Australian Government
Australian Institute of Health and Welfare

Economics of sport and physical activity participation and injury

Web report | Last updated: **05 Sep 2023** | Topic: Sports injury | Media release

About

This report estimates that in 2018-19, $2.4 billion was spent managing diseases caused by insufficient physical activity. The amount of physical activity that Australians did participate in prevented $1.7 billion in spending on diseases. At the same time, a further $1.2 billion in health spending could have been avoided through improved injury prevention and management in sport and other forms of physical activity (11% of total injury costs). Information is presented on the web pages using interactive visualisations, and downloadable Microsoft Excel workbooks.

Cat. no: INJCAT 235

Findings from this report:

- $2.4 billion was spent on diseases caused by physical inactivity, the fourth highest spending risk factor in 2018-19
- $1.7 billion in disease spending was prevented by physical activity, including sport, in Australia in 2018-19
- $149 million was spent on osteoarthritis following sport and physical activity injuries in 2018-19
- Overall, sport and physical activity had a net positive impact on the health system of $321 million in 2018-19

Summary

In June 2020, the Australian Sports Commission (ASC) commissioned the AIHW to investigate the benefits and costs to the health system associated with participation in sport and physical activity. This analysis is part of a broader project to develop methodology for gathering evidence around injuries arising from sport participation and the potential population benefits achieved through improved injury prevention and management and increased physical activity.

The purpose of this project is to quantify the health spending related to physical activity, including sport participation, within the Australian population. This is done by assessing:

- costs due to immediate and long term risk of injuries; and
- the avoided health spending due to better health status.

This report generally uses the term physical (in)activity, which includes sport, as well as other forms of exercise and bodily movements for leisure, transportation, and work.

The AIHW has previously published detailed estimates of the costs of physical activity related injuries in the Economics of Sports Injuries publication. These estimates are expanded in this report to include estimates of the long-term outcomes of injuries, relating to post-traumatic osteoarthritis. In 2018-19, it was estimated that $149 million of spending on osteoarthritis related to a prior injury that occurred while doing physical activity.

Preliminary estimates of the avoided health spending due to improved health status indicated a number of limitations to physical activity models used, due to the limited number of conditions included. This current report seeks to improve these initial estimates by incorporating associations of physical activity with a broader range of health conditions – both directly, and through intermediate risk factors (such as blood pressure). The additional disease estimates in this report include: depression, anxiety, falls, and the physical activity related proportion of diseases due to high blood pressure, high blood glucose, and low bone mineral density.

These estimates represent a first attempt to comprehensively quantify disease costs incurred due to physical inactivity and those potentially avoided through participation in physical activity through these additional conditions and intermediate risk factors.

Attributing disease burden and health costs to diseases is complex and generally not undertaken annually. The most recent year for which estimates of both disease burden due to risk factors and disease spending are available is 2018-19. Disease burden and risk factor estimates from the Australian Burden of Disease Study 2018 and the Disease expenditure in Australia 2018-19 report are the basis for inactivity costs and avoided spending estimates in this report.

Cost of disease due to physical inactivity

It is estimated that the cost to the health system of diseases caused by physical inactivity was $2.4 billion in 2018-19, with:

- $1.7 billion from the direct effects of physical inactivity, of which:
  - $369 million was from coronary heart disease, $319 million from falls (due to poorer muscle tone and balance), and $302 million from depressive disorders
- $560 million due to high blood pressure caused by inactivity
- $125 million due to high blood plasma glucose caused by inactivity
- $81 million due to osteoporosis (low bone mineral density) caused by inactivity

Physical activity likely also reduces cholesterol, which is further linked to coronary heart disease and stroke. However, this association is currently unable to be included in the model due to inadequate data to sufficiently quantify the reduction in cholesterol according to activity level. Similarly, while physical activity can influence body mass index (BMI), this does not occur independently of the overall energy balance achieved through food consumption. This model therefore does not include physical activity reducing BMI, as this may overestimate the impact activity has on health and healthcare spending

Disease prevented through physical activity

In addition to estimating the cost of diseases due to physical inactivity, this report further quantifies the estimated disease spending prevented in 2018-19 due to diseases averted through physical activity undertaken over the year.

In 2018-19, physical activity prevented $1.7 billion of disease spending. The benefit was similar for males ($820 million) and females ($832 million). Around $190 million in benefit was due to reduced blood pressure and associated diseases, while $108 million was due to improved bone mineral density and reduced fracture costs.

Information on physical inactivity costs and activity related injuries and health benefits are presented by age, sex, condition, and treatment location. Data in this report is available to download as an Excel workbook.

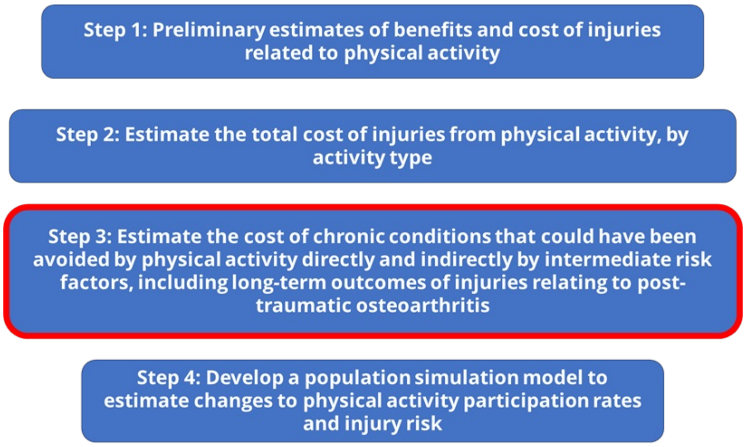
This report complements several others by the AIHW:

- Sports injury hospitalisations in Australia, 2019–20,

- National sports injury data strategy,
- Australian Burden of Disease Study 2018: Interactive data on risk factor burden, and
- Reducing the burden due to overweight (including obesity) and physical inactivity.

Work to estimate the benefits of sport and physical activity are ongoing, and this report is the third part of a series on methodology development of the economics of sports injury (Figure 1). The methods used in this report provide an average ‘snapshot’ in a year of the health effects of physical activity, and does not capture any dynamic effects on population health through changes to life expectancy, diagnosis of other conditions, or remission of disease. This will be incorporated into future reports through the development of a population simulation model, that will also include effects on the broader economy (such as productivity).

Figure 1: Overview of methodology development series.



Methods and data sources

On this page

Disease costs included in this report are derived from the Disease Expenditure Database. The AIHW disease expenditure database contains estimates of expenditure by Australian Burden of Disease Study (ABDS) condition, age group, and sex, for public and private admitted patient, emergency department, and outpatient hospital services, out-of-hospital medical services, and prescription pharmaceuticals (AIHW 2021a). In this database, spending on a given condition is viewed as a component of total health spending and as relative to spending on all other conditions.

The ABDS has estimated the proportion of disease burden for certain conditions that is due to physical inactivity as a risk factor. Physical activity is the inverse of physical inactivity and can be treated as such in a model. This project uses the fraction of chronic disease burden that is due to physical inactivity to calculate the health cost of inactivity, and to estimate the health costs avoided due to participation in activity.

The areas of spending in this analysis include hospital services, primary health care services and referred medical services (generally provided by medical specialists). Hospital services include public and private admitted patient services, public hospital emergency departments, and public hospital outpatient clinics. Primary health care includes general practitioner services, allied health services, pharmaceuticals and dental. Referred medical services include specialist services, medical imaging, and pathology. Due to data availability in the primary health care sector, these estimates are biased towards spending in hospitals and underestimates spending outside of these settings, and estimates should be interpreted with this in mind.

Burden of disease overview

Physical inactivity is an important risk factor for health, and is estimated to be responsible for 2.5% of disease burden in Australia (AIHW 2021b). In the Australian Burden of Disease Study 2018 (ABDS), physical inactivity is causally linked to the burden from type 2 diabetes, bowel cancer, dementia, coronary heart disease and stroke, as well as uterine and breast cancer in females. New evidence is available to further estimate the association of inactivity with several other conditions and risk factors, discussed below in Which new conditions/mediating factors are being included?

The estimated contribution of a risk factor to disease burden is calculated by comparing the observed risk factor distribution with an alternative and hypothetical distribution (the counterfactual scenario). For physical activity, the theoretical minimum risk distribution is compared with what is currently observed in the population. The relative risk of conditions due to physical inactivity is estimated on the basis of differences in disease outcomes for varying levels of physical activity compared to the minimal risk group, and combined with data on levels of activity undertaken in the population, to generate the population attributable fraction (PAF). Physical activity is measured by the Metabolic Equivalent of Tasks (METs) performed across the Australian population, and classified into eight levels. Each of the categories has a relative risk for various conditions, with the highest risk being the most sedentary group. Various studies have used different condition sets to estimate the health costs from physical inactivity, and the differences in disease inclusions may lead to large differences in the outcomes. The AIHW models 7 conditions (breast cancer, bowel cancer, coronary heart disease, dementia, type 2 diabetes, stroke, uterine cancer), while the Global Burden of Disease Study models 5 conditions (colorectal cancer, breast cancer, ischaemic heart disease, ischaemic stroke, type 2 diabetes). The analysis in this report includes several conditions in addition to those included in the Australian Burden of Disease Study (ABDS). Details of methods used to estimate levels of physical activity undertaken are available in the Australian Burden of Disease Study: methods and supplementary material 2018 publication (AIHW 2021c).

The ABDS risk factor of physical inactivity largely adheres to the scope from the Australian physical activity guidelines to estimate activity levels in terms of activities counted as physical activity (all physical activity domains, such as leisure, transport, occupational and household chores). This is to ensure that an accurate measure of total physical activity levels undertaken in Australia are included. However, it should be noted that the level of activity considered lowest risk for this analysis (4,200 METs/week) is different to the recommended level of physical activity in the Australian guidelines, as the purpose is to calculate total disease risk due to all levels of physical activity. Further information is available in the Frequently Asked Questions for the Australian Burden of Disease Study 2018: Interactive data on risk factor burden.

Estimating the benefits of physical activity

It is not possible to directly observe the health costs avoided by participating in physical activity. Therefore, to estimate the avoided health costs we must first examine the costs to the health system if no-one was physically active. This hypothetical condition is termed the ‘counterfactual’, as it’s ‘counter-to-the-fact’ that people are active in the population. This counterfactual is estimated in a similar way to the method outlined above, using ABDS relative risks, population age and size, and proportion of the population in each grouping of physical activity to estimate the population attributable fraction (PAF). However, rather than using the group with the highest possible level of physical activity as the comparator for a population risk analysis, the lowest level of activity is compared to the level of activity actually undertaken in the Australian population.

This PAF is applied to the condition costs to calculate the risk factor cost. The cost estimates that result from this process are the estimated cost of cancer, cardiovascular diseases, diabetes, and other conditions that may have occurred without the protective effects from physical activity. The difference between the observed expenditure and the counterfactual represents the health system savings from physical activity. This method provides an average 'snapshot' in a year of the health effects of physical activity, and does not capture any dynamic effects on population health through changes to life expectancy, diagnosis of other conditions, or remission of disease. This will be addressed in future stages of work to develop a population simulation model.

Which new conditions/mediating factors are being included?

The AIHW undertook a literature review to find updated evidence for associations between physical inactivity and conditions it is directly linked to, and to other risk factors that cause disease themselves.

The directly linked conditions that are being included in addition to the ABDS conditions in this model are: depression, anxiety, and falls.

The intermediate risk factors that are generally considered to be improved with physical activity are body mass index, blood pressure, blood sugar, cholesterol, and bone mineral density. This study is able to include the impact of physical activity on the ABDS risk factor 'high blood pressure', 'high fasting plasma glucose', and 'low bone mineral density'.

While physical activity can improve BMI through decreased fat mass and maintained or increased resting metabolic rate, the evidence suggests this does not occur independently of the overall energy balance achieved through food consumption. Therefore, this model does not include physical activity reducing high body mass index, as this may overestimate the impact activity has on health and healthcare spending.

Evidence does suggest that physical activity reduces low density lipoprotein cholesterol, but the estimates available are not sufficient to incorporate this risk factor association into the model at this stage.

Methods to update risk factor model

Direct associations

For new conditions that are directly associated with physical inactivity, a PAF for each condition by sex and age group was calculated and applied to expenditure estimates for the condition.

Depression

A dose response meta-analysis of cohort studies by Pearce et al (Pearce et al., 2022) with almost 200,000 participants (from predominantly high income countries) and 2.1 million person-years found the relative risk (RR) for 17.5 marginal MET-min per week for depression was 0.72. This study found a strong dose response relationship between activity levels and depression incidence.

This study was used to estimate the PAF of burden due to varying levels of physical activity undertaken, and was applied to expenditure estimates for depression by age and sex.

Anxiety

A meta-analysis by McDowell involving over 80,000 participants (from predominantly high income countries) reported results separately for anxiety symptoms, anxiety disorder, and generalised anxiety disorder (McDowell et al., 2019). This analysis found an odds ratio (OR) of 0.87 for anxiety symptoms, 0.66 for any anxiety disorder, and 0.54 for generalised anxiety disorder, for people who were active compared to inactive.

The odds ratio for anxiety symptoms was used in this analysis as a conservative estimate to model spending due to inactivity, and the risk difference was applied equally to those who did >600 MET-min/week compared to no activity (0-600 MET-min/week).

Falls

A systematic review and meta-analysis by Sherrington in 2020 (Sherrington et al., 2020) included approximately 25,000 participants (from predominantly high income countries) and found that physical activity reduces the rate of falls by up to 23% across intervention analyses. The analyses included were not targeted at frail people, and were not treatment interventions. A meta-regression analysis by the authors indicated there may be a dose-response relationship as interventions with greater frequency of exercise per week had a larger reduction in falls risk (although these findings did not reach traditional levels of statistical significance testing).

This analysis used the RR of 0.77 and applied the risk reduction to those who undertook any activity (>600MET-min/week) compared to no activity (0-600 MET-min/week) to estimate spending due to inactivity.

Mediation pathways

Estimating the attributable spending due to physical inactivity through other risk factors was undertaken in a two-step process. First, the fraction of each risk factor that is related to inactivity was estimated by age and sex. Second, this fraction was applied to the PAF estimated for each of the risk factor-disease combinations. For example, if 20% of high blood pressure is due to inactivity, then 20% of disease burden attributed to high blood pressure is then estimated to be due to inactivity.

These estimates do take into account mediation between these risk factors themselves, using the mediation factors from the ABDS, and a joint effect calculation. For further details, refer to *Technical notes* and the *Australian Burden of Disease Study: methods and supplementary material 2018.*

Blood pressure

A dose-response meta-analysis by Liu et al, 2017, estimated the risk of hypertension by level of total physical activity. This meta-analysis included 330,222 participants (from predominantly high income countries) from 22 prospective cohort studies, spanning 2-20 years of follow up. The average RR per 600 MET-min/week increase was 0.94.

The RR was calculated for each activity level and the proportion of high blood pressure due to inactivity was estimated. This proportion was then applied to the PAF estimates for each condition caused by high blood pressure.

Fasting plasma glucose

There has not been any systematic reviews that have evaluated the effect of physical inactivity on fasting plasma glucose itself, but several have included diabetes as the outcome of interest. The most robust of these studies was used to estimate the RR of inactivity to diabetes in the GBD and ABDS (Kyu 2016).

This analysis uses the current physical inactivity PAF for diabetes to estimate the cost of conditions linked to fasting plasma glucose that are due to physical inactivity.

Note that estimates for fasting plasma glucose in this analysis do not include diabetes, as the ABDS assumes 100% of diabetes burden is due to high fasting plasma glucose. The PAF used to directly estimate type 2 diabetes due to inactivity is unadjusted for mediation through this pathway, and includes the component that is caused by high fasting plasma glucose.

Osteoporosis (Low bone mineral density)

A study by the World Health Organisation by Pinheiro, 2020, estimated the risk of osteoporosis for those with low physical activity using meta-analysis of randomised controlled trials (RCTs) involving approximately 2000 participants (from predominantly high income countries). These results showed a small but statistically significant effect of 0.15 SEM (Standard Effect Measure, equal to OR =1.313). This study also provided a summary of 12 cohort studies that also showed an effect, though this was not included in the meta-analysis due to differences in study designs.

This analysis uses the risk difference applied to those who undertook any activity (>600MET-min/week) compared to no activity (0-600 MET-min/week) to estimate the fraction of low bone mineral density due to inactivity, and applies it to the low bone mineral density PAF to estimate spending due to inactivity.

Limitations

There are several key limitations to the estimation methods described above. The reduction in risk due to physical activity is applied equally to all levels of physical activity above 600 MET-min/week for anxiety, falls, and bone mineral density. This is due to the estimates available being generally presented as ‘active’ and ‘inactive’. The level of activity undertaken in the ‘active’ group is generally around a minimum of 600 MET-min/week, though can be above this level. For most conditions, there is a dose-response relationship between activity level and risk reduction, which is reflected in the risk estimates. For these conditions, this dose response is not able to be estimated from the available data, and the attributable fraction is likely to be an underestimate of the impact of inactivity, as the greater reduction in risk from higher levels of activity is not captured.

Which new conditions/mediating factors are being included?In addition, data quality of the underlying studies for these risk differences is not as robust as traditionally required for a burden of disease study. However, these studies and their inputs were used in our analyses as they provide more conservative estimates of risk differences than other studies for the same condition, and are consistent with other research in the field. These estimates are intended to provide an indication of the impact of these new disease associations being explored, and should be interpreted with this in mind.

References

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Pinheiro, M, Oliviera, J, Bauman, A, et al. Evidence on physical activity and osteoporosis prevention for people aged 65+ years: a systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. International Journal of Behavioral Nutrition and Physical Activity (2020) 17:150

Total cost of physical inactivity and related 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 inactivity. Biomedical risk factors (for example overweight) are bodily states that are often influenced by behavioural risk factors. Physical inactivity is an important behavioural risk factor for health that affects other biomedical risk factors including blood pressure, blood plasma glucose, and bone mineral density.

The estimates presented in this section provide an update on previously published preliminary estimates. This report estimates the cost of physical inactivity due to the previously modelled conditions (such as coronary heart disease and type 2 diabetes), additional directly linked conditions (depression, anxiety and falls), and those that are affected through intermediate risk factors.

Box 1: How is the cost of physical inactivity estimated?

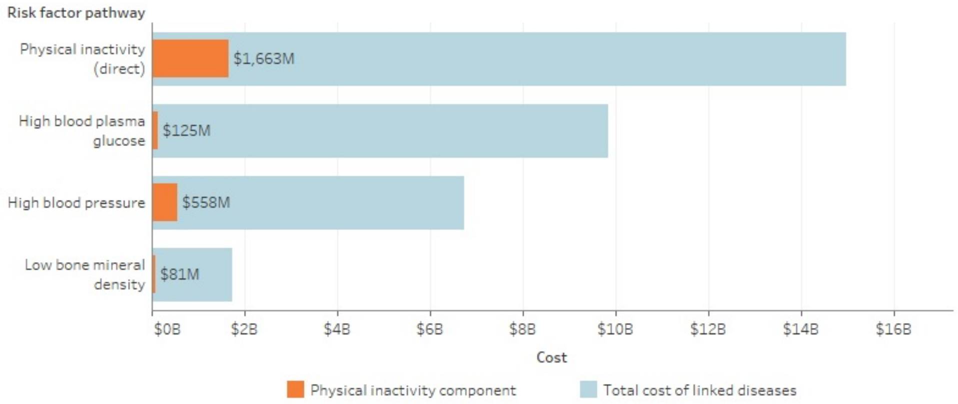
These estimates are calculated using total spending on disease from the disease expenditure database, and the estimated proportion of disease burden that is due to a risk factor. Estimates of risk factor burden are calculated using exposure information (the level of physical activity that was undertaken in 2018 in Australia), and the relative risk of a disease for those with and without a risk factor compared to an 'ideal' exposure level with minimum risk for a disease. The cost for each disease is multiplied by the proportion of disease due to a risk factor (risk factor cost = disease cost x attributable fraction).

For more details on how these estimates are derived, refer to *Methods and data sources*.

In 2018-19, a total of $2.4 billion was spent on health conditions due to physical inactivity (Figure 2). This included $1.7 billion directly from inactivity, and almost $763 million indirectly through other risk factors caused by inactivity. The majority of indirect spending was due to high blood pressure from insufficient physical activity ($558 million).

Figure 2: Direct and indirect cost of physical inactivity, and percent of total spending due to inactivity, 2018-19

Alt text: Bar chart showing the total cost and cost due to inactivity for conditions linked to inactivity directly, and for high blood plasma glucose, high blood pressure, and low bone mineral density.



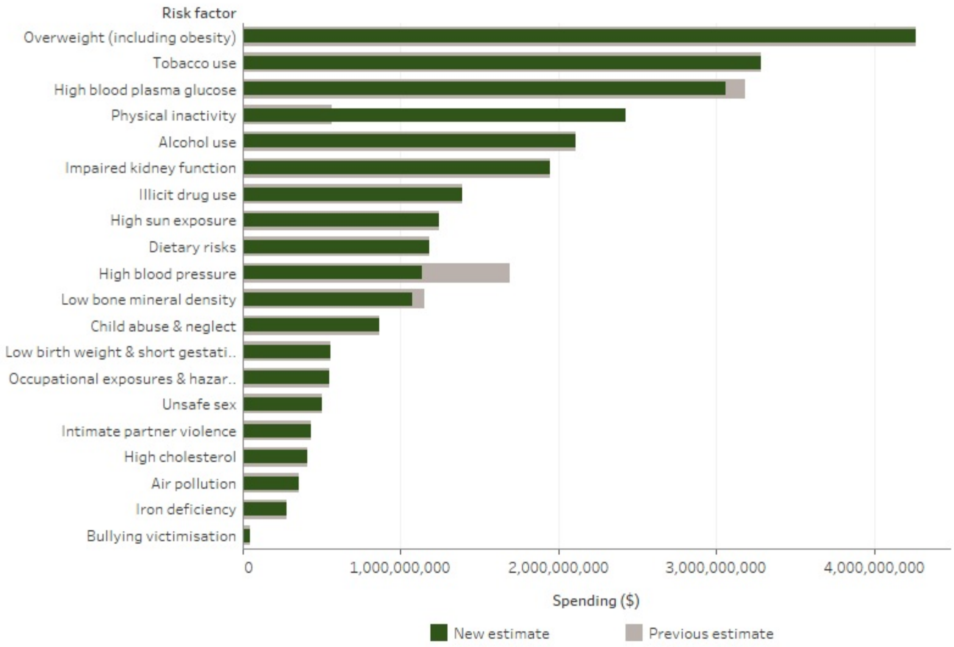
Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

For more detail, see data tables.

The inclusion of additional linked conditions and risk factors increased the previously estimated health system spending due to inactivity from $561 million to $2.4 billion (Figure 3), while decreasing spending on high blood plasma glucose, high blood pressure, and low bone mineral density. Physical inactivity increased from the 12th highest spending risk factor to the 4th highest. Note that estimates in this figure report physical inactivity spending that is due to intermediate risk factors as physical inactivity spending (instead of high blood pressure, for example). For other risk factor spending not due to physical inactivity, any spending due to intermediate risk factors is reported as spending from the intermediate risk factor (for example, dietary effects on cholesterol are reported under high cholesterol).

Figure 3: Total health system spending attributable to risk factors, Australia, 2018-19

Alt text: Bar chart showing previous and new estimates of the total cost of 20 risk factors. Physical inactivity increased to the 4th highest.



Source: adapted from *Health system spending per case of disease and for certain risk factors* (AIHW 2022)
https://www.aihw.gov.au

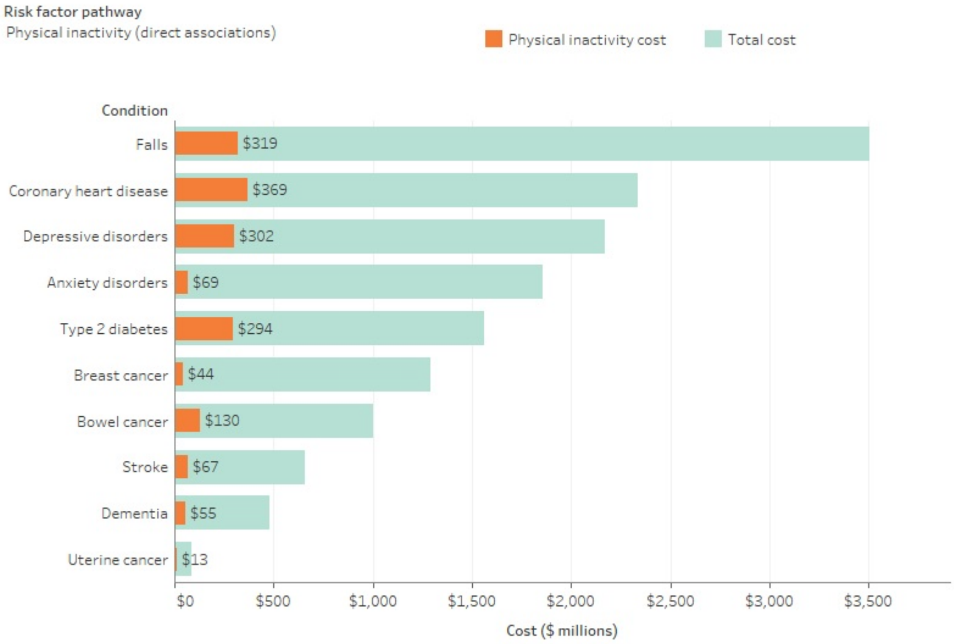
For more detail, see data tables.

Of the ten conditions that are directly caused by physical inactivity, *coronary heart disease* had the highest spending ($369 million) followed by *falls* ($319 million) and *depressive disorders* ($302 million) (Figure 4). A further $260 million was spent on *coronary heart disease* from physical inactivity mediated through high blood pressure ($236 million) and high fasting plasma glucose ($23 million).

Physical inactivity was ultimately responsible for 27% of all spending on *coronary heart disease*, 21% of stroke, and 16% of *hypertensive heart disease*.

Figure 4: Spending on conditions linked to physical inactivity and related risk factors, millions, 2018-19

Alt text: bar chart showing costs of conditions linked to each risk factor that are due to physical inactivity.



Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

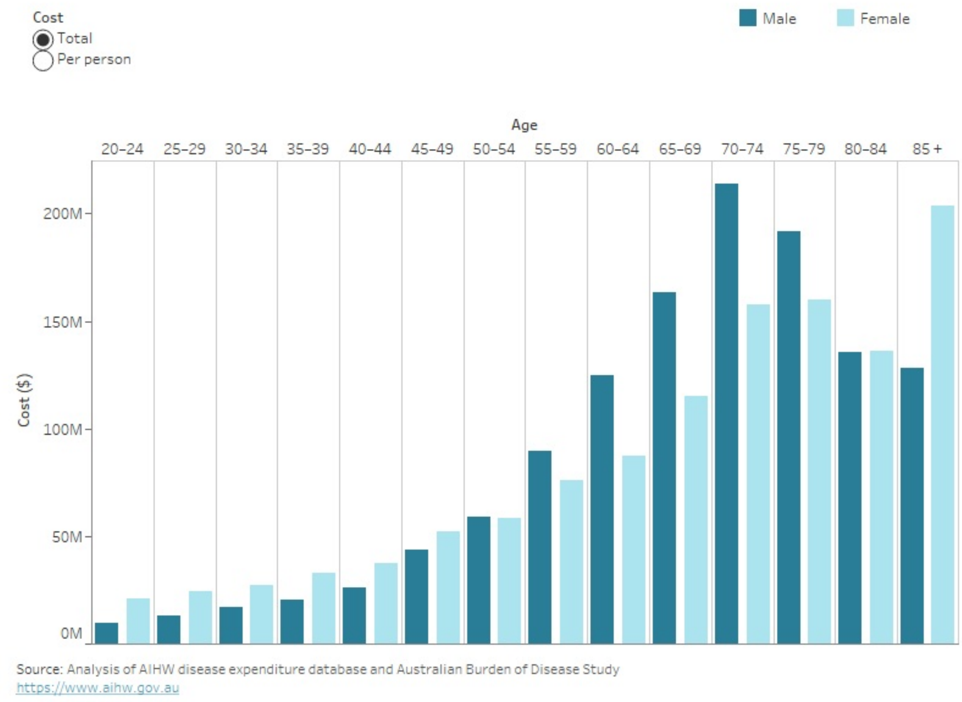
For more detail, see data tables.

Total spending related to physical inactivity was about equal for males and females ($1.2 billion each). Spending due to inactivity is relatively stable between ages 20 to 44, and begins increasing from age 45 onwards. Physical inactivity spending was higher for females than males between ages 20 to 49. From 50 years and older, spending was higher for males than females (with the exception of those aged 85 and over) (Figure 5).

Spending per person was $123 for females, and $133 for males. Between the ages of 20 and 55, per person spending for males and females is relatively equal. From age 55 onwards, spending for males increases much more per person than for females (Figure 5).

Figure 5: Total physical inactivity related spending by age group and sex, 2018-19

Alt text: Chart showing total and per person spending due to physical inactivity by age and sex.

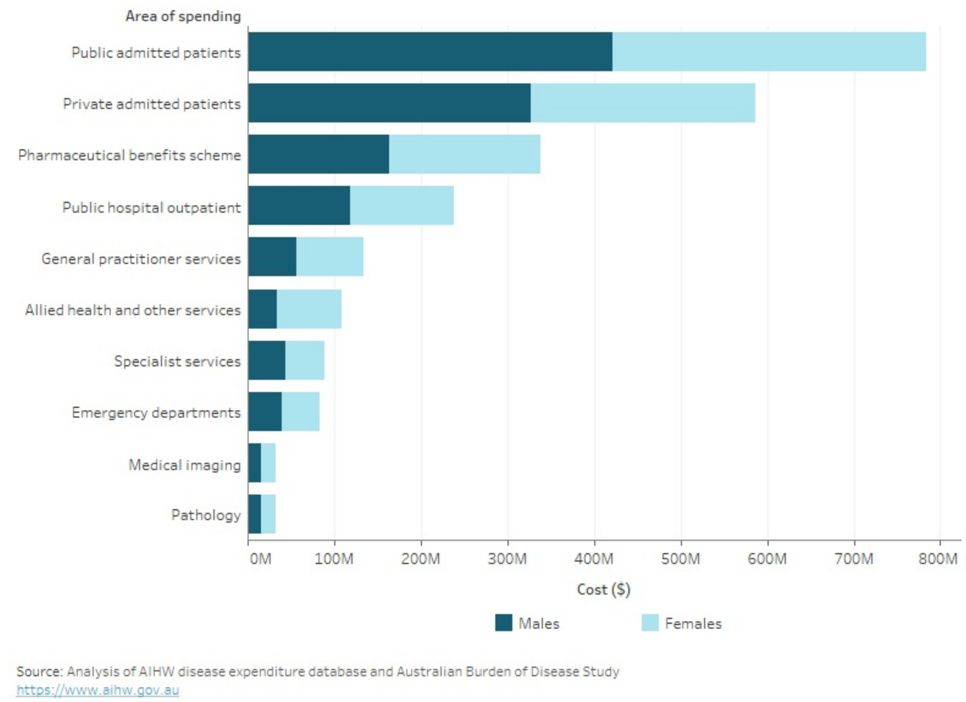


For more detail, see data tables.

Spending on all physical inactivity related conditions was highest for admissions to public hospitals ($784 million), private hospitals ($586 million), and pharmaceuticals ($338 million, Figure 6).

Figure 6: Total physical inactivity related spending by area of spending and sex, 2018-19

Alt text: Stacked bar chart showing costs from physical inactivity for males and females in each area of the health system.



For more detail, see data tables.

Health costs avoided from being physically active

Physical activity has many health benefits, and reduces the risk of developing various chronic health conditions. This component of work aims to quantify the health system costs that are avoided through the reduction in disease burden from participation in physical activity.

The estimates presented in this section provide an update on previously published preliminary estimates. They include the benefits to health that are due to the previously modelled conditions linked to physical inactivity, additional directly linked conditions (depression, anxiety and falls), and those that are affected through intermediate risk factors.

Box 2: How is the benefit of physical activity estimated?

These estimates are calculated by comparing the level of activity that was undertaken in 2018, the disease risk associated with those activity levels relative to the lowest risk level, and the disease risk for those undertaking no activity. This differs from the cost of inactivity section by additionally comparing activity risks to the highest risk category (doing no activity), rather than only the lowest risk category. This provides an indication of the benefit of physical activity.

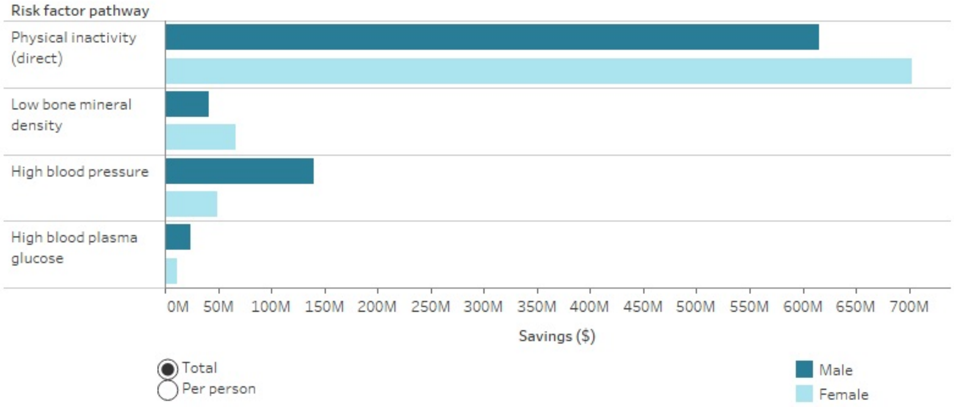
For more details on how these estimates are derived, refer to *Methods and data sources*.

Through this method, it was estimated that participation in physical activity saved the health system $1.7 billion in 2018-19 (Figure 7). The benefit of physical activity can be interpreted as the difference between the costs associated with current levels of inactivity in Australia ($2.4 billion) and the expected physical inactivity costs if the whole population was sedentary.

The benefit for males and females was similar ($820 million for males, and $831 million for females). Most of the indirect benefits were through improved blood pressure ($190 million) and bone mineral density ($108 million). For males, most of the indirect benefit was through blood pressure ($141 million), while for females most of the indirect benefit was through bone mineral density ($67 million).

Figure 7: Total health savings due to participation in physical activity by risk factor pathway and sex, 2018-19

Alt text: Bar chart showing the total and per person cost savings for each risk factor pathway due to participation in physical activity in 2018-19. Savings were higher for males for high blood pressure and high blood plasma glucose, while savings were higher for females for direct effects and for bone mineral density.



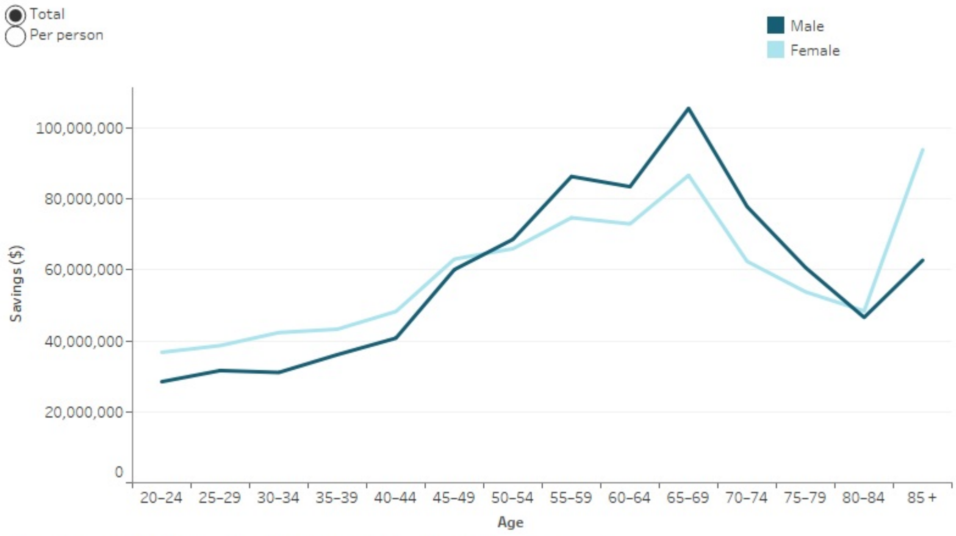
Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

For more detail, see data tables.

On average per person, around $70 of health spending was avoided on conditions directly linked to physical inactivity, $10 was avoided due to blood pressure, and $6 was avoided due to low bone mineral density. Savings per person from reductions in blood pressure due to physical activity for males ($15) were almost three times that of females ($5) (Figure 5). Total health costs avoided increased with age and were greatest for males and females after 45 years of age (Figure 8).

Figure 8: In 2018-19, health savings per person were highest directly due to participation in physical activity compared to indirectly via other risk factors

Alt text: The line graph shows total and per person savings by age group and sex in 2018-19. Savings where higher for females between ages 20 to 49, while savings were higher for males between ages 50 to 84.



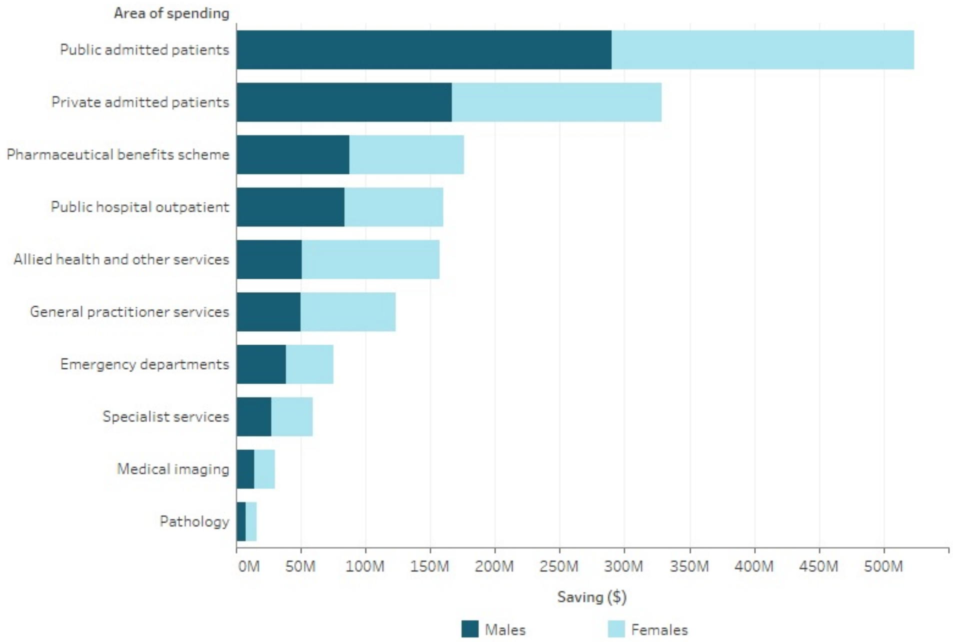
Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

For more detail, see data tables.

Health costs avoided from physical activity are greatest for public and private admitted patients ($524 million and $329 million, Figure 9), and hospital admissions would reflect more severe injuries compared to more minor injuries treated by primary care providers.

Figure 9: Total health savings were greatest for public and private admitted patients, 2018-19

Alt text: This stacked bar chart shows savings due to physical activity for males and females in each area of the health system. Savings were highest in hospitals.



Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

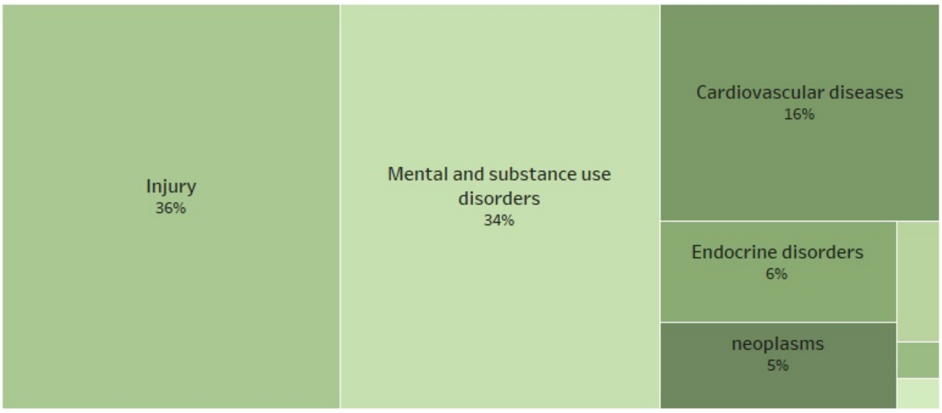
For more detail, see data tables.

Conditions prevented

The majority of health spending avoided through participation in physical activity related to *injury* (36%, both directly from falls prevented, and through fractures from low bone mineral density, Figure 10). This was followed by *mental and substance use disorders* (34%), and *cardiovascular diseases* (16%).

Figure 10: Total savings from physical activity, by burden of disease group, 2018-19

Alt text: Stacked bar chart showing spending for each risk factor pathway and linked condition for males and females.



Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

For more detail, see data tables.

From directly associated conditions, physical activity prevented the most spending on *falls* ($488 million), *depression* ($392 million), and *anxiety* ($173 million, Figure 11). The improvements in mental health were higher for females than males.

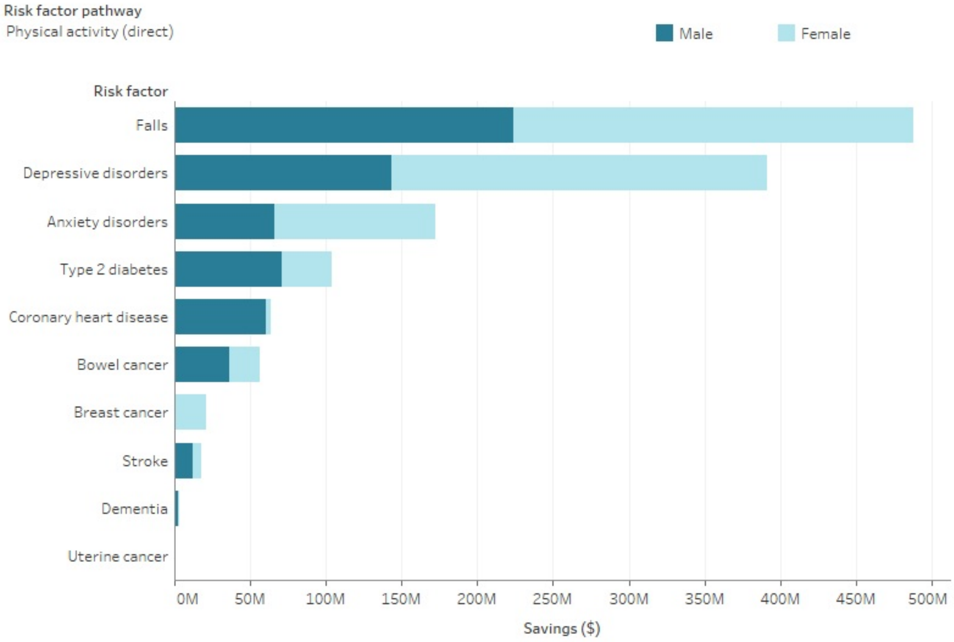
Through blood pressure, savings were highest for *coronary heart disease* ($82 million), *atrial fibrillation and flutter* ($34 million), and *stroke* ($21 million).

Through fasting plasma glucose, savings were highest for *coronary heart disease* ($7 million), *cataract* ($6 million), and *peripheral vascular disease* ($5 million).

Through low bone mineral density, savings were highest for *other fractures* ($50 million), *hip fracture* ($37 million), and *tibia and ankle fracture* ($13 million).

Figure 11: Avoided spending from physical activity on conditions through each risk factor pathway, by sex, 2018-19

Alt text: Stacked bar chart showing spending for each risk factor pathway and linked condition for males and females.



Source: Analysis of AIHW disease expenditure database and Australian Burden of Disease Study
https://www.aihw.gov.au

For more detail, see data tables.

Cost of injuries

On this page

- Acute costs
- Long term costs

Physical activity is associated with a range of health benefits, which have flow-on effects in terms of avoided health spending. On the other hand, physical activity can also be associated with injuries that have both acute and long-term health impacts that are associated with health spending.

The costs associated with injuries estimated in this report are assumed to reflect a preventable burden, in that the costs captured here reflect post-injury care rather than injury prevention activities, with the assumption that all injuries related to physical activity are potentially preventable (through improved prevention and injury management activities rather than avoiding activity). The cost of injuries presented in this report reflect injuries from all types of physical activity, not only 'sport related' injuries.

Injury treatment costs in this section are derived from the AIHW disease expenditure database, and includes hospital services, primary health care services and referred medical services. This analysis estimated that $1.2 billion was spent treating injuries caused by physical activity. For further details on the data used in this section and how these estimates were derived, refer to the Technical Notes and Economics of sports injury.

Injury treatment also occurs through other areas of the health system (see *Other sources of treatment and management*), including physiotherapy, chiropractic, acupuncture/acupressure and osteopathic services. In 2018-19, a total of $1.7 billion was spent on these services using private health insurance, though costs associated with these services are currently not able to be specifically attributed to injury versus other conditions.

This analysis includes estimates of the costs of osteoarthritis due to a prior physical activity related injury (see *Long term costs*), representing the first estimates of the long-term consequences of physical activity injuries in Australia.

Acute costs

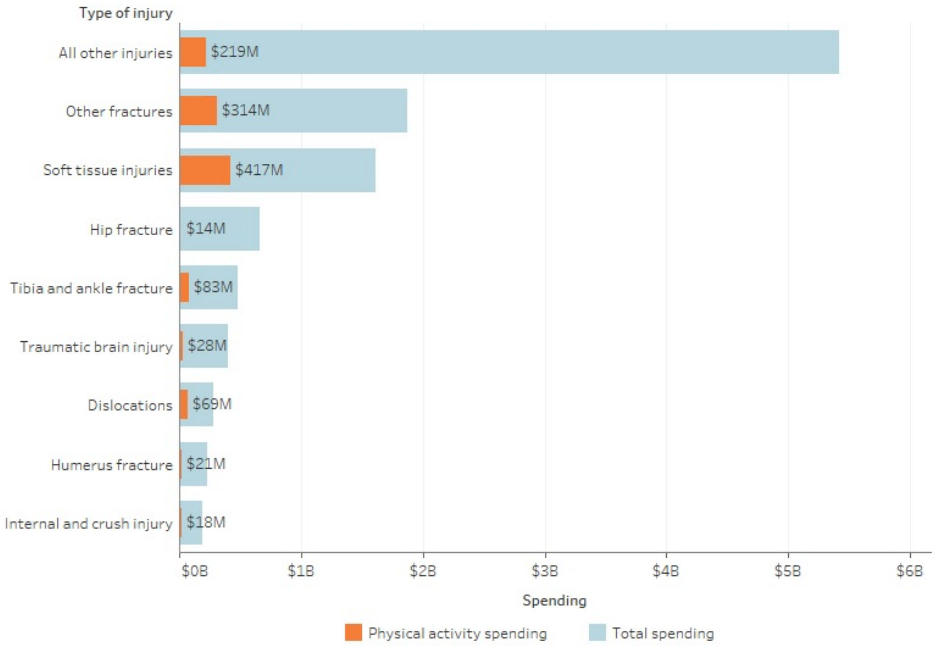
In 2018–19, total health spending was estimated at $195.4 billion, approximately $7,764 per person (AIHW 2021). Total injury spending was $11.2 billion (Figure 12). This analysis estimated that $1.2 billion was spent treating injuries caused by physical activity (around 11% of total injury spending). This includes spending across hospital services, primary health care services and referred medical services.

Around a quarter of this spending was for soft tissue injuries ($416 million), followed by other fractures ($313 million), and tibia and ankle fractures ($83 million).

The injury types with the highest proportion of total spending due to physical activity were soft tissue injuries (26%), dislocations (24%), and tibia and ankle fractures (17%).

Figure 12: Total spending and cost due to physical activity, by injury type, 2018-19

Alt text: Bar chart showing total injury spending and spending due to physical activity by injury type. Spending due to physical activity was highest for soft tissue injuries ($417 million).



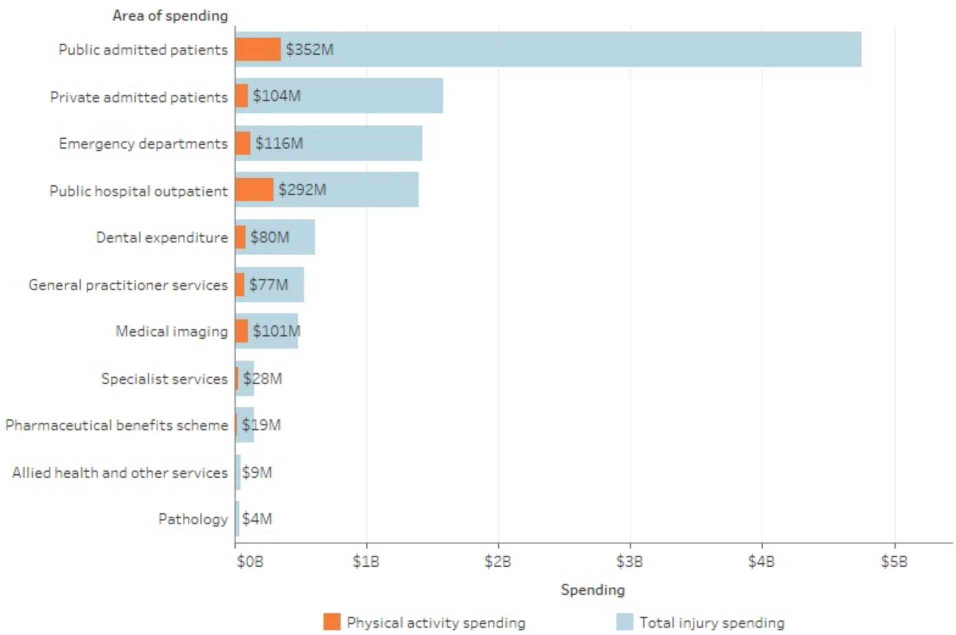
Source: Analysis of AIHW disease expenditure database
https://www.aihw.gov.au

For more detail, see data tables.

Spending for public hospital admitted patients accounted for almost a third of all physical activity related injury spending ($352 million), followed by outpatient clinics ($292 million) and emergency departments ($116 million, Figure 13). The areas with the greatest proportion of total injury costs due to physical activity were public hospital outpatient (21%), medical imaging (21%), and allied health and other services (20%).

Figure 13: Physical activity related injury spending, total injury spending, and percent of total due to physical activity, by area of spending, 2018-19

Alt text: Bar chart showing total injury spending and spending due to physical activity by area of spending. Spending from physical activity related injuries was highest for public admitted patients ($352 million).



Source: Analysis of AIHW disease expenditure database
https://www.aihw.gov.au

For more detail, see data tables.

Spending on physical activity related injuries was higher for males ($686 million) than females ($415 million, Figure 14). Spending was higher for younger age groups at around $90 to $100 million between the ages of 10 and 30. In these age groups, spending for males was around double the spending for females. Further information on patterns of physical activity related injury spending are reported in Economics of sports injury.

Figure 14: Total physical activity related injury spending by age and sex, 2018-19

Alt text: Bar chart showing total spending from physical activity related injuries, by age and sex. Injury spending was higher for males than females in all age groups except 85+.

Visualisation not available for printing

For more detail, see data tables.

Activity type

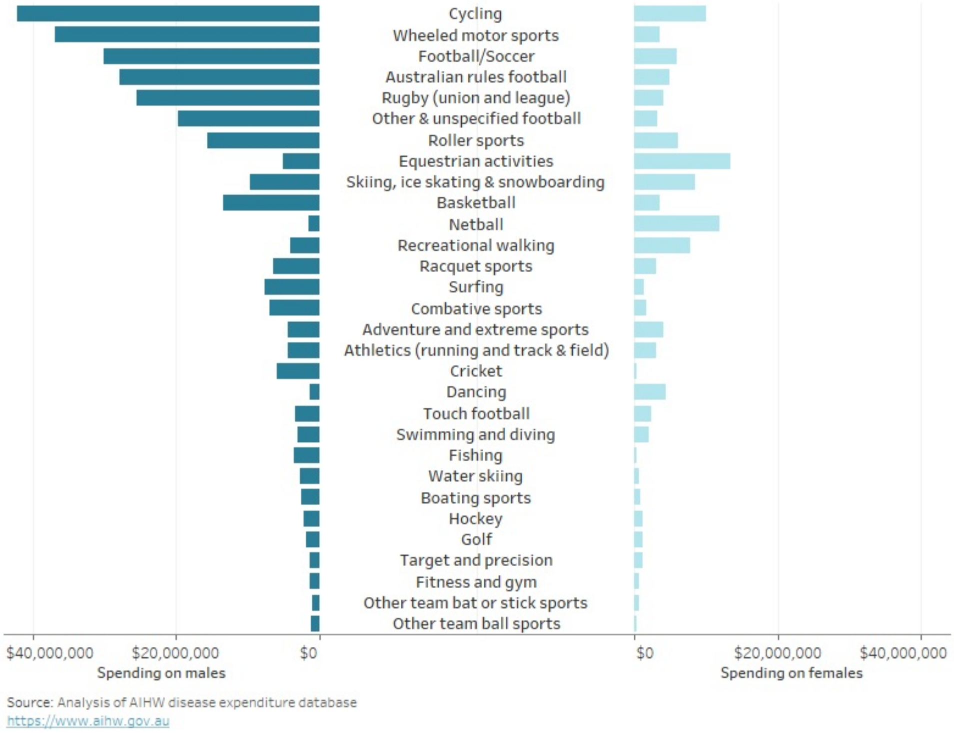
Specific activities at time of injury are only available for hospital admitted patients. The grouping of activities presented in this analysis are based on the sports reported in the Australian Sports Commission's AusPlay survey and are consistent with those in Sports Injury in Australia. Further information about the number and rate of injuries by activity type is available in this report.

The specific type of physical activity with the highest spending for hospital admissions was cycling ($52 million), followed by wheeled motor sports ($40 million) and football/soccer ($36 million, Figure 15).

The types of activities contributing to admitted patient injury costs varied for males and females. For males, the most spending was associated with cycling ($42 million), wheeled motor sports ($37 million) and football/soccer ($30 million). For females, this was equestrian activities ($13 million), netball ($12 million) and cycling ($10 million).

Figure 15: Spending by type of physical activity for males and females, 2018-19

Alt text: Bar chart showing total hospitalised injury spending for males and females by type of activity. Spending was highest for cycling ($51 million) and lowest for other team ball sports ($1.6 million).



For more detail, see data tables.

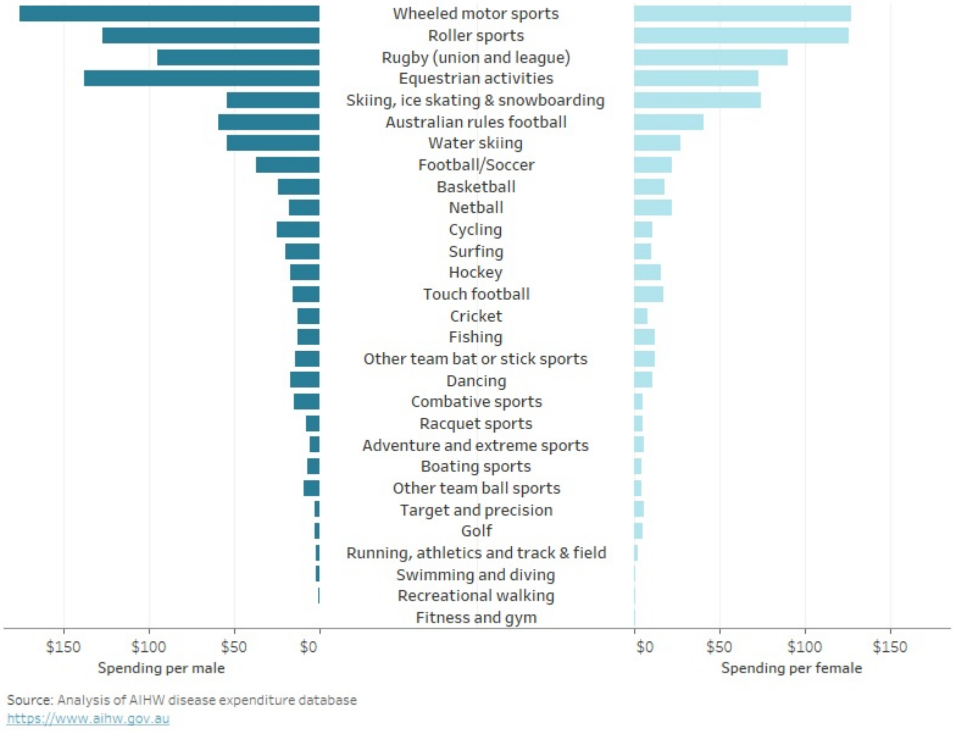
Accounting for participation rates

Activities with the highest participation rates were recreational walking, fitness and gym, and athletics (running and track & field). These activities were associated with very low levels of admitted patient injury spending, all around $2 or lower per participant in 2018-19. Along with swimming and diving, these activities had the lowest per participant cost of all specified categories.

Activities with the highest admitted patient spending per participant were wheeled motor sports ($170), roller sports ($127), and rugby (union and league) ($95) Figure 16).

Figure 16: Injury spending per participant, by type of activity, 2018-19

Alt text: Bar chart showing average hospitalised injury cost per participant, for males and females. Spending per participant was highest for wheeled motor sports ($170), and lowest for fitness and gym ($0.25).



For more detail, see data tables.

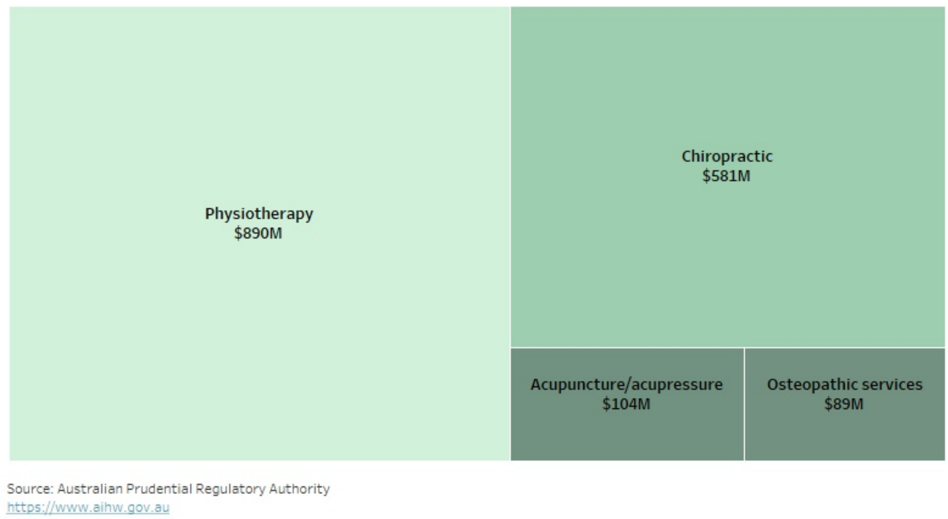
Other sources of treatment and management

The disease expenditure database does not include costs for allied health where the service was not funded through the MBS. Some of this information is available through the Australian Prudential Regulation Authority for private health insurance claims. Due to data availability, this does not include age, sex, or condition being managed. Spending estimates for private health insurance include both out of pocket costs and benefits paid.

Physiotherapy, chiropractic, acupuncture/acupressure, and osteopathic services are commonly used to treat sports injuries, and $1.7 billion was spent on these services through private health insurance in 2018-19 (Figure 17). Almost $900 million was spent on physiotherapy. However, a range of issues other than physical activity and sport related injuries are treated and managed in these settings so spending on these services is not necessarily related to sports injuries.

Figure 17: Spending on allied health services through private health insurance, 2018-19.

Alt text: Figure showing the total spending on allied health services that are claimed through private health insurance. Physiotherapy cost $890 million, followed by chiropractic ($581 million), acupuncture/acupressure ($104 million), and osteopathic services ($89 million).



For more detail, see data tables.

Long term costs

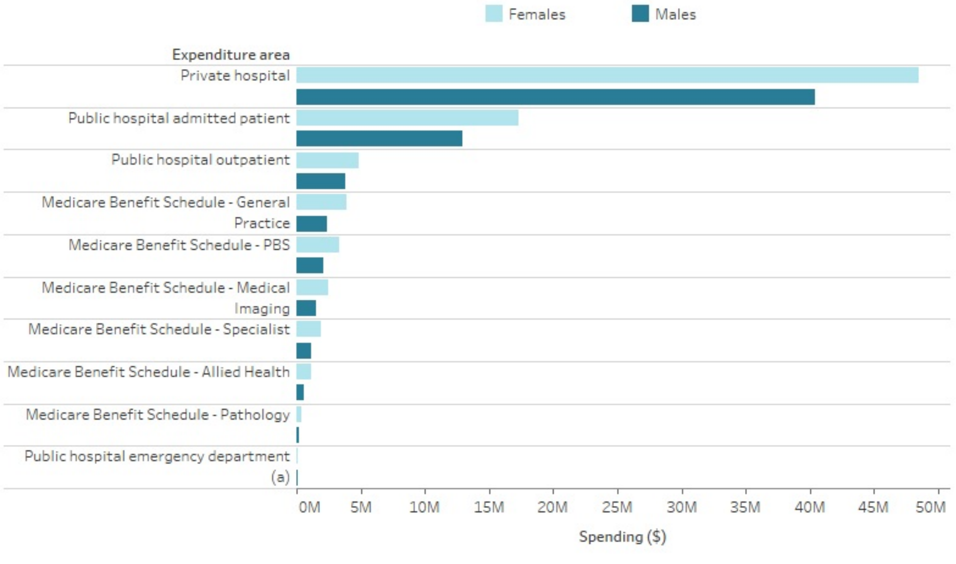
Injuries are known to contribute to the development of chronic musculoskeletal disorders (such as osteoarthritis). In many cases this burden might be prevented through improved injury prevention activities such as improved physical training exercises and routines and/or changes to rules, policies, and use of protective equipment.

This analysis has attempted to quantify the costs associated with osteoarthritis following a physical activity related injury. These estimates are modelled, and are indicative only. A study by Brown et al, 2006, was conducted in the US to estimate the incidence, prevalence and burden of post-traumatic osteoarthritis. They estimate that 12% of all osteoarthritis is due to previous trauma, predominantly fractures. This was used to estimate post-traumatic osteoarthritis costs in Australia. Australian data on the proportion of fractures that were due to physical activity was used to allocate the total post traumatic osteoarthritis cost (from all types of injury) to physical activity. Due to data limitations, this was unable to be reported by location of osteoarthritis.

These estimates indicate that around $150 million of spending on osteoarthritis in 2018-19 was due to previous physical activity injury (Figure 18). This was slightly higher for females ($84 million) than males ($65 million). Most of the spending related to private hospitals ($89 million), public admitted patients ($30 million) and public hospital outpatient clinics ($9 million).

Figure 18: Spending on osteoarthritis due to prior physical activity related injury, by sex and area of health system spending, 2018-19.

Alt text: Bar chart showing spending due to osteoarthritis from prior physical activity related injuries for males and females, in each area of the health system. Spending was higher for females ($84 million) than males ($65 million).



Source: Analysis of AIHW disease expenditure database
https://www.aihw.gov.au

For more detail, see data tables.

References

Brown, TD, Johnston, RC, Saltzman, SL, Marsh, JL, Buckwalter, JA. Posttraumatic Osteoarthritis: A First Estimate of Incidence, Prevalence, and Burden of Disease. *J Orthop Trauma* 2006;20:739–744.

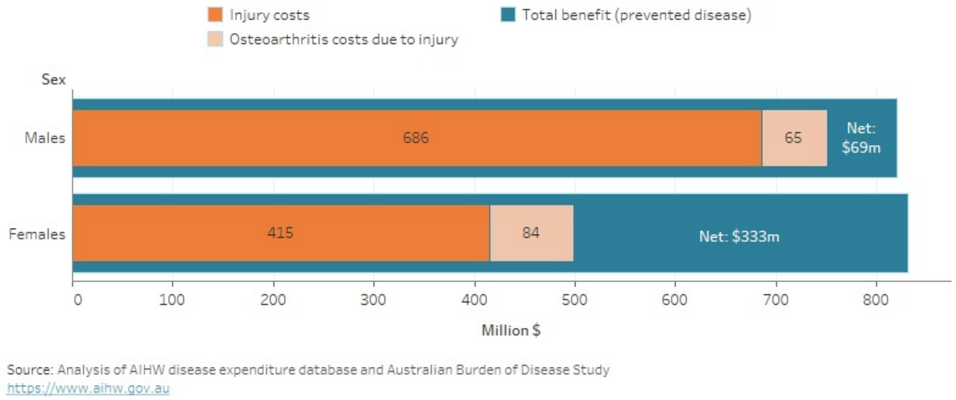
Net benefit of participation

This project has attempted to develop a more complete characterisation of the epidemiology of physical activity, to better understand the impact of physical activity on the health system. Until now, no attempt has been made to look at both health system spending related to physical activity as well as spending that was avoided because of participation in physical activity on a population level. These estimates are modelled using a variety of data sources and methods, and should be viewed as indicative only. Further estimation will be undertaken using a population simulation model. For details on how these estimates are derived, refer to *Methods and data sources*.

In 2018-19, it was estimated that a total of $1.7 billion of health system spending was avoided due to the level of physical activity, including sport, undertaken in Australia. At the same time, $1.2 billion was spent on injuries incurred while undertaking physical activity, and $149 million was spent on osteoarthritis due to previous injury from physical activity. Overall, sport and physical activity had a net positive impact on the health system of $321 million (Figure 19). The overall benefit was higher for females ($333 million) than males ($69 million), predominantly due to the lower cost of injuries among females. Note that costs from injuries in this analysis include costs for all age groups, while benefits from prevented chronic diseases are modelled for Australians aged 20 and older.

Figure 19: Benefits and costs of physical activity by sex, millions, 2018-19.

Alt text: Bar chart showing the total benefit and total costs (from injury and osteoarthritis) due to participation in physical activity and sport for males and females. The net benefit was $333 million for females, and $69 million for males in 2018-19.



For more detail, see data tables.

Technical notes

On this page

Disease expenditure database

The main source of information for this report is the AIHW's Disease Expenditure Database. It contains estimates of spending by Australian Burden of Disease Study condition, age group, and sex for admitted patient, emergency department, and outpatient hospital services, out-of-hospital medical services, and prescription pharmaceuticals.

The methods used for estimating disease spending is a mixture of 'top-down' and 'bottom-up' approaches, where total spending across the health system is estimated and then allocated to the relevant conditions based on the available service use data.

Although this approach produces consistency, good coverage and totals that add up to known expenditure, it is not as comprehensive for any specific disease as a detailed 'bottom-up' analysis, which would include the actual costs incurred for that disease. A lack of amenable data sources means that a more granular 'bottom-up' analysis is not possible.

Estimates in the Disease Expenditure Database have been derived by combining information from the:

- National Hospital Morbidity Database (NHMD)
- National Public Hospitals Establishments Database (NPHED)
- National Non-admitted Patient Emergency Department Care Database (NNAPEDC)
- National Non-admitted Patient Databases (aggregate, NAPAGG, and unit record, NAPUR)
- National Hospital Costs Data Collection (NHCDC)
- Private Hospital Data Bureau (PHDB) collection
- Bettering the Evaluation and Care of Health (BEACH) survey
- Medicare Benefits Schedule (MBS)
- Pharmaceutical Benefits Scheme (PBS)
- Health Expenditure Database.

It is not technically appropriate or feasible to allocate all spending on health goods and services by disease. For example, neither administration expenditure nor capital expenditure can be meaningfully attributed to any particular condition due to their nature. For the purposes of this report, $136 billion, or 73% of recurrent spending, was attributed to specific diseases and injuries. This expenditure includes payments from all sources of funds, such as the Australian and State and Territory Governments, Private Health Insurance, and out of pocket payments by patients.

Some components of recurrent expenditure are allocated differently between the health expenditure Australia database, and the disease expenditure study. This approach was taken to reflect patterns of healthcare use for particular conditions, which is the focus of this body of work, rather than health funding arrangements. Spending estimates in hospitals are slightly higher than in the Health Expenditure Database, while spending on referred medical services are lower. Further details of methods used are described in the *Disease Expenditure 2018–19 Study: Overview of analysis and methodology* report.

Australian Burden of Disease Study

Burden of disease quantifies the gap between a population's actual health, and an ideal level of health in the given year – that is, every individual living in full health for his or her ideal or potential life span – and includes both fatal and non-fatal components. Risk factor analysis allows death and health loss to be attributed to specific underlying (or linked) risk factors.

The Australian Burden of Disease Database contains aggregate burden of disease metrics from the Australian Burden of Disease Study. This includes Years of life lost (YLL), Years lived with disability (YLD) and Disability-adjusted life years (DALY) for over 200 diseases and injuries. It also includes estimates of attributable burden (DALY) for around 30 risk factors.

The ABDS 2018 uses and adapts the methods of global studies to produce estimates that are more relevant to the Australian health policy context. The chosen reference period (2018) reflects the data availability from key data sources (such as the National Health Survey, deaths data, hospital admissions data and various disease registers) at the time of analysis.

Results from the study provide an important resource for health policy formulation, health service planning and population health monitoring. The results provide a foundation for further assessments.

Full details on the various methods, data sources and standard inputs used in the ABDS 2018 are available in Australian Burden of Disease Study 2018: methods and supplementary material.

Risk factor modelling

A risk factor is any determinant that causes (or increases the likelihood of) one or more diseases or injuries. As well as providing estimates of fatal and non-fatal burden, burden of disease methodology allows death and health loss to be attributed to specific underlying (or linked) risk factors. 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.

The basic steps of estimating risk factor attributable burden are:

1. select risk factors
2. identify linked diseases based on convincing or probable evidence in the literature that the risk factor has a causal association with increased prevalence or mortality
3. define the exposure to the risk factor that is not associated with increased risk of disease (the theoretical minimum risk exposure distribution, or TMRED, or counterfactual)
4. estimate the population attributable fractions (PAFs) by either a direct method or the comparative risk assessment method:
    1. if PAFs appropriate to the disease and population in question are available from a comprehensive data source (such as a disease register), they are estimated directly from this data source (named a direct PAF in this report) and do not require steps 5, 6 and 7
    2. if not, PAFs are created using the comparative risk assessment method, which involves steps 5, 6 and 7
5. define the amount of increased risk (relative risk) of morbidity or mortality for the linked disease due to exposure to the risk factor
6. estimate exposure to each risk factor in the population
7. use these inputs to calculate the PAF. The PAF has a value between 0 and 1, where 0 means there was no burden attributable to the risk factor and 1 means that all the burden for the linked disease was attributable to the risk factor.

The burden attributable to each risk factor is calculated by applying the PAFs for each linked disease to the relevant year of life lost and year lived with disease.

For further information, refer to the *Australian Burden of Disease Study: methods and supplementary material 2018*.

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attributable burden: The disease burden attributed to a particular risk factor. It is the reduction in fatal and non-fatal burden that would have occurred if exposure to the risk factor had been avoided (or more precisely had been at its theoretical minimum).

body mass index: The most commonly used method of assessing whether a person is normal weight, underweight, overweight or obese. It is calculated by dividing the person's weight (in kilograms) by their height (in metres) squared; that is, kg ÷ m2. For both men and women, underweight is a BMI below 18.5, acceptable weight is from 18.5 to less than 25, overweight is from 25 to less than 30, and obese is 30 and over. Sometimes overweight and obese is combined, and is defined as a BMI of 25 and over.

burden of disease (and injury): The quantified impact of a disease or injury on a population, using the disability-adjusted life year (DALY) measure. Referred to as the 'burden' of the disease or injury in this report.

cholesterol: Fatty substance produced by the liver and carried by the blood to supply the rest of the body. Its natural function is to supply material for cell walls and for steroid hormones, but if levels in the blood become too high this can lead to atherosclerosis and heart disease.

chronic diseases: A diverse group of diseases, such as heart disease, cancer and arthritis, which tend to be long-lasting and persistent in their symptoms or development. Although these features also apply to some communicable diseases (infectious diseases), the term is usually confined to non-communicable diseases.

condition (health condition): A broad term that can be applied to any health problem, including symptoms, diseases and certain risk factors, such as high blood cholesterol and obesity. Often used synonymously with disorder or problem.

DALY (disability-adjusted life years): Measure (in years) of healthy life lost, either through premature death defined as dying before the expected life span at the age of death (YLL) or, equivalently, through living with ill health due to illness or injury (YLD).

disability: In burden of disease analysis, any departure from an ideal health state.

disease: A broad term that can be applied to any health problem, including symptoms, diseases, injuries and certain risk factors, such as high blood cholesterol and obesity. Often used synonymously with condition, disorder or problem.

fatal burden: The burden from dying 'prematurely' as measured by years of life lost. Often used synonymously with YLL, and also referred to as 'life lost'.

high blood cholesterol: Total cholesterol levels above 5.5 mmol/L.

high blood pressure/hypertension: The definition of high blood pressure (also known as hypertension) can vary but a well-accepted one is from the World Health Organization: a systolic blood pressure of 140 mmHg or more or a diastolic blood pressure of 90 mmHg or more, or [the person is] receiving medication for high blood pressure.

hypertension: See **high blood pressure**.

linked disease: A disease or condition on the causal pathway of the risk factor, which is therefore more likely to develop if exposed to the risk.

Metabolic equivalent of tasks (METs): A measure of physical activity representing the rate of energy expenditure incorporating the duration and intensity of activity, with one MET equivalent to 1 kcal/kg/hr, which is about the energy expended in sitting, with 1 MET-minute equal to 1 minute of activity at an intensity of 1 kcal/kg/hr.

non-fatal burden: The burden from living with ill health as measured by years lived with disability. Often used synonymously with YLD.

physical activity: Australia's Physical Activity and Sedentary Behaviour Guidelines (2014) recommend that:

- Young people (13-17 years) accumulate at least 60 minutes of moderate to vigorous physical activity everyday, from a variety of activities including some vigorous.
- Adults (18-64 years) should be active most days of the week, accumulate 150 to 300 minutes moderate intensity physical activity or 75 to 150 minutes of vigorous intensity physical activity (or an equivalent combination each week), and do muscle strengthening activities on at least two days each week.
- Older Australians (65 years and over) should accumulate at least 30 minutes of moderate intensity physical activity on most, preferably all, days.

population attributable fraction (PAF): The proportion (fraction) of a disease, illness, disability or death in a population that can be attributed to a particular risk factor or combination of risk factors.

risk factor: Any factor that represents a greater risk of a health condition or health event. For example, smoking, alcohol use, high body mass.

YLD (years lived with disability): A measure of the years of what could have been a healthy life but were instead spent in states of less than full health. YLD represent non-fatal burden.

YLL (years of life lost): Years of life lost due to premature death, defined as dying before the global ideal life span at the age of death. YLL represent fatal burden.

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