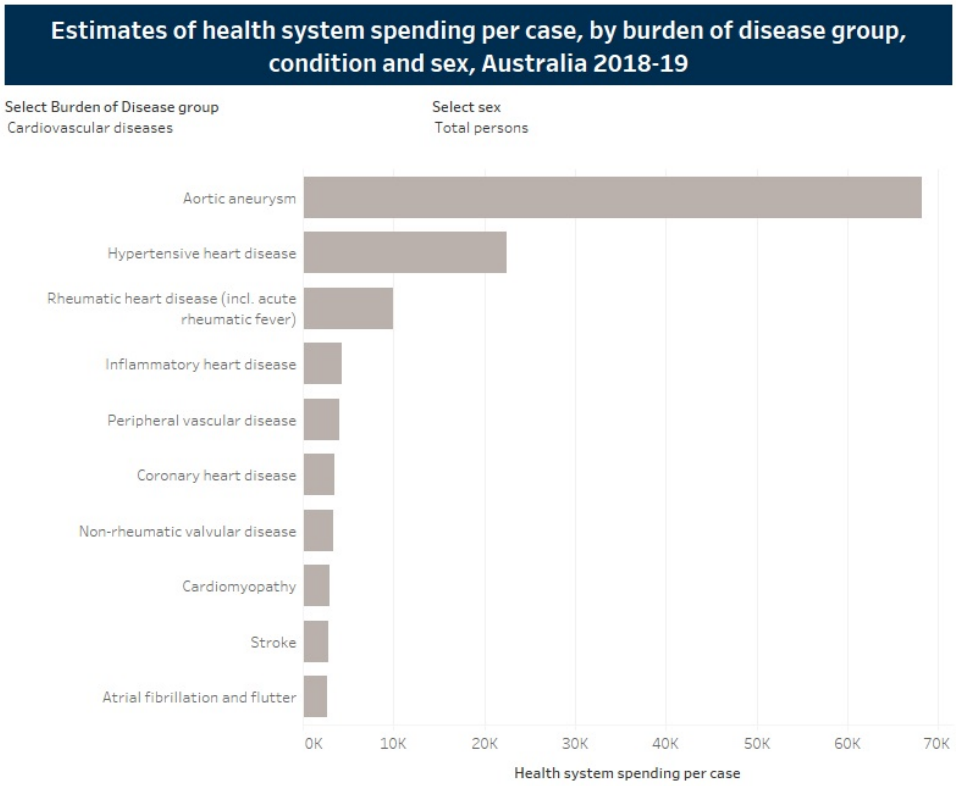
The first interactive data visualisation below shows the top 20 conditions with the highest spending per case in Australia in 2018–19. The second shows the spending per case for all burden of disease conditions where data is available. The third shows the average spending per case for each of the burden of disease groups. The data used to create the visualisations can also be downloaded as an Excel workbook.
This bar chart shows the top 20 burden of disease conditions with the highest health system spending per case by sex in 2018-19. At the disease conditions level, Hepatitis C (acute) had the highest spending per case at over $1 million spent per case for males in 2018-19 and around $800K for females. Benign and uncertain brain tumours, Hepatitis B (acute), Appendicitis and Chronic myeloid leukaemia (CML) had the next highest health system spending per case for both males and females.



Notes:
Conditions with a prevalence count less than or equal to 4 for either males, females or total persons are not included in this analysis.
Benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain 'other', 'unknown' or 'uncertain' in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.
CNS stands for central nervous system.
Estimates of health system spending are per case that was known to be prevalent in the community in that year.

Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018.
http://www.aihw.gov.au

This bar chart shows health system spending per case, by burden of disease groups and sex in 2018-19. Benign and uncertain brain tumours was the most expensive of all cancers, with the health system spending per case of $547K for females and $489K for males in 2018-19. Appendicitis was another expensive condition at around $260K on average per case for males and females.



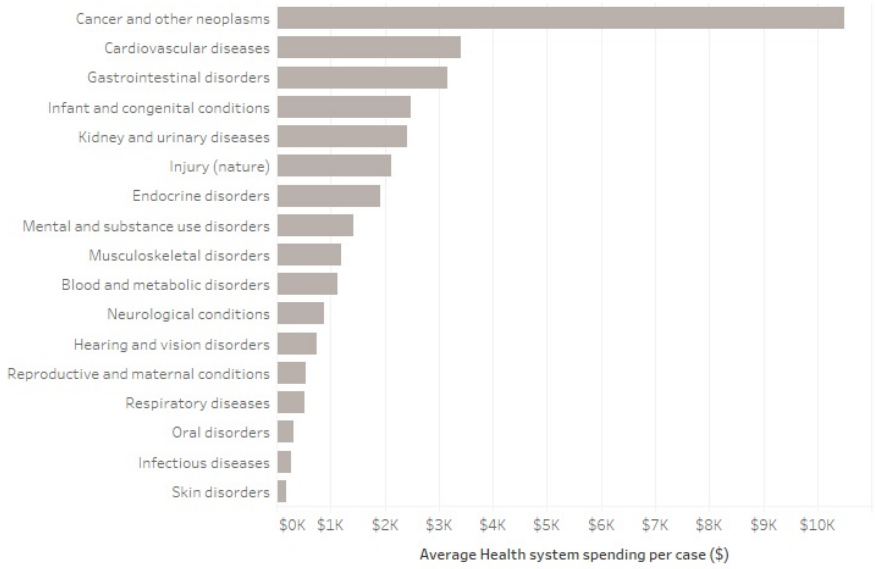
Notes:
Lower respiratory infections includes influenza and pneumonia.
Totals refer to recurrent spending per prevalent case attributed to burden of disease conditions.
Conditions with a prevalence count less than or equal to 4 for either males, females or total persons are not included in this analysis.
Benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain 'other', 'unknown' or 'uncertain' in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.
Estimates of health system spending are per case that was known to be prevalent in the community in that year.
CNS stands for central nervous system.
COPD stands for chronic obstructive pulmonary disease.
For hepatitis B and hepatitis C, average health system spending per case includes both acute and chronic cases for these conditions.

Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018; Kirby Institute; Doherty Institute.
http://www.aihw.gov.au

This bar chart shows the average health system spending per case by disease group and sex. Cancer and neoplasms had the highest average health system spending per case for both females and males at around $12,000. Infant and congenital conditions was the group with the second highest average spending per case for females at $5,104 whereas for males, the average spent on the same group was $2,403.

Estimates of health system spending per case, by burden of disease group, by sex, Australia 2018-19

Select sex
Total persons



Notes:
Conditions with a prevalence count less than or equal to 4 for either males, females or total persons are not included in this analysis.
Benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain 'other', 'unknown' or 'uncertain' in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.
Estimates of health system spending are per case that was known to be prevalent in the community in that year.

Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018; Kirby Institute; Doherty Institute.
http://www.aihw.gov.au

Risk factors

Health risk factors are attributes, characteristics or exposures that increase the likelihood of a person developing a disease or health disorder. In many cases, individuals can modify risk factors such as smoking, sun exposure or physical activity. Biomedical risk factors (for example overweight) are bodily states that are often influenced by behavioural risk factors. Together these risk factors are referred to as being either potentially avoidable or modifiable and they are distinct from other types of risk factors, such as genetic pre-dispositions, which are not generally modifiable.

Expenditure due to modifiable risk factors in this report refers to health system spending on a burden of disease condition that can be attributed to people having a particular risk factor e.g. history of smoking. It is not spending on addressing the risk factor itself i.e. not the amount of money spent on trying to reduce tobacco consumption across the Australian population.

In this report 20 risk factors have been identified as contributing to disease burden. These are:

- air pollution
- alcohol use
- bullying victimisation
- child abuse and neglect
- dietary risks
- high blood plasma glucose
- high blood pressure
- high cholesterol
- high sun exposure
- illicit drug use
- impaired kidney function
- intimate partner violence
- iron deficiency
- low birth weight and short gestation
- low bone mineral density
- occupational exposures and hazards
- overweight (including obesity)
- physical inactivity
- tobacco use
- unsafe sex.

For information on the methods used to derive risk factor spending estimates, refer to the Technical notes of this report and the Australian Burden of Disease Study: Methods and Supplementary material 2018.

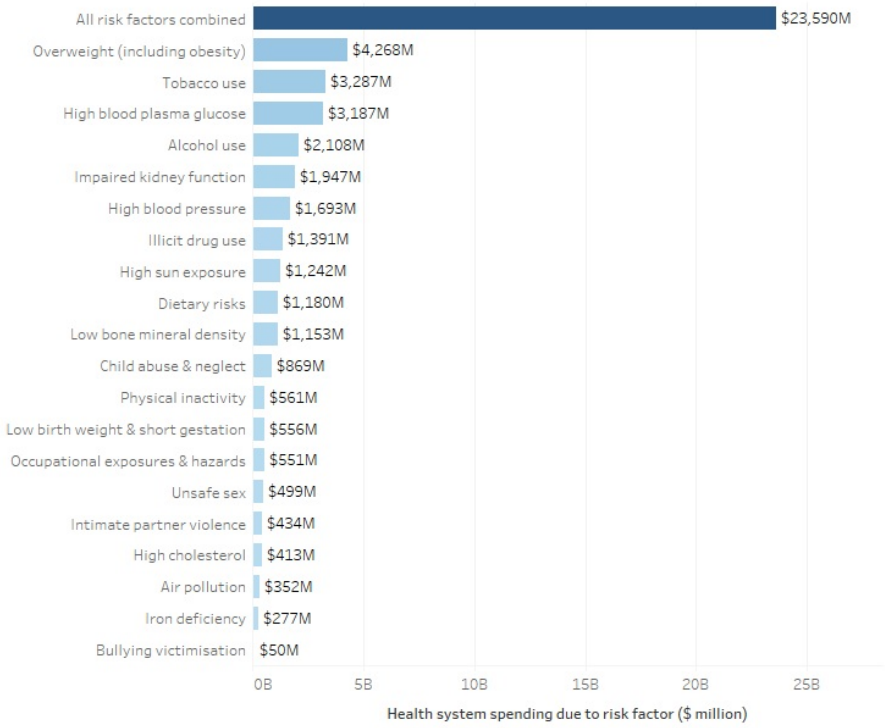
The true percentage of spending on conditions that is due to all modifiable risk factors is unknown. For those conditions for which attribution is possible, $24 billion (39%) of the estimated spending in 2018–19 is attributable to these potentially avoidable risk factors. The risk factor that contributed the highest share of this spending is overweight (including obesity) at $4.3 billion.

Key findings

- The top 5 risk factors contributing to health spending were: overweight (including obesity) ($4.3 billion); tobacco use ($3.3 billion); high blood plasma glucose ($3.2 billion); alcohol use ($2.1 billion); impaired kidney function ($1.9 billion).
- Risk factors contributed to 88% of total estimated spending on coronary heart disease and 74% of total estimated spending on stroke.
- High blood pressure contributed to around $470 million of spending for coronary heart disease.
- Half (50%) of the estimated spending for bowel cancer can be attributed to modifiable risk factors.
- Two-thirds (66%) of the estimated spending on chronic obstructive pulmonary disease (COPD) can be attributed to tobacco use.

The interactive data visualisations below show the health system spending in 2018–19 that can be attributed to different risk factors by disease group and condition at the national level. Also shown is the share of spending on the burden of disease conditions that can be attributed to risk factors. The data used to create the visualisations can also be& downloaded as an Excel workbook.

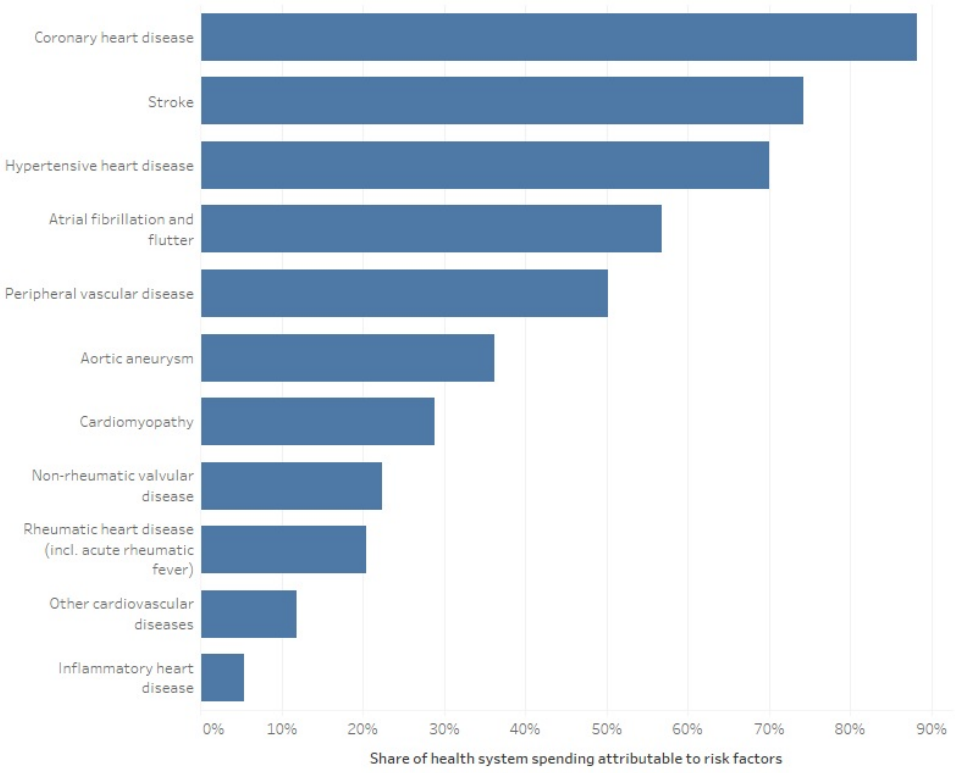
Total health system spending attributable to risk factors, Australia 2018-19



Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018
http://www.aihw.gov.au

Share of health system spending on disease conditions attributed to risk factors, Australia 2018-19

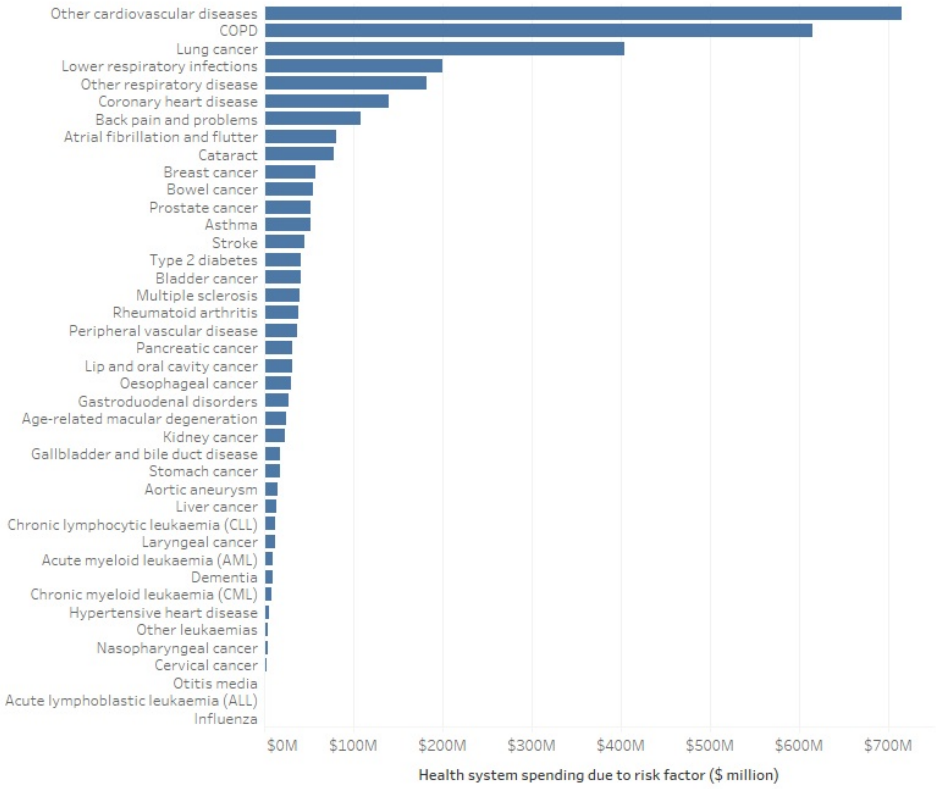
Select Burden of Disease group
Cardiovascular diseases



Notes:
COPD stands for Chronic obstructive pulmonary disease
Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018
http://www.aihw.gov.au

Total health system spending attributable to Tobacco use, by burden of disease condition, Australia 2018-19

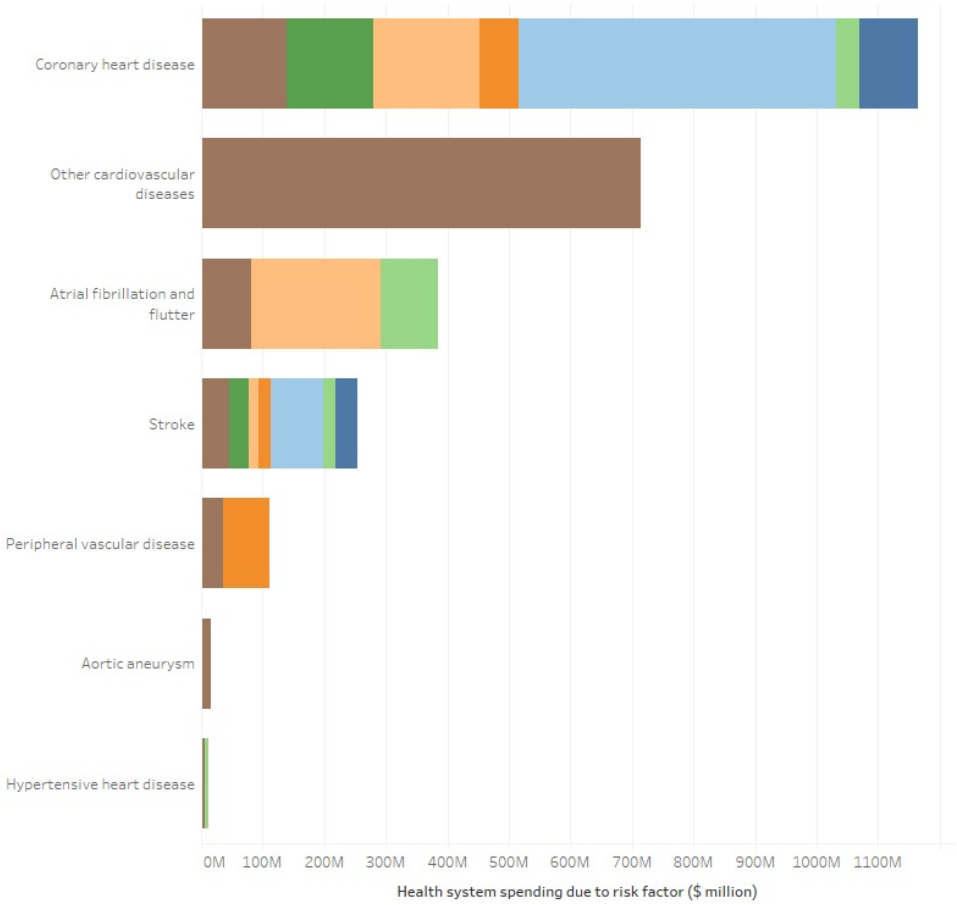
Select risk factor
Tobacco use



Notes:
COPD stands for Chronic obstructive pulmonary disease
Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018
http://www.aihw.gov.au

Health system spending attributable to risk factors by disease condition, Australia 2018-19

Select Burden of Disease group
Cardiovascular diseases



Risk factor
- Tobacco use
- Physical inactivity
- Overweight (including obesity)
- High blood plasma glucose
- Dietary risks
- Alcohol use
- Air pollution

Notes:
1. COPD stands for Chronic obstructive pulmonary disease
2. This bar chart excludes Blood and metabolic disorders, Infant and congenital conditions and Reproductive and maternal conditions

Source: AIHW disease expenditure database; Australian Burden of Disease Study 2018
http://www.aihw.gov.au

Technical notes

Technical notes

The Australian Burden of Disease Study (ABDS) aims to measure the human cost of disease in terms of the burden experienced by individuals and society through quality of life, and years of life lost. This does not however, give a measure of the number of people afflicted by a condition, and their contribution to total spending.

Prevalence is a measure of disease that indicates the proportion of a population with a disease over a specific period. The term ‘case’ is used here to refer to the number of prevalent cases, which is the total number of cases of a disease existing in a population over that period (period prevalence). By estimating the health system spending per prevalent case for a particular disease or condition, we can better understand how health system spending is distributed across the various diseases and conditions that Australian’s suffer. Among other things, this is useful for evaluating policy interventions, treatments and programs.

The term spending is used here, rather than cost, because the data does not cover the full cost (financial and non-financial) experienced by the individual, their family or the health system. It doesn’t cover, for example, the traumatic impacts and other strains experienced by those caring for the disease sufferer. In many cases, spending and actual cost are also not always completely aligned. The actual cost of the treatments and materials used or the staffing requirements for the care of an individual patient in a hospital, for example, is not always directly reflected in how hospital spending occurs at the state and territory and Commonwealth levels or through private funding mechanisms like private health insurance.

The ABDS uses prevalence measures as an input to estimate the burden of disease. As the same classification of diseases is used across both studies, this analysis uses the AIHW’s disease expenditure database and derived prevalence estimates from the ABDS to estimate the spending per prevalent case of disease. The measure of prevalence used for this analysis is period prevalence (number of people with a disease over a given time frame) for the year 2018.

For hepatitis B and hepatitis C, the ABDS was the source of prevalence for acute cases only. For chronic cases, the Kirby Institute was the source of prevalence for hepatitis C and the Doherty Institute was the source of prevalence for hepatitis B. The prevalence data used in the calculations for hepatitis C was the number of cases in the community at the end of 2017 while for hepatitis B, it was the number of cases in the community at the beginning of 2019.

Deriving prevalence estimates

Burden estimates in the ABDS are derived from the prevalence of multiple sequela of a condition, with health loss durations applied. Sequela (or health states) are the outcomes of conditions and often pathways through which burden is experienced. Health loss is the poor health and decreased quality of life due to a condition, or an outcome of it. For example immobilisation for a broken collar bone, or recovery during chemotherapy. The duration of health loss is the total time that individuals experience a particular outcome. For example, an individual with laryngeal cancer would have a particular health loss associated with the duration of their initial diagnosis and primary therapy, and then further health loss if they undergo a laryngectomy.

A review of the ABDS prevalence estimates was undertaken and concordances developed between the two studies, to identify which condition and sequela combinations would have individuals being counted across two or more sequelae, leading to double counting at the person level. Sequela were in scope if the people being captured in it were not likely to also be captured in another sequela for a condition. For example, ‘pelvic inflammatory disease due to chlamydia’ was excluded, as people with this health state are also captured in the ‘chlamydial infection’ health state. Once these sequelae are excluded, prevalence estimates can be calculated. Prevalence for infertility as a sequela of conditions (such as ‘infertility due to polycystic ovarian syndrome’) was allocated to the infertility condition prevalence, as the overall prevalence for this condition is distributed to various other conditions as a sequela during the ABDS estimation process.

The method for calculating ‘point prevalence’ differed depending on whether the condition was acute (such as an infection), or chronic (such as coronary heart disease). Burden estimates for acute conditions in the ABDS database are calculated using the duration of health loss. This health loss duration needs to be removed to calculate the number of people or events i.e., prevalent cases. For example, the number of people with tuberculosis multiplied by the average duration of health loss (8 months) is used to calculate the point prevalence. To calculate the number of prevalent cases for most acute conditions, the point prevalence estimate divided by the duration will give the number of people or cases. The ABDS point prevalence estimates were used directly for non-acute conditions since point prevalence was assumed to be equivalent to the one-year period prevalence for chronic conditions, where there are no sequela with multiple durations applied.

For some conditions there are multiple health loss durations for the components of a health state, generally due to varying levels of severity. Where this was the case, prevalence estimates were calculated directly from source datasets, and includes:

- uterine fibroids
- pressure ulcers
- cancer
- injuries

- aortic aneurism
- gastroduodenal disorders
- intestinal obstruction
- chronic liver disease
- diverticulitis

Burden estimates for cancer are complex, as burden can be experienced over many years. They include estimates of diagnosis and primary therapy, controlled phase, metastatic phase, terminal phase, and for some cancers, the ongoing impact of various treatments such as mastectomy or stoma. In this structure, patients who die from cancer (terminal phase) are assumed to have experienced metastases, while those who do not die are not recorded as being metastatic (and are counted in diagnosis and primary therapy). Therefore, to calculate the number of individuals undergoing treatment for cancer in a year, the estimates for diagnosis and primary therapy as well as terminal phase are used in the prevalence calculations for this analysis.

Burden estimates for chronic kidney disease are based on a variety of symptoms experienced during severe disease (stage 3, 4, and end stage), and do not include those with lower severity disease. To calculate the total prevalence of chronic kidney disease, diagnosed chronic kidney disease at each stage was used instead.

All of these calculations are undertaken before quality-of-life measures are applied to conditions. See Australian Burden of Disease Study: methods and supplementary material 2018 for more information on the calculation of the ABDS point prevalence estimates and the key data sources for prevalence. Estimates reported in the ABDS and included in this analysis are modelled and should be interpreted as such.

Calculating spending per prevalent case

Total disease expenditure estimates were calculated at the national level for each condition by sex and divided by the number of prevalent cases to estimate the spending per prevalent case. For example, in 2018–19 the total spending on depressive disorders was $2.1 billion, and the estimated number of prevalent cases was 828,785, giving a spending per prevalent case in that year of $2,549.

Spending per prevalent case estimates are of high importance for health economic modelling in Australia. It is the first time that a spending per prevalent case for almost all burden of disease conditions has been estimated using total health system expenditure, rather than a cost of illness approach. The data generated can be used to populate proportional multistate life table models, and various other health economic models.

In this study, conditions with a prevalence count less than or equal to 4 for either males, females or total persons are not included in the analysis. In addition, benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain ‘other’, ‘unknown’ or ‘uncertain’ in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.

Spending estimates for Hepatitis C include new treatments that are expensive, and cure historic cases of Hepatitis C. These historic cases are not captured in burden estimates, as only acute episodes are included. An estimate of the number of chronic cases for Hepatitis C is available from the Kirby Institute and has been added to the acute cases to derive spending per case for this condition.

Expenditure estimates do not include costs born outside of the health system, such as management of dementia in residential aged care facilities.

Technical notes

A risk factor is any determinant that causes (or increases the likelihood of) one or more diseases or injuries. The ABDS estimates the contribution of a range of risk factors to the burden of disease experienced in the Australian population. This includes risk factors that relate to personal behaviours (such as smoking), environment (such as air pollution) and biomedical risks (such as high blood pressure). Quantification of the impact of risk factors assists evidence-based decisions about where to direct efforts to prevent disease and injury and to improve population health. This analysis uses burden of disease data and disease expenditure data to estimate the financial cost of the diseases that are due to risk factors, to expand current analysis beyond disease burden.

Estimating risk factor attributable fractions

To estimate the burden of a condition that is due to a risk factor, there needs to be sufficient evidence of a causal link between the risk factor and the linked disease. The following 20 risk factors have been identified as having sufficient evidence of a contribution to the development of any disease measured in the ABDS:

- air pollution
- alcohol use
- bullying victimisation
- child abuse and neglect
- dietary risks
- high blood plasma glucose (including diabetes)
- high blood pressure
- high cholesterol
- high sun exposure
- illicit drug use
- impaired kidney function
- intimate partner violence
- iron deficiency
- low birth weight and short gestation
- low bone mineral density
- occupational exposures and hazards
- overweight (including obesity)
- physical inactivity
- tobacco use
- unsafe sex.

The burden of each condition due to a risk factor is estimated using the relative risks determined through epidemiological investigation, population age and size, and the proportion of the population in each exposure group. This risk distribution is compared to a 'counterfactual', what would have occurred if exposure to the risk factor had been avoided or had been reduced to its lowest level. This is a theoretical minimum exposure which may not be achievable, feasible or economically viable, for example no overweight people or obesity in the Australian population. Combining this information gives a measure of the population attributable fraction (PAF) of a disease that is due to a risk factor. The proportion the risk factor contributes to a condition was adjusted to account for overlaps between risk factors (such as high blood plasma glucose (including diabetes) and overweight) because each risk factor was calculated independently in the ABDS. This adjustment was made using the joint effect calculation and ensures that the burden allocated is not greater than actual burden. Further details are described in Australian Burden of Disease Study: Methods and Supplementary material 2018.

Estimating spending due to risk factors

Risk factor PAFs represent the proportion of disease burden that can be attributed to a risk factor, while disease expenditure estimates represent the spending on their treatment and management. The proportion of disease burden that is due to a risk factor for a particular disease was used to allocate expenditure due to the risk factor. One benefit of using national datasets around disease expenditure and disease burden is that expenditure attributable to an individual risk factor can be directly compared to that of another, as expenditure on each disease attributed is capped along with total health system expenditure.

To estimate the health spending on a risk factor is relatively simple: total expenditure for diseases by age and sex are multiplied by the corresponding risk factor PAFs, to calculate the percentage of the disease spending that is due to a risk factor. For example, if 90% of the burden of disease due to type 2 diabetes is estimated to be attributable to high blood plasma glucose (HBPG), then 90% of expenditure on type 2 diabetes has been allocated to HBPG.

This assumes that the treatment patterns and outcomes for a specific condition are the same for those with a risk factor as without a risk factor. For example, the spending on treating lung cancer in a smoker is the same as for a non-smoker. For various reasons, this may not necessarily be the case: smoking may increase healing time for wounds (increasing length of stay in hospital), or mean that certain treatment options are not appropriate or available. A literature review was undertaken for each risk factor and disease pair to determine if

there is any systemic difference in spending due to the presence of a risk factor for an individual. Through this process 114 studies were identified, and a large number indicated slight differences in disease treatment outcomes or spending may be present. However, many of these studies did not examine conditions for which a risk factor is causally linked in the ABDS, but examined clinical risk factors that may affect treatment.

However, due to differences in study designs and confounding factors, populations, classification of risk factors and types of spending included, or conflicting results between studies, none of the results have been adjusted for such differences in this analysis. It is important to interpret the results with care for these risk factor and disease combinations.

This risk factor spending analysis focuses on quantifying the spending on conditions that are caused by a risk factor, rather than the spending on managing a risk factor. Some risk factors are also coded as conditions within the ICD-10-AM, which therefore classifies them as conditions in the disease expenditure database, such as hypertension (captured in 'other cardiovascular conditions'). This is of particular relevance for pharmaceuticals that reduce blood pressure and cholesterol.

Notes

Amendments

24 June 2022 – Prevalence counts that are used in the calculation of spending per case of disease have been revised for some conditions in each of the following disease groups: infectious diseases, cardiovascular diseases and gastrointestinal diseases. In addition, benign and uncertain brain tumours, haemophilus influenzae type-b and all burden of disease conditions that contain 'other', 'unknown' or 'uncertain' in their description have all been excluded from the analysis due to the difficulty in obtaining reliable prevalence estimates for these conditions.

6 May 2022 – Prevalence counts that are used in the calculations for spending per case of disease for both hepatitis B and hepatitis C have been revised. The prevalence counts now include both acute and chronic cases for these two conditions. Previously the prevalence counts only included acute cases.

Data

Related material

Resources

Related topics

- Burden of disease