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Australian Burden of Disease Study

Impact and causes of illness and death in Australia

2011

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Foreword

I am pleased to present *Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011*, a landmark report that presents burden of disease estimates, tailored for their relevance to the Australian population and health system context.

This report provides a set of estimates (at the disease level) of the fatal and non-fatal burden, using the DALY (disability-adjusted life year), YLD (years lived with disability) and YLL (years of life lost) measures—for the 2011 and 2003 reference years. It also provides estimates of attributable burden for various risk factors for the 2011 and 2003 reference years, and disaggregation of estimates (by state/territory, socioeconomic group, and remoteness).

To date in Australia, there have been two major national burden of disease studies, and one for Indigenous Australians. The last national study was published in 2007 using data from 2003; and subsequently some states and territories have undertaken further burden of disease work. These previous studies provided an important resource for policy-makers enabling a more targeted approach to resource allocation and disease management.

Australian-specific burden of disease estimates aim to produce context specific information to inform policy and planning in Australia. This third national study incorporates methodological developments from global studies that are advancing within an international context. Methods for the Australian Burden of Disease Study 2011 have been tailored to align with health reporting and monitoring requirements in Australia—using the best quality country-level data available—(taking into account sub-national methodological issues)—while maintaining comparability with global studies, where possible. This study has rebuilt national capacity in burden of disease analysis, and has set up the relevant infrastructure to enable efficient and timely ongoing updates.

This comprehensive report aims to meet the need for detailed information about the burden of disease in 2011 (the year with the best data available at the time this study commenced) and how it has changed since 2003.

Finally, I would like to acknowledge the many individuals and organisations—including the authors, expert advisors and data suppliers—that contributed to this study and thank them for their valuable contributions.

Andrew Kettle
Acting Director

May 2016

Contents

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This report on the national burden was authored by Julie Ayre, Karen Bishop, Ilona Brockway, Melanie Dunford, Julianne Garcia, Melissa Goodwin, Michelle Gourley, Wendy Ho, Miriam Lum On, Nick Mann, Michael McGrath, Lynelle Moon, Vanessa Prescott and Nancy Stace-Winkles.

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A full list of contributors to disease and risk factor work is provided in Appendix E. Input from all these individuals and organisations was appreciated.

The Australian Burden of Disease Study 2011 utilises methodologies and inputs developed by the Institute of Health Metrics and Evaluation, University of Washington, which are gratefully acknowledged.

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Abbreviations

ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACOD	associated causes of death
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ANZDATA	Australian and New Zealand Dialysis and Transplant Registry
ASR	age-standardised rate
BMI	body mass index
CODURF	cause of death unit record files
COPD	chronic obstructive pulmonary disease
CVD	cardiovascular disease
DALY	disability-adjusted life years
GBD	Global Burden of Disease Study
HIV/AIDS	human immunodeficiency virus/ acquired immune deficiency syndrome
ICD	International Statistical Classification of Diseases and Related Health Problems
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, Tenth revision, Australian modification
IDEA	Intellectual Disability Exploring Answers Database
IHME	Institute for Health Metrics and Evaluation
LBW	low birthweight
MCOD	multiple causes of death
NSW	New South Wales
NT	Northern Territory
PAF	population attributable fraction
PYLL	potential years of life lost
Qld	Queensland
RTI	road traffic injuries
SA	South Australia
SE	socioeconomic
SIDS	sudden infant death syndrome
Tas	Tasmania
TMRED	theoretical minimum risk exposure distribution
UCOD	underlying cause of death
Vic	Victoria
WA	Western Australia
WHO	World Health Organization
YLD	years lived with disability
YLL	years of life lost

Symbols

—	nil or rounded to zero
. .	not applicable

Summary

Burden of disease analysis is a way to compare the impact of different diseases, conditions or injuries on a population. This impact can be broadly divided into non-fatal (living with a disease) and fatal (dying from a disease) effects. These studies also attribute a proportion of the burden to risk factors. Burden of disease studies are useful for monitoring population health, informing health policy and service planning, and as an input to analysing the cost-effectiveness of interventions.

The Australian Burden of Disease Study 2011 responds to a need for updated, comparable evidence on the health of the Australian population, to inform health policy decision making, with national estimates last published in 2007 using 2003 data. This report provides estimates of the total, non-fatal and fatal burden for the Australian population for 2011 and 2003, using DALY (disability-adjusted life year) metric for 200 diseases, as well as estimates of the burden attributable to nearly 30 risk factors. One (1) disability-adjusted life year (or 1 DALY) represents 1 year of healthy life lost, either through premature death or from living with an illness or injury.

Most of the burden of disease in 2011 is from chronic diseases

There were 4.5 million years lost to premature death or living with illness in 2011. The five disease groups causing the most burden were cancer, cardiovascular diseases, mental & substance use disorders, musculoskeletal conditions and injuries; together, these account for 66% of the total burden. Coronary heart disease, back pain & problems, chronic obstructive pulmonary disease and lung cancer, as the leading specific diseases, contributed 18% of the total burden.

Good gains in population health since 2003

After adjusting for population increase and ageing, there have been good gains in the health of the population between 2003 and 2011, mostly from a 15% reduction in fatal burden but also from a smaller (3.8%) reduction in non-fatal burden. The reduction was seen most in those aged 55–89 years.

Large proportion of the burden is preventable

At least 31% of the burden of disease in 2011 was preventable, being due to the modifiable risk factors included in this study. The risk factors causing the most burden were tobacco use, high body mass, alcohol use, physical inactivity and high blood pressure.

Burden differs across Australia and the population

Analysis of burden of disease at the national level may mask health issues for a particular population. The difference in the disease burden among states and territories was most pronounced in the Northern Territory, which had higher burden rates than the other jurisdictions. Large inequalities were also found across socioeconomic groups and remoteness areas. A 21% reduction of burden could be achieved if all of the five socioeconomic groups experienced the same disease burden as the highest group. Similarly, a 4% reduction could be achieved if all remoteness areas experienced the same level of burden as *Major cities*.

1 Introduction

Burden of disease analysis measures the combined impact of fatal and non-fatal burden. More than merely counting deaths or disease prevalence, it takes into account age at death and severity of disease. The estimates produced from a burden of disease study remain the best summary measure of a population's health (Richardson, in Murray et al. 2002).

High-quality information on the health impacts and distribution of different diseases, injuries and risk factors is important in providing an evidence base to inform health policy, program and service delivery. This, in turn, helps to ensure expenditure on health that is cost-effective, equitable and optimises health gains. The Australian Burden of Disease Study (ABDS) 2011 directly addresses this information requirement with detailed analysis of national and Indigenous burden of disease estimates that have been designed to meet Australia's needs.

This report presents a detailed picture of the burden of disease for the Australian population in 2011, as well as how this burden has changed since 2003 (the focus of the last Australian burden of disease study). A summary of key findings is available in the companion summary publication.

1.1 What is burden of disease?

Burden of disease analysis is a technique used to assess and compare the impact of different diseases, conditions or injuries (often referred to in this report as 'diseases' for simplicity) and risk factors on a population. It uses information from a range of sources to quantify the fatal (for example, dying from cancer) and non-fatal (for example, living with cancer) effects of these diseases in a consistent manner so that they can then be combined into a summary measure of health called disability-adjusted life years, or DALY. Simply put, a DALY combines the impact of dying early and living with illness. It combines the estimates of years of life lost due to premature death (YLL) and years lived in ill health or with disability (YLD) to count the total years of healthy life lost from disease and injury. These and other key terms are defined in Box 1.1 and explained further at Appendix A.

This health loss represents the difference between the current health status of the population and the ideal situation where everyone lived a long life, free of disease. Burden of disease estimates capture both the quantity and quality of life, and reflect the magnitude, severity and impact of disease and injury within a population. The analysis also estimates the contribution of various risk factors to health loss, known as the attributable burden.

Burden of disease analysis is a standard method for collating data of acceptable quality on causes of health loss to produce comparable and concise policy-relevant evidence. The ability to use data from a range of sources to construct an internally consistent measure for all diseases is a key strength of a burden of disease study. Similar comparisons and rankings across different diseases or injuries cannot be produced by using separate studies conducted on a disease-by-disease basis or by using disparate data sources.

Box 1.1: Key terms used in this report

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).

Burden of disease (and injury): Term referring to the quantified impact of a disease or injury on a population, using the disability-adjusted life year (DALY) measure.

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

Disease: A broad term that can be applied to any health problem. It is often used synonymously with condition, disorder or problem.

Disability weight: A factor that reflects the severity of non-fatal health loss from a particular health state on a scale from 0 (perfect health) to 1 (equivalent to death).

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'.

Health state: Consequences of diseases and conditions reflecting key differences in symptoms and functioning.

Incidence: The number of new cases (of an illness or injury) occurring during a given period.

Non-fatal burden: The burden from living with ill-health as measured by years lived with disability. It is often used synonymously with YLD, and also referred to as 'health loss' in this report.

Prevalence: The number of cases of a disease or injury in a population at a given time.

Risk factor: Any factor that represents a greater risk of a health condition or health event; for example, smoking, alcohol use, high body mass and so on.

Sequela: Consequence of diseases; often used in the plural, sequelae.

TMRED (theoretical minimum risk exposure distribution): The distribution of exposure to a risk factor that would have the lowest associated population risk.

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 ideal life span (Table A2 at Appendix A). YLL represent fatal burden.

(See Glossary for a full list of definitions.)

1.2 How are burden of disease studies used?

Burden of disease analysis provides a useful evidence base to support the activities described in this section.

Monitoring of population health

Burden of disease analysis is valuable for monitoring population health because it simultaneously quantifies the fatal and non-fatal impact of causes of ill health. It provides summary information on the level and distribution of health in the population, which can be used to measure population health over time and between groups. Further, it maintains comparability of these metrics between diseases and population groups. The contribution of various risk factors can also be described using the same metrics.

Health policy and health service planning

Burden of disease studies also provide valuable information to inform health policy formulation and health service planning. By comparing all diseases together, these studies can highlight which diseases and risk factors cause the most burden, which are increasing or decreasing and which are causing the greatest health inequalities and gaps. For example, they indicate the diseases most likely to have an impact on the health system and services, such as doctor visits, hospital admission or dental care.

As well, estimates of the burden attributable to specific risk factors can be used to target prevention policies. Burden of disease estimates are designed to inform health policy in relation to the prevention, early intervention and treatment (that is, aiming for lesser severity) of diseases and risk factors.

Assessment of the broader impact of diseases and the cost-effectiveness of interventions

Burden of disease information can be used to measure the health impact of interventions when undertaking cost-effectiveness analysis. Further, it can also be used to highlight which diseases or risk factors to focus for cost-effectiveness analyses—the areas where there is the most potential for health gains. It can also be useful to compare burden of disease information with disease expenditure estimates.

1.3 What burden of disease studies can't tell us

Burden of disease analysis quantifies the size of health problems. It does not take into account broader factors, such as social impacts, economic impacts or the direct impact on the health system. While it can provide some indication of areas of health workforce demand, it needs to be used together with other information to determine where there are gaps.

Since burden of disease analysis quantifies only the size of a health problem it should not be used on its own for resource allocation, as it does not show what interventions will work or which are most cost effective. However, as outlined earlier, burden of disease analysis helps to identify those conditions for which the cost-effectiveness of interventions should be investigated, to gain the maximum benefit.

1.4 Previous burden of disease studies

The first global study—for the year 1990—developed the DALY metric and quantified the global disease burden (and attribution to risk factors) reported for eight regions of the world (Murray & Lopez 1996).

Since then, additional global and country studies have been undertaken and methods have been further developed. To date in Australia, there have been two major national burden of disease studies conducted, and one for Indigenous Australians. Some states and territories have also completed burden of disease work. Table 1.1 provides a summary of global and national Australian studies.

Table 1.1: Summary of global and Australian burden of disease studies

Study	Reference year	Reference
Global study: Harvard School of Public Health in collaboration with The World Bank and the World Health Organization (WHO)	1990	Murray & Lopez 1996
First Australian study: Australian Institute of Health and Welfare (AIHW)	1996	Mathers et al. 1999
Global study: The World Bank	2000–2002	Lopez et al. 2006
Second Australian study: AIHW and The University of Queensland	2003	Begg et al. 2007
First Indigenous Australian study: The University of Queensland	2003	Vos et al. 2007
Global study: WHO	2004 with projections to 2030	WHO 2009
Global study: Institute for Health Metrics and Evaluation (IHME)	2010	Murray et al. 2012a
Global study: WHO	2012	WHO 2014a
Global study: IHME	2013	Murray et al. 2015

The Global Burden of Disease Study 2010 (hereafter referred to as the GBD 2010)—conducted by the IHME (located at the University of Washington) and other academic partners—was published in December 2012 (Murray et al. 2012a). It used substantially revised methods to generate DALY for 2010 and revised estimates for 1990 and 2005. Notable method changes included a new standard life table, removal of age weighting and discounting, and use of a prevalence-based YLD and new disability weights. Further details on these aspects are contained in the working paper *Assessment of Global Burden of Disease 2010: methods for the Australian context* (AIHW 2014a). More recently, the WHO applied these methods (with some modifications) to also produce global burden of disease estimates for 2000–2012 (WHO 2014a). The IHME has recently updated its estimates for the 2013 reference year, along with revised estimates for 2010 and earlier years (Murray et al. 2015).

Recent global studies have also estimated disease burden in Australia but not the burden in Indigenous and sub-national population groups. The primary use of these studies is for international comparisons, with methods and assumptions designed to match international data and context, which does not always align with the Australian health context. Therefore, results from other studies should not be compared with the estimates in this report.

1.5 Australian Burden of Disease Study 2011

In recent years, it had become increasingly clear that the 2003 Australian burden of disease estimates required updating. Stakeholders highlighted the need for updated information. To build on the AIHW's previous burden of disease studies and current disease monitoring work, the Department of Health and

the former Australian National Preventive Health Agency funded the AIHW to update burden of disease estimates for Australia.

It is important to have a good foundation of data for a burden of disease study. Hence, the chosen reference period was 2011, which reflects the data availability from key data sources (such as the Australian Health Survey (AHS), deaths data, hospital admission data and various disease registers) at the time analysis began.

The GBD 2010 and 2013 studies produced fatal and non-fatal burden estimates using statistical models based on a variety of international and countryspecific data. The country specific results included in the GBD 2010 and 2013 for Australia are valuable for comparing burden of disease at an international level; however, they do not extend to the Indigenous population or to sub-national Australian population groups. Further, the causes of health loss reported by the GBD do not fully capture the range and breadth of diseases and risk factors of importance in the Australian context, nor do they reflect the high quality and detailed and up to date health data available in Australia.

The ABDS 2011 provides Australian-specific burden of disease estimates best matched to the Australian context for the total population (including sub-national estimates) and the Aboriginal and Torres Strait Islander population for 2011 and 2003. The study uses Australian data sources and adapts the methods of global studies to quantify burden of disease. The resulting estimates thus aim to be better aligned to the Australian health policy context.

See Box 1.2 for a brief list of the main developments since the previous Australian study. Further details can be found in AIHW 2014a and at Appendix A.

Box 1.2: Key developments since the 2003 Australian study

- A simpler DALY. YLD are now calculated from prevalence rather than incidence, and have no age weighting or discounting.
- A new standard life table to calculate YLL which represents the theoretical maximum number of years that people can expect to live. The table is the same for males and females.
- Updated disability weights.
- YLD now based more directly on data, so there is less reliance on modelling; this is closer to how YLL are calculated.
- A more comprehensive list of diseases for explicit estimation.
- New conceptual models for some diseases.
- New data sources for many diseases, notably the Australian Health Survey, and greater use of linked hospital/deaths data.
- New risk factors and linked diseases.

Due to the substantial number of changes, **the estimates from previous Australian studies are not comparable with those for the ABDS 2011.** Estimates for 2003 have been recalculated using the updated methods to enable comparison (see Chapter 7).

Further information on these key developments can be found at Appendix A. See Box 1.1 for definitions of key terms used in this report.

Project governance and stages of work

The ABDS 2011 was undertaken between 2013 and 2016. At the outset, a set of principles and requirements were developed in consultation with the study's funders and the advisory groups to guide the work. It was agreed that the ABDS 2011 should be relevant to Australia, while maintaining comparability with global methods as much as possible; provide transparency in the data sources, assumptions and methods used; promote collaboration with stakeholders nationally and internationally; build national capacity and set up the relevant infrastructure to enable efficient and timely ongoing updates.

An Expert Advisory Group was set up to provide detailed advice on key technical issues including the overall methodology and policy implications. An Indigenous Reference Group provided advice on estimates for the Aboriginal and Torres Strait Islander population, and disease-specific advice was sought through engagement from expert panels. A Jurisdictional Working Group, comprising representatives from the states and territories and the Australian Government, was also set up to ensure communication on sub-national aspects of the study.

The first phase of the project explored a range of methodological issues, including the methodological developments of the GBD 2010, to determine the best methods to update the Australian and Indigenous estimates. The project's Expert Advisory Group, as well as other experts, reviewed the methods plan produced from this assessment. The AIHW published a working paper, *Assessment of Global Burden of Disease 2010 methods for the Australian context: Australian Burden of Disease Study, working paper no. 1,* which describes various aspects of this assessment (AIHW 2014a).

The second phase involved updating the burden of disease estimates, including analysis of fatal burden, non-fatal burden and total burden attributable to various risk factors. Methods used in other recently published burden of disease studies—notably the WHO's Global Health Estimates (WHO 2014b) (hereafter referred to as WHO 2012); the New Zealand Ministry of Health's Burden of Diseases, Injuries and Risk Factors Study, 2006–2016 (MOH 2012); and, more recently, the GBD 2013—have also been incorporated into the ABDS 2011 where appropriate.

Estimates of fatal burden for 2010 for the total and Aboriginal and Torres Strait Islander populations were the first publications from this study (AIHW 2015a, 2015b). The fatal burden for the total population has been updated in this report with the reference year 2011.

This report presents the full set of estimates for the total Australian population as well as by state and territory, remoteness areas and socioeconomic groups. It includes estimates of both fatal and non-fatal burden for the reference periods 2011 and 2003 along with risk factor and sub-national estimates. Burden of disease estimates for the Indigenous population are expected to be published in mid-2016.

1.6 How is the burden of disease measured?

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 an ideal life span. To quantify this gap, it uses a summary measure of health called the DALY. The more DALY associated with a disease or injury, the greater the burden.

YLD measure the number of healthy years of life lost due to disease in the year at the population level. This is calculated by estimating the amount of time spent with a condition, multiplied by a *disability weight* indicating the severity of the condition. Total YLD are influenced by the number of people with each

disease, the time spent in less than full health and the disability weights defined for each disease. The disability weights used in this study are drawn from the GBD 2013 and represent the health loss caused by the consequences of each disease.

YLL measure the years lost between the age at which a person dies and an *ideal life span*. In this study, the ideal remaining expectancy varies at each age but starts as a life expectancy at birth of 86.0 years for both men and women (see Appendix Table A2 for the full standard life expectancy table). This ideal life span is drawn from the GBD 2010 and is based on the lowest observed death rates at each age group from multiple countries (Murray et al. 2012b). Total YLL are influenced by both the total number of deaths, and the ages at which those deaths occur.

Constructed in this way, the DALY is a summary measure of the overall population health for the year being reported, enabling diseases, population groups and points in time to be compared.

Box 1.3: Example: What is a disability-adjusted life year?

Joe, aged 65, has angina. In technical terms, his health loss due to his angina has a weight—often known as a 'disability weight'. Angina is a chronic condition, with a disability weight of 0.2 and a duration of a year (0.2 x 1 year = 0.2 YLD). However, if Joe then has a heart attack in the same year, he would also experience short-term health loss (for about a month) with a disability weight of 0.5 (0.5 x 1/12 = 0.04). This gives Joe a total of 0.24 YLD for his health loss due to coronary heart disease.

If he then dies at the end of the year, Joe will lose a number of years by dying early. A male aged 65 would (according to the theoretical maximum life span) live until he is 88. If Joe dies at 65 he will have lost 23 years due to dying prematurely (or 23 YLL).

Joe's total disability-adjusted life years (DALY) will be 0.24 YLD plus 23 YLL, making 23.24 DALY.

DALY are estimated for every occurrence of every disease and then added together for the whole population to indicate the total disease burden. Using this approach, it is possible for the total YLL (and hence, total DALY) in an age group to exceed the number of people in the population—this is particularly evident in the older age groups where the population is small but there are many deaths.

How is the contribution of risk factors measured?

Information on the impact of various risk factors (such as smoking, physical inactivity, high blood pressure) on the health of the population can be used to measure the proportion of the burden of disease due to these risk factors. These estimates show how much of the disease burden could have been averted if the population's actual exposure to the risk had been modified to the lowest level (known as the TMRED)—for example, if smoking were eliminated.

The calculations use information on which diseases are linked to the various risk factors, the amount of extra risk of developing or dying from that disease caused by exposure to the risk factor (relative risks), and the number of people in the population exposed to the risk factor.

Where do the data come from?

Data to develop the ABDS estimates were obtained from many different sources. Deaths data for the fatal burden were sourced from the National Mortality Database. Data for the non-fatal burden came from a variety of sources including national data sets with complete coverage (such as the National

Hospital Morbidity Database and the Australian Cancer Database), national surveys (such as the Australian Health Survey 2011–12 and the National Survey of Mental Health and Wellbeing 2007) and a number of epidemiological studies.

Where possible and appropriate, other inputs for the ABDS were obtained from the 2010 or 2013 GBD. These included the standard life table for fatal burden, health states and disability weights for the non-fatal burden and relative risks and TMRED for the risk factor attribution.

Population estimates underpinning all estimates were sourced from the Australian Demographic Statistics from the Australian Bureau of Statistics (ABS).

Details on the various data sources, including standard inputs, are at Appendix A.

1.7 Scope of this report

The primary audiences of this report are analysts, researchers and policy users who are interested in the detailed results from the ABDS 2011, and require a broad understanding of the methods used to produce them.

The purposes of this report are to:

- provide a set of estimates of the fatal and non-fatal burden of disease for the Australian population, using the DALY, YLD and YLL measures, for the 2011 and 2003 reference years
- provide estimates of attributable burden for various risk factors for the 2011 and 2003 reference years
- provide sub-national estimates (by state/territory, socioeconomic group, and remoteness) for the 2011 reference year
- describe the high-level methodology used to derive the estimates
- provide guidance on understanding and using burden of disease estimates.

1.8 Structure of this report

The structure of the report has been designed to provide a descending level of detail of the results.

At a broad level, Chapter 2 presents a synthesis of the key findings from across the chapters that follow.

Chapters 3, 4 and 5 summarise the burden of disease results for the overall burden, non-fatal and fatal burden.

Chapter 6 summarises the impact of the selected risk factors on the burden of disease.

Chapter 7 presents a comparison of burden between the two reference years, 2011 and 2003.

Chapter 8 presents a summary of the sub-national results: by state and territory, by remoteness category, and by socioeconomic groups.

At a more detailed level, Chapter 9 provides results for each of the 17 disease groups used in this study, while Chapter 10 summarises the main results for each of the 29 risk factors used in this study.

Lastly, Chapter 11 provides commentary on the limitations of the report, as well as an international comparison of burden of disease in Australia using the results from the GBD 2013.

Appendix A provides a summary of technical methods.

A summary of the quality of the estimates is contained in Appendix B.

Appendix C aims to provide guidance on interpreting burden of disease estimates. It is written to help people with limited knowledge of burden of disease methods to be able to use and interpret the results in this report.

The remaining appendixes include additional tables, figures and a list of contributors to this work.

Additional tables/information are also provided for this report on the AIHW website <www.aihw.gov.au>.

2 Synthesis and discussion of key results

2.1 Health loss across the life course

There were 4.5 million years of healthy life lost to premature death or living with illness in 2011, equivalent to 201 DALY per 1,000 people.

A fundamental output from burden of disease analysis is a measure of the health gap in the population that combines the current impact of death and illness with the ideal of a long life, free from disease.

Overall, in 2011, there were 201 years lost due to premature death or living with disease or injury for every 1,000 people in Australia, equivalent to 4.5 million DALY.

The DALY was higher for males than females at almost all ages, mostly due to fatal rather than non-fatal burden (figures 3.2, 4.1 and 5.2).

DALY rates are relatively high in the first year of life, after which they decline in early childhood; there is then a gradual increase to around age 55, followed by rapid increases (Figure 3.1). Most of the absolute burden was from non-fatal burden to age 50, after which the fatal burden was higher.

2.2 Chronic diseases and injuries dominate

The five disease groups causing the most burden were cancer, cardiovascular diseases, mental disorders, musculoskeletal conditions and injuries.

Five disease groups caused the most burden: cancer (19%), cardiovascular diseases (15%), mental & substance use disorders (12%), musculoskeletal conditions (12%) and injuries (9%) (Figure 3.3). The cancer burden was mostly fatal while burden from mental & substance use disorders and musculoskeletal conditions was mostly non-fatal. The burden from cardiovascular diseases and from injuries was also largely fatal but the non-fatal component was notable (Figure 3.4).

The largest differences in DALY rates between males and females were for injuries, cardiovascular diseases and cancer (Table 3.2).

The disease groups with the highest burden varied across the life course. Mental & substance use disorders and injuries were the largest disease groups in terms of DALY in the younger age groups (from childhood into working age). Musculoskeletal conditions caused burden from the 20s and cancer from the 40s. Cardiovascular diseases become more prominent in terms of DALY from the 50s, though the burden started at a somewhat younger age for the fatal burden (figures 3.5, 4.3, and 5.4).

2.3 Role of specific diseases

Coronary heart disease, other musculoskeletal conditions, back pain & problems, COPD, and lung cancer caused the most burden. Together they accounted for almost one-fifth of the total burden.

The 20 specific diseases with the highest burden account for more than half (55% for males, 59% for females) of the burden. Within this, coronary heart disease, other musculoskeletal conditions, back pain & problems, chronic obstructive pulmonary disorder (COPD) and lung cancer account for more than

one-fifth (24% for males, 21% females) of the burden (Table 3.3). Addressing these conditions would make a substantial contribution to reducing the disease burden.

The top-ranked specific diseases differ for males and females. For males, coronary heart disease, lung cancer, other musculoskeletal conditions, suicide & self-inflicted injuries, and back pain & problems were the highest ranking diseases. For females, it was coronary heart disease, other musculoskeletal conditions, dementia, anxiety disorders, and back pain & problems (Table 3.3).

The diseases causing the most burden also differed across the life course (figures 3.6 and 3.7). The patterns for the younger age groups were driven by the non-fatal patterns (figures 4.4 and 4.5) and the remaining age groups by the fatal patterns (figures 5.5 and 5.6).

2.4 Substantial gains in population health since 2003

After adjusting for population increase and ageing, there have been good gains in the health of the Australian population between 2003 and 2011, mostly from reductions in fatal burden but also from some reduction in non-fatal burden.

The total (unadjusted) number of DALY increased by 6.9% between 2003 and 2011, from 4.2 to 4.5 million. However, after accounting for population increase and ageing, the burden of disease for the Australian population decreased by 10%, from 210.5 to 189.9 DALY per 1,000 people. Most of this improvement came from decreases in the rate of fatal burden (15%), by preventing or delaying deaths from particular diseases or injuries. There was also a smaller (3.8%) improvement in the non-fatal burden (Chapter 7). This suggests that, overall, the impact from gains in life expectancy for the population is not outweighed by more ill health.

There were some differences by disease group. After adjusting for population changes, the main patterns were:

1. **decrease in overall burden due to decreases in both fatal and non-fatal burden:** included cardiovascular diseases, respiratory diseases, musculoskeletal conditions, infections and blood & metabolic disorders
2. **decrease in overall burden due to decrease in the fatal burden but with small increase in the non-fatal burden:** included cancer, injuries, gastrointestinal disorders and infant & congenital conditions
3. **increase in overall burden where decreases in the fatal burden were outweighed by larger increases in the non-fatal burden:** included kidney & urinary diseases and endocrine disorders
4. **increase in overall burden due to increases in fatal and non-fatal burden:** was the case for neurological conditions.

There was little change in overall burden from 2003 to 2011 between the ages of 1 and 50. The main reductions in disease burden occurred in the 55–89-year age group, driven by reductions in fatal burden. There was an increase in burden in age groups over 90 due to increases in non-fatal burden (figures 7.1 to 7.3).

2.5 Small reduction in impact of people living with disease

There was a small reduction in the impact of people living with disease between 2003 and 2011, suggesting that success in reducing premature deaths has not resulted in more health loss due to illness.

The 3.8% reduction in non-fatal burden, after accounting for population increases and ageing, indicates that the substantial successes in preventing or delaying deaths between 2003 and 2011 has not increased the impact of ill health in the population; rather, it has decreased it slightly (see Chapter 7).

While there has been a general decrease in non-fatal burden, there have been increases for particular disease groups: notably, from injuries, cancer, neurological conditions, kidney & urinary diseases (mostly chronic kidney disease) and endocrine disorders (mostly diabetes). Non-fatal burden for these disease groups was higher than would have been expected, given the population changes over this time period. This is due to increasing underlying disease prevalence and/or severity of these conditions.

2.6 Large proportion of burden is preventable

At least 31% of the burden of disease is preventable, being due to the modifiable risk factors included in this study. The risk factors causing the most burden were tobacco use, high body mass, alcohol use, physical inactivity and high blood pressure.

About one-third (31%) of the total burden of disease was attributed to the modifiable risk factors that were able to be measured in this study. This indicates that, with further decreases in the exposure to these risk factors, a large proportion of the burden experienced by the population could be reduced.

The five risk factors causing the most burden were tobacco use, high body mass, alcohol use, physical inactivity and high blood pressure (Table 6.1). Alcohol caused the largest amount of burden to age 44, then tobacco to age 84. High blood pressure caused the most burden for females aged over 85 and for males aged over 95 years, with tobacco use remaining important (figures 6.1 and 6.2).

For three of the top five disease groups—namely, cancer, cardiovascular diseases and injuries—a large proportion of the burden was due to the risk factors included in this study (the joint effects were 44%, 69% and 30% respectively) (Table 6.2). For cancer, the largest risk factor was tobacco use (which caused 22% of its burden); for cardiovascular diseases, it was high blood pressure (32%); and for injuries it was alcohol use (21%).

The burden due to the measured risk factors decreased between 2003 and 2011, from 28% to 27% of the total burden. This change was driven by both improved risk factor exposure profiles and reduced burden from the linked diseases. The biggest improvement in the exposure profiles among the top 10 risk factors was for occupational exposure (15% reduction). The largest improvement in attributable DALY amongst the top 10 risk factors was for high cholesterol (29% reduction) (tables 7.6 and 7.7). There were also some risk factors where the situation worsened. Among the top 10 risk factors, high body mass was the factor for which deterioration in exposure profile had the greatest influence (accounting for a 23% increase in its attributable DALY).

2.7 Differences across population groups

The Northern Territory has substantially higher burden than other jurisdictions. Socioeconomic group accounts for 21% of differences in burden across Australia, with remoteness accounting for 4%. The lower socioeconomic groups and the more remote areas have a higher burden.

The patterns across states and territories, remoteness categories and socioeconomic groups were analysed separately.

Overall, there was some variation across states and territories, with the largest disease burden seen in the Northern Territory. This was driven by fatal rather than non-fatal burden and mostly in adulthood—particularly in the oldest age group (Figure 8.1). Similarly, the higher rates of burden for people living in *Remote* and *Very remote* areas of Australia was largely due to fatal rather than non-fatal burden (Figure 8.3).

By comparison, the pattern of successively higher rates of disease burden in the lower socioeconomic groups was driven by variations in both non-fatal and fatal burden (Figure 8.6). The age-adjusted rate for the lowest socioeconomic group was 1.5 times that of the highest group.

One way to compare the relative impact of remoteness and socioeconomic group is to consider *excess burden*. This is the reduction that would occur in overall disease burden if all groups had the same rate of burden as the least burdened group (in this case, the *Major cities* remoteness category and the highest socioeconomic group). Using this method, the excess from the gradients described account for 21% of the disease burden across the five socioeconomic groups and 4% across the five remoteness categories (tables 8.4 and 8.8).

Cardiovascular diseases and injuries are key disease groups behind the higher burden in the Northern Territory (Figure 8.2). These disease groups were also important in terms of the differences across remoteness areas and socioeconomic groups.

In relative terms (using rate ratios), the disease groups with the largest differentials for both remoteness and socioeconomic groups were endocrine disorders and injuries. The differential for mental & substance use disorders was also notable across socioeconomic groups, while the differential for kidney & urinary diseases was notable across remoteness groups.

In absolute terms, the largest differences in age-standardised rates (ASR) for remoteness were cardiovascular diseases and injuries (Table 8.6). The most notable differences for socioeconomic group were mental & substance use disorders followed by cardiovascular diseases and cancer (Table 8.10).

Looking at specific diseases, coronary heart disease ranked first for all states and territories. Suicide & self-inflicted injuries, which was much higher in the Northern Territory than in other jurisdictions, was similarly very high in the ranking for the *Remote* and *Very remote* areas—this may account, in part, for the ranking in the Northern Territory. Burden from vehicle occupants in road traffic incidents was also ranked high in *Remote* and *Very remote* areas (and in the Northern Territory) accounting for 3.2% and 3.1% of the burden, respectively (figures 8.2 and 8.5). Diabetes and chronic kidney disease were also ranked noticeably higher in *Very remote* areas than in other regions. Analysis of data at the state/territory level by remoteness (which was outside the scope of this study) would be useful to separate the jurisdiction and remoteness effects described here.

Substantial gradients across all five socioeconomic groups were particularly noticeable for coronary heart disease, COPD and lung cancer (Figure 8.8). These were also listed in the top five diseases for the lowest three socioeconomic groups, suggesting that improvements in these diseases, in particular, would substantially improve the health gap between the lowest and highest socioeconomic groups.

Importantly, analysis at the level of state/territory, remoteness and socioeconomic group highlights how leading causes for a particular population may be masked in the national data. For example, diabetes—which ranked as a leading cause of burden for *Outer regional*, *Remote* and *Very remote* areas; for people in the lowest socioeconomic quintile; and in Tasmania and the Northern Territory—did not rank in the 10 leading causes of burden.

3 Total burden of disease

Key results

- In 2011, there were 201 years of life lost due to premature death or living with disease or injury for every 1,000 people in Australia, equivalent to 4.5 million DALY.
- Close to half the burden was due to dying early and half due to living with diseases or injuries.
- Males experienced a greater share of the disease burden (54%) than females (46%).
- Cancer, cardiovascular diseases, mental & substance use disorders, musculoskeletal conditions, and injuries were the disease groups that caused the most total burden in 2011.
- Mental & substance use disorders and injuries were the main causes of burden in younger people, with cancer becoming the main burden for people aged between 50 and 79. Cardiovascular disease was the major cause of burden in older Australians.
- At the disease level, coronary heart disease, lung cancer, other musculoskeletal conditions, back pain & problems, COPD and lung cancer caused the most burden.

Burden of disease (expressed as DALY) is a measure of the health impact of disease on a population in a given year—both from dying from, and living with, disease and injuries. As well as providing an overall measure, burden of disease estimates show how different diseases have an impact on the health of the population. Details on the calculation of DALY and on interpreting the results presented in this chapter can be found at appendixes A and C.

3.1 Total burden experienced in 2011

In 2011, Australians lost 4.5 million DALY due to premature death or living with disease or injury, which equates to around 201 DALY for every 1,000 people. This burden was split almost equally between 2.3 million YLL due to premature death and 2.2 million healthy years lost due to YLD (50.5% fatal, 49.5% non-fatal burden), which affected people differently across the life course (Figure 3.1).

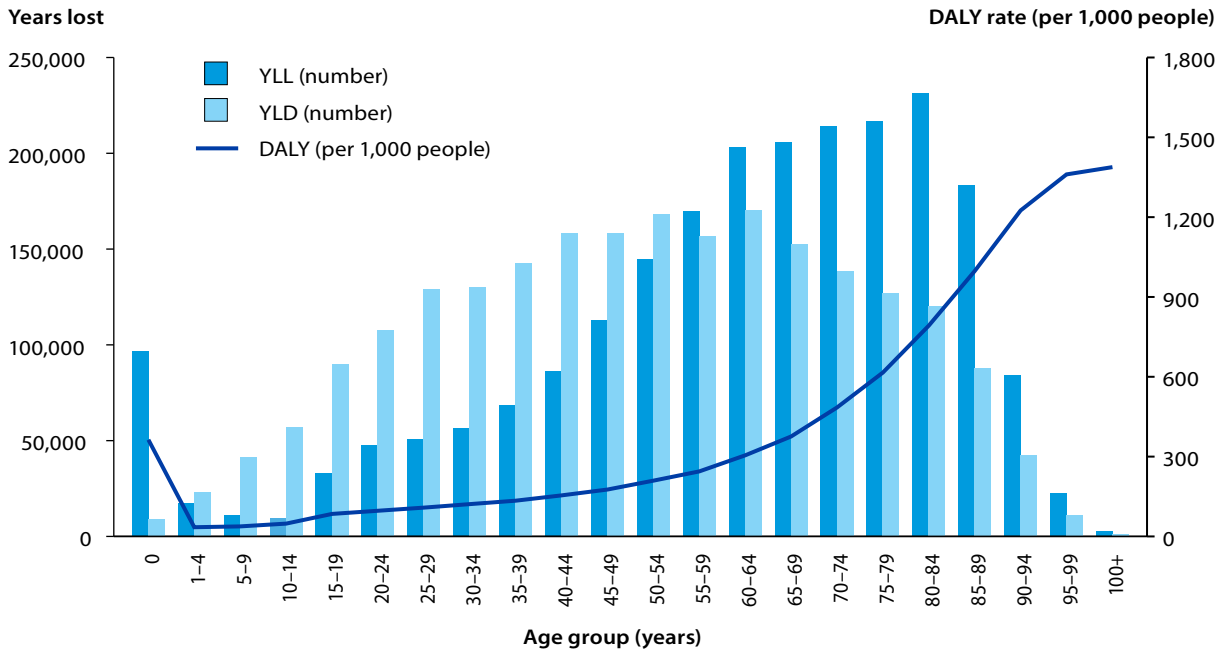


Figure 3.1: Fatal and non-fatal composition of the total burden, by age, 2011

Males experienced 331,000 more DALY than females overall, accounting for 54% of the total burden (compared with 46% for females). More burden was experienced by males than females across all age groups, as reflected in the higher DALY rates (Figure 3.2).

Higher DALY counts in females aged 85 and over were driven by both higher YLD and YLL counts in this group. The drop in rates for males aged 95 and over were driven by the drop in fatal burden in this group. The reasons for these differences are explored further in chapters 4 and 5.

3.2 Which disease groups cause the most burden?

Cancer (19% of total DALY), cardiovascular diseases (15%), mental & substance use disorders (12%), musculoskeletal conditions (12%) and injuries (9%) were the leading causes of total burden in Australia in 2011. Together, they accounted for around two-thirds of the disease burden (69% for males, 62% for females) (Figure 3.3; Table 3.1). For a full list of diseases within each disease group, see Appendix Table A1.

After cancer, the ranking of disease groups differed for males and females. For males, cardiovascular diseases ranked second, followed by mental & substance use disorders and injuries, then musculoskeletal conditions. For females, musculoskeletal conditions ranked second, followed by cardiovascular diseases, then mental & substance use disorders. Notably, injuries were responsible for a higher proportion of the burden in males (12%), compared with females (5.3%), whereas females experienced more burden from musculoskeletal conditions (9.6% males; 14% females).

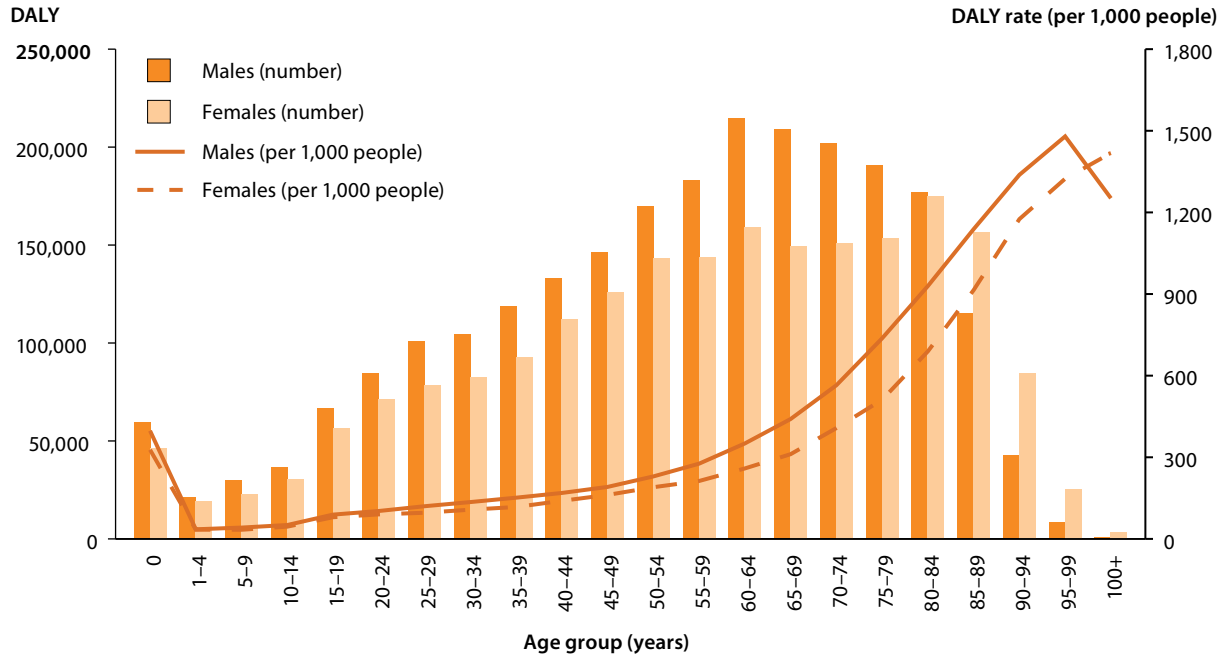


Figure 3.2: Number and rates of DALY, by age and sex, 2011

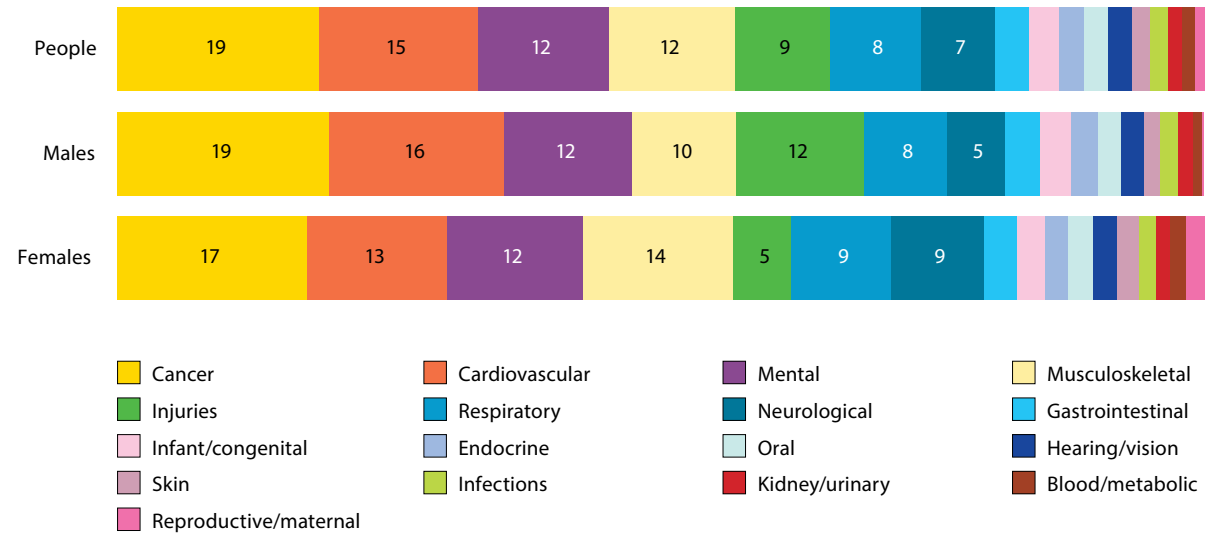


Figure 3.3: Proportion (%) of total burden, by disease groups and sex, 2011

Table 3.1: Total burden, DALY and proportions, by disease group and sex, 2011

	Males		Females		People	
Disease group	**DALY**	**Proportion (%)**	**DALY**	**Proportion (%)**	**DALY**	**Proportion (%)**
Cancer	470,110	19.5	363,140	17.4	833,250	18.5
Cardiovascular	388,306	16.1	268,898	12.9	657,203	14.6
Mental	283,652	11.8	258,902	12.4	542,554	12.1
Musculoskeletal	232,044	9.6	289,242	13.9	521,286	11.6
Injuries	283,228	11.7	111,226	5.3	394,454	8.8
Respiratory	184,297	7.6	190,688	9.2	374,985	8.3
Neurological	128,273	5.3	178,136	8.6	306,409	6.8
Gastrointestinal	78,839	3.3	64,296	3.1	143,136	3.2
Infant/congenital	68,212	2.8	51,739	2.5	119,951	2.7
Endocrine	60,587	2.5	45,510	2.2	106,097	2.4
Oral	50,651	2.1	48,286	2.3	98,936	2.2
Hearing/vision	50,825	2.1	46,229	2.2	97,055	2.2
Skin	36,598	1.5	40,353	1.9	76,951	1.7
Infections	40,026	1.7	33,209	1.6	73,235	1.6
Kidney/urinary	32,199	1.3	27,145	1.3	59,344	1.3
Blood/metabolic	20,693	0.9	29,800	1.4	50,493	1.1
Reproductive/maternal	3,991	0.2	35,097	1.7	39,088	0.9
Total	**2,412,531**	**100.0**	**2,081,896**	**100.0**	**4,494,427**	**100.0**

The contributions of fatal and non-fatal burden for each disease group are shown in Figure 3.4a. Among the five highest burden disease groups, the burden from cancer was predominantly fatal (94%), while the burden from cardiovascular diseases and injuries was more than three-quarters due to fatal burden (80% and 79%, respectively). The burden from mental & substance use disorders and musculoskeletal conditions was predominantly non-fatal (97% each). The small contribution of fatal burden in these latter two groups highlights the importance of including non-fatal health outcomes in population health measurement.

The distribution of overall burden between the sexes varied by disease group (Figure 3.4b). Males experienced almost three-quarters (72%) of the burden from injuries and a greater share of the burden from cardiovascular diseases (59%), endocrine disorders and infant & congenital conditions (57% each) and cancer (56%). Females experienced a greater share of the burden from blood & metabolic disorders (59%), neurological conditions (58%) and musculoskeletal conditions (56%). Reproductive & maternal conditions were characterised by predominantly female-related conditions, which accounted for the high proportion of burden in females.

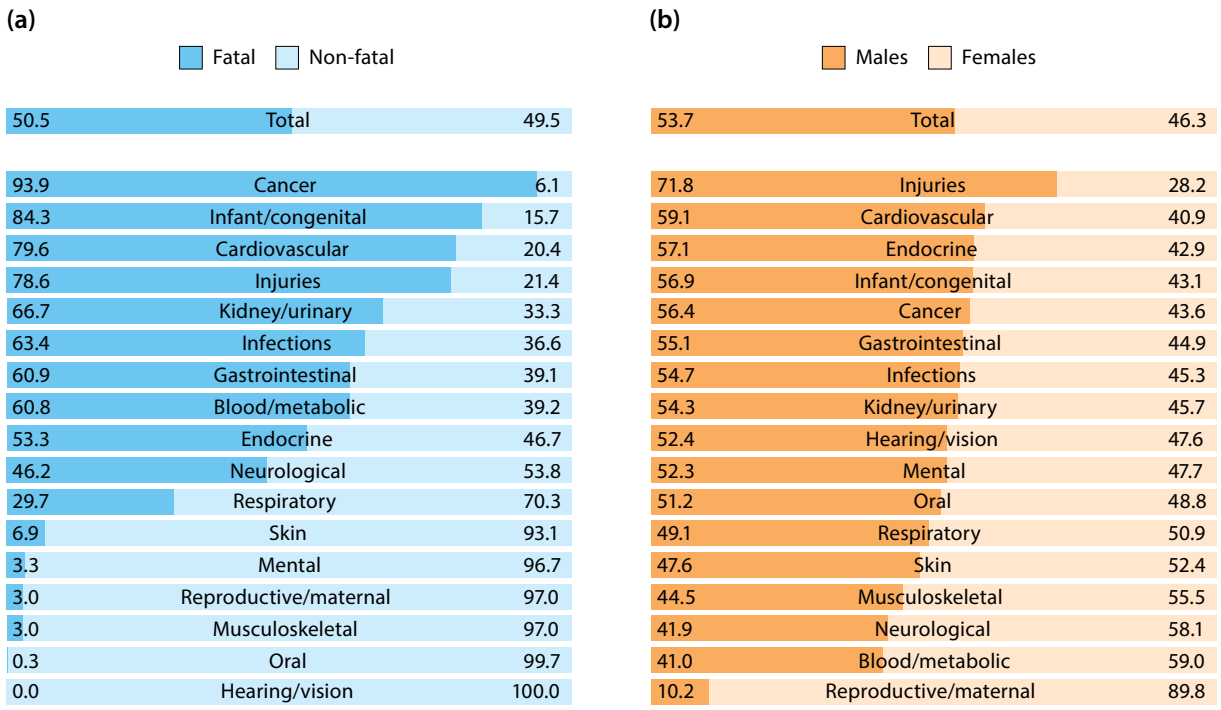


Figure 3.4: Proportion (%) of total burden by fatal versus non-fatal (a) and sex (b), by disease group, 2011

Differences by sex

Rate ratios and rate differences of ASR were compared to evaluate the difference in total burden between males and females (Table 3.2). A rate ratio of 1.0 indicates that the age-adjusted rate for males and females was the same; a rate higher than 1.0, that the burden was higher among males; and a rate lower than 1.0, that the burden was lower among males.

After adjusting for differences in the population age structure, the overall rate ratio of males:females was 1.3. This means that males experienced rates of burden that were 30% higher than those for females overall; however, there were clear differences in burden by disease group (Table 3.2). Males had 2.7 times the burden from injuries, 1.8 times the burden from cardiovascular diseases and 1.4 times the burden from cancer. Due to the high rate of burden for these conditions, this translated into large rate differences. While males also experienced around 1.5 times the burden from kidney & urinary diseases and endocrine disorders compared with females, the relatively low rates of burden from these conditions resulted in small rate differences. Hence, they contributed only modestly to the difference between male and female DALY overall.

Females experienced higher rates of burden than males for blood & metabolic disorders, musculoskeletal conditions, neurological conditions and skin disorders; however, the low DALY rates of blood & metabolic and skin disorders did not result in a large rate difference. In contrast, there was a larger rate difference for musculoskeletal and neurological conditions, and hence a greater impact on overall burden due to its higher rates.

Table 3.2: Comparison of age-standardised DALY rates—males: females, by disease group, 2011

Disease group	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Cancer	40.6	28.8	1.4	11.8
Cardiovascular	34.5	18.9	1.8	15.5
Mental	25.9	23.3	1.1	2.5
Musculoskeletal	20.3	23.8	0.9	–3.4
Injuries	25.4	9.6	2.7	15.9
Respiratory	16.5	15.7	1.0	0.7
Neurological	11.7	13.0	0.9	–1.3
Gastrointestinal	6.9	5.1	1.3	1.8
Infant/congenital	6.0	4.8	1.3	1.3
Endocrine	5.3	3.5	1.5	1.8
Oral	4.5	4.0	1.1	0.5
Hearing/vision	4.5	3.4	1.3	1.1
Skin	3.3	3.5	0.9	–0.2
Infections	3.6	2.6	1.4	1.0
Kidney/urinary	2.9	2.0	1.5	1.0
Blood/metabolic	1.9	2.4	0.8	–0.6
Reproductive/maternal	0.4	3.1	0.1	–2.7
Overall	**214.2**	**167.5**	**1.3**	**46.6**

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate ratio is the relative difference of females compared with males, calculated as the male ASR divided by the female ASR.

(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as male ASR minus the female ASR.

Differences by age

Figure 3.5a shows the number of DALY by disease over the life course, while Figure 3.5b shows the proportion of total DALY for each age range attributed to each disease.

Apart from infancy, where infant & congenital conditions were the predominant cause of burden, total burden was low in children. It then increased with age, peaking at age 60–64, before decreasing rapidly after age 84, reflecting the declining population.

Mental & substance use disorders were the main causes of burden for late childhood, adolescence and adulthood to age 49. Cancer caused the most burden for ages 50–79 while cardiovascular diseases was the major cause of burden in older Australians. Other major causes of burden included injuries for ages 15–44, musculoskeletal conditions for ages 25–74 and neurological conditions in older Australians.

Respiratory diseases affected all age groups, accounting for between 6–10% of total burden between age 15 and 90. Children aged between 1 and 15 had a slightly higher contribution (12–17%), while Australians aged 90 and over experienced only 4–6% of total burden due to respiratory diseases.

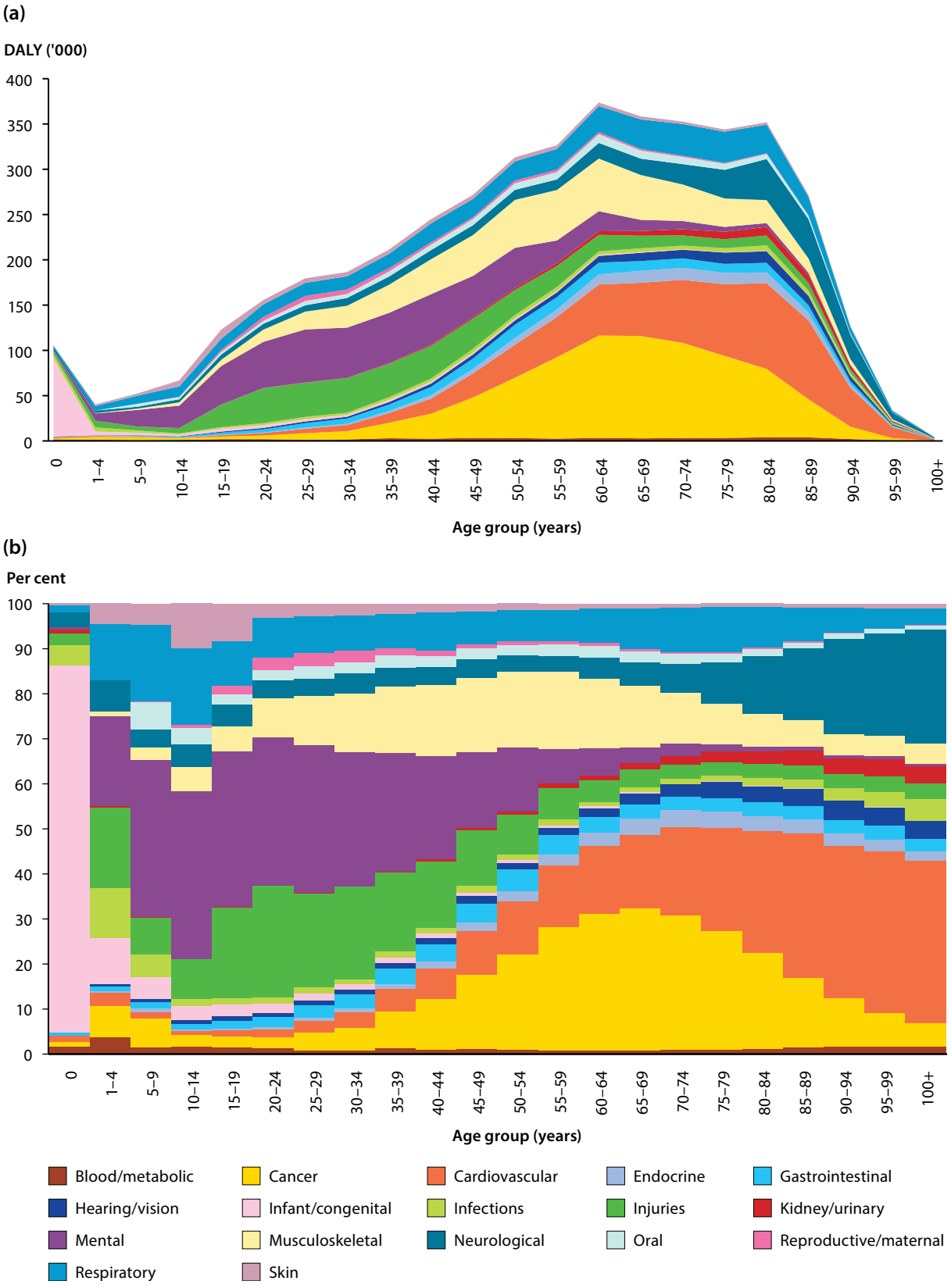


Figure 3.5: Number (a) and relative proportion (b) of total burden (DALY), by disease group and age, 2011

3.3 Which diseases cause the most burden?

The top 20 diseases accounted for 55% of the burden (55% in males and 59% in females). Coronary heart disease, other musculoskeletal conditions, and back pain & problems were ranked in the top five diseases for both sexes; however, the proportion of burden contributed by each was quite different (Table 3.3).

As would be expected, most of the 20 diseases causing the most burden fell within the top five disease groups. However, there were a few exceptions, the most notable being dementia, COPD and diabetes.

3.4 Age and sex patterns

The overall disease burden was not evenly distributed over the different stages of life for either males or females. This was partly due to different diseases that have an impact at different ages, and partly due to the different population structures for males and females. The burden in five broad age groups is described in this section, drawing on results shown in figures 3.6 and 3.7.

Infants and children aged 0–14

Infants and children aged 0–14 comprised 19% of the population, but accounted for only 6% of the total burden in Australia in 2011.

Infant & congenital conditions accounted for a large portion of the burden in those aged under 5; this was mostly due to pre-term/low birthweight complications, birth trauma & asphyxia and other disorders of infancy. From ages 5–14, anxiety disorders and asthma became the main causes of health loss in both males and females.

Adolescents and adults aged 15–44

Adolescents and adults to age 44 made up 42% of the population but accounted for one-quarter (24%) of the burden. The distribution of diseases responsible for this burden was different between the sexes.

Males

From ages 15–44, injuries (suicide & self-inflicted injuries, road traffic injuries–motor vehicle occupants and poisoning) and mental & substance use disorders (drug and alcohol use disorders, depressive disorders and anxiety) were major contributors of burden in males. From ages 25–44, back pain & problems increased to be the second leading cause of burden.

Females

From ages 15–44, anxiety and depressive disorders were the major cause of burden in females. Asthma, back pain & problems, and other musculoskeletal conditions, suicide & self-inflicted injuries, bipolar affective disorders and polycystic ovarian syndrome also affected this age group.

Adults aged 45–64

Adults aged 45–64 made up 25% of the population and 29% of the burden.

Males

From 45–64, coronary heart disease was the leading cause of burden in males, followed by lung cancer, other musculoskeletal conditions and back pain & problems. Together, these four diseases accounted for one-quarter (26%) of the burden in this age group. Suicide & self-inflicted injuries and chronic liver disease were also leading contributors of burden in men in this age group.

Females

Other musculoskeletal conditions was the leading cause of burden in women aged between 45–64. Breast cancer, back pain & problems, anxiety disorders and lung cancer were also major causes of female burden in this age group.

Adults aged 65–84

Adults in this age group made up only 12% of the population, but accounted for the greatest burden (31%).

Males

Chronic diseases such as coronary heart disease, COPD, cancers (lung, bowel and prostate cancer), stroke and diabetes were the major contributors to burden in men aged 65–84. Dementia was also a major cause, from age 75 onwards.

Females

Coronary heart disease was the leading cause of burden for women in this age group. Lung cancer, dementia, COPD, stroke, other musculoskeletal conditions and breast cancer were also major causes of burden.

Older Australians aged 85+

Older Australians made up only 2% of the population in 2011, but accounted for 10% of the burden, with coronary heart disease, dementia and stroke responsible for the majority of this burden. COPD, diabetes, falls, hearing loss, vision loss, chronic kidney disease and prostate cancer (in men) also contributed to the burden in this age group.

Table 3.3: Top 20 causes of total burden (DALY), by sex, 2011

Rank	Males	DALY	% of total	Females	DALY	% of total	People	DALY	% of total
1	Coronary heart disease	226,021	9.4	Coronary heart disease	120,629	5.8	Coronary heart disease	346,651	7.7
2	Lung cancer	94,508	3.9	Other musculoskeletal	96,661	4.6	Other musculoskeletal	183,947	4.1
3	Other musculoskeletal	87,285	3.6	Dementia	95,716	4.6	Back pain & problems	163,788	3.6
4	Suicide & self-inflicted injuries	84,920	3.5	Anxiety disorders	84,922	4.1	COPD	160,346	3.6
5	Back pain & problems	82,143	3.4	Back pain & problems	81,645	3.9	Lung cancer	154,890	3.4
6	COPD	80,951	3.4	COPD	79,395	3.8	Dementia	151,308	3.4
7	Stroke	65,689	2.7	Depressive disorders	73,295	3.5	Anxiety disorders	140,971	3.1
8	Diabetes	59,298	2.5	Stroke	71,081	3.4	Stroke	136,771	3.0
9	Anxiety disorders	56,048	2.3	Breast cancer	70,268	3.4	Depressive disorders	127,659	2.8
10	Dementia	55,593	2.3	Lung cancer	60,382	2.9	Suicide & self-inflicted injuries	113,470	2.5
11	Depressive disorders	54,364	2.3	Asthma	58,200	2.8	Asthma	107,313	2.4
12	Bowel cancer	53,084	2.2	Osteoarthritis	56,961	2.7	Diabetes	101,653	2.3
13	Alcohol use disorders	49,335	2.0	Rheumatoid arthritis	53,260	2.6	Bowel cancer	92,422	2.1
14	Prostate cancer	49,232	2.0	Diabetes	42,356	2.0	Osteoarthritis	85,806	1.9
15	Asthma	49,113	2.0	Upper respiratory conditions	39,703	1.9	Rheumatoid arthritis	83,489	1.9
16	Poisoning	37,461	1.6	Bowel cancer	39,338	1.9	Upper respiratory conditions	75,674	1.7
17	Falls	36,842	1.5	Hearing loss	30,567	1.5	Breast cancer	70,675	1.6
18	Upper respiratory conditions	35,972	1.5	Suicide & self-inflicted injuries	28,550	1.4	Hearing loss	66,506	1.5
19	Hearing loss	35,939	1.5	Falls	22,274	1.1	Alcohol use disorders	66,042	1.5
20	RTI–motor vehicle occupant	34,158	1.4	Chronic kidney disease	21,084	1.0	Falls	59,116	1.3
	Top 20 diseases	**1,327,956**	**55.0**	**Top 20 diseases**	**1,226,286**	**58.9**	**Top 20 diseases**	**2,488,495**	**55.4**
	All other diseases	*1,084,575*	*45.0*	*All other diseases*	*855,610*	*41.1*	*All other diseases*	*2,005,931*	*44.6*
	Total	**2,412,531**	**100.0**	**Total**	**2,081,896**	**100.0**	**Total**	**4,494,427**	**100.0**

Colour legend:

> 5%	4–5%	3–4%	2–3%	0–2%

Figure 3.6: Leading causes of total burden (DALY '000, proportion %) for males, by age group, 2011

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Pre-term/lbw complications (14.8; 18%)	Asthma (8.1; 12%)	Suicide/self-inflicted injuries (16.9; 11%)	Suicide/self-inflicted injuries (40.3; 8.8%)	Coronary heart disease (76.9; 11%)	Coronary heart disease (52.4; 13%)	Coronary heart disease (52.8; 14%)	Coronary heart disease (28.6; 18%)	Coronary heart disease (1.9; 20%)
2nd	Birth trauma/ asphyxia (8.2; 10%)	Anxiety disorders (6.5; 9.9%)	Alcohol use disorders (10.7; 7.1%)	Back pain and problems (27.4; 6.0%)	Lung cancer (37.0; 5.2%)	Lung cancer (30.8; 7.5%)	COPD (25.0; 6.8%)	Dementia (17.5; 11%)	Dementia (1.4; 15%)
3rd	Other disorders of infancy (5.7; 7.1%)	Autism spectrum disorders (4.8; 7.2%)	RTI/motor vehicle occupant (10.1; 6.7%)	Alcohol use disorders (26.1; 5.7%)	Other musculoskeletal (34.8; 4.9%)	COPD (27.4; 6.7%)	Dementia (22.4; 6.1%)	Stroke (11.7; 7.5%)	Stroke (0.7; 7.7%)
4th	SIDS (5.5; 6.9%)	Conduct disorder (4.3; 6.6%)	Depressive disorders (8.0; 5.3%)	Poisoning (24.3; 5.3%)	Back pain and problems (33.5; 4.7%)	Diabetes (16.3; 4.0%)	Stroke (21.0; 5.7%)	COPD (8.8; 5.6%)	Prostate cancer (0.4; 3.9%)
5th	Other congenital conditions (5.1; 6.4%)	Depressive disorders (3.9; 5.9%)	Asthma (7.2; 4.8%)	Depressive disorders (24.1; 5.3%)	Suicide/self-inflicted injuries (22.3; 3.1%)	Bowel cancer (16.2; 3.9%)	Lung cancer (19.9; 5.4%)	Prostate cancer (7.1; 4.5%)	COPD (0.3; 3.7%)
6th	Cardiovascular defects (4.6; 5.7%)	Upper respiratory conditions (3.9; 5.9%)	Anxiety disorders (6.8; 4.5%)	Anxiety disorders (21.4; 4.7%)	Chronic liver disease (19.8; 2.8%)	Prostate cancer (15.1; 3.7%)	Prostate cancer (17.4; 4.7%)	Diabetes (4.6; 2.9%)	Lower respiratory infections (0.3; 3.6%)
7th	Asthma (2.8; 3.5%)	Dental caries (2.8; 4.3%)	Upper respiratory conditions (5.5; 3.6%)	Other musculoskeletal (19.3; 4.2%)	Diabetes (19.5; 2.7%)	Other musculoskeletal (14.7; 3.6%)	Diabetes (13.2; 3.6%)	Lung cancer (4.3; 2.7%)	Chronic kidney disease (0.3; 2.8%)
8th	Brain malformations (1.9; 2.4%)	Epilepsy (2.0; 3.0%)	Other musculoskeletal (4.5; 3.0%)	Drug use disorders (14.5; 3.2%)	Bowel cancer (18.5; 2.6%)	Stroke (13.4; 3.3%)	Bowel cancer (11.4; 3.1%)	Chronic kidney disease (3.6; 2.3%)	Falls (0.3; 2.8%)
9th	Other neurological conditions (1.8; 2.3%)	Attention deficit hyperactivity disorder (1.8; 2.8%)	Acne (4.4; 2.9%)	Asthma (14.2; 3.1%)	COPD (18.2; 2.5%)	Back pain and problems (10.1; 2.5%)	Hearing loss (9.7; 2.6%)	Falls (3.4; 2.2%)	Diabetes (0.2; 2.1%)
10th	Other gastrointestinal infections (1.7; 2.1%)	Acne (1.8; 2.8%)	Back pain and problems (4.3; 2.9%)	Coronary heart disease (13.2; 2.9%)	Anxiety disorders (17.5; 2.5%)	Dementia (9.4; 2.3%)	Other musculoskeletal (9.1; 2.5%)	Hearing loss (3.2; 2.0%)	Non-rheumatic valvular disease (0.2; 2.1%)

Figure 3.7: Leading causes of total burden (DALY '000, proportion %) for females, by age group, 2011

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Birth trauma/ asphyxia (8.6; 13%)	Anxiety disorders (5.7; 11%)	Anxiety disorders (14.0; 11%)	Anxiety disorders (33.8; 9.2%)	Other musculoskeletal (38.8; 6.8%)	Coronary heart disease (20.3; 6.8%)	Coronary heart disease (35.2; 11%)	Dementia (43.1; 18%)	Dementia (6.5; 23%)
2nd	Pre-term/lbw complications (8.6; 13%)	Asthma (5.2; 9.9%)	Depressive disorders (11.1; 8.7%)	Depressive disorders (27.9; 7.6%)	Breast cancer (36.2; 6.3%)	Lung cancer (18.3; 6.1%)	Dementia (30.9; 9.4%)	Coronary heart disease (37.2; 15%)	Coronary heart disease (5.3; 19%)
3rd	Other disorders of infancy (4.8; 7.4%)	Depressive disorders (4.5; 8.4%)	Asthma (7.9; 6.2%)	Back pain and problems (25.8; 7.0%)	Back pain and problems (31.0; 5.4%)	COPD (18.1; 6.0%)	COPD (22.6; 6.9%)	Stroke (22.6; 9.4%)	Stroke (2.8; 9.7%)
4th	SIDS (3.6; 5.5%)	Dental caries (2.7; 5.1%)	Suicide/self-inflicted injuries (6.6; 5.2%)	Other musculoskeletal (19.0; 5.2%)	Anxiety disorders (26.6; 4.6%)	Other musculoskeletal (17.2; 5.7%)	Stroke (21.6; 6.6%)	COPD (10.7; 4.4%)	Lower respiratory infections (0.8; 3.0%)
5th	Cardiovascular defects (3.1; 4.7%)	Upper respiratory conditions (2.7; 5.0%)	Bipolar affective disorder (5.7; 4.5%)	Asthma (16.8; 4.6%)	Lung cancer (25.3; 4.4%)	Breast cancer (13.9; 4.6%)	Lung cancer (11.5; 3.5%)	Diabetes (6.4; 2.6%)	Falls (0.8; 2.8%)
6th	Other congenital conditions (2.9; 4.4%)	Conduct disorder (2.6; 4.9%)	Back pain and problems (5.7; 4.4%)	Upper respiratory conditions (13.9; 3.8%)	Osteoarthritis (24.1; 4.2%)	Osteoarthritis (13.0; 4.3%)	Other musculoskeletal (11.4; 3.5%)	Hearing loss (5.8; 2.4%)	COPD (0.7; 2.5%)
7th	Other neurological conditions (2.7; 4.2%)	Acne (2.5; 4.7%)	Upper respiratory conditions (5.1; 4.0%)	Suicide/self-inflicted injuries (12.1; 3.3%)	Depressive disorders (22.5; 3.9%)	Dementia (10.8; 3.6%)	Diabetes (10.2; 3.1%)	Falls (5.7; 2.4%)	Chronic kidney disease (0.7; 2.4%)
8th	Other mental disorders (2.7; 4.1%)	Epilepsy (1.9; 3.6%)	Polycystic ovarian syndrome (5.1; 4.0%)	Bipolar affective disorder (10.2; 2.8%)	Rheumatoid arthritis (22.5; 3.9%)	Back pain and problems (10.3; 3.4%)	Osteoarthritis (9.7; 2.9%)	Atrial fibrillation (5.5; 2.3%)	Diabetes (0.6; 2.1%)
9th	Other chromosoma abnormalities (2.0; 3.1%)	Dermatitis and eczema (1.7; 3.1%)	RTI/motor vehicle occupant (5.0; 3.9%)	Rheumatoid arthritis (9.0; 2.5%)	COPD (22.0; 3.8%)	Rheumatoid arthritis (9.9; 3.3%)	Hearing loss (9.5; 2.9%)	Chronic kidney disease (4.9; 2.0%)	Hearing loss (0.6; 2.1%)
10th	Other gastrointestinal infections (1.5; 2.3%)	Other musculoskeletal (1.3; 2.4%)	Alcohol use disorders (4.8; 3.8%)	Breast cancer (8.6; 2.4%)	Coronary heart disease (19.5; 3.4%)	Stroke (9.4; 3.1%)	Bowel cancer (9.3; 2.8%)	Other musculoskeletal (4.7; 2.0%)	Vision loss (0.6; 2.0%)

4 Non-fatal burden of disease

Key results

- In 2011, Australians lost 2.2 million years of healthy life due to the impact of living with diseases and injury.
- Overall, there was little difference in this health loss between males and females, though males experienced a slightly higher rate of non-fatal burden from age 60 onwards.
- Rates of non-fatal burden increased with age. In older ages, the rate of non-fatal burden continued to increase but the number of YLD decreased due to small population size.
- Two disease groups accounted for almost half of the non-fatal health loss in Australia in 2011: mental health & substance use disorders (25% males; 22% females) and musculoskeletal conditions (21% males; 25% females).
- Males had around 2.7 times the non-fatal health loss due to injuries than females, twice the health loss due to kidney & urinary diseases and 1.7 times the health loss due to cardiovascular diseases. However, females had greater health loss due to blood & metabolic disorders and neurological conditions.
- The leading causes of non-fatal burden for men were other musculoskeletal conditions, back pain & problems, anxiety disorders, depressive disorders and asthma. For women, the leading causes were other musculoskeletal conditions, anxiety disorders, back pain & problems, depressive disorders and osteoarthritis.

Health is more than avoiding death. As we live longer, the time spent living with effects of disease and injury can also increase. In addition to the impact on quality of life, individuals, households and health systems devote substantial resources to the prevention, cure and treatment of this 'non-fatal' burden.

Expressed as YLD, non-fatal burden is a measure of healthy years lost due to ill health. YLD are calculated from the *point prevalence* (the number of people with the condition on a given day) multiplied by a *disability weight* (which reflects the severity of the disease) (see Box 4.1 for more information). The non-fatal burden is added to the fatal burden to derive the total burden experienced by the population. Further details on the calculation and interpretation of YLD can be found at appendixes A and C.

Box 4.1: Prevalent versus incident YLD: two perspectives for different purposes

Non-fatal estimates in this study are based on *prevalent* cases—that is, the number of people experiencing each disease at a given point in time. The YLD should be interpreted as the total number of years spent in less than full health by the population in the reference year, weighted by severity, which directly measures the YLD experienced by the population in the reference year.

Previous Australian burden of disease studies primarily estimated non-fatal burden based on *incident* cases in the year, which described the number of healthy years lost from the new cases in a given year that will accrue into the future.

As a result, the estimates in this report cannot be compared with incidence-based estimates in previous Australian burden of disease studies.

4.1 Years lived in less than full health in 2011

In 2011, Australians lost 2.2 million years of healthy life due to the impact of living with disease and injury. This was 46,000 less years than the total years of life lost due to dying early, and accounted for approximately half (49.5%) of the total burden.

Differences by sex

There was little overall difference in non-fatal health loss between males and females (Figure 4.1). While females experienced 50,000 more YLD than males, they accounted for only 51% of the total YLD compared with 49% for males.

After adjusting for differences in the age structure of the populations, the ASR ratio of females to males was 1.0, indicating the minor difference in total YLD is due to the different age structures of the populations.

Differences by age

The age pattern of this health loss differed only slightly between the sexes. The total YLD in infants and young children was low, but increased rapidly in absolute terms until early adulthood. Although boys experienced almost 11,100 (25.3%) more YLD than girls aged between 5 and 14, rates for girls were only slightly lower than those for boys.

Between ages 25 and 59, the burden increased only slightly—both in absolute terms and rates. Rates for males and females were very similar in these age groups, with only minor differences.

While the total YLD decreased in absolute terms from age 60 onwards, the rate increased in both sexes, with a sharper increase from age 85, indicating that a substantial amount of health loss was experienced by the elderly population. Males generally had a slightly higher rate of YLD for most age groups. This means that the higher number of YLD experienced in women aged 80 and over was due to the higher number of women still alive in these age groups.

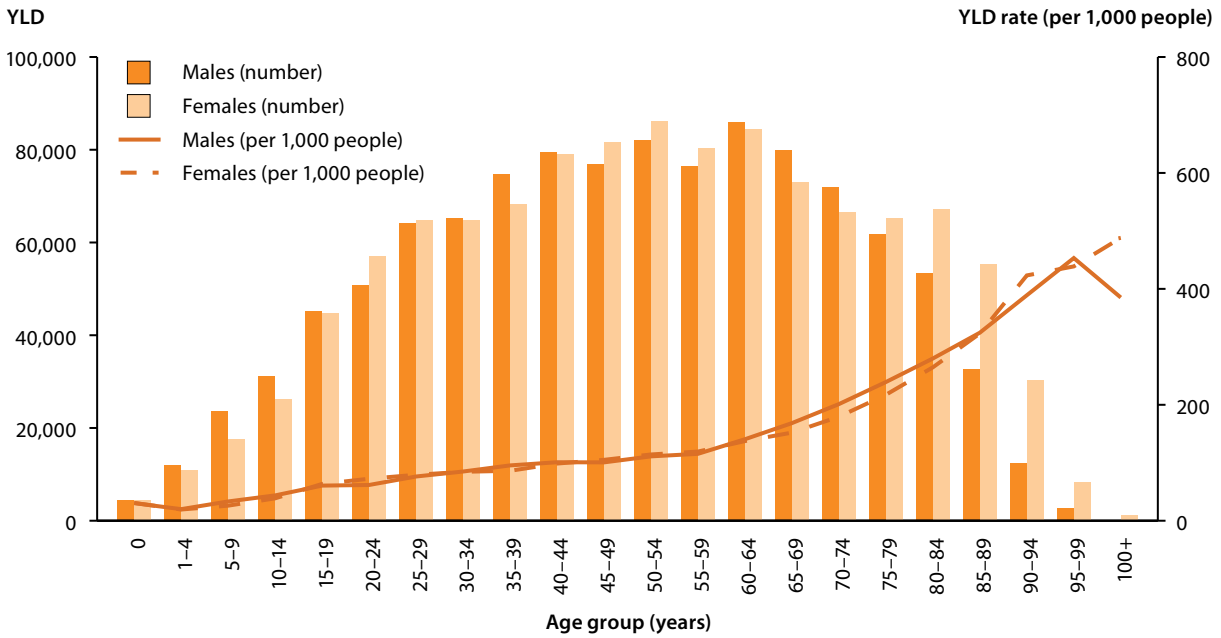


Figure 4.1: Number and rates of YLD, by age and sex, 2011

4.2 Which disease groups cause the most health loss?

Causes of health loss can be examined by disease groups and by specific diseases. This section looks at health loss by broad disease group. See Appendix C for further guidance on interpreting estimates by disease groups, and by individual diseases.

Differences by sex

Five disease groups accounted for more than two-thirds of the non-fatal health loss in 2011: mental health & substance use disorders (25% males; 22% females), musculoskeletal conditions (21% males; 25% females), respiratory diseases (11% males; 12% females), neurological conditions (5.7% males; 9.1% females) and cardiovascular diseases (7.3% males; 4.9% females) (Figure 4.2; Table 4.1).

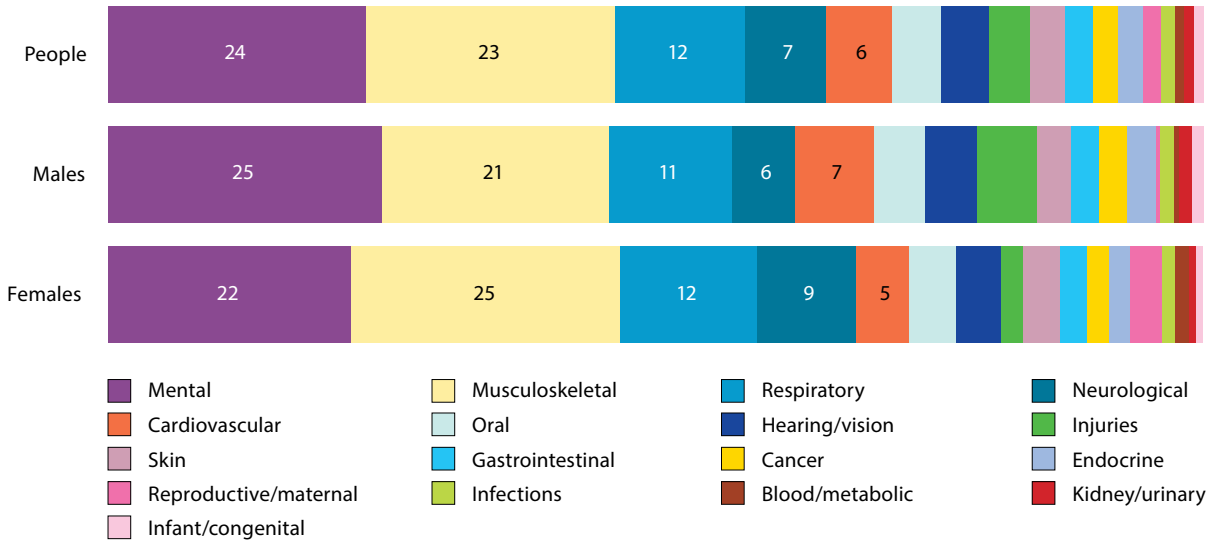


Figure 4.2: Proportion (%) of non-fatal burden, by disease groups and sex, 2011

Table 4.1: Non-fatal burden, YLD and proportions, by sex, 2011

	Males		Females		People	
Disease group	**YLD**	**Proportion (%)**	**YLD**	**Proportion (%)**	**YLD**	**Proportion (%)**
Mental	271,818	25.0	252,883	22.2	524,701	23.6
Musculoskeletal	226,023	20.8	279,651	24.6	505,673	22.7
Respiratory	122,303	11.3	141,300	12.4	263,603	11.9
Neurological	61,573	5.7	103,313	9.1	164,886	7.4
Cardiovascular	78,909	7.3	55,269	4.9	134,179	6.0
Oral	50,472	4.6	48,120	4.2	98,592	4.4
Hearing/vision	50,825	4.7	46,229	4.1	97,055	4.4
Injuries	60,432	5.6	23,828	2.1	84,260	3.8
Skin	34,117	3.1	37,558	3.3	71,675	3.2
Gastrointestinal	26,971	2.5	29,055	2.6	56,026	2.5
Cancer	27,882	2.6	23,019	2.0	50,901	2.3
Endocrine	28,796	2.6	20,802	1.8	49,598	2.2
Reproductive/ maternal	3,891	0.4	34,018	3.0	37,909	1.7
Infections	13,980	1.3	12,837	1.1	26,817	1.2
Blood/metabolic	5,140	0.5	14,649	1.3	19,789	0.9
Kidney/urinary	12,239	1.1	7,533	0.7	19,772	0.9
Infant/congenital	11,674	1.1	7,218	0.6	18,891	0.8
Total	**1,087,045**	**100.0**	**1,137,281**	**100.0**	**2,224,326**	**100.0**

Rate ratios and rate differences of ASRs were compared to evaluate the difference in non-fatal burden between males and females (Table 4.2). Rate ratios greater than 1.0 mean that the burden was greater in males than females.

While there was little difference in total YLD between the sexes, after adjusting for differences in the population age structure, there were clear differences in non-fatal health loss by disease group between males and females. Males had around 2.7 times the health loss due to injuries than females, 2.0 times the health loss due to kidney & urinary diseases and 1.7 times the health loss due to cardiovascular diseases. However, females had greater health loss due to blood & metabolic disorders (rate ratio of 0.4) and neurological conditions (rate ratio of 0.7). Reproductive & maternal conditions included a number of highly gender-specific diseases, which account for the small rate ratio of ASRs (Table 4.2).

Table 4.2: Comparison of age-standardised YLD rates—males: females, by disease group, 2011

	ASR[a]			
Disease group	**Males**	**Females**	**Rate ratio[b]**	**Rate difference[c]**
Mental	24.8	22.9	1.1	1.9
Musculoskeletal	19.8	23.1	0.9	–3.3
Respiratory	10.9	12.0	0.9	–1.1
Neurological	5.6	7.8	0.7	–2.1
Cardiovascular	6.9	4.0	1.7	2.9
Oral	4.5	4.0	1.1	0.5
Hearing/vision	4.5	3.4	1.3	1.1
Injuries	5.3	2.0	2.7	3.4
Skin	3.1	3.3	0.9	–0.3
Gastrointestinal	2.4	2.5	1.0	–0.1
Cancer	2.4	1.8	1.3	0.6
Endocrine	2.5	1.6	1.5	0.8
Reproductive/maternal	0.3	3.0	0.1	–2.6
Infections	1.3	1.1	1.1	0.1
Blood/metabolic	0.5	1.2	0.4	–0.7
Kidney/urinary	1.1	0.6	2.0	0.5
Infant/congenital	1.1	0.7	1.6	0.4
Overall	**97.0**	**94.9**	**1.0**	**2.1**

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
(b) Rate ratio is the relative difference of females compared with males, calculated as male ASR divided by the female ASR.
(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with that for females, calculated as male ASR minus the female ASR.

Differences by age

The main cause of non-fatal burden varied across the life course (Figure 4.3). In infants, infant & congenital conditions, infections and neurological conditions were responsible for over three-quarters (77%) of this health loss in 2011.

From ages 1 to 49, non-fatal health loss was dominated by mental & substance use disorders, which accounted for between one-quarter to one-half (28–47%) of the health loss in these age groups.

The burden of musculoskeletal conditions also gradually increased from childhood onwards. From ages 35–79, musculoskeletal conditions accounted for between 21–35% of the non-fatal health loss, and chronic diseases such as cancer and cardiovascular diseases also began to emerge. By age 75, cardiovascular diseases, neurological conditions, hearing & vision disorders, and musculoskeletal conditions together became the greatest cause of this health loss.

The proportion of non-fatal health loss from respiratory diseases remained between 4–13% across all ages, except in children aged 1–14 where it accounted for 19–21%.

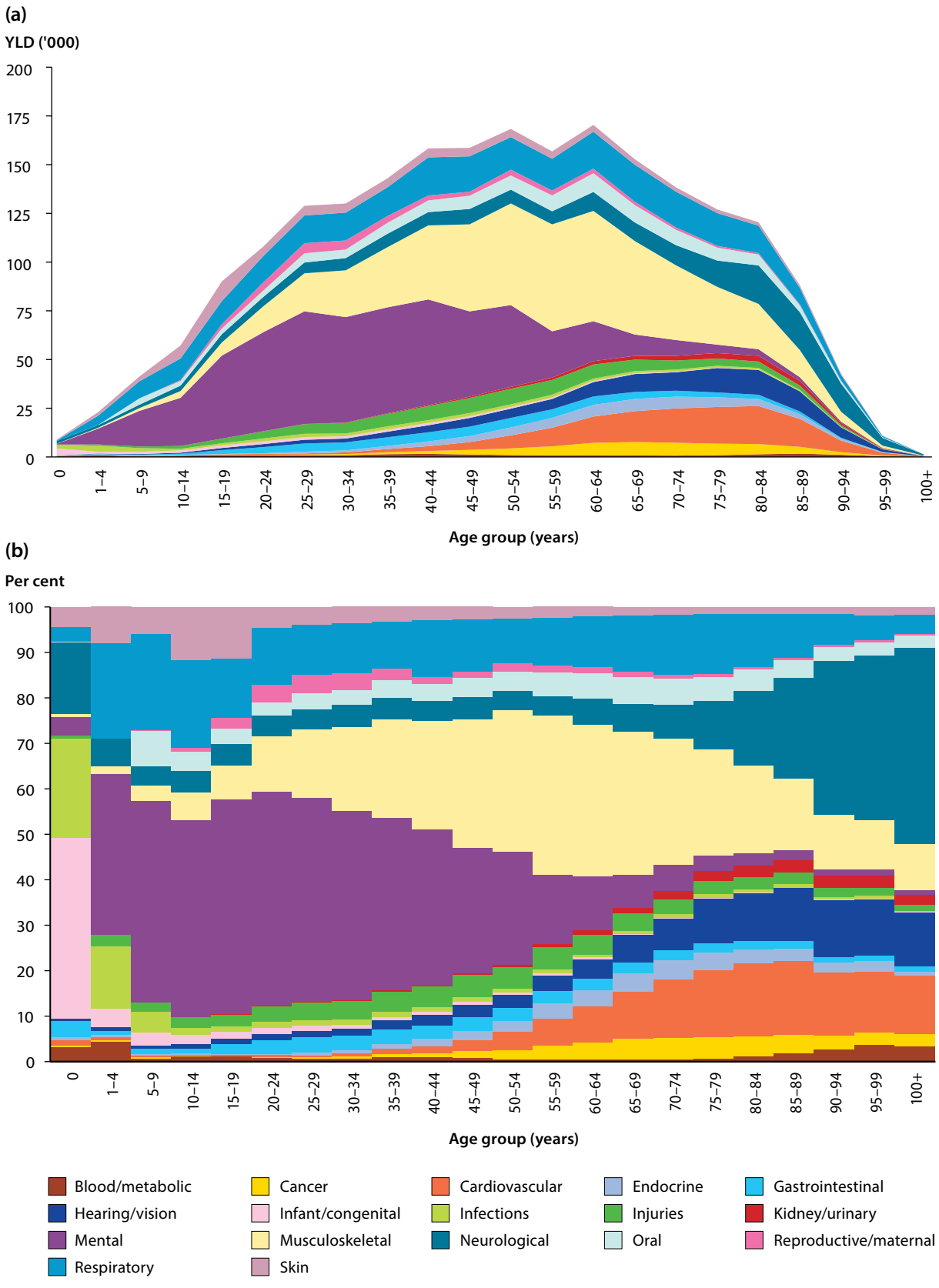


Figure 4.3: Number (a) and relative proportion (b) of non-fatal burden (YLD), by disease group and age, 2011

4.3 Which diseases cause the most health loss?

The leading 20 diseases in terms of non-fatal burden are presented in Table 4.3. Together, these accounted for 70% of the non-fatal burden (70% in males; 73% in females). The list was predominantly characterised by chronic diseases. Other musculoskeletal conditions, anxiety disorders, back pain & problems and depressive disorders were leading causes of health loss in both males and females. Asthma rounded out the highest ranking five diseases in men, while, in women, osteoarthritis completed the top five. See Chapter 9 for more information on conditions included in other musculoskeletal conditions.

While the ranking is of interest, it is also important to note the spread of health loss. YLD for anxiety were much higher in women than in men for anxiety and attracted greater health loss than the highest ranking disease in men (other musculoskeletal conditions).

One of the major differences between males and females was the high level of non-fatal health loss for alcohol use disorders in males, which was ranked seventh in males, but outside the leading 20 causes in females. Falls, schizophrenia and drug use disorders also ranked within the leading 20 causes in males, whereas bipolar affective disorder, migraine and eating disorders ranked in the top 20 in females.

Table 4.3: Top 20 causes of non-fatal burden (YLD) by sex, 2011

Rank	Males	YLD	% of total	Females	YLD	% of total	People	YLD	% of total
1	Other musculoskeletal	83,023	7.6	Other musculoskeletal	90,083	7.9	Other musculoskeletal	173,106	7.8
2	Back pain & problems	81,510	7.5	Anxiety disorders	84,919	7.5	Back pain & problems	162,393	7.3
3	Anxiety disorders	56,017	5.2	Back pain & problems	80,883	7.1	Anxiety disorders	140,936	6.3
4	Depressive disorders	54,121	5.0	Depressive disorders	72,914	6.4	Depressive disorders	127,034	5.7
5	Asthma	46,487	4.3	Osteoarthritis	56,421	5.0	Asthma	100,017	4.5
6	Coronary heart disease	44,343	4.1	Asthma	53,530	4.7	Osteoarthritis	85,088	3.8
7	Alcohol use disorders	43,416	4.0	Rheumatoid arthritis	51,634	4.5	COPD	84,985	3.8
8	COPD	38,086	3.5	COPD	46,899	4.1	Rheumatoid arthritis	81,036	3.6
9	Hearing loss	35,939	3.3	Dementia	46,385	4.1	Upper respiratory conditions	75,151	3.4
10	Upper respiratory conditions	35,704	3.3	Upper respiratory conditions	39,447	3.5	Coronary heart disease	70,946	3.2
11	Rheumatoid arthritis	29,402	2.7	Hearing loss	30,567	2.7	Dementia	70,658	3.2
12	Osteoarthritis	28,667	2.6	Coronary heart disease	26,603	2.3	Hearing loss	66,506	3.0
13	Diabetes	28,183	2.6	Bipolar affective disorder	20,952	1.8	Alcohol use disorders	58,211	2.6
14	Autism spectrum disorders	27,055	2.5	Severe tooth loss	20,424	1.8	Diabetes	47,543	2.1
15	Dementia	24,273	2.2	Migraine	19,445	1.7	Bipolar affective disorder	38,201	1.7
16	Falls	22,783	2.1	Diabetes	19,360	1.7	Dental caries	36,615	1.6
17	Schizophrenia	21,959	2.0	Dental caries	16,647	1.5	Severe tooth loss	35,274	1.6
18	Drug use disorders	20,394	1.9	Epilepsy	16,432	1.4	Falls	34,982	1.6
19	Dental caries	19,968	1.8	Dermatitis & eczema	15,984	1.4	Epilepsy	33,738	1.5
20	Epilepsy	17,306	1.6	Eating disorders	15,846	1.4	Schizophrenia	32,943	1.5
	Top 20 diseases	**758,636**	**69.8**	**Top 20 diseases**	**825,376**	**72.6**	**Top 20 diseases**	**1,555,363**	**69.9**
	All other diseases	*328,409*	*30.2*	*All other diseases*	*311,904*	*27.4*	*All other diseases*	*668,963*	*30.1*
	Total	**1,087,045**	**100.0**	**Total**	**1,137,281**	**100.0**	**Total**	**2,224,326**	**100.0**

Colour legend:

>5%	4–5%	3–4%	2–3%	0–2%

4.4 Age and sex patterns

Health loss due to individual diseases varied across the life course (figures 4.4 and 4.5). In infancy and early childhood, asthma, other gastrointestinal infections, other mental & substance use disorders, dermatitis & eczema and anxiety disorders accounted for almost half the health loss (44% in males and 46% in females). In this age group, other mental & substance use disorders included conditions such as sleep disorders and separation anxiety.

From ages 5–14, anxiety disorders and asthma became the main causes of non-fatal health loss in both males and females. Depressive disorders, conduct disorders, dental caries and acne also caused substantial health loss in both boys and girls.

From ages 15–44, a variety of mental & substance use disorders accounted for a large proportion of the non-fatal health loss. In males, alcohol use disorders, depressive disorders, anxiety disorders and, to a lesser extent, drug use, bipolar affective disorder and schizophrenia became major sources of health loss. In females, it was anxiety and depressive disorders, bipolar affective disorder and (to a lesser extent) alcohol, drug use and eating disorders. Males also experienced non-fatal health loss from back pain & problems, asthma and other musculoskeletal conditions, while females experienced substantial health loss from back pain & problems, other musculoskeletal conditions, asthma and polycystic ovarian syndrome.

Musculoskeletal problems, including back pain, rheumatoid arthritis and osteoarthritis, as well as other musculoskeletal conditions, dominated health loss in both males and females from ages 45–74, along with coronary heart disease, COPD and diabetes in males, and respiratory diseases (COPD, asthma and upper respiratory conditions) in females. By age 65, mental & substance use disorders no longer ranked among the top 10 diseases in either males or females.

In older Australians (age 75 and over) dementia, coronary heart disease, hearing & vision disorders, COPD and musculoskeletal conditions were the predominant sources of health loss in both males and females.

Figure 4.4: Leading causes of non-fatal burden (YLD '000, proportion %) for males, by age group, 2011

Rank	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
	Age group (years)								
1st	Asthma (2.6; 16%)	Asthma (8.0; 15%)	Alcohol use disorders (10.7; 11%)	Back pain and problems (27.3; 9.6%)	Other musculoskeletal (33.6; 10%)	COPD (14.7; 9.7%)	Coronary heart disease (11.3; 9.8%)	Dementia (7.4; 16%)	Dementia (0.8; 26%)
2nd	Other gastrointestinal infections (1.6; 9.8%)	Anxiety disorders (6.5; 12%)	Depressive disorders (8.0; 8.3%)	Alcohol use disorders (24.9; 8.8%)	Back pain and problems (33.4; 10%)	Other musculoskeletal (13.7; 9.0%)	COPD (10.5; 9.1%)	Coronary heart disease (4.4; 9.7%)	Coronary heart disease (0.2; 8.2%)
3rd	Other congenital conditions (1.3; 8.2%)	Autism spectrum disorders (4.8; 8.7%)	Asthma (7.0; 7.3%)	Depressive disorders (24.1; 8.5%)	Anxiety disorders (17.5; 5.5%)	Coronary heart disease (13.2; 8.7%)	Hearing loss (9.7; 8.5%)	Hearing loss (3.2; 7.0%)	Hearing loss (0.2; 6.2%)
4th	Other mental disorders (1.3; 8.0%)	Conduct disorder (4.3; 7.9%)	Anxiety disorders (6.8; 7.1%)	Anxiety disorders (21.4; 7.5%)	Depressive disorders (14.2; 4.4%)	Back pain and problems (10.0; 6.6%)	Dementia (8.5; 7.4%)	COPD (2.9; 6.4%)	Epilepsy (0.2; 6.2%)
5th	Dermatitis and eczema (0.9; 5.7%)	Depressive disorders (3.9; 7.1%)	Upper respiratory conditions (5.5; 5.7%)	Other musculoskeletal (19.0; 6.7%)	Coronary heart disease (14.1; 4.4%)	Hearing loss (8.3; 5.5%)	Other musculoskeletal (8.1; 7.0%)	Other musculoskeletal (2.4; 5.4%)	Vision loss (0.2; 6.0%)
6th	Anxiety disorders (0.7; 4.4%)	Upper respiratory conditions (3.9; 7.1%)	Other musculoskeletal (4.4; 4.6%)	Asthma (13.6; 4.8%)	Rheumatoid arthritis (12.8; 4.0%)	Diabetes (7.5; 4.9%)	Osteoarthritis (4.8; 4.2%)	Vision loss (2.2; 4.8%)	Other musculoskeletal (0.1; 4.0%)
7th	Intellectual disability (0.7; 4.3%)	Dental caries (2.8; 5.2%)	Acne (4.4; 4.6%)	Upper respiratory conditions (12.9; 4.5%)	Osteoarthritis (12.3; 3.8%)	Osteoarthritis (6.7; 4.4%)	Diabetes (4.5; 3.9%)	Osteoarthritis (1.8; 4.0%)	Osteoarthritis (0.1; 3.6%)
8th	Autism spectrum disorders (0.6; 3.5%)	Attention deficit hyperactivity disorder (1.8; 3.4%)	Back pain and problems (4.3; 4.4%)	Drug use disorders (12.5; 4.4%)	Diabetes (11.2; 3.5%)	Rheumatoid arthritis (6.6; 4.3%)	Back pain and problems (4.5; 3.9%)	Atrial fibrillation (1.5; 3.4%)	COPD (0.1; 3.2%)
9th	Other neurological conditions (0.5; 3.2%)	Acne (1.8; 3.3%)	Bipolar affective disorder (4.2; 4.3%)	Schizophrenia (11.8; 4.1%)	Asthma (10.1; 3.1%)	Dementia (5.0; 3.3%)	Atrial fibrillation (4.0; 3.5%)	Diabetes (1.3; 2.8%)	Other kidney and urinary diseases (0.1; 2.6%)
10th	Upper respiratory conditions (0.5; 3.1%)	Epilepsy (1.8; 3.3%)	Drug use disorders (4.1; 4.3%)	Bipolar affective disorder (9.6; 3.4%)	Hearing loss (9.3; 2.9%)	Severe tooth loss (4.7; 3.1%)	Severe tooth loss (3.7; 3.2%)	Stroke (1.2; 2.7%)	Atrial fibrillation (0.1; 2.4%)

Figure 4.5: Leading causes of non-fatal burden (YLD '000, proportion %) for females, by age group, 2011

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Other mental disorders (2.6; 17%)	Anxiety disorders (5.7; 13%)	Anxiety disorders (14.0; 14%)	Anxiety disorders (33.8; 12%)	Other musculoskeletal (37.3; 11%)	Other musculoskeletal (16.0; 11%)	Dementia (13.7; 10%)	Dementia (21.5; 25%)	Dementia (3.2; 34%)
2nd	Other gastrointestinal infections (1.5; 9.9%)	Asthma (5.1; 12%)	Depressive disorders (11.1; 11%)	Depressive disorders (27.9; 10%)	Back pain and problems (30.9; 9.3%)	Osteoarthritis (13.0; 9.3%)	COPD (12.4; 9.3%)	Hearing loss (5.8; 6.8%)	Coronary heart disease (0.7; 6.9%)
3rd	Asthma (1.4; 9.3%)	Depressive disorders (4.5; 10%)	Asthma (7.5; 7.3%)	Back pain and problems (25.8; 9.3%)	Anxiety disorders (26.6; 8.0%)	Back pain and problems (10.2; 7.3%)	Other musculoskeletal (9.8; 7.4%)	COPD (5.8; 6.7%)	Hearing loss (0.6; 6.2%)
4th	Other neurological conditions (1.4; 8.9%)	Dental caries (2.7; 6.2%)	Bipolar affective disorder (5.7; 5.6%)	Other musculoskeletal (18.2; 6.6%)	Osteoarthritis (24.1; 7.2%)	Rheumatoid arthritis (9.3; 6.7%)	Osteoarthritis (9.5; 7.2%)	Coronary heart disease (5.7; 6.7%)	Vision loss (0.6; 5.9%)
5th	Dermatitis and eczema (0.9; 5.8%)	Upper respiratory conditions (2.7; 6.1%)	Back pain and problems (5.7; 5.6%)	Asthma (16.1; 5.8%)	Depressive disorders (22.5; 6.8%)	COPD (8.5; 6.1%)	Hearing loss (9.5; 7.2%)	Osteoarthritis (4.3; 5.0%)	Osteoarthritis (0.4; 4.0%)
6th	Other congenital conditions (0.6; 3.7%)	Conduct disorder (2.6; 6.0%)	Upper respiratory conditions (5.1; 5.0%)	Upper respiratory conditions (13.9; 5.0%)	Rheumatoid arthritis (22.2; 6.7%)	Coronary heart disease (6.1; 4.4%)	Coronary heart disease (8.5; 6.4%)	Vision loss (4.1; 4.8%)	COPD (0.4; 3.9%)
7th	Anxiety disorders (0.6; 3.6%)	Acne (2.5; 5.7%)	Polycystic ovarian syndrome (5.1; 5.0%)	Bipolar affective disorder (10.2; 3.7%)	COPD (14.8; 4.5%)	Severe tooth loss (6.1; 4.4%)	Rheumatoid arthritis (6.3; 4.8%)	Other musculoskeletal (3.5; 4.1%)	Protein-energy deficiency (0.3; 3.1%)
8th	Protein-energy deficiency (0.4; 2.9%)	Epilepsy (1.7; 3.9%)	Alcohol use disorders (4.8; 4.7%)	Rheumatoid arthritis (9.0; 3.2%)	Asthma (14.4; 4.3%)	Hearing loss (5.9; 4.2%)	Back pain and problems (5.7; 4.3%)	Rheumatoid arthritis (2.8; 3.2%)	Epilepsy (0.3; 2.9%)
9th	Epilepsy (0.4; 2.7%)	Dermatitis and eczema (1.7; 3.8%)	Acne (3.9; 3.9%)	Polycystic ovarian syndrome (8.6; 3.1%)	Upper respiratory conditions (11.5; 3.5%)	Dementia (5.7; 4.1%)	Severe tooth loss (5.4; 4.1%)	Severe tooth loss (2.5; 2.9%)	Other musculoskeletal (0.3; 2.7%)
10th	Upper respiratory conditions (0.4; 2.7%)	Other musculoskeletal (1.3; 3.0%)	Eating disorders (3.7; 3.6%)	Eating disorders (8.3; 3.0%)	Genital prolapse (7.4; 2.2%)	Asthma (4.8; 3.4%)	Atrial fibrillation (3.8; 2.9%)	Atrial fibrillation (2.4; 2.9%)	Rheumatoid arthritis (0.2; 2.5%)

5 Fatal burden of disease

Key results

- In 2011, Australians lost 2.3 million years of life due to the 146,712 deaths in that year.
- Males had a 61% higher rate of fatal burden than females. This was due to a greater number of males dying in 2011, and at younger ages than females.
- Two disease groups accounted for the majority of YLL in Australia in 2011: cancers (33% males and 36% females) and cardiovascular diseases (23% in both males and females).
- After adjusting for differences in the population age structure, males had more than twice the rate of fatal burden for injuries and mental & substance use disorders than females, and almost twice the rate for cardiovascular diseases and gastrointestinal disorders.
- Five diseases resulted in more than one-third of YLL: coronary heart disease, lung cancer, stroke, suicide & self-inflicted injuries and bowel cancer.

Measures of mortality are of fundamental importance to policy debate and public health intervention and planning. With ageing of the population, Australians are largely dying at older ages, reflecting the benefits to the population over time of better health and safety, better hygiene and improved medical interventions and technology.

Expressed as YLL, fatal burden is a measure of years lost due to dying prematurely. YLL are calculated by summing, across age groups, the *number of deaths* multiplied by the *life expectancy* at this age according to a *standard life table*. The ABDS 2011 uses the aspirational life table used in the GBD 2010 and 2013 studies (see Murray et al. 2012b). It is different from the actual life table of the population being studied. The estimates should be interpreted as the number of YLL by the population due to deaths occurring in 2011. The fatal burden is added to the non-fatal burden to derive the total burden experienced by the population. Differences in calculating YLL for this study, compared with those for previous studies, are explained in Box 5.1. Further details on the calculation and interpretation of YLL can be found at appendixes A and C.

Box 5.1: Differences from previous studies

YLL estimates in this study are based on a standard life table in which there are no differences in the survival potential between males and females, and no age weighting or discounting applied. Previous Australian burden of disease studies estimated fatal burden using different methods from those for this study, including age weighting (the assignment of weights to reflect social values on life lost at different ages), discounting for time (where lower weight is given to YLL in the future) and a standard life table that had different values by sex. Since that time, burden of disease methodology has evolved such that age weighting and discounting have been omitted from calculating estimates of fatal burden, and revised life tables are used. This means the estimates from this study cannot be compared with estimates from previous Australian burden of disease studies.

The results reported here for 2011 provide an update of the 2010 YLL results (AIHW 2015a). However, comparisons should be made with caution as there have been some modifications to the disease list, although the methods, including for redistribution, remain largely the same.

5.1 Years of life lost in 2011

In 2011, Australians lost 2.3 million years of life due to premature death. This was based on 146,712 deaths in that year. The fatal burden in 2011 comprised 50.5% of the total burden of disease and injury.

Fatal burden is influenced by both the *number of deaths* and the *life expectancy* (remaining years a person of that age could have, on average, expected to live). Figure 5.1 shows the influence of these factors. Deaths occurring at a younger age have a higher YLL due to the longer life expectancy at those ages. Fewer deaths at younger ages can contribute substantially to total YLL while a disproportionately larger number of deaths among older people can give greater weight to YLL.

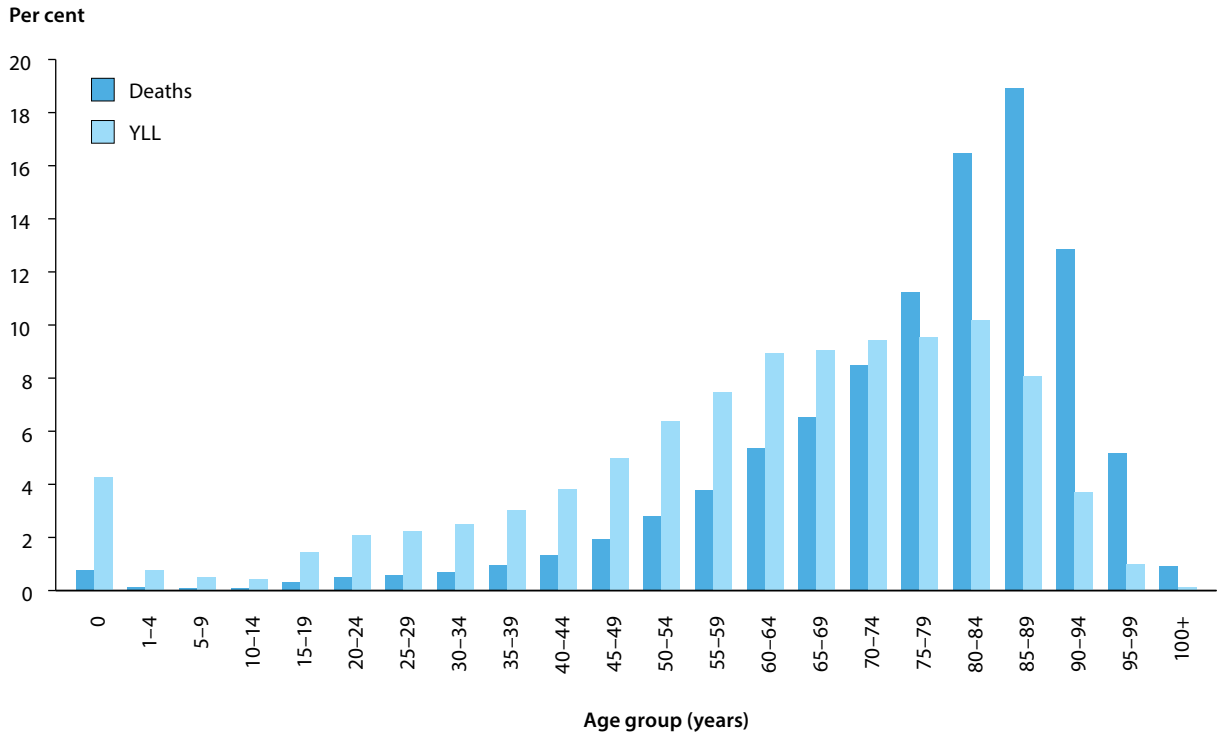


Figure 5.1: Proportion of YLL and deaths, by age, 2011

Differences by sex

Males experienced more of the fatal burden than females (58% compared with 42%). After adjusting for the differences in age structure of the population, the difference was more apparent. It showed that, on average, males experienced 61% higher fatal burden than females (rate ratio of 1.6).

Figure 5.2 shows that, for males, the number of YLL in each age group before the age of 85 was greater than that for females. As the influence of age at death on YLL was constant within each age group, this difference was due to the higher number of deaths in males than females in this age range. Conversely, as seen in the older age groups (over age 85), the YLL for females was higher than it was for males; within each age group, this was again due to the number of deaths.

Age-specific YLL rates were higher for males in all age groups except the highest (age 100 and over). The drop-off in the male rate in this age group was likely due to the relatively small number of deaths and small population in this age group.

Differences by age

Australia has an ageing population and the vast majority of deaths occurred in older ages: 38% of deaths are for people aged 85 or over and 66% for people aged 75 or over. Even though the life expectancy (from the standard life table) was lower in the oldest age groups compared with younger age groups, the high number of deaths means that a considerable proportion of the fatal burden was experienced in these older ages.

Further, given the relative proportion of deaths for those aged under 1 (less than 1% of deaths), infants contributed substantially to total YLL (4%). This age group had a relatively high mortality and deaths at

this age incurred the largest number of YLL. Also note that the proportion of YLL in later working age (ages 45–64) was higher again compared with that for younger adults (30% for males; 25% for females; see Appendix Table D1).

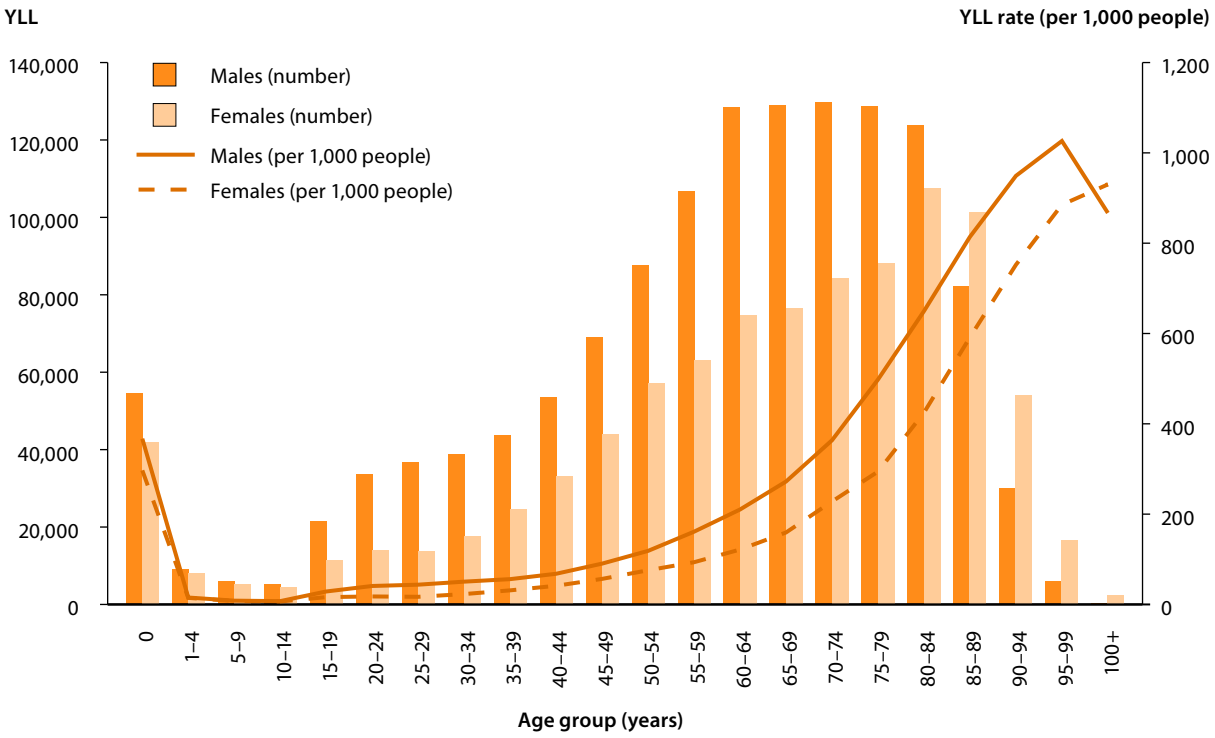


Figure 5.2: Number and rates of YLL, by age and sex, 2011

5.2 Redistribution of deaths

In burden of disease analysis, causes of death are aligned to a list of diseases and injuries. However, some causes of death are not appropriate or valid and do not align to this list. These deaths are reassigned to an appropriate disease or injury (see Box 5.2). In this study, most (90%) of the deaths corresponded directly to the disease and injury list for the ABDS; the remaining 10% were reassigned to other disease or injuries using specific redistribution algorithms. (For information on comparing death estimates in this study with those in other publications, see Appendix C).

The influence of age at death was particularly apparent in the burden by cause of death. For example, causes that typically lead to death in older people contributed a relatively high proportion of YLL. Conversely, deaths among children aged under 14 were relatively few for most causes of death; as such, causes of death typical for this age group contribute relatively less to YLL.

Box 5.2: Further details on redistribution of deaths

Some causes of death do not align directly with the disease and injury list, for example:

- causes of death that are considered as implausible as the underlying cause, such as hypertension and paraplegia
- intermediate causes include deaths that have a precipitating cause, such as septicaemia and pneumonitis
- immediate causes: causes that occur in the final stages of dying, such cardiac arrest and respiratory failure
- causes that are ill-defined or unspecified, such as ill-defined digestive cancer or ill-defined digestive diseases.

In this study, 10% of deaths were identified as belonging to one of these categories. These deaths have been aligned to a (more probable) cause in the disease and injury list. This process is referred to as 'redistribution'. Redistribution algorithms were based on:

- direct evidence, such as data linkage studies
- empirical methods, using patterns from analysis of underlying causes of death and their associated causes
- proportional allocation, using age–sex patterns of selected probable causes.

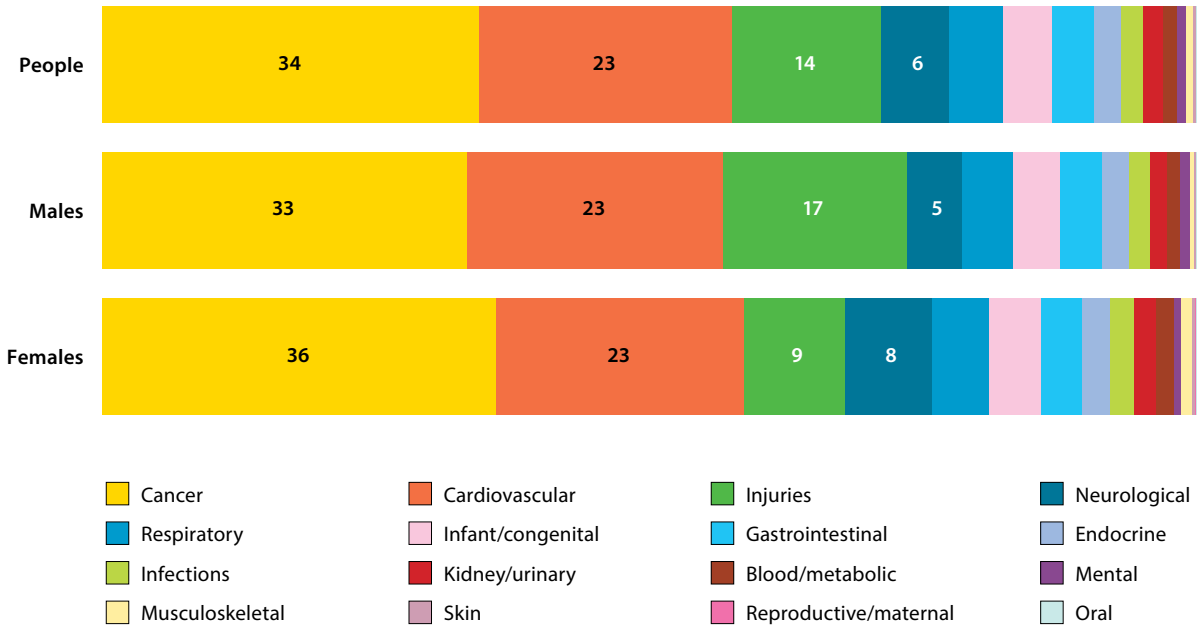
More detail on how deaths were identified for redistribution and the methods used to assign to the cause list is described at Appendix A.

5.3 Which disease groups resulted in the most life lost?

Differences by sex

Two disease groups accounted for the majority of the YLL in Australia in 2011: cancers (33% males; 36% females) and cardiovascular diseases (23% in both males and females) (Figure 5.3). Other disease groups that contributed substantially to the fatal burden included injuries (17% males; 9% females), followed by neurological conditions (5% males; 8% females), respiratory diseases (5% in both males and females) and infant & congenital conditions (4% males; 5% females).

Deaths due to all other diseases contributed 13% of the total fatal burden for males and 14% for females.



Note: Hearing & vision disorders are not included, as this disease group did not incur any YLL.

Figure 5.3: Proportion (%) of fatal burden, by disease groups and sex, 2011

Table 5.1 shows that while there may be fewer deaths from some disease groups, they can contribute proportionally higher YLL. Extreme differences, such as a low number of deaths and high YLL, reflect that the disease typically caused death at younger ages.

Injuries were responsible for 8% of male and 5% of female deaths, but contributed 17% and 9% of YLL, respectively.

Similarly, cancer deaths comprised 27% of all female deaths but 36% of female YLL. Cardiovascular diseases caused 33% of female deaths but contributed relatively fewer YLL, 23%. On average, cancer deaths occurred at younger ages than those from cardiovascular diseases. This pattern was not as readily apparent for cancer in males, where similar proportions of death and YLL were due to cancer (34% and 33%, respectively).

Table 5.1: Number and percentage of YLL and deaths, by sex, 2011

	Males				Females			
Disease group	**Deaths (number)**	**Deaths (%)**	**YLL (number)**	**YLL (%)**	**Deaths (number)**	**Deaths (%)**	**YLL (number)**	**YLL (%)**
Blood/metabolic	830	1.1	15,553	1.2	931	1.3	15,151	1.6
Cancer	25,371	33.7	442,228	33.4	19,385	27.2	340,121	36.0
Cardiovascular	22,277	29.6	309,396	23.3	23,867	33.4	213,628	22.6
Endocrine	2,208	2.9	31,791	2.4	2,211	3.1	24,708	2.6
Gastrointestinal	2,818	3.7	51,869	3.9	2,822	4.0	35,241	3.7
Infant /congenital	763	1.0	56,538	4.3	622	0.9	44,521	4.7
Infections	1,722	2.3	26,046	2.0	1,903	2.7	20,372	2.2
Injuries	6,175	8.2	222,796	16.8	3,490	4.9	87,399	9.3
Kidney	1,775	2.4	19,960	1.5	2,053	2.9	19,612	2.1
Mental	480	0.6	11,834	0.9	348	0.5	6,019	0.6
Musculoskeletal	421	0.6	6,021	0.5	860	1.2	9,591	1.0
Neurological	5,540	7.4	66,700	5.0	8,522	11.9	74,823	7.9
Oral	10	0.0	179	0.0	20	0.0	166	0.0
Reproductive/ maternal	7	0.0	100	0.0	32	0.0	1,079	0.1
Respiratory	4,720	6.3	61,994	4.7	4,023	5.6	49,388	5.2
Skin	208	0.3	2,481	0.2	298	0.4	2,795	0.3
Total	**75,324**	**100.0**	**1,325,486**	**100.0**	**71,388**	**100.0**	**944,615**	**100.0**

Notes

1. The numbers may not add to total for all disease groups due to rounding.
2. Hearing & vision disorders are not included, as this disease group did not incur any YLL.

Comparison of the age-standardised YLL rates by disease group (Table 5.2) shows that males had:

- more than twice the fatal burden of females for injuries (rate ratio of 2.6) and mental illness & substance use disorders (rate ratio of 2.2)
- almost twice the fatal burden of females for cardiovascular diseases (1.8) and gastrointestinal disorders (1.7)
- lower fatal burden than females for musculoskeletal conditions (0.8).

Table 5.2: Comparison of age-standardised YLL rates—males: females, by disease group, 2011

Disease group	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Cancer	38.1	27.0	1.4	11.2
Cardiovascular	27.5	14.9	1.8	12.6
Injuries	20.1	7.6	2.6	12.5
Neurological	6.1	5.2	1.2	0.9
Respiratory	5.5	3.7	1.5	1.8
Infant/congenital	5.0	4.1	1.2	0.9
Gastrointestinal	4.5	2.7	1.7	1.9
Endocrine	2.8	1.8	1.5	1.0
Infections	2.4	1.5	1.6	0.8
Kidney/urinary	1.8	1.4	1.3	0.4
Blood/metabolic	1.4	1.2	1.1	0.2
Mental	1.1	0.5	2.2	0.6
Musculoskeletal	0.5	0.7	0.8	–0.2
Skin	0.2	0.2	1.2	0.0
Reproductive/maternal	0.0	0.1	0.1	–0.1
Oral	0.0	0.0	1.2	0.0
Overall	**117.1**	**72.6**	**1.6**	**44.5**

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate ratio is the relative difference of females compared with males, calculated as the male ASR divided by the female ASR.

(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as the male ASR minus the female ASR.

Note: Hearing & vision disorders are not included, as this disease group did not incur any YLL.

Differences by age

The main disease groups causing fatal burden vary across the life course (Figure 5.4). Not surprisingly, infant & congenital conditions were responsible for 85% of YLL in 2011 in babies aged under 1. Injuries, cancer and infant & congenital conditions were the main causes of fatal burden among children and adolescents aged 1–14. Among young adults (aged 15–24), injuries predominantly caused fatal burden, with cancer second, at a much lower proportion.

Among the younger working age (25–44), fatal burden from injuries was high while the contribution from cancer and cardiovascular diseases became apparent and then increased with increasing age. In the later working age (45–64), chronic diseases, mainly cancer and cardiovascular diseases, became the main contributors to fatal burden.

Among older ages, the impact on YLL from cardiovascular diseases continued to increase; the burden of cancer was still prominent but declined into old age. Importantly, there was a very clear increase with age in the contribution of neurological conditions.

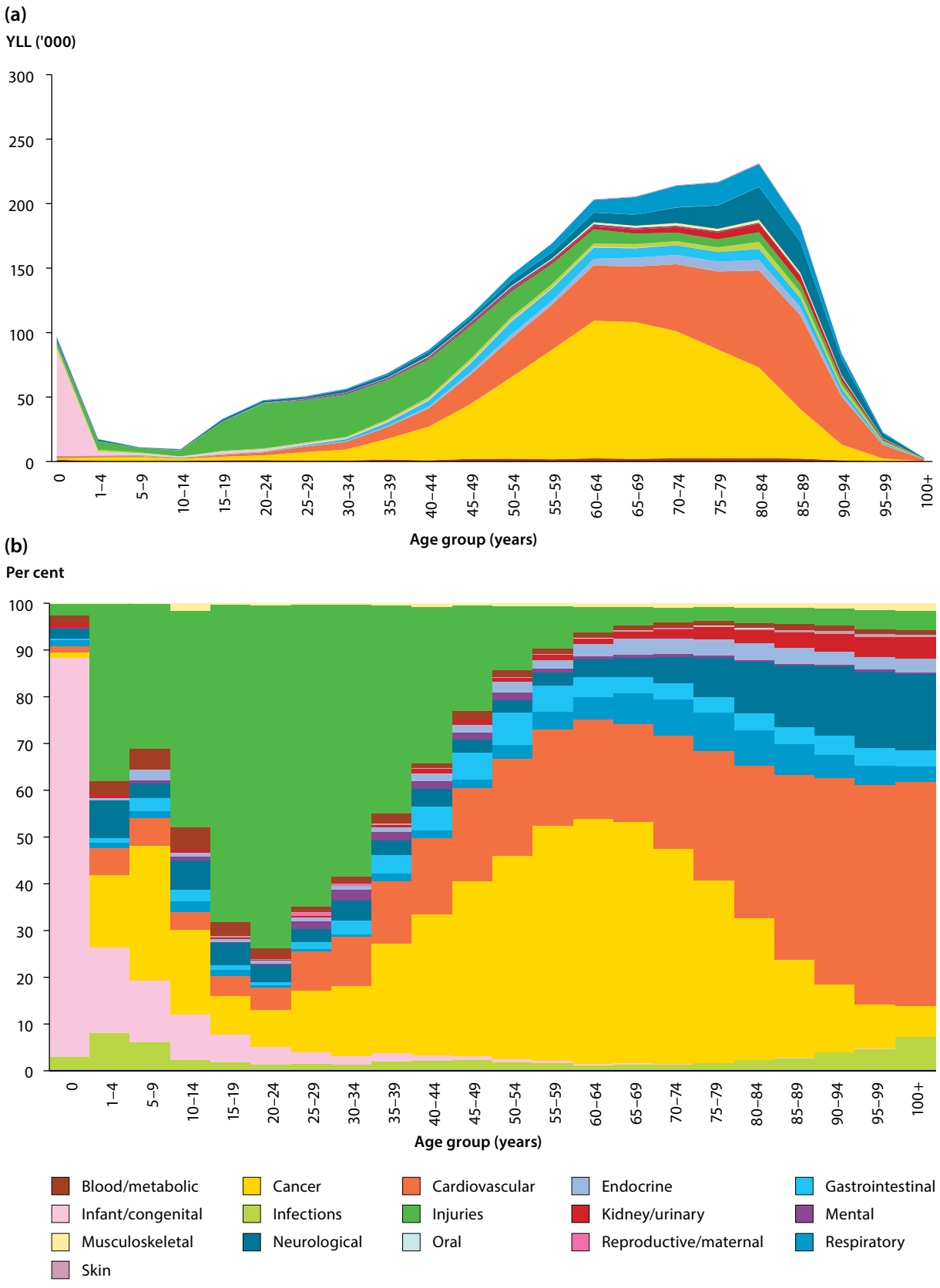


Figure 5.4: Number (a) and relative proportion (b) of fatal burden (YLL), by disease groups and age, 2011

Table 5.3: Top 20 causes of fatal burden (YLL), by sex, 2011

Rank	Males	YLL	% of total	Females	YLL	% of total	People	YLL	% of total
1	Coronary heart disease	181,678	13.7	Coronary heart disease	94,026	10.0	Coronary heart disease	275,704	12.1
2	Lung cancer	92,299	7.0	Stroke	63,347	6.7	Lung cancer	151,205	6.7
3	Suicide & self-inflicted injuries	84,178	6.4	Breast cancer	63,026	6.7	Stroke	119,989	5.3
4	Stroke	56,642	4.3	Lung cancer	58,905	6.2	Suicide & self-inflicted injuries	111,920	4.9
5	Bowel cancer	49,443	3.7	Dementia	49,330	5.2	Bowel cancer	85,824	3.8
6	COPD	42,865	3.2	Bowel cancer	36,381	3.9	Dementia	80,650	3.6
7	Prostate cancer	40,191	3.0	COPD	32,496	3.4	COPD	75,361	3.3
8	Poisoning	36,974	2.8	Suicide & self-inflicted injuries	27,741	2.9	Breast cancer	63,368	2.8
9	Chronic liver disease	31,655	2.4	Diabetes	22,996	2.4	Diabetes	54,110	2.4
10	Dementia	31,320	2.4	Pancreatic cancer	19,544	2.1	Poisoning	50,654	2.2
11	Diabetes	31,114	2.3	Ovarian cancer	18,789	2.0	Chronic liver disease	45,832	2.0
12	RTI – motor vehicle occupants	28,982	2.2	Chronic kidney disease	14,965	1.6	Pancreatic cancer	43,890	1.9
13	Pancreatic cancer	24,347	1.8	Unknown primary	14,921	1.6	RTI–motor vehicle occupants	42,171	1.9
14	Melanoma of the skin	21,732	1.6	Other malignant cancers	14,446	1.5	Prostate cancer	40,191	1.8
15	Liver cancer	21,523	1.6	Chronic liver disease	14,178	1.5	Brain cancers	34,407	1.5
16	Brain cancers	20,740	1.6	Other cardiovascular diseases	13,880	1.5	Unknown primary	34,214	1.5
17	Unknown primary	19,294	1.5	Poisoning	13,680	1.4	Melanoma of the skin	31,647	1.4
18	Oesophageal cancer	18,136	1.4	Brain cancers	13,667	1.4	Chronic kidney disease	30,645	1.3
19	Leukaemia	17,658	1.3	Other blood and metabolic	13,367	1.4	Other cardiovascular diseases	29,954	1.3
20	Other cardiovascular diseases	16,074	1.2	RTI–motor vehicle occupants	13,188	1.4	Leukaemia	29,210	1.3
	Top 20 diseases	**866,846**	**65.4**	**Top 20 diseases**	**612,873**	**64.9**	**Top 20 diseases**	**1,430,946**	**63.0**
	All other diseases	*458,640*	*34.6*	*All other diseases*	*331,742*	*35.1*	*All other diseases*	*839,155*	*37.0*
	Total	**1,325,486**	**100.0**	**Total**	**944,615**	**100.0**	**Total**	**2,270,101**	**100.0**

Colour legend:

> 5%	4–5%	3–4%	2–3%	0–2%

5.4 Which diseases resulted in the most life lost?

Of the 188 specific diseases in the ABDS 2011, five diseases resulted in one-third of life lost: coronary heart disease, lung cancer, stroke, suicide & self-inflicted injuries and bowel cancer. The leading 20 diseases were responsible for nearly two-thirds of the burden for males and females (each 65%) (Table 5.3). The leading causes were largely chronic diseases, except for injuries.

Coronary heart disease was the leading cause of life lost for both males (14%) and females (10.0%). Among males, this was followed by lung cancer (7.0%), suicide & self-inflicted injuries (6.4%) and stroke (4.3%). For females, the subsequent causes were stroke and breast cancer (6.7% each), lung cancer (6.2%) and dementia (5.2%).

Although diabetes ranked higher among females (ninth) than among males (eleventh), males overall had greater fatal burden from diabetes than females (31,100 and 23,000 YLL, respectively).

5.5 Patterns of life lost by age

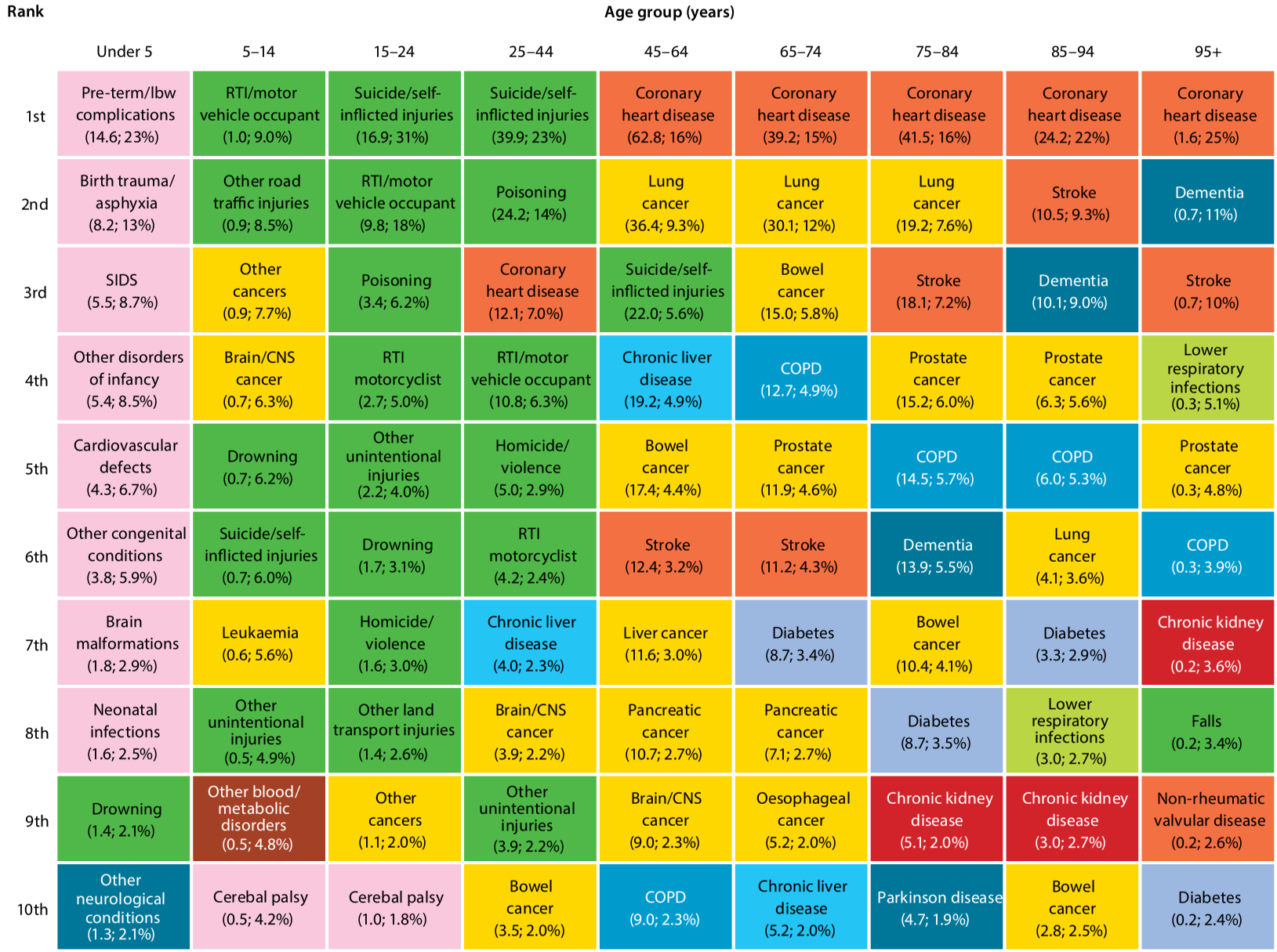
The specific causes of YLL vary across the life course; patterns of leading causes of fatal burden are shown in figures 5.5 (males) and 5.6 (females).

Almost all life lost in infancy and early childhood was due to infant-related diseases, such as birth trauma & asphyxia, pre-term/low birthweight complications, sudden infant death syndrome and other disorders of infancy.

From ages 5–14, the predominant causes of life lost were injuries and cancer. Injuries to motor vehicle occupants from road traffic injuries, other road traffic injuries and other cancers were the main causes of life lost for males. For females, brain cancer and road traffic injuries to motor vehicle occupants were leading causes of life lost in this age group.

From ages 15–44, injuries dominated as the leading cause of life lost for males and (to a lesser extent) females—specifically, suicide & self-inflicted injuries, injuries to motor vehicle occupants from road traffic injuries, poisoning and homicide & violence. Cancers also featured as causes of life lost in these ages, both sexes losing substantial life from brain, bowel and other cancers and (additionally for females) breast cancer and melanoma. In the 25–44 age group, coronary heart disease started to feature as a leading cause of life lost for males and females.

In the remaining age groups, chronic diseases were the major causes of fatal burden, dominated by cancer and cardiovascular related diseases. Lung, bowel, breast and prostate cancers were prominent leading causes of life lost for males and females aged 45–84, with the addition of ovarian and pancreatic cancer for females. Cardiovascular diseases (mainly coronary heart disease and stroke) were leading causes of life lost, from age 45 onwards. Dementia was also a prominent cause after age 75 for males and age 65 for females.



Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Pre-term/lbw complications (14.6; 23%)	RTI/motor vehicle occupant (1.0; 9.0%)	Suicide/self-inflicted injuries (16.9; 31%)	Suicide/self-inflicted injuries (39.9; 23%)	Coronary heart disease (62.8; 16%)	Coronary heart disease (39.2; 15%)	Coronary heart disease (41.5; 16%)	Coronary heart disease (24.2; 22%)	Coronary heart disease (1.6; 25%)
2nd	Birth trauma/ asphyxia (8.2; 13%)	Other road traffic injuries (0.9; 8.5%)	RTI/motor vehicle occupant (9.8; 18%)	Poisoning (24.2; 14%)	Lung cancer (36.4; 9.3%)	Lung cancer (30.1; 12%)	Lung cancer (19.2; 7.6%)	Stroke (10.5; 9.3%)	Dementia (0.7; 11%)
3rd	SIDS (5.5; 8.7%)	Other cancers (0.9; 7.7%)	Poisoning (3.4; 6.2%)	Coronary heart disease (12.1; 7.0%)	Suicide/self-inflicted injuries (22.0; 5.6%)	Bowel cancer (15.0; 5.8%)	Stroke (18.1; 7.2%)	Dementia (10.1; 9.0%)	Stroke (0.7; 10%)
4th	Other disorders of infancy (5.4; 8.5%)	Brain/CNS cancer (0.7; 6.3%)	RTI motorcyclist (2.7; 5.0%)	RTI/motor vehicle occupant (10.8; 6.3%)	Chronic liver disease (19.2; 4.9%)	COPD (12.7; 4.9%)	Prostate cancer (15.2; 6.0%)	Prostate cancer (6.3; 5.6%)	Lower respiratory infections (0.3; 5.1%)
5th	Cardiovascular defects (4.3; 6.7%)	Drowning (0.7; 6.2%)	Other unintentional injuries (2.2; 4.0%)	Homicide/ violence (5.0; 2.9%)	Bowel cancer (17.4; 4.4%)	Prostate cancer (11.9; 4.6%)	COPD (14.5; 5.7%)	COPD (6.0; 5.3%)	Prostate cancer (0.3; 4.8%)
6th	Other congenital conditions (3.8; 5.9%)	Suicide/self-inflicted injuries (0.7; 6.0%)	Drowning (1.7; 3.1%)	RTI motorcyclist (4.2; 2.4%)	Stroke (12.4; 3.2%)	Stroke (11.2; 4.3%)	Dementia (13.9; 5.5%)	Lung cancer (4.1; 3.6%)	COPD (0.3; 3.9%)
7th	Brain malformations (1.8; 2.9%)	Leukaemia (0.6; 5.6%)	Homicide/ violence (1.6; 3.0%)	Chronic liver disease (4.0; 2.3%)	Liver cancer (11.6; 3.0%)	Diabetes (8.7; 3.4%)	Bowel cancer (10.4; 4.1%)	Diabetes (3.3; 2.9%)	Chronic kidney disease (0.2; 3.6%)
8th	Neonatal infections (1.6; 2.5%)	Other unintentional injuries (0.5; 4.9%)	Other land transport injuries (1.4; 2.6%)	Brain/CNS cancer (3.9; 2.2%)	Pancreatic cancer (10.7; 2.7%)	Pancreatic cancer (7.1; 2.7%)	Diabetes (8.7; 3.5%)	Lower respiratory infections (3.0; 2.7%)	Falls (0.2; 3.4%)
9th	Drowning (1.4; 2.1%)	Other blood/ metabolic disorders (0.5; 4.8%)	Other cancers (1.1; 2.0%)	Other unintentional injuries (3.9; 2.2%)	Brain/CNS cancer (9.0; 2.3%)	Oesophageal cancer (5.2; 2.0%)	Chronic kidney disease (5.1; 2.0%)	Chronic kidney disease (3.0; 2.7%)	Non-rheumatic valvular disease (0.2; 2.6%)
10th	Other neurological conditions (1.3; 2.1%)	Cerebal palsy (0.5; 4.2%)	Cerebal palsy (1.0; 1.8%)	Bowel cancer (3.5; 2.0%)	COPD (9.0; 2.3%)	Chronic liver disease (5.2; 2.0%)	Parkinson disease (4.7; 1.9%)	Bowel cancer (2.8; 2.5%)	Diabetes (0.2; 2.4%)

Note: 'Brain/CNS cancer' refers to 'Brain & central nervous system cancers'.

Figure 5.5: Leading causes of fatal burden (YLL '000, proportion %) for males, by age group, 2011

Figure 5.6: Leading causes of fatal burden (YLL '000, proportion %), for females, by age group, 2011

Note: 'Brain/CNS cancer' refers to 'Brain & central nervous system cancers'.

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Birth trauma/ asphyxia (8.6; 17%)	Brain/CNS cancer (0.9; 9.2%)	Suicide/self-inflicted injuries (6.5; 26%)	Suicide/self-inflicted injuries (11.8; 13%)	Breast cancer (32.8; 14%)	Lung cancer (17.8; 11%)	Coronary heart disease (26.7; 14%)	Coronary heart disease (31.5; 20%)	Coronary heart disease (4.7; 24%)
2nd	Pre-term/lbw complications (8.5; 17%)	RTI/motor vehicle occupant (0.7; 7.3%)	RTI/motor vehicle occupant (4.8; 19%)	Breast cancer (7.9; 8.9%)	Lung cancer (24.9; 10%)	Coronary heart disease (14.2; 8.8%)	Stroke (19.2; 9.8%)	Dementia (21.6; 14%)	Dementia (3.3; 17%)
3rd	Other disorders of infancy (4.6; 9.2%)	Fire, burns and scalds (0.6; 6.4%)	Poisoning (1.2; 4.6%)	Poisoning (6.5; 7.3%)	Coronary heart disease (14.3; 6.0%)	Breast cancer (12.3; 7.6%)	Dementia (17.2; 8.8%)	Stroke (20.8; 13%)	Stroke (2.6; 14%)
4th	SIDS (3.6; 7.2%)	Cerebal palsy (0.6; 6.2%)	Other cancers (0.9; 3.5%)	RTI/motor vehicle occupant (3.7; 4.1%)	Bowel cancer (13.3; 5.6%)	COPD (9.6; 6.0%)	Lung cancer (11.1; 5.6%)	COPD (4.9; 3.2%)	Lower respiratory infections (0.8; 4.4%)
5th	Cardiovascular defects (2.8; 5.6%)	Suicide/self-inflicted injuries (0.6; 6.1%)	Epilepsy (0.8; 3.3%)	Chronic liver disease (3.1; 3.4%)	Stroke (9.6; 4.0%)	Stroke (8.1; 5.0%)	COPD (10.3; 5.2%)	Diabetes (4.8; 3.1%)	Falls (0.6; 3.4%)
6th	Other congenital conditions (2.3; 4.6%)	Homicide/ violence (0.5; 5.1%)	Homicide/ violence (0.8; 3.2%)	Bowel cancer (2.6; 2.9%)	Ovarian cancer (8.3; 3.5%)	Bowel cancer (7.9; 4.9%)	Bowel cancer (8.5; 4.3%)	Lower respiratory infections (4.0; 2.6%)	Chronic kidney disease (0.5; 2.9%)
7th	Other chromosomal abnormalities (2.0; 4.0%)	Other cancers (0.5; 5.0%)	Cerebal palsy (0.7; 2.7%)	Homicide/ violence (2.6; 2.9%)	Suicide/self-inflicted injuries (7.4; 3.1%)	Pancreatic cancer (5.8; 3.6%)	Breast cancer (7.0; 3.6%)	Falls (4.0; 2.5%)	Diabetes (0.4; 2.3%)
8th	Other neurological conditions (1.4; 2.7%)	Other unintentional injuries (0.4; 4.4%)	Cystic fibrosis (0.5; 2.2%)	Melanoma (2.4; 2.7%)	COPD (7.1; 3.0%)	Dementia (5.1; 3.2%)	Diabetes (6.6; 3.4%)	Bowel cancer (3.9; 2.5%)	Atrial fibrillation (0.4; 1.9%)
9th	Neural tube defects (1.3; 2.6%)	Cardiovascular defects (0.4; 4.3%)	Other unintentional injuries (0.5; 1.9%)	Coronary heart disease (2.4; 2.7%)	Chronic liver disease (7.1; 3.0%)	Diabetes (4.9; 3.1%)	Pancreatic cancer (4.7; 2.4%)	Chronic kidney disease (3.7; 2.4%)	Non-rheumatic valvular disease (0.4; 1.9%)
10th	Brain malformations (1.2; 2.5%)	Other blood/ metabolic disorders (0.4; 4.2%)	Brain/CNS cancer (0.5; 1.9%)	Stroke (2.4; 2.6%)	Pancreatic cancer (6.5; 2.7%)	Ovarian cancer (4.6; 2.8%)	Chronic kidney disease (4.2; 2.1%)	Non-rheumatic valvular disease (3.4; 2.2%)	COPD (0.3; 1.8%)

6 Contribution of risk factors to burden

Key results

- Risk factors included in this study were responsible for 31% of the total burden of disease and injury in Australia in 2011.
- The risk factors contributing the most burden in 2011 were tobacco use (9.0%), high body mass (5.5%), alcohol use (5.1%), physical inactivity (5.0%) and high blood pressure (4.9%).
- The joint effect of all the risk factors combined contributed greatly to the burden for endocrine disorders (96%), cardiovascular diseases (69%), injuries (30%), kidney & urinary diseases (42%) and cancer (44%).
- Overall, alcohol was the leading contributor to burden for ages 0–44, tobacco for ages 45–94 in men and 45–84 in women and high blood pressure in the older ages.

The contribution of selected risk factors to the burden of disease (referred to as attributable burden) is quantified in this chapter. The attributable burden is the reduction in burden that would have occurred if exposure to the risk factor had been avoided or reduced to the lowest possible exposure.

There are 29 risk factors included in this report (Table 6.1). While it is an extensive list, it does not cover all potential risk factors. The included risk factors:

- are behavioural, metabolic, dietary, environmental and occupational risks
- are modifiable
- have strong evidence of causal association
- can be measured in the Australian population
- are linked to diseases that occur in Australia.

The risk factors included are based on those in the GBD 2010 that were relevant to Australia, with the addition of high sun exposure (Lim et al. 2012). Sub-optimal breastfeeding linked to intestinal infection diseases was not included as it was not common in Australia. Exposure to lead was also excluded because data were not available for the Australian population. Risk factors that were social determinants (such as income, employment and education) could not be included because they are not standard in burden of disease studies and it was not possible to develop an appropriate methodology within the timeframe of this study. However, their importance is clear and it is hoped that they could be included as risk factors in future burden of disease studies. Chapter 8 contains an analysis of the burden of disease by socioeconomic group.

The selection of diseases linked to each risk factor and the method of calculating the attributable disease burden was also largely based on the methods used in the GBD 2010 (Lim, et al. 2012; US Burden of Disease Collaborators 2013). For more details, see Appendix A.

Attributable burden measures the direct relationship between a risk factor and a disease outcome. The method uses the comparative risk assessment approach, which is the standard method for burden of disease studies globally. The proportion of disease burden that can be attributed to a risk factor is called the population attributable fraction (PAF).

Detailed estimates of attributable burden due to individual risk factors are presented in Chapter 10. The risk factors are broadly grouped into categories (behavioural, metabolic, environmental and dietary risks). Estimates for individual risk factors cannot be added together (Box 6.1).

Box 6.1: Why risk factor estimates cannot be added together

For the majority of the analysis in this chapter, the risk factors are analysed independently. It is important to note that it is not possible to add or combine the separate estimates for different risk factors without further analysis, due to complex pathways and interactions between them. For example, if the burden of diabetes attributable to a diet high in sweetened beverages and high body mass was added, more diabetes would be found attributable than is occurring in Australia. This is because these risk factors can be found along the same causal pathway—for example, where high intake of sweetened beverages increases the risk of high body mass, which in turn increases the risk of diabetes.

Further analysis is needed to combine risk factors. In this report, this has been done for all the included risk factors to produce an estimate for 'All risk factors combined'. This is referred to as the 'joint effect' of all risk factors in this study. This study has not calculated joint effects for other combinations of these risk factors (e.g. for all behavioural risk factors).

6.1 All risk factors combined

The joint effect of all the risk factors included in this study was 31% of the total burden of disease and injury in Australia in 2011. This illustrates the potential for health gain through disease and injury prevention by reducing exposure to these risk factors.

6.2 Which risk factors contribute the most burden?

The individual contribution of each risk factor was calculated as the number of attributable DALY for each relevant disease. Table 6.1 shows the proportion of the total burden of disease in Australia in 2011 attributed to each risk factor. The risk factors contributing the most burden were tobacco use (9%), alcohol use (5.1%), high body mass (5.5%), physical inactivity (5.0%) and high blood pressure (4.9%).

Influencing these results was the amount and quality of evidence of a causal relationship between risk factors and disease outcomes. The lists of risk factors and of the multiple conditions to which they are linked changes between successive burden of disease studies as more research evidence becomes available. This study used the most recently available evidence at the time of analysis and was largely based on the methods used in the GBD 2010 (Lim et al. 2012).

Table 6.1: Proportion (%) of total burden attributable to each risk factor, 2011

Risk factor	Per cent of total DALY	Risk factor	Per cent of total DALY
Behavioural		**Dietary risk factors**	
Tobacco use	9.0	Diet low in fruit	2.0
Alcohol use	5.1	Diet low in vegetables	1.4
Physical inactivity	5.0	Diet high in processed meat	1.4
Drug use	1.8	Diet low in nuts and seeds	1.4
Intimate partner violence	0.5	Diet low in whole grains	1.1
Unsafe sex	0.4	Diet low in fibre	1.0
Childhood sexual abuse	0.4	Diet high in saturated fat	0.7
Metabolic risks		Diet low in omega-3 fatty acids	0.3
High body mass	5.5	Diet high in sweetened beverages	0.3
High blood pressure	4.9	Diet high in sodium	0.3
High blood plasma glucose	2.7	Diet low in milk	0.2
High cholesterol	2.4	Diet high in red meat	0.2
Iron deficiency	0.3	Diet low in calcium	0.1
Low bone mineral density	0.1		
Environmental			
Occupational exposures & hazards	1.9		
High sun exposure	0.8		
Air pollution	0.6	**Joint effect**	**31.5**

Exposure to risk factors in the past can influence the proportion of burden attributable in the reference year of the study. For risk factors that are declining, such as tobacco use, burden may continue to exist from past high exposure levels. In the case of tobacco smoking, it has been possible to include past exposure when calculating current attributable burden. This is because evidence of past exposure can be linked to current burden—for example, to take into account the lag time from exposure to outcomes such as cancer. Other risk factors where past exposure contributes to the calculation of attributable burden in this study are occupational risk factors, alcohol use, drug use and unsafe sex. For risk factors that are increasing (for example, high body mass), current exposure may impact future burden.

The amount of burden estimated for linked disease and/or injury also influences the percentage of total burden for each risk factor. For example, risk factors linked to cardiovascular diseases have a high attributable burden, partly because there is a high burden due to these diseases in Australia.

The proportion of burden attributable to each risk factor within each disease group is presented in Table 6.2. Blank cells indicate that the risk factor was not linked to any diseases or injuries in the disease group in this study. When interpreting this table, note that the number of DALY for each disease group differs, so the percentages are not always comparable. Also note that the numbers in the table cannot be added together, as the risk factors are analysed independently (Box 6.1).

Some risk factors had linked diseases and/or injuries across a large number of disease groups. Tobacco use contributed to the burden for five disease groups including 36% of respiratory diseases, 22% of cancers, 12% of cardiovascular diseases and 3.5% of endocrine disorders. High body mass also contributed to a range of disease groups, including 49% of the burden for endocrine disorders, 28% for kidney & urinary diseases, 21% for cardiovascular diseases and 4.5% for cancers (Table 6.2).

All the risk factors combined (the joint effect) contributed greatly to the burden for endocrine disorders (96%), cardiovascular diseases (69%), injuries (30%), kidney & urinary diseases (42%) and cancer (44%) (Table 6.2).

Table 6.2: Proportion (%) of burden attributable to selected risk factors for each disease group, 2011

Risk factor	Cancer	Cardiovascular	Mental	Musculoskeletal	Injuries	Respiratory	Neurological	Gastrointestinal	Endocrine	Infections	Kidney
DALY (number)	833,200	657,200	542,600	521,300	394,500	375,000	306,400	143,100	106,100	73,200	59,300
						Attributable burden (%)					
Tobacco use	22.0	12.0				36.2			3.5	0.5	
Physical inactivity	6.4	21.2							29.7		
High body mass	4.5	21.1		0.2					49.4		27.5
Alcohol use	3.3	4.8	12.2		20.6		1.9	8.2	2.0	2.7	
Diet low in fruit	2.6	10.1									
Occupational exposures & hazards	2.4			5.4	4.8	4.4					
Drug use	1.9		5.9		1.7			17.1		0.6	
Unsafe sex	1.1							3.3		6.6	
Diet low in vegetables	0.5	8.9									
Air pollution	0.1	4.1				0.1				0.0	
Child sex abuse			2.1		1.5						
High blood pressure		31.7									21.5
High blood plasma glucose levels		2.8							95.8		2.9
High cholesterol		16.2									
Intimate partner violence			1.6		3.3						
Joint effect	**43.8**	**69.1**	**20.8**	**5.5**	**30.0**	**39.4**	**1.9**	**22.5**	**95.8**	**10.0**	**41.6**

Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for that disease group. Disease groups are ordered by number of total burden.
2. The percentages in the table cannot be added together by row or column and do not add up to the joint effect row as the risk factors were analysed independently.
3. Blank cells indicate that the risk factor has no associated diseases or injuries in the disease group.

6.3 Age and sex patterns

The health impacts due to risk factors varied by age and sex. Risk factors ranked by their contribution to total burden in each age group are shown for males (Figure 6.1) and females (Figure 6.2). The number of attributable DALY and the proportion of attributable burden to the overall DALY by risk factor, age and sex are also shown.

Overall, alcohol was the leading contributor to burden for ages 0–44, tobacco for ages 45–84 and high blood pressure for ages over 85. Males experienced a higher amount of attributable burden due to the top three ranking risk factors from ages 0–84. After age 85, females experienced a higher attributable burden.

Children and young people aged 0–24

In children and young people (aged 0–24), alcohol and drug use were the leading causes of the total burden in males (8.2% and 2.0%, respectively), and alcohol and iron deficiency in females (3.4% and 1.0%, respectively). In this age group, males experienced nearly three times the burden from alcohol use and nearly three times the burden from drug use, compared with females. Note that many other risk factors were not measured in this age group due to low disease burden of linked diseases at this age.

Adults aged 25–44

In ages 25–44, alcohol remained the leading cause of disease burden in both males and females; however, it caused an increased proportion (nearly four times) of the burden in males compared with females.

Males

In males, drug use (4.7%), occupational exposures & hazards (4.0%), high body mass (3.3%) and tobacco use (2.7%) were also among the leading five causes of disease burden. Metabolic risk factors (high cholesterol, blood glucose and blood pressure), physical inactivity and diet high in processed meat made up the 10 leading risk factors causing burden in males.

Females

Various behavioural risk factors were included in the top 10 causes of burden in females—tobacco use ranked second (2.9%), followed by intimate partner violence (2.7%), high body mass (2.3%); and physical inactivity ranked fifth (2.3%). Iron-deficiency was ranked ninth in females (1.1%).

Adults aged 45–64

For people aged 45–64, tobacco use was the leading cause of disease burden in both males and females (13% males; 9.3% females). Alcohol use remained within the top four causes in both males and females, with an increased proportion in males compared with females (7.0% males; 3.3% females). This age group experienced increased contributing burden from metabolic and dietary risk factors; however, this differed by sex.

Males

In males, high body mass (8.6%), physical inactivity (7.0%) and high blood pressure (6.4%) were among the leading five risk factors. High cholesterol accounted for 4.8% of the burden in this age group, and occupational exposures & hazards remained within the top 10 causes (3.6%).

Females

Similar risk factors made up the top five causes for females as in males; physical inactivity ranked second (6.0%), high body mass ranked third (5.2%) and high blood pressure ranked fifth (2.7%). Remaining risk factors within the top 10 were similar to those for males, with the exception of intimate partner violence. Females experienced smaller proportions of burden from these risk factors compared with males.

Adults aged 65–84

Tobacco use remained the top risk factor in adults aged 65–84, where males experienced a slightly increased proportion compared with females. High blood pressure increased in ranking with increasing age; it was ranked second for both males and females age 75–84 (9.1% males; 8.9% females). The contributing burden from dietary risk factors also increased with advancing age.

Males

High blood glucose replaced alcohol use in the top five causes of burden in males aged 65–84, along with high body mass (8.8% aged 65–74; 6.9% aged 75–84) and physical inactivity (7.4% aged 65–74; 6.6% aged 75–84). Males experienced an increased proportion of burden from most dietary risk factors within the top 10 causes (including diet low in nuts and seeds and diet high in processed meat) compared with females.

Females

Alcohol use no longer remained within the top five causes in females aged 65–84 (2.5% aged 65–74; 3.0% aged 75–84). By comparison high body mass (7.3% in each age group) and physical inactivity (6.5% aged 65–74; 6.6% aged 75–84) still ranked in the top five.

Older Australians aged 85+

In older Australians, tobacco use was replaced as the leading cause of disease burden by high blood pressure in males from age 95, and from age 85 in females. From age 95, the contribution of alcohol use increased slightly in females, while the contribution of physical inactivity, high body mass, high cholesterol and blood glucose decreased compared with ages 85–94.

Figure 6.1: Leading risk factor contribution to total burden (DALY '000, proportion %), for males, by age group, 2011

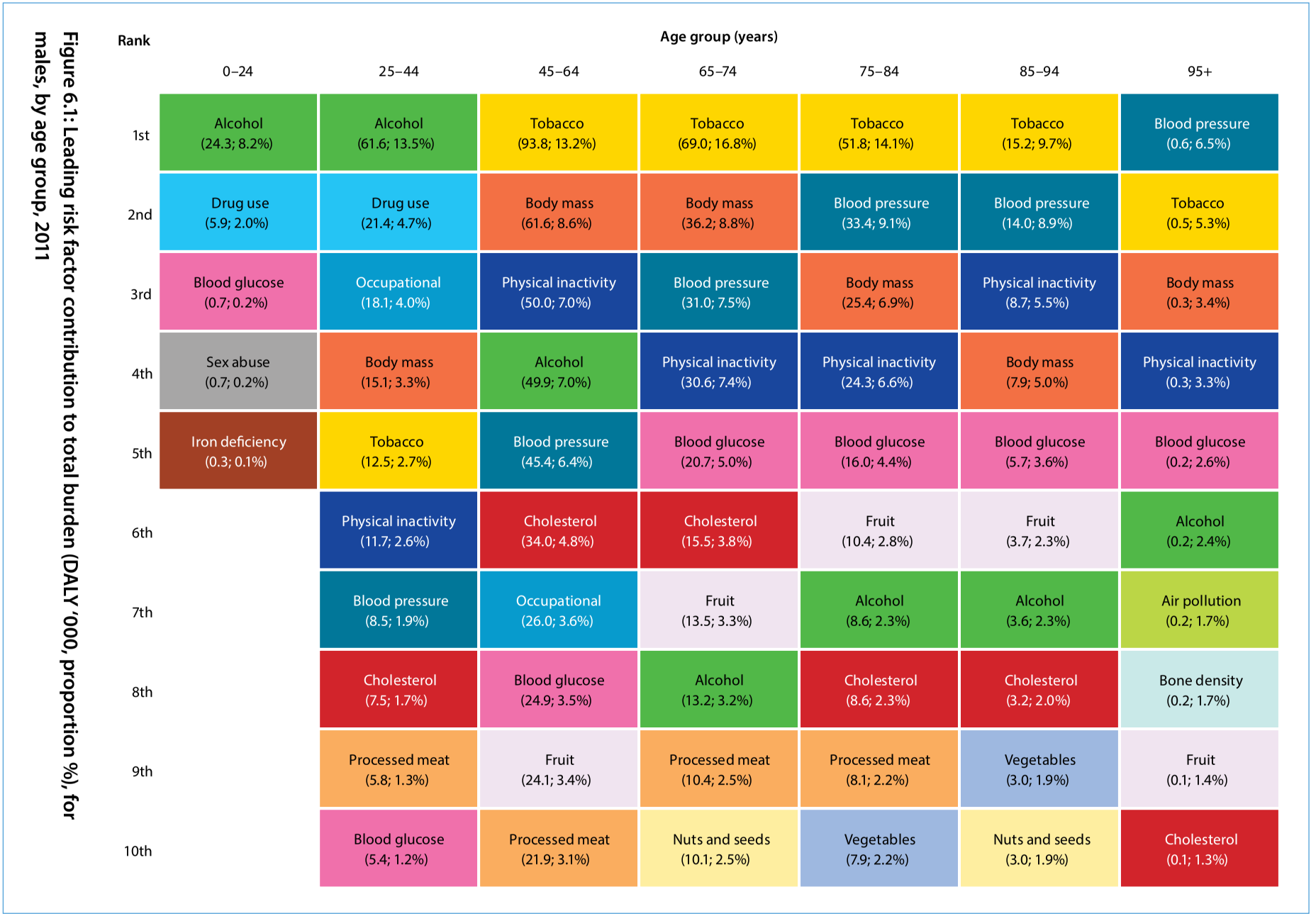


Figure 6.2: Leading risk factor contribution to total burden (DALY '000, proportion %), for females, by age group, 2011

Rank	Age group (years)						
	0–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Alcohol (8.3; 3.4%)	Alcohol (12.7; 3.5%)	Tobacco (53.3; 9.3%)	Tobacco (40.0; 13.3%)	Tobacco (38.0; 11.6%)	Blood pressure (23.4; 9.7%)	Blood pressure (2.1; 7.4%)
2nd	Iron deficiency (2.4; 1.0%)	Tobacco (10.7; 2.9%)	Physical inactivity (34.3; 6.0%)	Body mass (21.9; 7.3%)	Blood pressure (29.3; 8.9%)	Tobacco (16.4; 6.8%)	Body mass (1.2; 4.1%)
3rd	Partner violence (1.8; 0.7%)	Partner violence (10.0; 2.7%)	Body mass (29.8; 5.2%)	Physical inactivity (19.6; 6.5%)	Body mass (23.9; 7.3%)	Body mass (14.1; 5.9%)	Physical inactivity (1.0; 3.6%)
4th	Drug use (1.7; 0.7%)	Body mass (8.4; 2.3%)	Alcohol (18.8; 3.3%)	Blood pressure (16.4; 5.5%)	Physical inactivity (21.6; 6.6%)	Physical inactivity (13.9; 5.8%)	Tobacco (1.0; 3.6%)
5th	Sex abuse (1.5; 0.6%)	Physical inactivity (8.3; 2.3%)	Blood pressure (15.2; 2.7%)	Blood glucose (10.7; 3.6%)	Blood glucose (12.0; 3.7%)	Alcohol (8.0; 3.3%)	Alcohol (1.0; 3.5%)
6th	Blood glucose (0.8; 0.3%)	Occupational (8.1; 2.2%)	Blood glucose (12.7; 2.2%)	Cholesterol (7.5; 2.5%)	Alcohol (9.9; 3.0%)	Blood glucose (7.7; 3.2%)	Blood glucose (0.7; 2.5%)
7th	Unsafe sex (0.2; 0.1%)	Drug use (7.1; 1.9%)	Occupational (11.2; 2.0%)	Alcohol (7.5; 2.5%)	Cholesterol (9.2; 2.8%)	Cholesterol (6.8; 2.8%)	Cholesterol (0.6; 2.0%)
8th		Sex abuse (4.2; 1.1%)	Cholesterol (11.1; 1.9%)	Fruit (5.9; 2.0%)	Fruit (8.0; 2.4%)	Fruit (5.4; 2.2%)	Air pollution (0.5; 1.7%)
9th		Iron deficiency (3.9; 1.1%)	Fruit (8.8; 1.5%)	Vegetables (4.2; 1.4%)	Vegetables (6.7; 2.1%)	Vegetables (5.0; 2.1%)	Bone density (0.5; 1.7%)
10th		Blood glucose (3.6; 1.0%)	Partner violence (8.4; 1.5%)	Nuts and seeds (4.0; 1.3%)	Nuts and seeds (5.1; 1.6%)	Nuts and seeds (3.8; 1.6%)	Fruit (0.4; 1.5%)

7 Change between 2003 and 2011

Key results

- Between 2003 and 2011, the total burden of disease increased by 6.9% (from 4.2 million to 4.5 million DALY). Non-fatal and fatal burden increased by 12% and 2.3%, respectively.
- When the impact of the increasing age and size of the population was taken into account, the rate of burden decreased 10% during this period, from 210.5 to 189.9 DALY per 1,000 people. Non-fatal burden decreased 3.8% from 99.8 to 96.0 YLD per 1,000 people and fatal burden decreased 15% from 110.7 to 93.9 YLL per 1,000 people.
- At the disease group level, most ASRs of total burden decreased or stayed the same between 2003 and 2011, although there was a notable increase for neurological conditions.
- For non-fatal burden, rates increased for kidney & urinary diseases, and endocrine disorders; there was a large decrease in the rate of fatal burden for cardiovascular diseases.
- Between 2003 and 2011, there was a small overall decrease in the proportion of burden attributable to the risk factors measured at both time points (from 28% in 2003 to 27% in 2011). This reflects reductions in exposure to the risk factors or reductions in burden from the linked diseases and injuries, or both.
- There was a substantial decrease in total DALY attributable to high cholesterol (29%), low bone mineral density (27%) and high blood pressure (20%) between 2003 and 2011. There were also increases in total attributable DALY for some risk factors, including high body mass (23%) and drug use (22%).

This chapter compares the disease burden at two points in time: 2003 and 2011. As noted earlier, comparisons can be made within a study only where the same methods have been used to produce the non-fatal, fatal and total burden, and the burden attributed to risk factors. The data from 2003 have been analysed using the methods for the ABDS 2011 to produce comparable estimates.

The estimates for 2003 contained here cannot be compared with those estimates for 2003 from the previous Australian study (Begg et al. 2007) as they are developed using different methodologies. See Appendix A for further information on the methods used to develop the estimates presented here.

7.1 Interpreting changes between two time points

When comparing estimates for the same disease between two time points, it is important to note:

- YLD and YLL may change by differing proportions, thus make differing contributions to the change in DALY
- unless adjusted for, the impact of population changes (for example, ageing) may mask changes in underlying disease prevalence and/or severity.

Where possible, adjustments were made for definitional changes between the two time points.

To help interpret the change in disease burden, this section presents changes in DALY, YLD, YLL and attributable burden in a number of ways:

- **Numbers:** these show the *impact* of the disease burden on the population at each time point. Changes are expressed as the absolute change for 2011 compared with 2003 and the relative change expressed as a percentage. A negative absolute or relative change indicates a decline between 2003 and 2011 and a positive value indicates an increase.
- **ASRs:** these account for changes in population composition over time, such as increasing size and ageing. *Rate ratios* used in this chapter show how many times the rate of burden is in 2011 relative to that in 2003—values greater than 1 indicate an increase in underlying burden, once changes to the population are taken into account, while values less than 1 indicate a decrease *in underlying burden*. Values close to 1 indicate that there has been minimal change. *Rate differences* show the difference between the ASR of burden from 2003 to 2011. The difference between ASRs are also expressed as a percentage.
- **Changes in ranking:** disease rankings are often used in burden of disease reporting. While they are used in some places, we caution against placing too great an emphasis on changes in rankings as the story can be misleading. Rankings do not provide the reader with context of the size of each estimate, nor of the magnitude of difference between estimates that are adjacent in rank.
- **Drivers of change:** these describe the influence of increasing population size, ageing and epidemiological changes on burden estimates.

7.2 Changes in total burden

Changes in DALY reflect the changes in the component YLD and YLL.

Overall change in burden

There was a 6.9% increase in total DALY between 2003 and 2011, from 4.2 million to 4.5 million DALY. However, the crude overall *rate* of DALY decreased from 213.2 to 201.2 DALY per 1,000 people.

Age-specific DALY *rates* were lower in 2011 than in 2003 for infants and those aged 55–89, but higher for those aged 95 and over; however, there was little change in total burden between 2003 and 2011 for ages 1 to 50. The increase in the DALY *counts* experienced in most of the 55–89-year age group is due to the increased population in this group (Figure 7.1).

After taking account of the impact of the increasing age of the population (by using ASRs), there was a more pronounced decrease by 20.6 (10%) in overall burden, from 210.5 to 189.9 DALY per 1,000 people (Table 7.1).

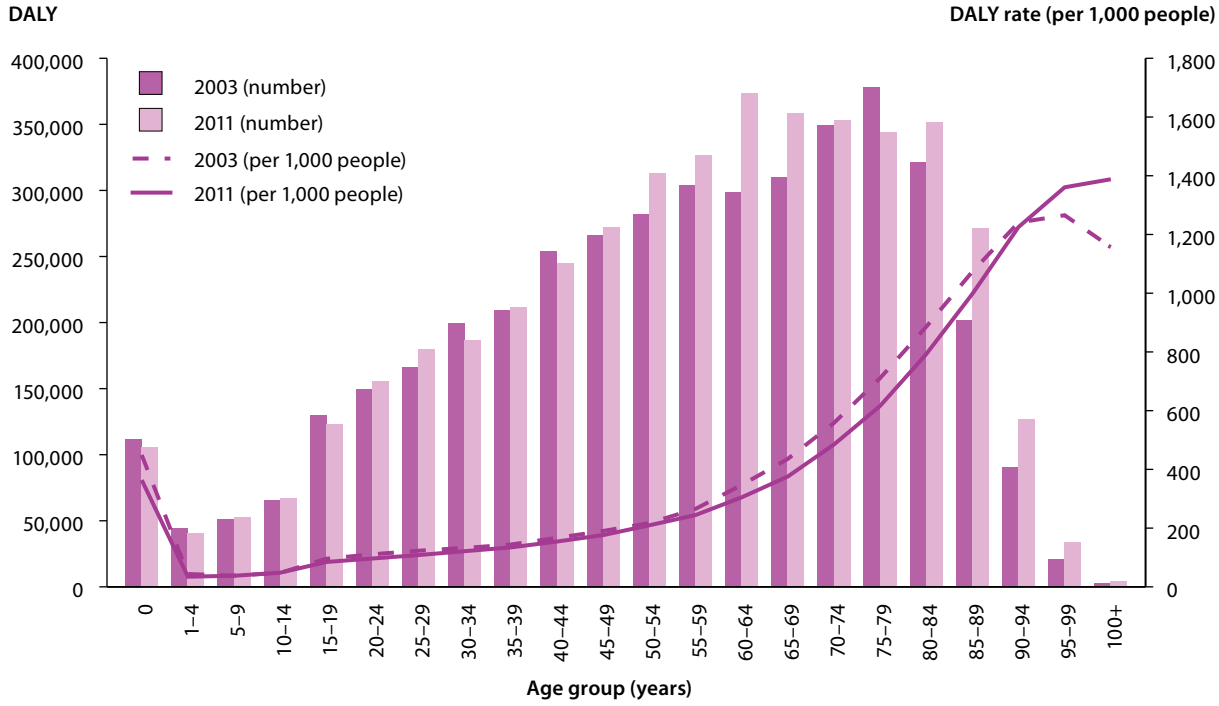


Figure 7.1: Number and rates of total burden (DALY per 1,000 people), by age, 2003 and 2011

Drivers of changes observed between 2003 and 2011

Changes in YLD and YLL

The contributions of fatal burden and non-fatal burden were closer to one another in 2011 than in 2003 (YLL:YLD was 53:47 in 2003 compared with 51:49 in 2011). This indicates that differences (or lack of differences) in DALY between two time points may sometimes mask opposing changes in fatal and non-fatal burden (see Appendix C for examples of this effect). The shift toward more non-fatal burden between 2003 and 2011 may be due to decreasing fatal burden, increasing non-fatal burden, or to shifts in the same direction but at different rates.

The higher DALY that occurred in those aged 60–69 is driven primarily by an increase in YLD in these age groups, along with minor increases in YLL. The increase in DALY for those aged 80 and over is driven by large increases in both YLD and YLL (figures 7.2 and 7.3). The changes in YLD and YLL are described in more detail in section 7.3.

Disease-specific drivers of change

While the estimated number of DALY were higher for most disease groups (notable exceptions being cardiovascular diseases, infections and musculoskeletal conditions), the ASR were generally very similar and, in many cases, lower in 2011, indicating an improvement in underlying disease epidemiology (Table 7.1). This implies that the increases in DALY are predominantly due to population changes, which is discussed further at the end of this chapter.

The most notable increase in age-standardised burden rates was in neurological conditions (rate ratio 1.2), while the most notable decrease was for cardiovascular diseases and infections (rate ratio 0.7 each). Disease-specific changes are described more fully in the following sections and in Chapter 9.

Table 7.1: Change in total burden between 2003 and 2011, by disease group

Disease group	2003 DALY (number)	2011 DALY (number)	Change in DALY (number)	Change in DALY (%)	2003 DALY ASR	2011 DALY ASR	Change in ASR	ASR rate ratio 2011:2003
Cancer	767,210	833,250	66,040	8.6	38.1	34.2	–3.9	0.9
Cardiovascular	725,878	657,203	–68,674	-9.5	35.9	26.4	–9.5	0.7
Mental	480,736	542,554	61,818	12.9	24.5	24.6	0.2	1.0
Musculoskeletal	524,403	521,286	–3,117	–0.6	26.2	22.1	–4.1	0.8
Injuries	370,260	394,454	24,195	6.5	18.8	17.5	–1.3	0.9
Respiratory	343,114	374,985	31,871	9.3	17.2	16.0	–1.2	0.9
Neurological	216,237	306,409	90,172	41.7	10.8	12.4	1.7	1.2
Gastrointestinal	128,614	143,136	14,522	11.3	6.4	6.0	–0.4	0.9
Infant/congenital	121,076	119,951	–1,125	-0.9	6.3	5.4	–0.9	0.9
Endocrine	86,395	106,097	19,702	22.8	4.3	4.3	0.1	1.0
Oral	84,525	98,936	14,412	17.1	4.2	4.2	–<0.1	1.0
Hearing/vision	79,153	97,055	17,902	22.6	3.9	4.0	–<0.1	1.0
Skin	66,524	76,951	10,427	15.7	3.4	3.4	0.1	1.0
Infections	84,790	73,235	–11,555	–13.6	4.3	3.1	–1.2	0.7
Kidney/urinary	46,926	59,344	12,418	26.5	2.3	2.4	0.1	1.0
Blood/metabolic	45,247	50,493	5,246	11.6	2.3	2.1	–0.1	0.9
Reproductive/maternal	34,136	39,088	4,952	14.5	1.7	1.7	–0.0	1.0
Total	**4,205,223**	**4,494,427**	**289,203**	**6.9**	**210.5**	**189.9**	**–20.6**	**0.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Change in DALY is 2011 DALY minus 2003 DALY, expressed as a percentage of 2003 DALY.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.

7.3 Changes in non-fatal and fatal burden

The following sections describe the contribution of changes in non-fatal and fatal burden between 2003 and 2011.

Changes in non-fatal burden

Changes in YLD rates are influenced by changes in the prevalence and/or the severity of the disease.

Overall change in YLD

There was a 12% increase in the total YLD between 2003 and 2011, from 2.0 million to 2.2 million YLD. The increase in YLD has occurred in almost all age groups and is largest in the older age groups. However, there is little difference in age-specific YLD *rates* for all age groups up to age 85 (Figure 7.2). Beyond age 85, the 2011 rate was slightly higher than that for 2003; factors contributing to this are explored further.

Like the total burden, after adjusting for the ageing population, age-standardised YLD rates decreased by 3.8% between 2003 and 2011. The rate decreased from 99.8 to 96.0 YLD per 1,000 people (rate ratio 0.96) (Table 7.2).

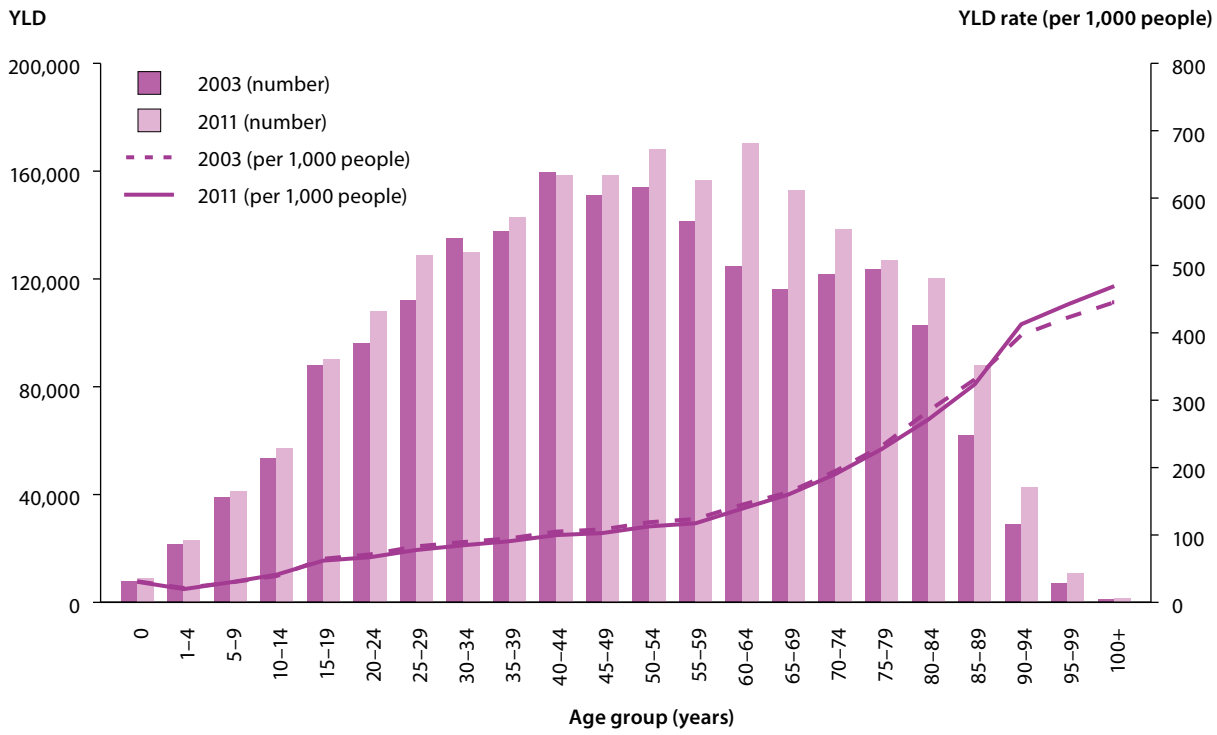


Figure 7.2: Number and rates of non-fatal burden (YLD per 1,000 people), by age, 2003 and 2011

Changes in YLD by disease group

All disease groups except musculoskeletal conditions contributed to the overall increase in the number of YLD, but in differing amounts (Table 7.2). Comparing ASRs, most disease groups showed very little underlying change (that is, most rate ratios are around 1.0).

The most notable increases in ASRs of non-fatal burden were observed for kidney & urinary disease (rate ratio 1.3), followed by endocrine disorders (rate ratio 1.2). Rates were lower in 2011 for musculoskeletal conditions and cardiovascular diseases (each with a rate ratio 0.8), and there were minor decreases in infections, and blood & metabolic disorders (rate ratio 0.9 each).

Table 7.2: Change in non-fatal burden between 2003 and 2011, by disease group

Disease group	2003 YLD (number)	2011 YLD (number)	Change in YLD (number)	Change in YLD (%)	2003 YLD ASR	2011 YLD ASR	Change in ASR	ASR rate ratio 2011:2003
Mental	464,058	524,701	60,643	13.1	23.6	23.8	0.2	1.0
Musculoskeletal	509,938	505,673	–4,265	–0.8	25.5	21.5	–4.0	0.8
Respiratory	237,998	263,603	25,605	10.8	12.0	11.5	–0.5	1.0
Neurological	125,219	164,886	39,668	31.7	6.2	6.8	0.5	1.1
Cardiovascular	129,043	134,179	5,135	4.0	6.4	5.4	–1.0	0.8
Oral	84,369	98,592	14,223	16.9	4.2	4.2	–<0.1	1.0
Hearing/vision	79,153	97,055	17,902	22.6	3.9	4.0	0.0	1.0
Injuries	66,806	84,260	17,454	26.1	3.4	3.6	0.3	1.1
Skin	62,725	71,675	8,950	14.3	3.2	3.2	<0.1	1.0
Gastrointestinal	48,201	56,026	7,824	16.2	2.4	2.4	<0.1	1.0
Cancer	39,512	50,901	11,388	28.8	2.0	2.1	0.1	1.1
Endocrine	33,215	49,598	16,382	49.3	1.7	2.1	0.4	1.2
Reproductive/maternal	33,215	37,909	4,694	14.1	1.7	1.7	–<0.1	1.0
Infections	24,993	26,817	1,824	7.3	1.3	1.2	–0.1	0.9
Blood/metabolic	18,074	19,789	1,715	9.5	0.9	0.8	–0.1	0.9
Kidney/urinary	12,819	19,772	6,953	54.2	0.6	0.8	0.2	1.3
Infant/congenital	16,528	18,891	2,364	14.3	0.8	0.9	0.0	1.0
Total	**1,985,866**	**2,224,326**	**238,460**	**12.0**	**99.8**	**96.0**	**–3.8**	**1.0**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Change in YLD is 2011 YLD minus 2003 YLD, expressed as a percentage of 2003 YLD.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.

Disease-specific changes in YLD

There were some differences between 2003 and 2011 for many of the top ranking causes of non-fatal burden (Table 7.3). Of particular note, were:

- higher YLD rates in 2011 for dementia (rate ratio 1.4), diabetes (1.3) and falls (1.1)
- lower rates for other musculoskeletal conditions (rate ratio 0.7), coronary heart disease and rheumatoid arthritis (0.8 each) and asthma (0.9).

There was little or no change in the non-fatal burden of the remaining top 20 ranking diseases.

Table 7.3: Change in non-fatal burden between 2003 and 2011, by top ranking diseases

Disease	Rank 2003	Change in YLD (number)	Change in YLD (%)	ASR difference	ASR rate ratio 2011:2003	Rank 2011
Other musculoskeletal	1	–39,932	–18.7	–3.3	0.7	1
Back pain & problems	2	28,084	20.9	0.3	1.0	2
Anxiety disorders	3	15,753	12.6	<0.1	1.0	3
Depressive disorders	4	14,344	12.7	<0.1	1.0	4
Asthma	5	–170	–0.2	–0.6	0.9	5
Osteoarthritis	9	15,581	22.4	<0.1	1.0	6
COPD	8	13,723	19.3	–<0.1	1.0	7
Rheumatoid arthritis	6	–5,349	–6.2	–0.9	0.8	8
Upper respiratory conditions	10	10,069	15.5	0.1	1.0	9
Coronary heart disease	7	–2,144	–2.9	–0.8	0.8	10
Dementia	13	30,535	76.1	0.7	1.4	11
Hearing loss	11	11,226	20.3	–<0.1	1.0	12
Alcohol use disorders	12	6,258	12.0	<0.1	1.0	13
Diabetes	16	15,900	50.2	0.4	1.3	14
Bipolar affective disorder	14	4,152	12.2	<0.1	1.0	15
Dental caries	15	3,562	10.8	–<0.1	1.0	16
Severe tooth loss	20	6,641	23.2	<0.1	1.0	17
Falls	23	9,367	36.6	0.2	1.1	18
Epilepsy	17	3,752	12.5	–<0.1	1.0	19
Schizophrenia	18	3,900	13.4	<0.1	1.0	20

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Change in YLD is 2011 YLD minus 2003 YLD, expressed as a percentage of 2003 YLD.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.

Changes in fatal burden

Changes in YLL are influenced by both the number of deaths and the ages at which those deaths occur.

Overall change in YLL

Overall, the total YLL was 2.3% higher in 2011 (2.3 million YLL) compared with that for 2003 (2.2 million YLL). The higher number of YLL in 2011 can in part be attributed to the natural increase in the number of deaths over time due to increases in the overall population.

In the age groups 0–49 and 70–79, there were more YLL in 2003 than in 2011 (Figure 7.3). The YLL rate is similar for both reference years up to age 55, beyond which it remains consistently lower in 2011 than in 2003 until age 94. This reflects a rising trend in the age at death.

Like the total burden, after adjusting for the ageing population, age-standardised YLL rates decreased by 15% between 2003 and 2011. The rate decreased from 110.7 to 93.9 YLL per 1,000 people (rate ratio 0.8) (Table 7.4).

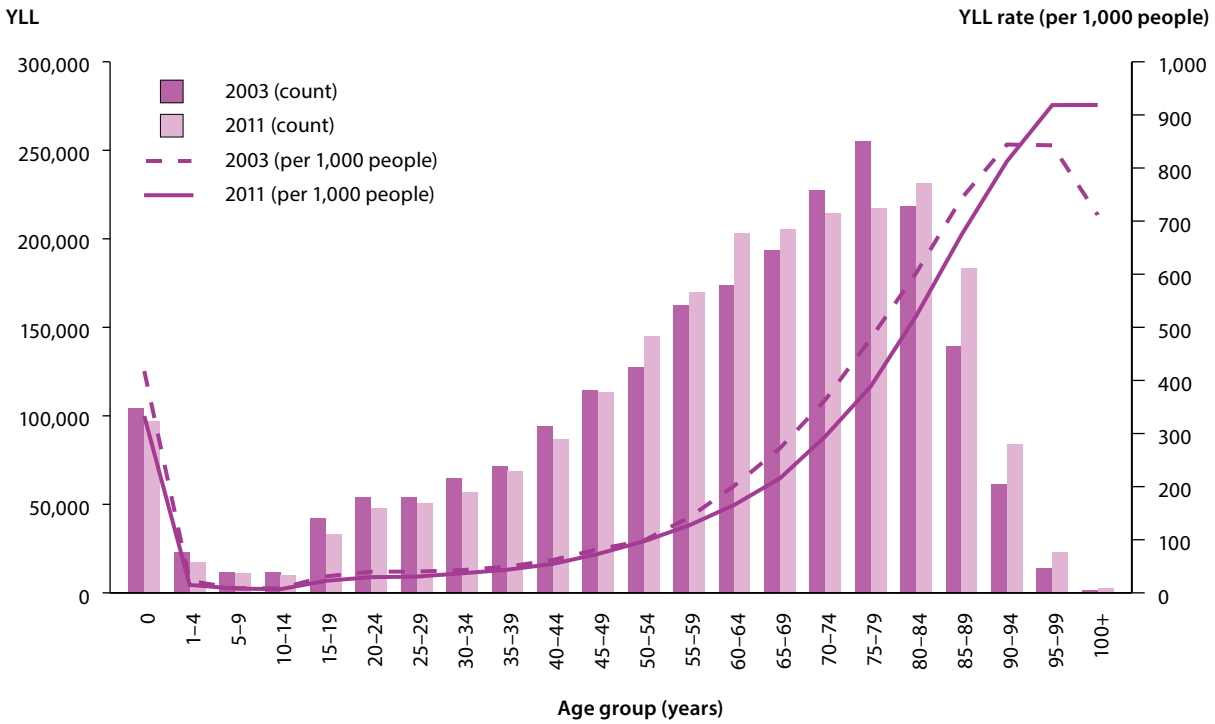


Figure 7.3: Number and rates of fatal burden (YLL per 1,000 people), by age, 2003 and 2011

Changes in YLL by disease group

Age-standardised YLL rates (per 1,000 people) were lower or the same in 2011 for all major causes of death except neurological conditions (Table 7.4). The largest relative differences in rates were observed for infections (rate ratio 0.6) and cardiovascular diseases (rate ratio 0.7). Oral disorders contribute only a small amount to life lost; the apparently high rate ratio may reflect the instability of ratios between small, fluctuating rates.

Table 7.4: Change in fatal burden between 2003 and 2011, by disease group

Disease group	2003 YLL (number)	2011 YLL (number)	Change in YLL (number)	Change in YLL (%)	2003 YLL ASR	2011 YLL ASR	Change in ASR	ASR rate ratio 2011:2003
Cancer	727,697	782,349	54,652	7.5	36.1	32.1	−4.0	0.9
Cardiovascular	596,834	523,024	−73,810	−12.4	29.5	20.9	−8.6	0.7
Injuries	303,453	310,194	6,741	2.2	15.4	13.8	−1.6	0.9
Neurological	91,019	141,523	50,504	55.5	4.5	5.6	1.1	1.3
Respiratory	105,116	111,382	6,266	6.0	5.2	4.5	−0.7	0.9
Infant/congenital	104,549	101,060	−3,489	−3.3	5.4	4.5	−0.9	0.8
Gastrointestinal	80,413	87,110	6,698	8.3	4.0	3.6	−0.4	0.9
Endocrine	53,179	56,499	3,320	6.2	2.6	2.3	−0.4	0.9
Infections	59,797	46,418	−13,379	−22.4	3.0	1.9	−1.1	0.6
Kidney/urinary	34,107	39,572	5,465	16.0	1.7	1.6	−0.1	0.9
Blood/metabolic	27,172	30,704	3,532	13.0	1.4	1.3	−0.1	1.0
Mental	16,678	17,853	1,175	7.0	0.8	0.8	−0.1	0.9
Musculoskeletal	14,465	15,613	1,148	7.9	0.7	0.6	−0.1	0.9
Skin	3,799	5,276	1,477	38.9	0.2	0.2	<0.1	1.1
Reproductive/maternal	922	1,179	257	27.9	0.0	0.1	<0.1	1.1
Oral	156	345	189	120.7	0.0	0.0	<0.1	1.8
Total	**2,219,357**	**2,270,101**	**50,744**	**2.3**	**110.7**	**93.9**	**−16.8**	**0.8**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Change in YLL is 2011 YLL minus 2003 YLL, expressed as a percentage of 2003 YLL.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.
5. Vision & hearing disorders are not included as this disease group did not incur an YLL.

Disease-specific changes in YLL

Table 7.5 shows the top ranking causes of fatal burden in 2011 compared with 2003, including the absolute and relative change in the number of deaths for each cause. There were substantial changes between 2003 and 2011 contributing to the overall decrease in YLL. Of particular note, were:

- **Coronary heart disease, stroke and motor vehicle occupants in road traffic injuries** had fewer deaths and fewer YLL in 2011 compared with 2003.
- **Breast cancer, bowel cancer and leukaemia** had more deaths, but fewer YLL in 2011 compared with 2003—this is due to deaths occurring at older ages for these diseases.
- **Lung, prostate and brain cancer; cancers of unknown primary site; COPD; and diabetes** had more deaths and higher YLL in 2011 than in 2003, but a slightly lower age-standardised YLL rate in 2011 compared with 2003 (rate ratios 0.8 and 0.9, respectively). These results reflect the impact of population ageing combined with delayed mortality from these causes.

- **Dementia** had substantially higher deaths and YLL in 2011 compared with 2003, resulting in a substantial increase in YLL rate (rate ratio 1.6). This increase is most likely due to a large increase in deaths being coded to dementia from 2006 onwards. This increase is well documented by the ABS (see Box 7.1).
- **Poisoning** also showed a substantial increase in age-standardised YLL rates (rate ratio 1.3). This large difference can in part be explained by changes in coding practices (see Injuries section in Chapter 9).

Table 7.5: Change in fatal burden between 2003 and 2011, by top ranking diseases

Disease	Rank 2003	Change in deaths (number)	Change in YLL (number)	Change in YLL (%)	ASR rate ratio 2011:2003	Rank 2011
Coronary heart disease	1	–3,432	–65,177	–19.1	0.7	1
Lung cancer	3	1,144	16,107	11.9	0.9	2
Stroke	2	–754	–16,440	–12.0	0.7	3
Suicide & self-inflicted injuries	4	314	8,690	8.4	1.0	4
Bowel cancer	5	82	–4,610	–5.1	0.8	5
Dementia	11	5,921	41,925	108.3	1.6	6
COPD	6	462	2,160	3.0	0.8	7
Breast cancer	7	221	–1	–<0.1	0.8	8
Diabetes	9	666	3,445	6.8	0.9	9
Poisoning	14	381	14,558	40.3	1.3	10
Chronic liver disease	10	241	5,475	13.6	1.0	11
Pancreatic cancer	15	563	8,866	25.3	1.0	12
Road traffic injuries – motor vehicle occupants	8	–265	–16,121	–27.7	0.6	13
Prostate cancer	12	478	2,405	6.4	0.9	14
Brain and central nervous system cancer	16	155	1,594	4.9	0.9	15
Unknown primary	18	288	2,852	9.1	0.9	16
Melanoma of the skin	21	407	5,615	21.6	1.0	17
Chronic kidney disease	22	694	4,950	19.3	1.0	18
Other cardiovascular diseases	17	–22	–1,941	–6.1	0.8	19
Leukaemia	19	263	–806	–2.7	0.8	20

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Change in deaths is 2011 deaths minus 2003 deaths.
3. Change in YLL is 2011 YLL minus 2003 YLL, expressed as a percentage of 2003 YLL.
4. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.

Box 7.1: Changes in deaths due to dementia

There has been a substantial increase in the number of deaths coded to dementia since 2006. According to the ABS (ABS 2012a), there are two issues that may be partly responsible for this increase:

- Updates to the ICD-10 coding instructions resulted in deaths that may have previously been coded as cerebrovascular diseases (which includes stroke) being coded as vascular dementia.
- Changes to the *Veterans' Entitlements Act 1986* and *Military Rehabilitation and Compensation Act 2004,* and a subsequent promotional campaign targeted at health professionals, which allowed for death from vascular dementia of veterans or members of the defence forces to be related to relevant service.

YLL estimates are based on the cause of death data, which is coded by the ABS without any adjustment for this variation. Consequently, no adjustments have been made in the ABDS.

7.4 Changes in risk factors

Analyses of the effects of changes in risk factors are provided only for those risk factors that were included in both the 2003 and the 2011 estimates. The risk factors that could not be measured for 2003 were air pollution, childhood sexual abuse, dietary risk factors (except fruit and vegetables), high fasting plasma glucose, iron deficiency and sun exposure.

Results are expressed as changes in the total burden (DALY) attributable to each risk factor, as well as changes in the fraction of burden (PAF) that is attributable to each risk factor.

Changes in attributable burden

In this analysis, changes in attributable burden may be due to

- changes in exposure to the risk factors
- changes in the age at which exposure occurs, or
- changes in the overall burden for those diseases or injuries that are linked to these risk factors.

Overall change in attributable burden

The risk factors able to be measured in 2003 contributed to 28% of the total burden in 2003. These same risk factors contributed to 27% of the total burden in 2011, indicating there was a small decrease in the proportion of burden attributable to these common risk factors between the 2 years.

Changes in attributable burden by risk factor

There was a decrease in total DALY attributable to high cholesterol (29%), low bone mineral density (27%), high blood pressure (20%), diet low in vegetables (5.4%) and tobacco use (0.2%) between 2003 and 2011 (Table 7.6). The ASR (which adjusts for changes in the structure and size of the population) decreased for high cholesterol by 41%, for high blood pressure by 35% and for tobacco use by 18%.

There was an increase in total DALY attributable to high body mass (23%), drug use (22%), intimate partner violence (14%), occupational risks (9.0%), alcohol use (5.4%), unsafe sex (4.0%) and physical inactivity (1.2%)

between 2003 and 2011. However, once having taken into consideration differences between the 2011 and 2003 population size and structure, the resulting ASRs for these risk factors also decreased or stayed the same (for example high body mass increased by 2%). This indicates that population changes are driving the increase in DALY attributable to these risk factors.

It is important to note that these results are summary measures that are influenced by the changes in the fatal and non-fatal burden of the various diseases attributed to each risk factor. The combined mortality and morbidity effects of risk factor changes on total burden may mask changes when viewed separately; or the period from 2003 to 2011 may be too short a time span to reflect the changes in overall burden. Possible reasons behind each change are too complex to unpack within the scope of this report; however, case studies of tobacco and high body mass are provided in Box 7.2, and further information on specific disease burden attributable to each risk factor is provided in Chapter 10.

Table 7.6: Change in total attributable burden between 2003 and 2011, by risk factor

Risk factor	2003 attributable DALY	2011 attributable DALY	Change in attributable DALY	Change in attributable DALY (%)	2003 attributable DALY ASR	2011 attributable DALY ASR	Change in ASR	ASR rate ratio 2011:2003
Tobacco use	403,054	402,377	−677	−0.2	20.0	16.5	−3.5	0.8
High body mass	199,654	245,816	46,162	23.1	9.9	10.1	0.2	1.0
Alcohol use	215,920	227,666	11,746	5.4	10.9	9.9	−1.0	0.9
Physical inactivity	221,513	224,198	2,685	1.2	11.0	9.2	−1.8	0.8
High blood pressure	277,533	221,315	−56,218	−20.3	13.7	8.9	−4.8	0.6
High cholesterol	149,116	106,151	−42,965	−28.8	7.4	4.3	−3.0	0.6
Diet low in fruit	81,339	88,393	7,054	8.7	4.1	3.8	−0.3	0.9
Occupational exposures & hazards	96,382	87,714	−8,668	−9.0	4.8	3.6	−1.2	0.7
Drug use	64,522	78,943	14,421	22.3	3.3	3.5	0.2	1.1
Diet low in vegetables	66,299	62,751	−3,548	−5.4	3.3	2.6	−0.7	0.8
Intimate partner violence	19,007	21,608	2,601	13.7	1.0	1.0	<0.1	1.0
Unsafe sex	17,951	18,673	722	4.0	0.9	0.8	−0.1	0.9
Low bone mineral density	8,265	6,050	−2,215	−26.8	0.4	0.2	−0.2	0.6

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.
3. Rate differences subtract 2011 ASRs from the corresponding 2003 ASRs.

Box 7.2: Case studies of changes in attributable burden

Tobacco use

The total burden attributable to tobacco use was only slightly lower (0.2%) in 2011 than in 2003. The largest impact from tobacco use is on cancer, respiratory diseases and cardiovascular diseases. However, while the burden of cancer and respiratory diseases due to tobacco use increased (15,000 and 10,000 DALY, respectively), this was outweighed by a large decrease in the burden of cardiovascular diseases (26,000 DALY).

There was a drop in the ASR (rate ratio 0.8) of attributable DALY for tobacco use in 2011 compared with that for 2003. This change varied between diseases linked to tobacco use. The rate ratio for cancer and respiratory diseases was 0.9 compared with 0.6 for cardiovascular diseases. This is likely to be due to health improvements from reductions in tobacco use taking longer to become apparent in cancer and chronic respiratory diseases than in cardiovascular diseases (CDC 2015).

High body mass

The total burden attributable to high body mass was 23% higher in 2011 than in 2003, but with a stable ASR (rate ratio 1.0). High body mass is linked to a number of different diseases—the most prevalent being cardiovascular diseases, followed by endocrine disorders, kidney & urinary diseases and cancer. There was fall in the ASR (rate ratio 0.9) for the burden of cardiovascular diseases due to high body mass, but this was balanced by a large increase in the burden of endocrine disorders and kidney & urinary diseases (rate ratio 1.2 each) and a smaller increase in cancer (rate ratio 1.1).

Changes in population attributable fraction

The PAF is the proportion of a disease or injury that can be attributed to a risk factor. When comparing the PAF between 2003 and 2011, the causal relationship between the risk factor and the linked conditions (relative risk and TMRED) was assumed to be the same, but exposure for 2003 was calculated either directly or from trend information.

Changes in PAF are expressed as the percentage change in *median age-adjusted PAF.* A positive percentage change in median PAF indicates that the exposure to the risk factor has either increased or the age at which exposure occurs has changed, leading to a higher fraction of disease burden attributable. When it is negative, exposure to the risk factor has either decreased or the age of exposure has changed, leading to a lower fraction of attributable disease burden. In some cases (usually where no information on exposure in 2003 was available), the PAF calculated in 2011 was applied to 2003 and does not change. More information on how the median age-adjusted PAF is calculated is at Appendix A.

Changes in population attributable fraction by risk factor

The same risk factors were ranked in the top five for both 2003 and 2011.

Tobacco use remained the top ranking risk factor in 2003 and 2011, despite a 2.8% drop in its median age-adjusted PAF due to a reduction in exposure to tobacco use. High blood pressure, which was ranked second in 2003, also had a drop (10%) in the median age-adjusted PAF, and the ranking fell to fifth in 2011. The median age-adjusted PAF also fell for occupational risks (16%), and high cholesterol (7.5%) between 2003 and 2011 (Table 7.7).

The percentage change in median age-adjusted PAF for high body mass increased by 23% between 2003 and 2011 and it moved from fifth to second in ranking. Other risk factors where the median age-adjusted PAF increased were physical inactivity (20%), alcohol use (9.9%), diet low in vegetables (8.7%), unsafe sex (3.6%), drug use (2.7%) and diet low in fruit (1.0%). Exposure to these risk factors increased between 2003 and 2011 (Table 7.7).

Table 7.7: Change in median PAF and ranking between 2003 and 2011

Risk factor	Rank 2003	Change in median age-adjusted PAF (%)	Rank 2011
Tobacco use	1	–2.8	1
High body mass	5	23.5	2
Alcohol use	4	9.9	3
Physical inactivity	3	20.2	4
High blood pressure	2	–10.2	5
High cholesterol	6	–7.5	6
Occupational exposures & hazards	8	–15.5	7
Diet low in fruit	7	1.0	8
Drug use	10	2.7	9
Diet low in vegetables	9	8.7	10
Intimate partner violence	11	0.0	11
Unsafe sex	12	3.6	12
Low bone mineral density	13	0.0	13

Note: Ranking does not include risk factors not measured in 2003.

7.5 Distinguishing between changes due to population and changes due to disease

ASRs, rate ratios (which show how many times the rate of burden is from one time point to another) and rate differences (which show the difference in rate of burden from one time point relative to another) are helpful to tease out the changes in burden, as distinct from the changes in population size and structure.

To help distinguish the impact of population increase compared with population ageing—as well as impacts of epidemiological changes—this study estimated:

(a) a hypothetical DALY/YLD/YLL for 2011, reflecting just the population size increase (that is, with the same age–sex structure as for 2003 and with the same 2003 age–sex specific rates), and

(b) a hypothetical DALY/YLD/YLL for 2011, using the 2011 population size and age–sex structure, but with 2003 age–sex specific rates.

Looking at the differences between the actual and hypothetical scenarios provide a measure of the change due to:

- population increase only: measured as the difference between the 2003 estimate and scenario (a)
- population ageing: measured as the difference between the estimates in scenarios (a) and (b)
- epidemiological change: measured as the difference between the 2011 estimates and scenario (b).

Changes in DALY due to demographic and epidemiological factors

Figure 7.4 compares the actual estimates for 2011 for each disease group with those that would have been expected, based on population increase and ageing. The percentage differences are provided in Appendix Table D2.

Generally, the actual 2011 DALY for most disease groups was lower than would have been expected if the rates in 2003 had also applied in 2011. This indicates an improvement in the underlying disease burden of these groups. Proportionally large gains were evident in cardiovascular diseases and infections.

While overall burden for cancer and injuries was higher in 2011 than in 2003, these increases were lower than would have been expected based on population changes.

Conversely, 2011 DALY were considerably higher than expected for neurological conditions, and slightly higher for kidney & urinary diseases, skin disorders, hearing & vision disorders and endocrine disorders.

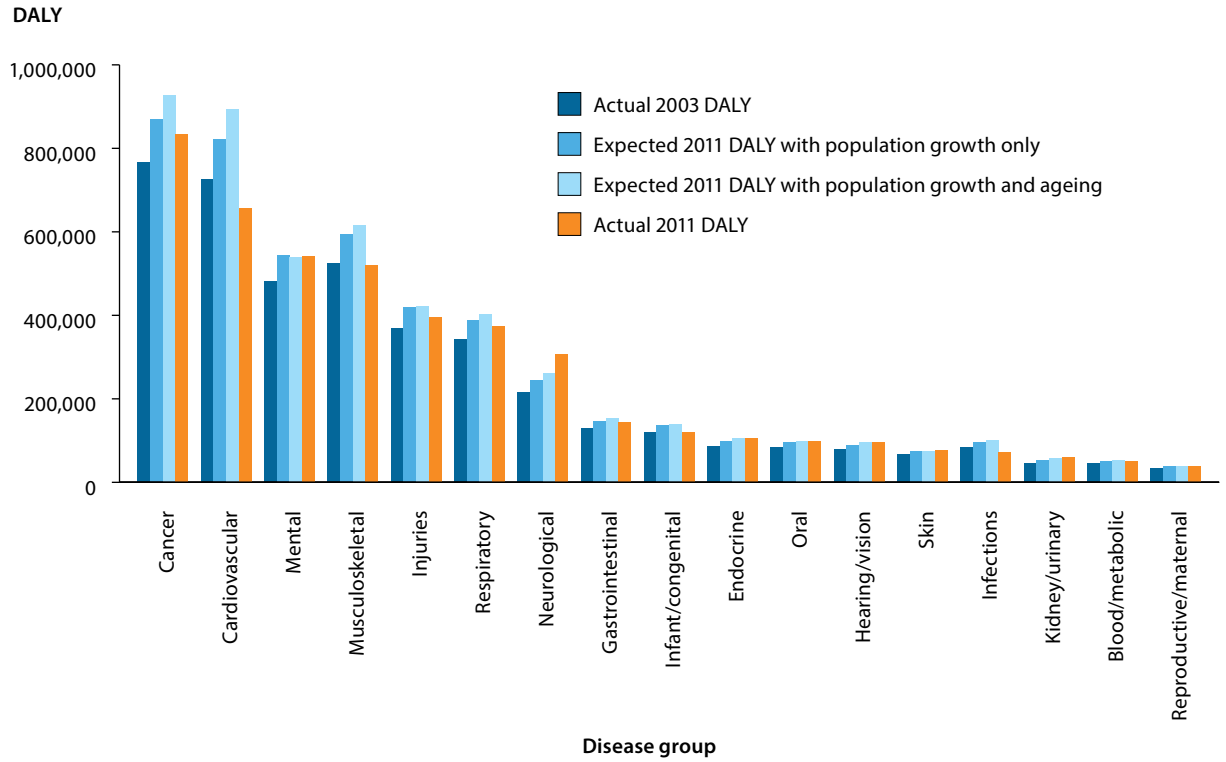


Figure 7.4: Expected and actual DALY by disease group, 2003 and 2011

Changes in YLD due to demographic and epidemiological factors

The slight reduction in ASRs between 2003 (99.8 YLD per 1,000 people) and 2011 (96.0 YLD per 1,000 people) shows that the 12% increase in YLD is predominantly due to demographic factors. Figure 7.5 compares the actual estimates for 2011 for each disease group with those that would have been expected based on population increase and ageing. The percentage differences are provided in Appendix Table D3.

While there has been some reduction of non-fatal burden due to underlying disease (in particular, in musculoskeletal conditions), increases in underlying disease for a number of disease groups, coupled with population growth and ageing, is increasing the overall YLD in the Australian population.

Non-fatal burden (YLD) for 2011 was higher than in 2003 in all disease groups except musculoskeletal conditions. However, many were lower than would have been expected, given the population changes over this time period: cardiovascular diseases, blood & metabolic disorders, infections, reproductive & maternal conditions and respiratory diseases. Further information on the changes within each disease group, along with quality considerations, is included in the disease-specific sections in Chapter 9.

Conversely, there were larger than expected increases in non-fatal burden from injuries, cancer, neurological conditions, kidney & urinary diseases (mostly chronic kidney disease) and endocrine disorders (mostly diabetes).

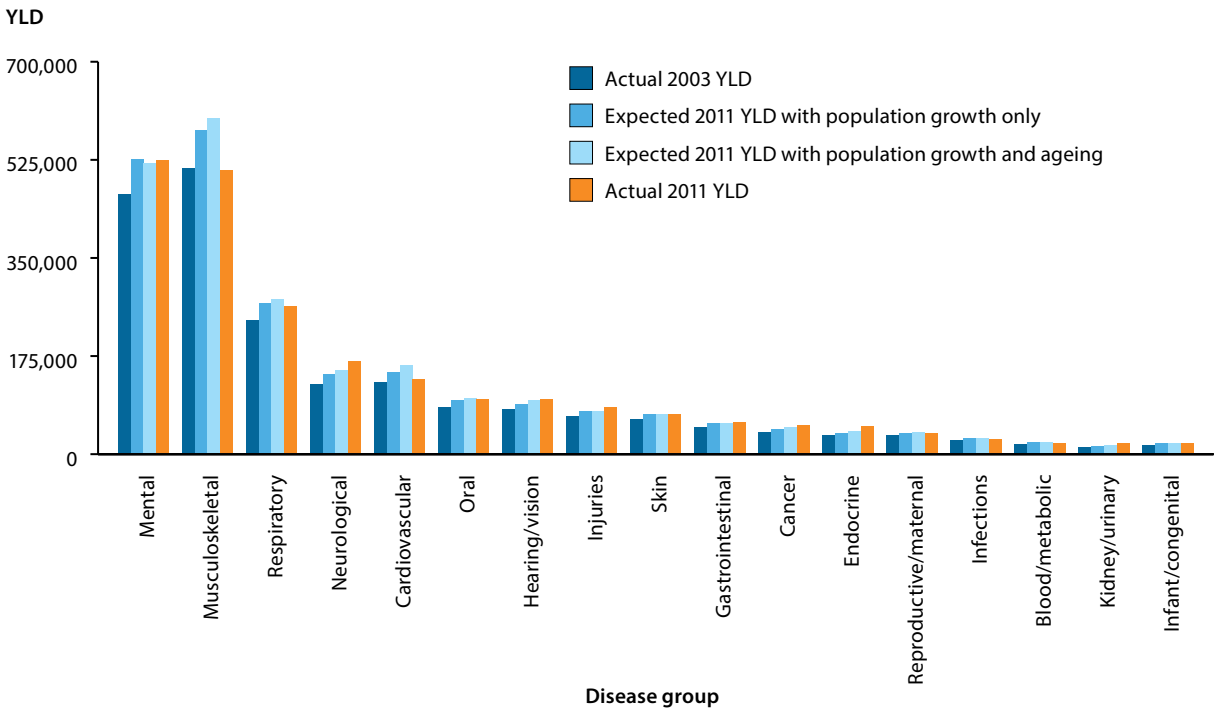


Figure 7.5: Expected and actual YLD by disease group, 2003 and 2011

Changes in YLL due to demographic and epidemiological factors

The substantial reduction in age-standardised fatal burden rates in 2003 (110.7 YLL per 1,000 people) compared with 2011 (93.9 YLL per 1,000 people) corresponds to a small (2.3%) increase in YLL, due primarily to the increasing and ageing population.

Figure 7.6 shows actual and expected YLL estimates by disease group for 2011 and 2003 while percentage differences between the actual and expected estimates are provided in Appendix Table D4.

There was less fatal burden in 2011 compared with 2003 for infections (overall reduction of 22%), cardiovascular diseases (12%), and infant & congenital conditions (3.3%).

Increases in YLL were apparent for all other disease groups but, for many, these increases were less than would have been expected based on population changes. The most notable exception to this is neurological conditions which was 56% higher in 2011 than in 2003. This is much higher than would be expected due to population changes, and is largely due to an increase in dementia deaths. Further details on this change are provided in Chapter 9.

Note that differences between 2003 and 2011 for reproductive & maternal conditions, skin disorders and oral disorders are based on a small number of deaths and the results are subject to volatility.

Further information on the changes within each disease group, along with data quality considerations, is included in the disease-specific sections in Chapter 9.

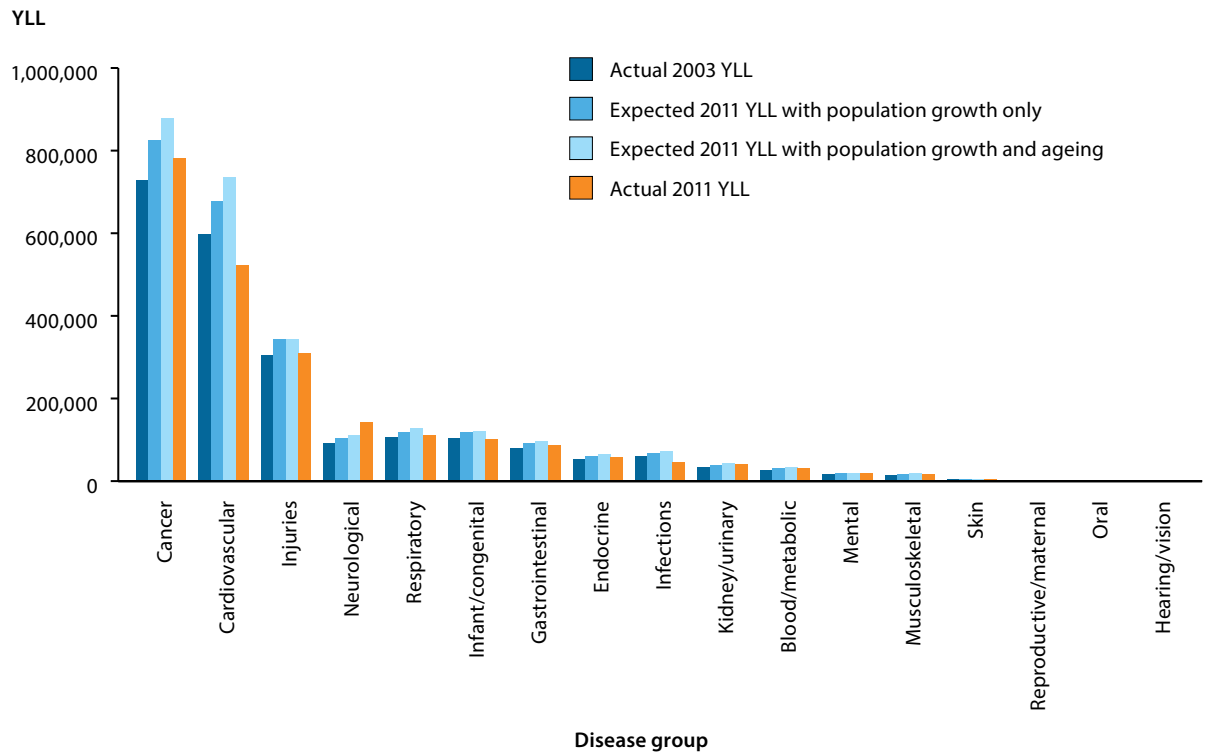


Figure 7.6: Expected and actual YLL by disease group, 2003 and 2011

Changes in attributable burden due to demographic and epidemiological factors

Figure 7.7 compares the actual estimates for 2011 for each risk factor with those that would have been expected, based on population increase, ageing and changes to risk factor exposure. Changes to risk factor exposure were calculated by applying the percentage change in median age-adjusted PAF to the

expected 2011 DALY due to population growth and ageing. The percentage differences are provided in Appendix Table D5.

Generally, the actual 2011 DALY for most risk factors was lower than would have been expected if the DALY rates in 2003 also applied to 2011, while also taking into account changes in risk factor exposure (Figure 7.7). This indicates an improvement in the disease burden linked to these risk factors, potentially due to improved prevention or treatment of the diseases. The exception was drug use where the actual 2011 DALY was as high as expected.

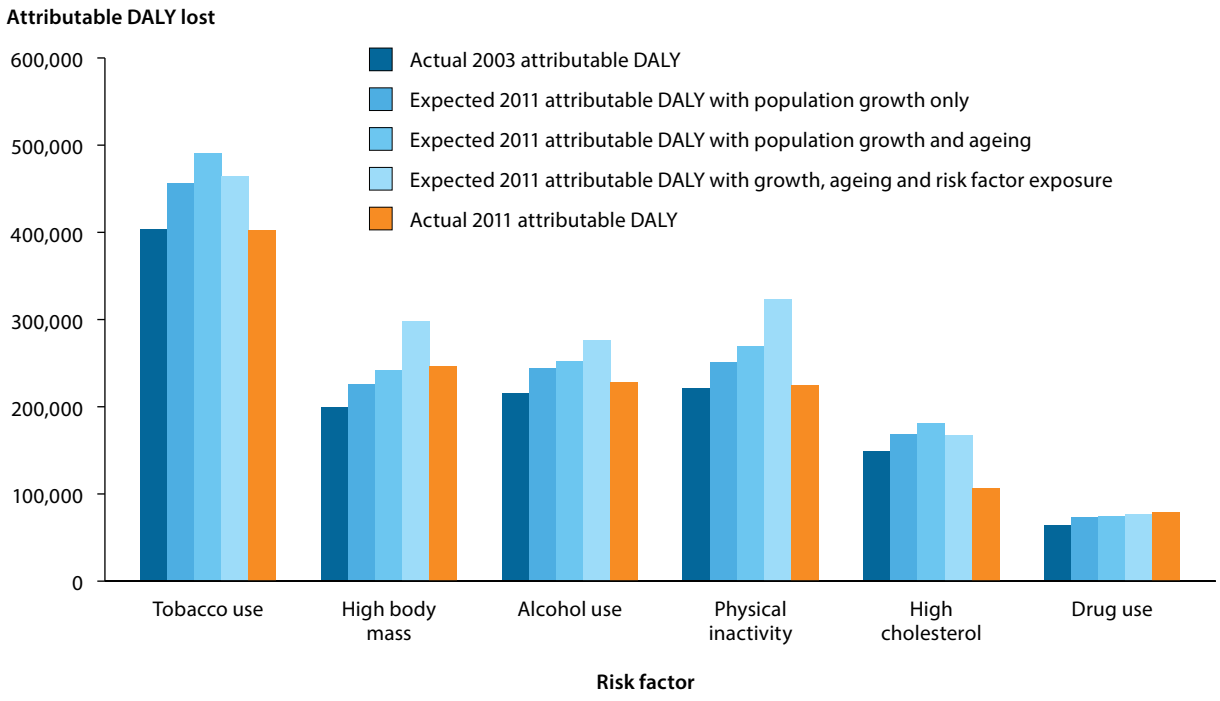


Figure 7.7: Expected and actual attributable DALY for top seven risk factors, 2003 and 2011

8 Variation across geographic and population groups

Key results

- Variation in burden across geographic and population groups may reflect a complex interaction of factors, such as demographic, socioeconomic and environmental variations. There may also be variation in access to goods and services and in the uptake of risky health behaviours.
- The ASR were similar for all states and territories, except the Northern Territory where DALY rates were around 1.5 times as high as the national average. The higher rates for total burden for the Northern Territory can be mostly attributed to three disease groups: kidney and urinary diseases were more than 3 times the national rate; infections, and endocrine disorders were both more than 2.5 times higher.
- *Very remote* areas experienced 1.7 times the rate of burden of *Major cities*. There were higher rates of burden in *Very remote* areas for injuries, cardiovascular diseases, kidney & urinary diseases and endocrine disorders.
- Total burden would have been 4.2% lower if all areas had the same rates of burden as *Major cities*.
- Lower socioeconomic groups had greater total burden than higher groups. Mental & substance use disorders, cardiovascular diseases, cancer and injuries had the greatest disparity in burden rates when comparing the lowest and highest socioeconomic groups. These disease groups were among the six leading contributors of overall burden in every quintile.
- Total burden would have been 21% lower if all areas had the same rates of burden as the highest socioeconomic group.

8.1 Burden of disease by state and territory

Variations in patterns of disease burden across states and territories reflect a complex interaction of a number of factors, such as demographic (including the age structure of the population and the proportion of the population that is Indigenous), socioeconomic and environmental variations (Table 8.1). For example, the Northern Territory is quite different from other states and territories. Not only does it have the smallest population, but also its population is younger, less likely to live in or near the capital city and more likely to identify as Aboriginal and Torres Strait Islander Australians compared with other states and territories. By comparison, Tasmania also has a relatively small population, however, the population tends to be older, a larger proportion live in or near the capital city, and a smaller proportion identify as Aboriginal and Torres Strait Islander Australians, although this is also relatively high compared to other states and territories, excluding the Northern Territory. The forthcoming report on Indigenous burden of disease estimates will provide comparisons of the Indigenous and non-Indigenous populations for selected states and territories.

Table 8.1: Demographic characteristics of population, by state or territory, 2011

Jurisdiction	Total population (million)	Proportion living in greater capital city (%)	Median age (years)	Proportion of population aged <15 (%)	Proportion aged 65+ years (%)	Proportion of Indigenous Australians (%)
NSW	7.21	64	37.7	19	14	2.5
Vic	5.53	75	37.3	18	14	0.7
Qld	4.47	48	36.6	20	13	3.6
WA	2.35	78	36.3	19	12	3.1
SA	1.64	75	39.5	18	16	1.9
Tas	0.51	73	40.4	19	16	4.0
ACT	0.37	100	34.5	18	11	1.5
NT	0.23	56	31.4	23	6	26.8

Sources: ABS 2012b, 2012c.

This chapter focuses on the variability of burden across states and territories, rather than the detailed estimates for each jurisdiction. Results are presented as ASR, a method that removes the influence of differences in age structure but not those for other demographic, socioeconomic or environmental factors.

Total burden

The ASR of total burden were fairly similar across states and territories, except for the Northern Territory where age-standardised DALY rates were around 1.5 times as high as the national rate (Table 8.2).

Most of the differences in ASR of burden can be attributed to fatal burden. ASR of fatal burden varied considerably, from 79 YLL per 1,000 people in the Australian Capital Territory to 170 per 1,000 people in

the Northern Territory. By comparison, ASR of non-fatal burden were fairly similar across all jurisdictions, ranging from 94 YLD per 1,000 people in Western Australia and New South Wales to 116 YLD per 1,000 people in the Northern Territory (Table 8.2).

As a result of the differences in fatal burden, the proportion of burden attributed to fatal burden ranged from 44% in the Australian Capital Territory to 59% in the Northern Territory. For most jurisdictions, this proportion was around 49–51%.

Table 8.2: DALY, YLL and YLD counts, age-standardised rates and rate ratios, by state or territory, 2011

	Total burden			Non-fatal burden			Fatal burden		
Jurisdiction	**DALY (000s)**	**ASR**	**Rate ratio**	**YLD (000s)**	**ASR**	**Rate ratio**	**YLL (000s)**	**ASR**	**Rate ratio**
NSW	1,464	187.0	1.0	715	94.2	1.0	749	92.8	1.0
Vic	1,095	184.9	1.0	560	96.9	1.0	534	87.9	0.9
Qld	907	197.8	1.0	441	97.1	1.0	466	100.7	1.1
WA	435	183.3	1.0	223	93.9	1.0	212	89.4	1.0
SA	373	201.2	1.1	178	100.4	1.0	196	100.8	1.1
Tas	118	202.4	1.1	53	96.4	1.0	64	106.0	1.1
ACT	62	175.1	0.9	35	96.2	1.0	27	78.9	0.8
NT	54	286.3	1.5	22	116.2	1.2	32	170.1	1.8
Australia	**4,494**	**189.9**	**—**	**2,224**	**96.0**	**—**	**2,270**	**93.9**	**—**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Rate ratios compare the state/territory rate of burden with the Australian rate of burden.

Age

States and territories had a similar trend of an increasing rate of burden with increasing age. Rates were higher in the Northern Territory than in other jurisdictions across all age groups. The gap between rates for the Northern Territory and other jurisdictions increased as age increased, but was most pronounced from age 65 (Figure 8.1).

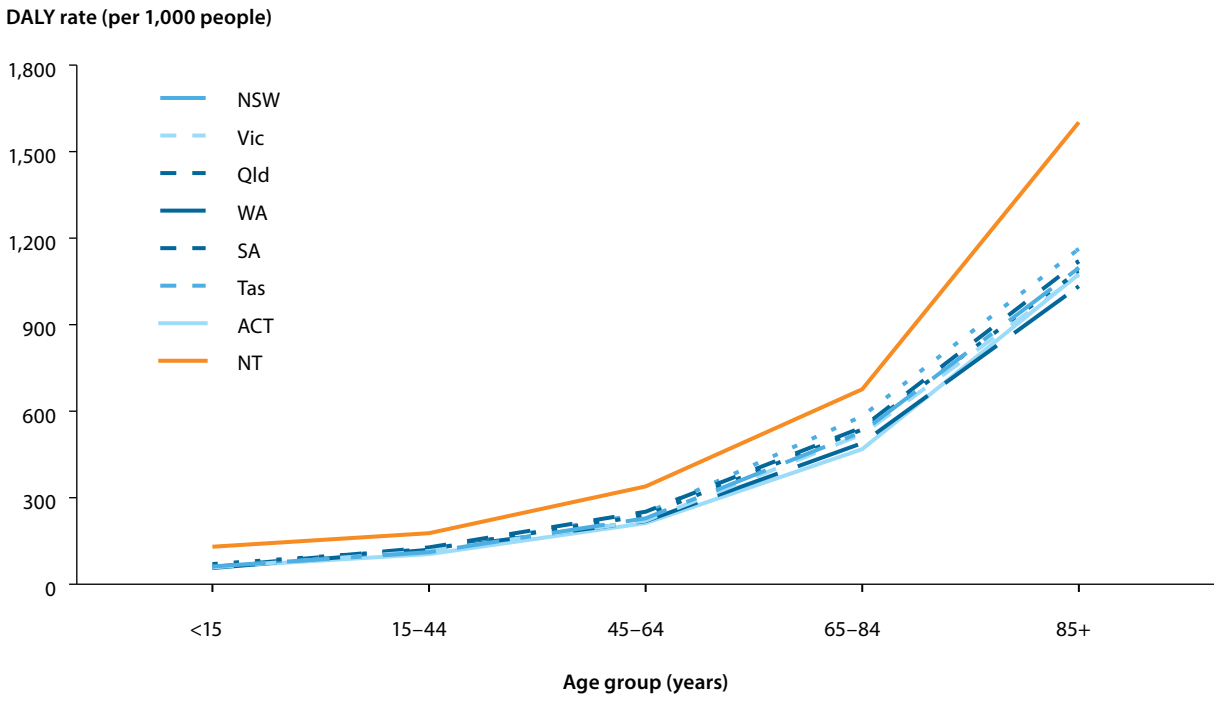


Figure 8.1: Age-specific rates of burden (DALY), by life stage and state or territory, 2011

Disease groups

There was greater variation across states and territories by disease groups. Importantly, the higher rates for total burden described above for the Northern Territory can be attributed to higher rates in almost all disease groups, except for mental & substance use disorders and musculoskeletal conditions. In particular, kidney & urinary diseases were more than 3 times the national rate; the rates for infections were 2.7 times the national rate, endocrine disorders 2.6 times, injuries 2.3 times and cardiovascular diseases 1.8 times. For the remaining jurisdictions, ASR were most varied for cancer, injuries, mental & substance use disorders and cardiovascular diseases (Table 8.3).

Fatal burden differed considerably by states and territories for cancer, cardiovascular diseases and injuries—the three main causes of fatal burden (Appendix Table D7). In particular, rates of injuries ranged from 10 YLL per 1,000 people in the Australian Capital Territory to 30 YLL per 1,000 people in the Northern Territory.

By comparison, there was less variation in rates of non-fatal burden across states and territories (Appendix Table D6). The greatest differences were observed for mental & substance use disorders, respiratory diseases, injuries, musculoskeletal conditions and cardiovascular diseases. For example, Victoria and South Australia had the highest ASR in non-fatal burden for mental & substance use disorders (26 YLD per 1,000 people) and Tasmania had the lowest (19 YLD per 1,000 people).

Table 8.3: Age-standardised DALY rates, by disease group and state or territory, 2011

Disease group	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	Australia
Blood/metabolic	2.0	2.0	2.3	2.1	2.4	2.6	2.6	4.0	2.1
Cancer	34.8	33.7	34.6	31.9	37.9	37.4	28.7	42.0	34.2
Cardiovascular	27.0	24.0	28.3	24.0	28.1	27.2	22.1	47.6	26.4
Endocrine	4.0	4.0	4.7	4.4	5.1	4.9	4.0	11.3	4.3
Gastrointestinal	6.1	5.8	6.1	5.8	6.5	5.8	6.1	12.2	6.0
Hearing/vision	4.0	3.9	4.0	4.2	3.7	4.5	3.4	4.5	4.0
Infant/congenital	5.5	4.6	6.6	4.3	4.7	6.3	4.4	11.7	5.4
Infections	3.1	2.9	3.3	2.8	3.5	2.2	2.2	8.3	3.1
Injuries	15.3	15.7	21.1	19.1	18.6	18.4	13.4	39.8	17.5
Kidney/urinary	2.3	2.2	2.5	2.2	2.5	2.3	2.1	7.8	2.4
Mental	23.9	26.8	23.2	25.0	26.4	20.0	25.3	22.2	24.6
Musculoskeletal	21.4	21.5	23.1	22.1	22.8	26.3	23.4	20.6	22.1
Neurological	12.7	11.9	11.7	12.1	13.3	15.4	14.2	17.8	12.4
Oral	4.3	4.5	4.4	3.2	4.2	5.1	2.8	4.1	4.2
Reproductive/maternal	1.6	1.8	1.9	1.6	1.7	2.1	1.8	1.7	1.7
Respiratory	15.4	16.2	16.5	15.3	16.5	18.6	15.3	26.4	16.0
Skin	3.5	3.4	3.4	3.4	3.4	3.5	3.4	4.2	3.4
All	**187.0**	**184.9**	**197.8**	**183.3**	**201.2**	**202.4**	**175.1**	**286.3**	**189.9**

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Variation by disease

Figure 8.2 depicts the 10 specific diseases that contributed the most burden in 2011 for each state or territory. Importantly, some of the diseases with the greatest burden nationally were not ranked as highly for some jurisdictions. For example, stroke did not feature in the top 10 for Western Australia, the Northern Territory or the Australian Capital Territory; and suicide & self-inflicted injuries did not feature in the top 10 for New South Wales, Victoria and the Australian Capital Territory. Conversely, asthma appeared in the 10 highest ranking conditions for New South Wales, Victoria, Western Australia and the Australian Capital Territory, but not nationally.

The Northern Territory showed the greatest variation from the national rankings, with diabetes, injuries to motor vehicle occupants from road traffic injuries, alcohol use disorders and chronic liver disease ranking in the top 10.

These variations reflect a complex interaction between factors described at the beginning of this section. Analyses of burden by remoteness and socioeconomic (see sections 8.2 and 8.3, respectively) provide further information on how these factors influence the distribution of the burden in Australia. Chapter 2 provides additional discussion of interactions between jurisdiction, remoteness and socioeconomic disadvantage.

Data quality

Data quality for fatal burden was high for all states and territories. Data quality for estimating non-fatal burden varied across diseases at the jurisdictional level. For some diseases, there were reliable data for all states and territories. For others, there were reliable data for some jurisdictions but not for others. Even when data were available by state and territory, estimates may not have been reliable in jurisdictions with smaller populations (for example, the Northern Territory, Tasmania and the Australian Capital Territory). When appropriate data were not available, adjustments were made to national prevalence rates to produce jurisdiction-specific rates.

Figure 8.2: Leading causes of total burden (proportion %; age-standardised DALY rate per 1,000 people), by state or territory, 2011

Rank	State/territory								
	NSW	Vic	Qld	WA	SA	Tas	NT	ACT	Australia
1st	Coronary heart disease (8.0%; 13.9)	Coronary heart disease (7.3%; 12.6)	Coronary heart disease (7.8%; 15.2)	Coronary heart disease (7.2%; 13.1)	Coronary heart disease (8.2%; 14.6)	Coronary heart disease (7.4%; 13.3)	Coronary heart disease (8.2%; 26.7)	Coronary heart disease (5.8%; 10.7)	Coronary heart disease (7.7%; 13.8)
2nd	Other musculoskeletal (4.1%; 7.7)	Back pain and problems (3.9%; 7.4)	Other musculoskeletal (4.6%; 9.1)	Other musculoskeletal (4.3%; 7.8)	Dementia (4.1%; 6.6)	Other musculoskeletal (4.9%; 9.8)	Suicide/self-inflicted injuries (4.7%; 9.9)	Other musculoskeletal (5.1%; 9.0)	Other musculoskeletal (4.1%; 7.8)
3rd	Lung cancer (3.6%; 6.5)	Other musculoskeletal (3.8%; 7.0)	COPD (3.8%; 7.4)	Back pain and problems (3.9%; 7.0)	Back pain and problems (3.8%; 8.2)	COPD (4.1%; 7.6)	COPD (4.5%; 16.3)	Anxiety disorders (5.1%; 8.4)	Back pain and problems (3.6%; 7.1)
4th	COPD (3.6%; 6.3)	Anxiety disorders (3.6%; 7.2)	Lung cancer (3.4%; 6.5)	Depressive disorders (3.5%; 6.5)	COPD (3.6%; 6.5)	Lung cancer (4.1%; 7.4)	RTI/motor vehicle occupant (3.6%; 7.8)	Back pain and problems (4.3%; 7.1)	COPD (3.6%; 6.5)
5th	Back pain and problems (3.6%; 7.0)	Depressive disorders (3.6%; 7.1)	Back pain and problems (3.4%; 6.7)	Suicide/self-inflicted injuries (3.4%; 6.2)	Other musculoskeletal (3.2%; 6.7)	Dementia (4.0%; 6.9)	Lung cancer (3.1%; 10.1)	Dementia (3.0%; 5.9)	Lung cancer (3.4%; 6.3)
6th	Dementia (3.5%; 5.6)	Dementia (3.6%; 5.8)	Suicide/self-inflicted injuries (3.3%; 6.8)	Lung cancer (3.3%; 5.9)	Lung cancer (3.2%; 6.1)	Stroke (3.1%; 5.6)	Diabetes (3.0%; 10.7)	Asthma (2.8%; 4.8)	Dementia (3.4%; 5.7)
7th	Stroke (3.5%; 5.9)	COPD (3.4%; 6.1)	Stroke (3.0%; 5.8)	Anxiety disorders (3.2%; 5.8)	Stroke (3.2%; 5.5)	Back pain and problems (3.0%; 6.6)	Back pain and problems (2.6%; 6.9)	Depressive disorders (2.7%; 4.5)	Anxiety disorders (3.1%; 6.4)
8th	Anxiety disorders (3.1%; 6.3)	Lung cancer (3.4%; 6.0)	Anxiety disorders (2.9%; 5.9)	Dementia (3.1%; 5.7)	Anxiety disorders (2.8%; 6.5)	Rheumatoid arthritis (2.8%; 5.7)	Other musculoskeletal (2.5%; 6.7)	COPD (2.7%; 5.1)	Stroke (3.0%; 5.4)
9th	Depressive disorders (2.5%; 5.0)	Stroke (2.9%; 5.0)	Dementia (2.8%; 5.4)	COPD (3.0%; 5.7)	Depressive disorders (2.8%; 6.4)	Suicide/self-inflicted injuries (2.8%; 6.7)	Alcohol use disorders (2.3%; 5.0)	Lung cancer (2.6%; 4.9)	Depressive disorders (2.8%; 5.8)
10th	Asthma (2.2%; 4.5)	Asthma (2.7%; 5.2)	Depressive disorders (2.5%; 5.2)	Asthma (2.5%; 4.5)	Suicide/self-inflicted injuries (2.7%; 6.4)	Diabetes (2.5%; 4.7)	Chronic liver disease (2.3%; 6.1)	Upper respiratory conditions (2.4%; 4.1)	Suicide/self-inflicted injuries (2.5%; 5.1)

8.2 Burden of disease by remoteness

In this report, remoteness is divided into *Major cities, Inner regional, Outer regional, Remote* and *Very remote* areas. These categories are defined by an area's relative distance to services (ABS 2013). Most (88%) of Australia's population lives in *Major cities* and *Inner regional* areas (Table 8.4).

The key aim of the analysis in this chapter is to assess the variation in disease burden across remoteness areas, rather than to provide detailed estimates (or analysis of them) for a particular remoteness category. However, it is worth noting that there are a range of important demographic, socioeconomic and environmental factors that differ by remoteness, which will influence health status:

- As well as different population sizes, each remoteness area has a different population age structure. Children generally make up a greater proportion of the population in more remote areas than in less remote areas, whereas elderly Australians make up a smaller proportion. Age-standardising removes the influence of these different age structures to allow different regions to be compared.
- People living in more remote areas are often disadvantaged with regard to educational and employment opportunities, income, and access to goods and services. Health behaviours and risks may also differ by remoteness. For example, the proportion of people who go to hospital for conditions that are considered potentially preventable with timely and adequate non-hospital care is higher outside *Major cities*. There are also higher proportions of Aboriginal and Torres Strait Islander people in more remote areas (AIHW 2014b). These factors have not been adjusted for in these comparisons.
- Together, variance across remoteness areas presents a fairly unique challenge for health provision in Australia, as 2.3% of people living in *Remote* and *Very remote* areas are dispersed across 85% of Australia's total land area. Added to this geographical challenge are the socioeconomic disadvantages, a higher cost of providing health services in more remote areas and the more limited availability of both infrastructure and the workforce required to provide these services. The following analysis highlights the overarching health inequalities across remoteness areas. While this cannot fully explain *why* such health inequalities exist, it does contribute to a more informed and specialised approach to health-care planning, program development and service delivery models outside of *Major cities*.

Total burden

As would be expected, the greatest proportion of total burden was experienced in *Major cities* and the smallest proportion in *Very remote* areas, in proportions roughly similar to the distribution of the population.

Across Australia, 188,800 DALY (or 4.2% of all DALY) were considered 'excess' due to remoteness. 'Excess' DALY is the burden that would have been avoided if the rate of burden had been the same as in the area with the lowest rate of burden (in this case, *Major cities).* As a proportion of total burden, excess was greatest in *Very remote* areas (40.5%) (Table 8.4).

Table 8.4: Distribution of population and burden (DALY), by remoteness, 2011

Remoteness area	Population ('000)	Population (% of total)	DALY ('000)	DALY (% of total)	Excess DALY ('000)[a]	Excess DALY (%)[b]
Major cities	15,685	70.2	2,961	65.9	0	0.0
Inner regional	4,111	18.4	950	21.2	98	10.3
Outer regional	2,026	9.1	456	10.2	52	11.3
Remote	315	1.4	73	1.6	18	24.4
Very remote	203	0.9	52	1.1	21	40.5
Australia[c]	**22,340**	**100.0**	**4,494**	**100.0**	**188**	**4.2**

(a) Observed burden for each remoteness area was compared with the expected burden if age-specific rates of burden were the same as for *Major cities*.

(b) The proportion (%) of excess burden is expressed as a proportion of excess to total observed burden for the remoteness area.

(c) Excess burden in Australia reflects all excess burden attributed to remoteness areas (outside of *Major cities*).

The ASR of burden increased with increasing remoteness—*Major cities* experienced the least burden per population (181 DALY per 1,000 people) while *Very remote* areas experienced the most burden (301 DALY per 1,000 people). This rate was 1.7 times the rate for *Major cities* (Table 8.5). This pattern was mostly driven by fatal burden; in *Very remote* areas, the ASR of fatal burden was twice the rate for *Major cities* (178 and 87 YLL per 1,000 people, respectively). As a result, fatal burden made up a greater proportion of total burden in *Very remote* areas (61%) compared with *Major cities* (49%).

Table 8.5: DALY, YLL and YLD counts, age-standardised rates and rate ratios, by remoteness, 2011

	Total burden			Non-fatal burden			Fatal burden		
Remoteness area	DALY ('000)	ASR	Rate ratio[a]	YLD ('000)	ASR	Rate ratio[a]	YLL ('000)	ASR	Rate ratio[a]
Major cities	2,961	181.4	1.0	1,517	94.2	1.0	1,443	87.2	1.0
Inner regional	950	205.3	1.1	450	102.2	1.1	501	103.1	1.2
Outer regional	456	206.8	1.1	202	94.3	1.0	254	112.5	1.3
Remote	73	242.0	1.3	33	107.0	1.1	41	135.0	1.5
Very remote	52	300.8	1.7	20	122.8	1.3	31	178.0	2.0
Australia	**4,494**	**189.9**		**2,224**	**96.0**		**2,270**	**93.9**	

(a) Rate ratios compare the remoteness area rate of burden with the *Major cities* rate of burden.

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Each remoteness area showed a similar pattern of increasing rates of burden in older age groups; this increase was the greatest for *Very remote areas.* Apart from *Very remote* areas, burden in infants and children aged under 15 was mostly similar; however, the trend of increasing burden with increasing remoteness became more evident in older ages (Figure 8.3).

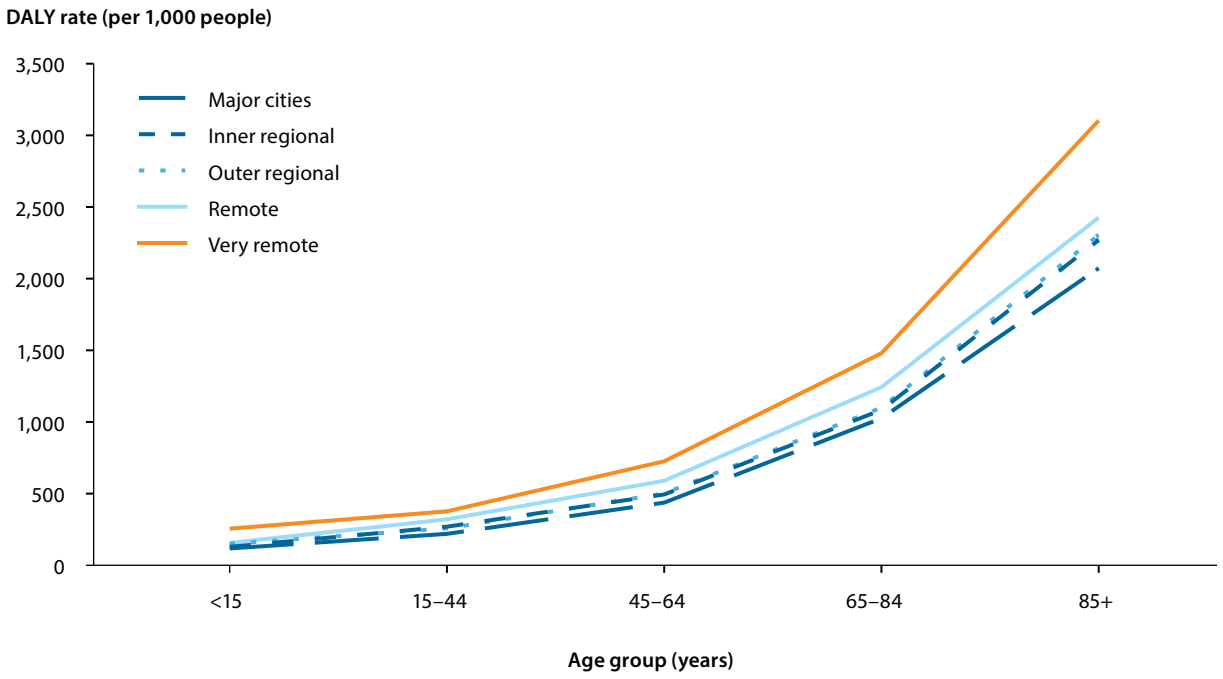


Figure 8.3: Age-specific rates of burden (DALY), by life stage and remoteness, 2011

Disease groups

For most disease groups, ASR of burden increased with remoteness. Table 8.6 contrasts the ASR in the least remote *(Major cities)* and more remote *(Very remote)* areas to indicate how the effect of remoteness differs across disease groups. For most disease groups, the rate of burden was greater in *Very remote* areas (represented as rate ratios greater than 1). The greatest relative difference in rates of burden was for kidney & urinary diseases (*Very remote* areas had more than 6.0 times the rate of *Major cities*), followed by endocrine disorders (3.2 times) and injuries (3.0 times). Because of the high national rate, cardiovascular diseases and injuries had the greatest absolute difference in rates between *Major cities* and *Very remote* areas (differences of 28 and 29 DALY per 1,000 people, respectively). As a result, cardiovascular diseases and injuries contributed to around 24% and 29%, respectively, of the excess burden in *Very remote* areas.

*Very remote a*reas had lower rates of burden than *Major cities* for mental & substance use disorders, reproductive & maternal conditions and neurological conditions.

Table 8.6: Age-standardised DALY rates, by disease group and remoteness, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote	Australia	Rate ratio[(a)]	Rate difference[(b)]
Blood/metabolic	2.0	2.3	2.4	2.7	2.4	2.1	1.2	0.3
Cancer	32.8	36.4	37.8	38.8	37.2	34.2	1.1	4.3
Cardiovascular	24.8	28.1	30.6	38.5	53.2	26.4	2.1	28.4
Endocrine	4.1	4.2	5.1	8.0	13.0	4.3	3.2	8.9
Gastrointestinal	5.7	6.4	6.8	8.6	11.0	6.0	1.9	5.3
Hearing/vision	3.9	4.4	3.9	2.7	5.1	4.0	1.3	1.2
Infant/ congenital	5.0	5.9	7.1	5.7	11.7	5.4	2.4	6.8
Infections	2.9	3.1	3.6	5.4	8.5	3.1	2.9	5.6
Injuries	15.0	21.4	24.4	36.8	44.4	17.5	3.0	29.4
Kidney/urinary	2.3	2.2	2.6	4.8	14.0	2.4	6.2	11.8
Mental	25.6	23.5	20.7	20.8	22.2	24.6	0.9	–3.4
Musculoskeletal	21.0	25.6	21.0	24.2	29.9	22.1	1.4	8.9
Neurological	12.0	13.9	13.4	12.4	13.0	12.4	1.1	1.0
Oral	3.7	4.9	5.3	6.4	6.4	4.2	1.7	2.7
Reproductive/ maternal	1.6	2.1	1.7	1.6	1.4	1.7	0.8	–0.3
Respiratory	15.4	17.3	17.1	21.0	22.9	16.0	1.5	7.5
Skin	3.4	3.4	3.4	3.5	4.4	3.4	1.3	0.9
All	**181.4**	**205.3**	**206.8**	**242.0**	**300.8**	**189.9**	**1.7**	**119.4**

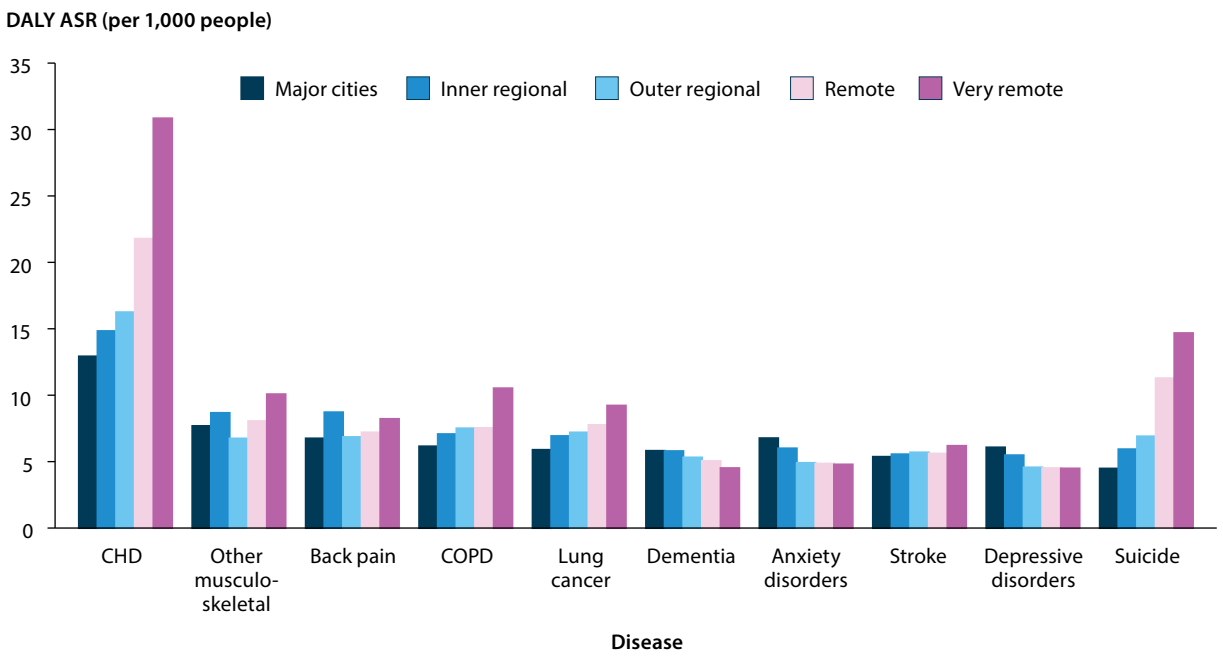
(a) Rate ratios are expressed as *Very remote* ASR divided by *Major cities* ASR.

(b) Rate differences are expressed as *Very remote* ASR minus *Major cities* ASR.

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Variation by disease

Patterns of age-standardised DALY rates across remoteness areas depend on the disease (Figure 8.4). For example, coronary heart disease, suicide & self-inflicted injuries, lung cancer and COPD showed a clear trend of greater rates of burden in more remote areas. In contrast, anxiety disorders, depressive disorders and dementia showed lower rates of burden in more remote areas. For some diseases, remoteness was not closely related to burden rates, as was the case for other musculoskeletal conditions and back pain & problems.



Notes
1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. 'CHD' refers to 'Coronary heart disease'; 'Other musculoskeletal' refers to 'Other musculoskeletal conditions'; 'Suicide' refers to 'Suicide & self-inflicted injuries'.

Figure 8.4: Age-standardised DALY rate (per 1,000 people) of the top 10 diseases, by remoteness, 2011

The top five sources of burden nationally (coronary heart disease, other musculoskeletal conditions, back pain & problems, COPD and lung cancer) appeared in the leading 10 causes of burden for each remoteness area (Figure 8.5). In all remoteness areas, coronary heart disease was the leading cause of burden. There were also several leading causes that did not rank as highly on a national level, indicating that regional patterns may be masked in the national data. These included diabetes (for *Outer regional, Remote* and *Very remote)*, asthma (for *Major cities, Outer regional, Remote* and *Very remote*), road traffic injuries/motor vehicle occupant injuries (for *Remote* and *Very remote*), rheumatoid arthritis (for *Remote*), and chronic kidney disease (for *Very remote*).

These variations reflect a complex interaction between demographic, socioeconomic and environmental factors. Further information about the impacts of jurisdiction and socioeconomic group on burden can be found in sections 8.1 and 8.3, respectively.

Rank	Remoteness category					
	Major City	Inner Regional	Outer Regional	Remote	Very Remote	Australia
1st	Coronary heart disease (7.4%; 12.9)	Coronary heart disease (8.2%; 14.8)	Coronary heart disease (8.4%; 16.2)	Coronary heart disease (8.8%; 21.8)	Coronary heart disease (9.4%; 30.8)	Coronary heart disease (7.7%; 13.8)
2nd	Other musculoskeletal (4.2%; 7.7)	Other musculoskeletal (4.2%; 8.7)	COPD (3.9%; 7.5)	Suicide/self-inflicted injuries (4.6%; 11.3)	Suicide/self-inflicted injuries (6.4%; 14.7)	Other musculoskeletal (4.1%; 7.8)
3rd	Back pain and problems (3.7%; 6.7)	COPD (3.9%; 7.1)	Lung cancer (3.9%; 7.2)	Asthma (3.4%; 8.1)	Diabetes (3.7%; 12.7)	Back pain and problems (3.6%; 7.1)
4th	Anxiety disorders (3.6%; 6.8)	Back pain and problems (3.9%; 8.7)	Other musculoskeletal (3.4%; 6.7)	Other musculoskeletal (3.4%; 8.0)	RTI/motor vehicle occupant (3.1%; 7.3)	COPD (3.6%; 6.5)
5th	Dementia (3.5%; 5.8)	Lung cancer (3.8%; 6.9)	Back pain and problems (3.2%; 6.8)	Lung cancer (3.3%; 7.8)	Other musculoskeletal (3.0%; 10.1)	Lung cancer (3.4%; 6.3)
6th	COPD (3.4%; 6.1)	Dementia (3.4%; 5.8)	Stroke (2.9%; 5.7)	RTI/motor vehicle occupant (3.2%; 7.7)	Chronic kidney disease (2.9%; 11.5)	Dementia (3.4%; 5.7)
7th	Lung cancer (3.3%; 5.9)	Stroke (3.1%; 5.6)	Suicide/self-inflicted injuries (2.9%; 6.9)	Back pain and problems (3.1%; 7.2)	Back pain and problems (2.7%; 8.2)	Anxiety disorders (3.1%; 6.4)
8th	Depressive disorders (3.2%; 6.1)	Anxiety disorders (2.5%; 6.0)	Dementia (2.8%; 5.3)	Diabetes (3.0%; 7.6)	Lung cancer (2.7%; 9.2)	Stroke (3.0%; 5.4)
9th	Stroke (3.1%; 5.4)	Suicide/self-inflicted injuries (2.3%; 5.9)	Diabetes (2.5%; 4.8)	COPD (2.9%; 7.5)	COPD (2.6%; 10.5)	Depressive disorders (2.8%; 5.8)
10th	Asthma (2.4%; 4.6)	Depressive disorders (2.3%; 5.5)	Asthma (2.3%; 5.3)	Rheumatoid arthritis (2.2%; 5.0)	Asthma (2.6%; 7.3)	Suicide/self-inflicted injuries (2.5%; 5.1)

Figure 8.5: Leading causes of total burden (proportion %; age-standardised DALY rate per 1,000 people), by remoteness, 2011

Data quality

Data quality varied substantially across diseases for remoteness estimates. For some diseases, reliable data were available; for others, only some remoteness categories were available, or some remoteness categories were grouped together. Data availability was particularly limited for *Very remote* areas as few large national surveys sampled from *Very remote* areas. When appropriate data were not available, adjustments were made to national prevalence rates to produce rates by remoteness.

8.3 Burden of disease by socioeconomic group

This section provides information on the burden of disease across socioeconomic groups by disaggregating the burden estimates for the whole population by socioeconomic position. An alternative method for examining the impact of socioeconomic position on the burden of disease would be to treat social determinants as a risk factor. That approach was not in scope for this current study, but could be a worthwhile future project. See the Chapter 11 for further information.

In this report, socioeconomic groups are based on an index of relative socioeconomic disadvantage defined by the area in which a person lives. This index is determined by factors such as household income, employment and education level, and is developed as part of the Socio-Economic Indexes for Areas by the ABS (ABS 2010).

Socioeconomic groups are presented as quintiles in this analysis. Quintile 1 (Q1) represents the 20% of the population with the lowest socioeconomic (SE) characteristics. The level of socioeconomic position increases with each quintile, through to the 20% of the population with the highest SE characteristics (Q5).

Poorer health outcomes are generally observed more in lower socioeconomic groups. This disparity is caused by a complex and interrelated set of social and economic factors, including reduced access to both health services and resource availability, and the influence of uptake of risky behaviours (AIHW 2014b).

Each quintile has a similar number of people; however, the lower SE groups have a larger proportion of elderly people compared with the higher groups (Table 8.7). Over 90% of the highest SE group live in *Major cities* compared with just over half from the lowest SE group. A greater proportion of the Indigenous population and individuals with disability are also found in the lowest SE group (ABS 2010).

Table 8.7: Demographic characteristics of socioeconomic groups, 2011

Socioeconomic group	Total population (million)	Proportion in Major cities (%)	Proportion aged <15 years (%)	Proportion aged 65+ years (%)
Q1 (lowest)	4.3	53.9	19.9	15.4
Q2	4.4	54.1	18.7	15.2
Q3	4.5	65.9	18.8	14.1
Q4	4.6	82.4	18.6	12.1
Q5 (highest)	4.6	93.0	18.9	12.4

Source: ABS 2010.

Similar to analysing burden by remoteness, the aim of this section is to assess variation of disease burden across quintiles, highlighting any health disparities. This can contribute to a more informed and targeted approach to prevention of diseases and health-care planning, program development and service delivery models.

Total burden

The lowest SE group of the population (Q1) experienced the greatest proportion (24%) of total burden (Table 8.8). Total burden decreased with increasing SE position, with the smallest proportion of burden found in the highest SE group (Q5).

The highest SE group experienced only two-thirds of the burden experienced by the lowest group. This SE gradient results in 21% of DALY being considered 'excess'—that is, the total burden that would have been avoided if all quintiles had the same rate as those in the highest SE quintile (Q5). The proportion (%) of excess burden is the proportion of the excess to total burden experienced in each group.

Table 8.8: Distribution of burden (DALY) in socioeconomic groups, 2011

Socioeconomic group	DALY ('000)	DALY (% of total)	Excess ('000)[a]	Excess DALY (%)[b]
Q1 (lowest)	1,067	23.6	357	33.5
Q2	1,020	22.6	287	28.2
Q3	922	20.4	197	21.3
Q4	800	17.7	106	13.3
Q5 (highest)	708	15.7	0	0.0
Australia[c]	**4,494**	**100.0**	**962**	**21.0**

(a) Observed burden for each socioeconomic group was compared with the expected burden if age-specific rates of burden were the same as for the highest socioeconomic group (Q5).

(b) The proportion (%) of excess burden is expressed as a proportion of excess to total observed burden for the socioeconomic group.

(c) Excess burden in Australia reflects all excess burden attributed to socioeconomic group (outside of Q5).

Even when taking differing age structures into consideration, the overall rate of burden still decreased with increasing SE position. The highest SE group (Q5) experienced the lowest burden per population (149.7 DALY per 1,000 people) while the lowest SE group (Q1) experienced the most burden (230.2 DALY per 1,000 people) (Table 8.9).

The contribution of fatal and non-fatal burden to total burden also differed across SE groups. Premature mortality contributed slightly more to overall burden in Q1 (54% YLL; 46% YLD), whereas the proportion of ill health was slightly higher in Q5 (47% YLL; 53% YLD).

Table 8.9: DALY, YLL and YLD counts, age-standardised rates and rate ratios, by socioeconomic group, 2011

	Total burden			Non-fatal burden			Fatal burden		
Socioeconomic group	**DALY ('000)**	**ASR**	**Rate ratio[a]**	**YLD ('000)**	**ASR**	**Rate ratio[a]**	**YLL ('000)**	**ASR**	**Rate ratio[a]**
Q1 (lowest)	1,067	230.2	1.5	492	110.3	1.4	575	120.0	1.7
Q2	1,020	212.6	1.4	494	106.7	1.3	526	105.8	1.5
Q3	922	192.3	1.3	459	98.1	1.2	462	94.1	1.3
Q4	800	173.0	1.2	423	91.7	1.2	377	81.3	1.2
Q5 (highest)	708	149.7	1.0	372	79.2	1.0	335	70.5	1.0
Australia	**4,494**	**189.9**		**2,224**	**96.0**		**2,270**	**93.9**	

(a) Rate ratios compare the socioeconomic group rate of burden with the rate of burden in the highest socioeconomic group (Q5).

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Figure 8.6 shows the rate of total burden by socioeconomic group and age group. The age pattern of burden rate is similar for all quintiles, with the rate of burden increasing with advancing age, coinciding with the onset of many chronic and age-related conditions. The rate of burden decreased as SE position increased; however, the gap between quintiles varied across the life course, with smaller gaps in the youngest and oldest age groups.

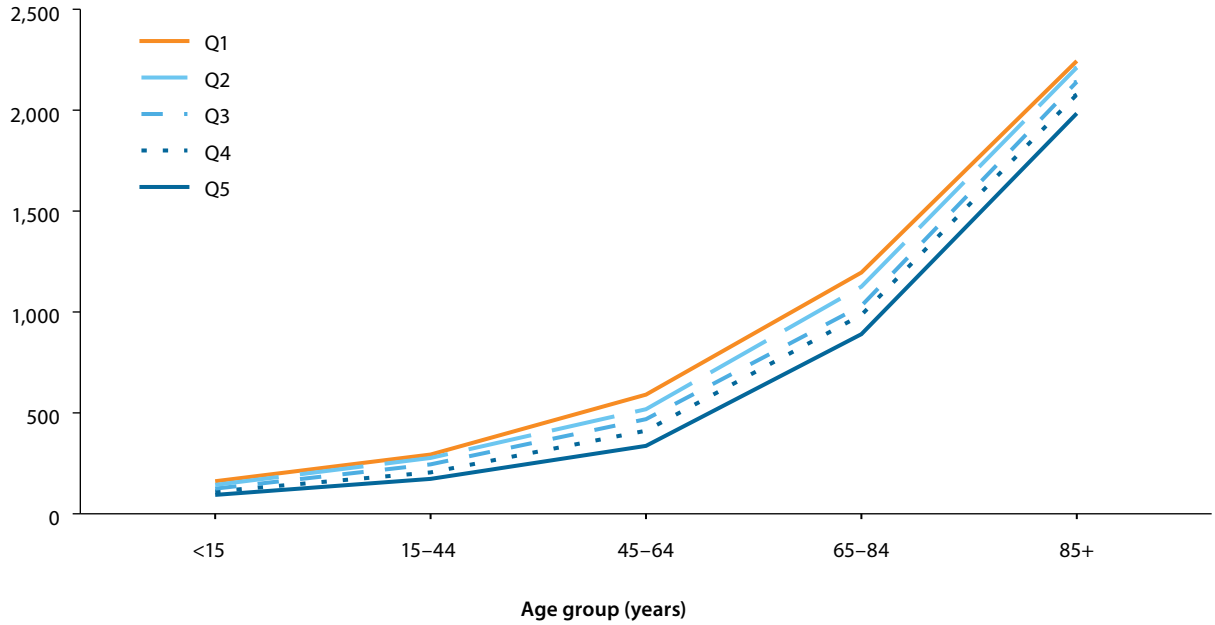


Figure 8.6: Age-specific rates of burden (DALY), by life stage and socioeconomic group, 2011

Disease groups

The lowest SE quintile (Q1) experienced greater burden compared with the highest quintile in every disease group; however, the absolute difference in rates varied by disease group.

Table 8.10 shows the absolute and relative differences in ASRs of overall burden, comparing Q1 with Q5 by disease group. The difference in DALY rate per 1,000 people were highest for mental & substance use disorders (16 DALY per 1,000 people), cardiovascular diseases (13), cancer (12) and injuries (11). These disease groups were the leading contributors of overall burden in every quintile, collectively responsible for 56% of the total burden in the lowest SE group and 51% in the highest SE group. Each disease group had a rate ratio above 1—indicating overall burden was greater in the lowest SE group compared with the highest. The rate of endocrine disorders in the lowest SE group was 2.3 times the rate in the highest SE group. The rate of burden due to injuries and to mental & substance use disorders in the lowest SE group was around double the rate in the highest SE group (rate ratios 1.9 and 2.0, respectively), whereas the burden from skin and hearing & vision disorders was fairly similar between these two socioeconomic groups (rate ratio of 1.1).

Table 8.10: Age-standardised DALY rate, by disease group and socioeconomic group, 2011

Disease group	Q1 (lowest)	Q2	Q3	Q4	Q5 (highest)	Australia	Rate ratio[a]	Rate difference[b]
Blood/metabolic	2.8	2.4	2.3	1.7	1.5	2.1	1.8	1.2
Cancer	40.3	36.6	34.3	31.6	28.4	34.2	1.4	11.8
Cardiovascular	33.2	29.5	26.1	22.9	20.2	26.4	1.6	13.0
Endocrine	6.5	4.8	3.9	3.7	2.8	4.3	2.3	3.7
Gastrointestinal	7.6	6.7	5.9	5.2	4.7	6.0	1.6	2.9
Hearing/vision	4.1	3.7	4.1	4.0	3.8	4.0	1.1	0.3
Infant/congenital	6.8	6.3	5.3	4.7	4.3	5.4	1.6	2.5
Infections	4.0	3.5	3.0	2.7	2.4	3.1	1.7	1.6
Injuries	23.5	20.6	17.8	14.4	12.3	17.5	1.9	11.2
Kidney/urinary	3.3	2.4	2.2	2.1	1.8	2.4	1.8	1.5
Mental	31.6	30.8	27.8	21.8	16.0	24.6	2.0	15.6
Musculoskeletal	24.0	23.4	22.7	21.9	18.8	22.1	1.3	5.2
Neurological	13.7	13.4	12.3	11.8	11.3	12.4	1.2	2.5
Oral	4.9	5.3	4.2	3.9	3.2	4.2	1.5	1.7
Reproductive/ maternal	1.9	1.8	1.6	1.7	1.6	1.7	1.2	0.3
Respiratory	18.4	17.8	15.3	15.6	13.1	16.0	1.4	5.3
Skin	3.6	3.4	3.4	3.4	3.4	3.4	1.1	0.2
All	**230.2**	**212.6**	**192.3**	**173.0**	**149.7**	**189.9**	**1.5**	**80.5**

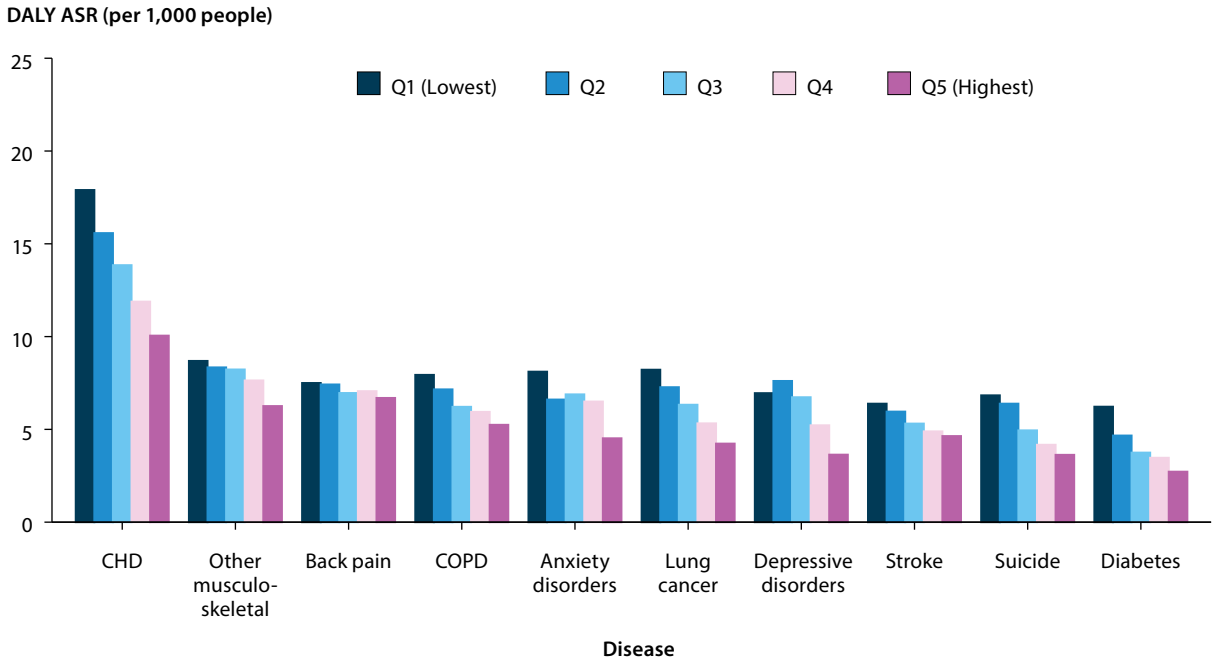
(a) Rate ratios are expressed as Q1 ASR divided by Q5 ASR.

(b) Rate differences are expressed as Q1 ASR minus Q5 ASR.

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Variation by disease

Generally, a strong gradient was seen across quintiles in the ASRs, with higher rates of burden in the lowest SE group (Figure 8.7). There was a clear pattern of decreasing rate of burden from coronary heart disease, lung cancer, suicide & self-inflicted injuries, COPD and stroke with increasing socioeconomic position.



Notes
1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. 'CHD' refers to 'Coronary heart disease'; 'Other musculoskeletal' refers to 'other musculoskeletal conditions'; 'Suicide' refers to 'Suicide & self-inflicted injuries'.

Figure 8.7: Age-standardised DALY rate of the top 10 diseases, by socioeconomic group, 2011

Despite these variations, similar diseases made up the top 10 contributors of total burden in each of the socioeconomic groups; however, the ASR of total burden and the ranking within each socioeconomic group varied.

Coronary heart disease was the leading cause of burden across all quintiles (Figure 8.8). As the level of SE position increased, the contribution of lung cancer and COPD to total burden decreased. Lung cancer was in the next two major causes of burden in quintiles 1 and 2, whereas musculoskeletal conditions (other musculoskeletal conditions, and back pain & problems) were the next two highest contributors in quintiles 3 to 5.

Diabetes ranked ninth in the lowest SE quintile (Q1); however, it was not one of the top 10 rankings in quintiles 2 to 5. This coincides with the higher rate of endocrine disorders in Q1 compared with Q5, shown previously in the burden by disease groups section.

Figure 8.8: Leading causes of total burden (proportion %; age-standardised DALY rate per 1,000 people), by socioeconomic group, 2011

Data quality

Data quality by socioeconomic group varied. Where possible, data by socioeconomic group were obtained directly. When appropriate data were not available, adjustments were made to national prevalence rates to produce rates by socioeconomic group, using secondary data sources such as hospitalisations or national survey data.

Similar to estimating burden by remoteness, data availability was particularly limited for *Very remote* areas, which have a high proportion of quintile 1 compared with other remoteness areas.

9 Overview of results by disease group

Overview

Burden of disease analysis is available for each of the following disease groups:

- Blood and metabolic disorders
- Cancer and other neoplasms
- Cardiovascular diseases
- Endocrine disorders
- Gastrointestinal disorders
- Hearing and vision disorders
- Infant and congenital conditions
- Infectious diseases
- Injuries
- Kidney and urinary diseases
- Mental and substance use disorders
- Musculoskeletal conditions
- Neurological conditions
- Oral disorders
- Reproductive and maternal conditions
- Respiratory diseases
- Skin disorders.

This chapter presents more detailed results for each disease group (in alphabetical order), including changes since 2003, risk factor attribution and a short statement on data quality. More information on the quality of estimates is included at Appendix B.

9.1 Blood and metabolic disorders

Blood & metabolic disorders capture the burden from bleeding conditions, nutritional disorders and conditions affecting immune or metabolic related processes. Diseases not included in this group include leukaemia and other blood cancers (see cancer & other neoplasms), infections that lower immunity (human immunodeficiency virus/acquired immune deficiency syndrome [HIV/AIDS]; see infectious diseases), endocrine disorders and injuries or external factors affecting metabolic function (for example, poisoning, alcohol use disorders).

The burden of iron-deficiency anaemia does not include anaemia due to haemolytic anaemias, gastroduodenal disorders, chronic kidney disease and maternal haemorrhage, as it is included in the burden of each of these diseases.

Overview

Blood & metabolic disorders was responsible for 1.1% of the total burden of disease in 2011 (50,500 DALY). This was predominantly due to burden from conditions included as other blood & metabolic disorders (57%), followed by iron-deficiency anaemia (23%) and protein-energy deficiency (malnutrition) (Figure 9.1a).

Fatal burden

Premature mortality caused 61% of the burden from blood & metabolic disorders. As shown in Figure 9.1b, burden due to other blood & metabolic disorders and cystic fibrosis was predominantly fatal burden. Other blood & metabolic disorders included a variety of conditions that collectively contributed over 90% of fatal burden in this disease group (27,700 YLL). The highest number of deaths within other blood & metabolic disorders was caused by elevated cholesterol and blood lipid level. Fatal burden from all blood & metabolic disorders was responsible for 1.4% of the overall fatal burden.

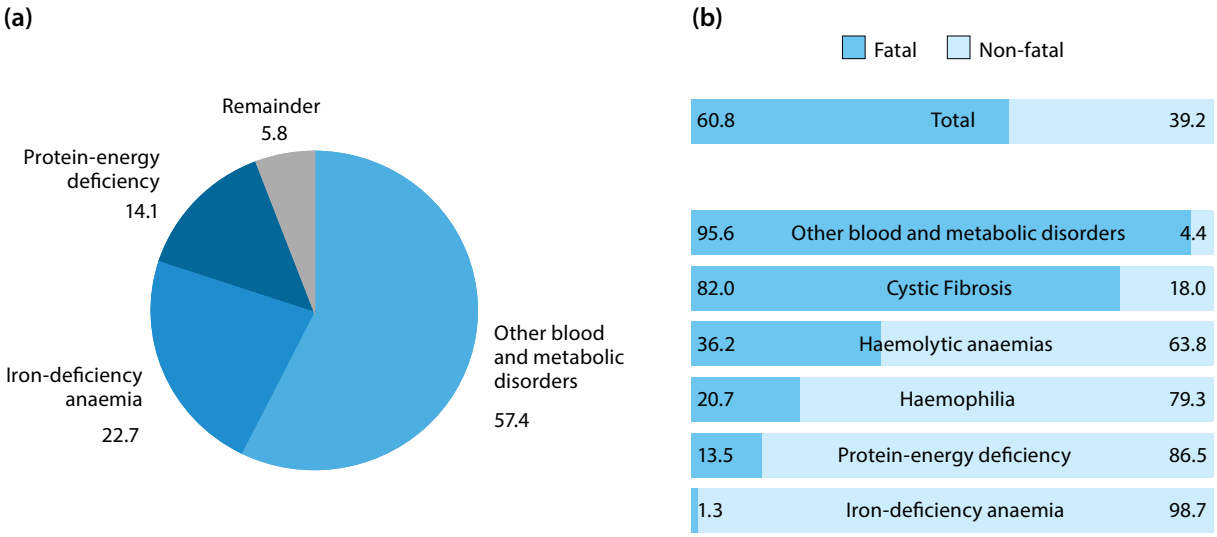


Figure 9.1: Blood and metabolic disorders burden, by disease: disease group proportion (a) and fatal and non-fatal proportions (b), 2011 (%)

Burden due to blood & metabolic disorders varied by age (Figure 9.2). Protein-energy malnutrition and other blood & metabolic disorders were responsible for the majority of burden under age 5. Burden due to iron-deficiency anaemia increased during adolescence, but declined after age 45. Genetic disorders such as cystic fibrosis and inherited haemolytic anaemias caused burden on a much smaller scale during adult years. As these conditions can lead to early death, the number of people living to older ages is far less, declining noticeably in non-fatal burden after age 60. Total burden peaked at age 80–89, predominantly due to other blood & metabolic disorders, followed by protein-energy malnutrition.

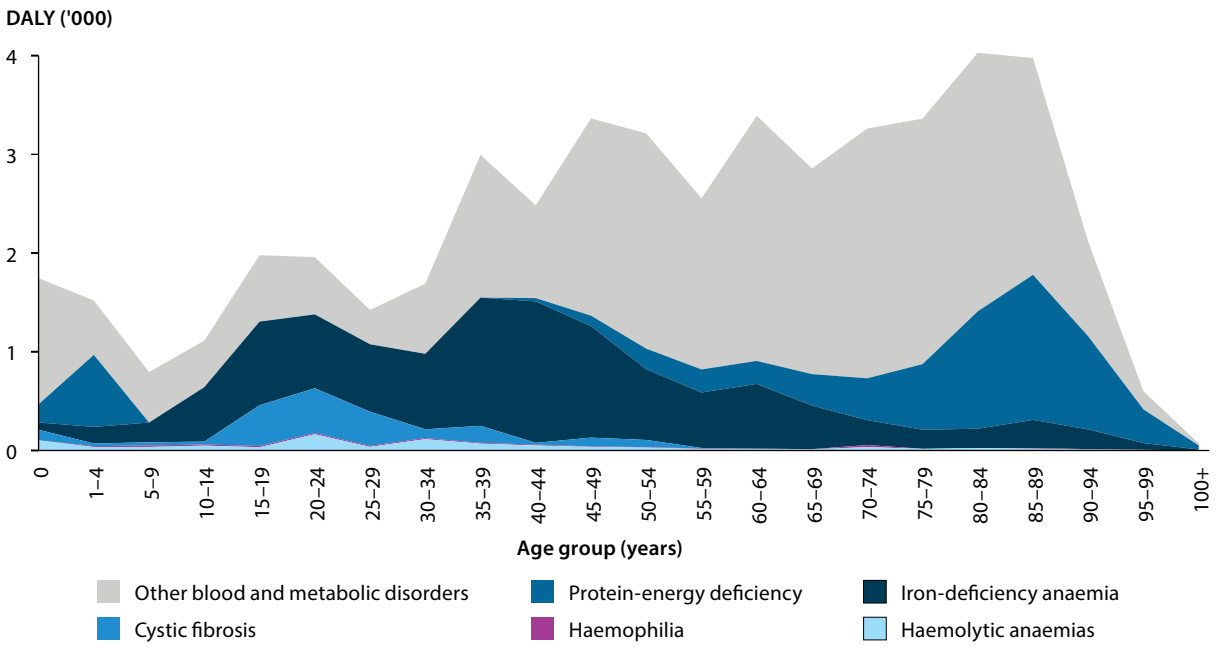


Figure 9.2: Blood and metabolic disorders burden by age and disease, 2011

Non-fatal burden

Blood & metabolic disorders were responsible for less than 1.0% of the total non-fatal burden (19,800 YLD); however, this differed by age and sex. Men experienced bleeding disorders (haemophilia and haemolytic anaemias) more often and more severely than women, whereas women experienced more iron-deficiency anaemia, accounting for 85% of the iron-deficiency non-fatal burden (Figure 9.3).

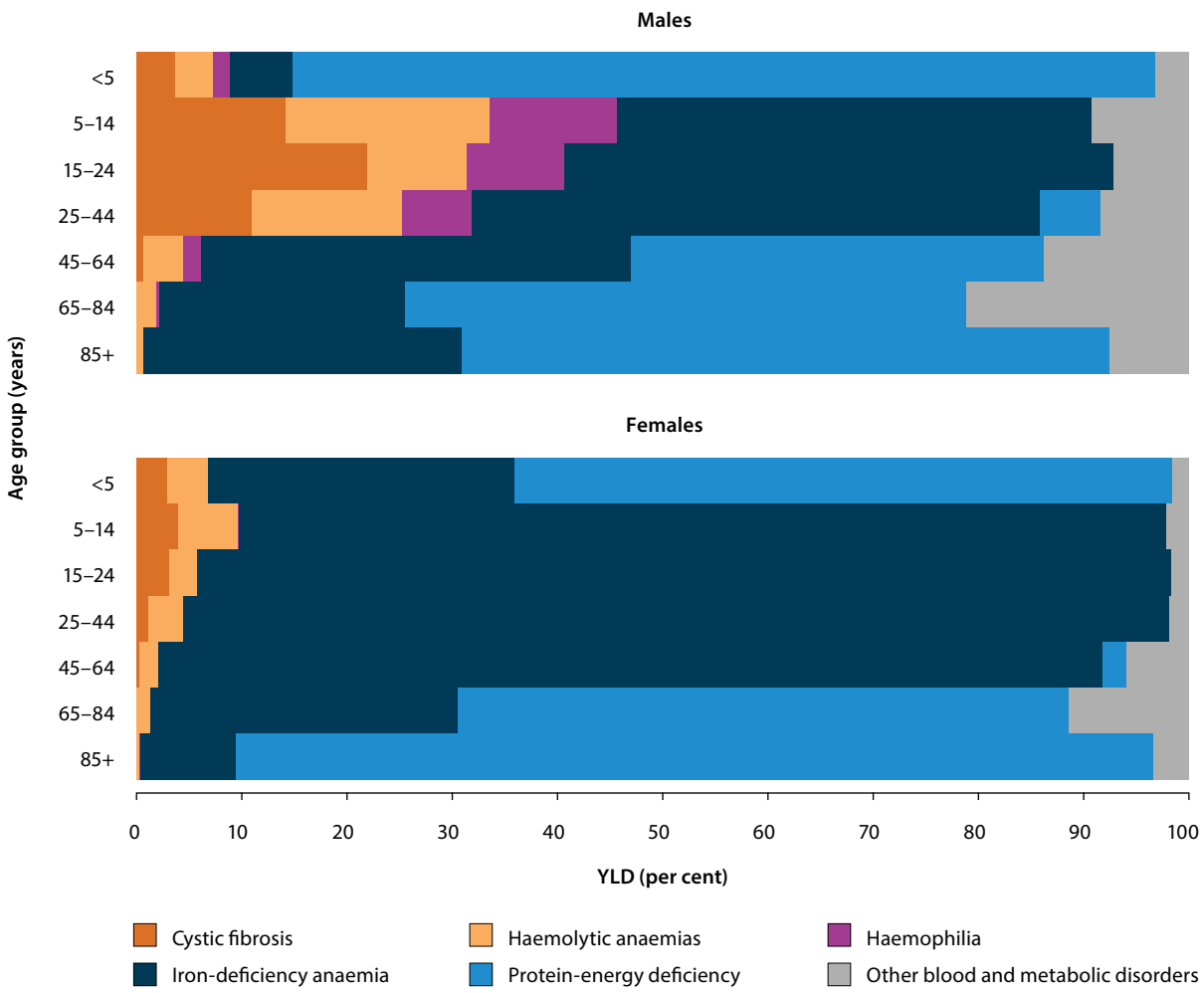


Figure 9.3: Blood and metabolic disorders non-fatal burden (YLD), by disease: proportion by broader age groups in males and females, 2011

Risk factors

Evidence is available to quantify the impact of iron deficiency for iron-deficiency anaemia. Iron deficiency was responsible for the entire burden due to iron-deficiency anaemia (11,500 DALY) (Appendix Table D15).

Changes since 2003

Since 2003, burden due to blood & metabolic disorders increased by 12% from 45,200 DALY in 2003 to 50,500 DALY in 2011. Age-standardised DALY rates reduced slightly for most conditions in 2011, compared with 2003 (Table 9.1).

Table 9.1: Age-standardised fatal and non-fatal burden rates of blood and metabolic disorders by disease, 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
Disease	**2003**	**2011**	**2003**	**2011**	**2003**	**2011**
Iron-deficiency anaemia	0.0	0.0	1.2	1.0	1.2	1.0
Protein-energy deficiency	0.1	0.1	0.5	0.5	0.6	0.5
Cystic fibrosis	0.2	0.1	<0.1	<0.1	0.2	0.2
Haemolytic anaemias	<0.1	<0.1	0.1	0.1	0.1	0.1
Haemophilia	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other blood and metabolic disorders	2.4	2.3	1.2	1.0	1.2	1.0
All blood and metabolic disorders	**2.7**	**2.6**	**1.8**	**1.7**	**4.5**	**4.3**

Note: Rates were age-standardised to the Australian population as at 30 June 2001 and are expressed per 1,000 people.

Data quality

Fatal burden estimates for blood & metabolic disorders were calculated using deaths registered in the National Mortality Database and are considered to be of high quality. Deaths from amyloidosis and electrolyte & fluid imbalance disorders are considered intermediate causes so they were redistributed to disease groups containing the most likely direct cause.

YLD estimates for haemophilia and cystic fibrosis were obtained from national registries and are considered representative of these conditions in Australia.

YLD estimates for haemolytic anaemia were based on hospitalisations. As there may be multiple admissions for the one person during the year, linked hospital data were used to determine the number of people by anaemia type. Individuals with symptoms manageable outside of hospital are not included in the analysis; therefore, estimates may underestimate health loss from less severe cases.

Non-fatal estimates for iron-deficiency anaemia and protein-energy deficiency in children were based on national surveys that obtained blood iron levels and biometric measurements, as well as on epidemiological studies. Data from national surveys were considered nationally representative; however, a sample across diverse geographical areas for iron-deficiency anaemia would provide more robust estimates.

9.2 Cancer and other neoplasms

The cancer & other neoplasms disease group include both malignant neoplasms (cancers) and benign, in situ and uncertain neoplasms. All neoplasms are included except uterine fibroids, which are included in the reproductive & maternal disease group. For a complete list of individual cancers included in this study, see Appendix Table A1.

Overview

Collectively, the disease group cancer & other neoplasms was responsible for 19% of the total burden of disease in 2011, making it the most burdensome group of diseases (20% males; 17% females). Despite the high survival and prevalence rates of cancer in Australia (AIHW 2014c), this burden was almost entirely due to dying prematurely, with only 6% of this burden due to living with cancer.

Lung (19%), bowel (11%), breast (8.5%), prostate (5.9%) and pancreatic (5.3%) cancers accounted for almost half (49%) of the cancer burden (Figure 9.4a). Despite improved survival for all these cancers since 1982 (AIHW 2012b), the burden from these five cancers was predominantly due to dying early (Figure 9.4b).

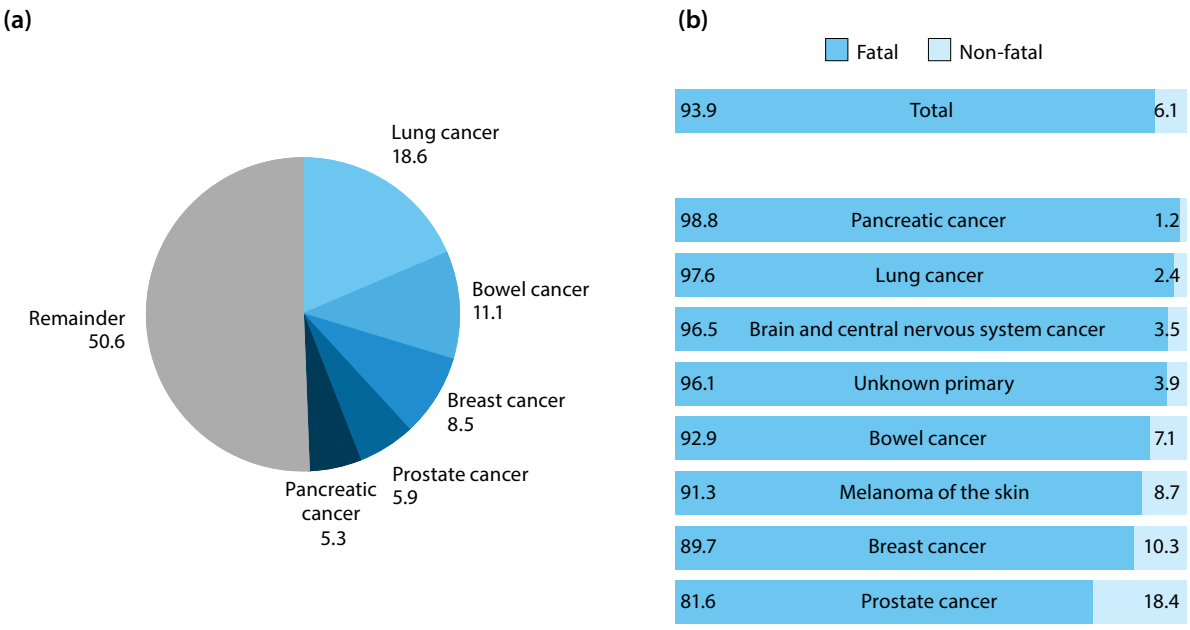


Figure 9.4: Cancer burden (DALY) by cancer type: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Health impact of living with cancer versus dying early

The burden of living with cancer versus dying early varied by cancer type. Lung and pancreatic cancer had proportionately very little non-fatal burden due to the low survival rate of these cancers, whereas prostate cancer, melanoma and breast cancer— which had higher survival rates— had a proportionately higher non-fatal burden.

Lung cancer accounted for almost one-fifth (19%) of the burden of dying early from cancer, bowel cancer 11% and breast cancer a further 8% (Table 9.2). Pancreatic cancer (responsible for around 2,500 deaths a year) had a slightly higher fatal burden (5.6%) than prostate cancer (5.1%) despite its higher number of deaths (around 3,400 deaths); this was primarily due to the younger age at which people died (average age of death in 2011 from pancreatic cancer was 73 compared with 80 for prostate cancer).

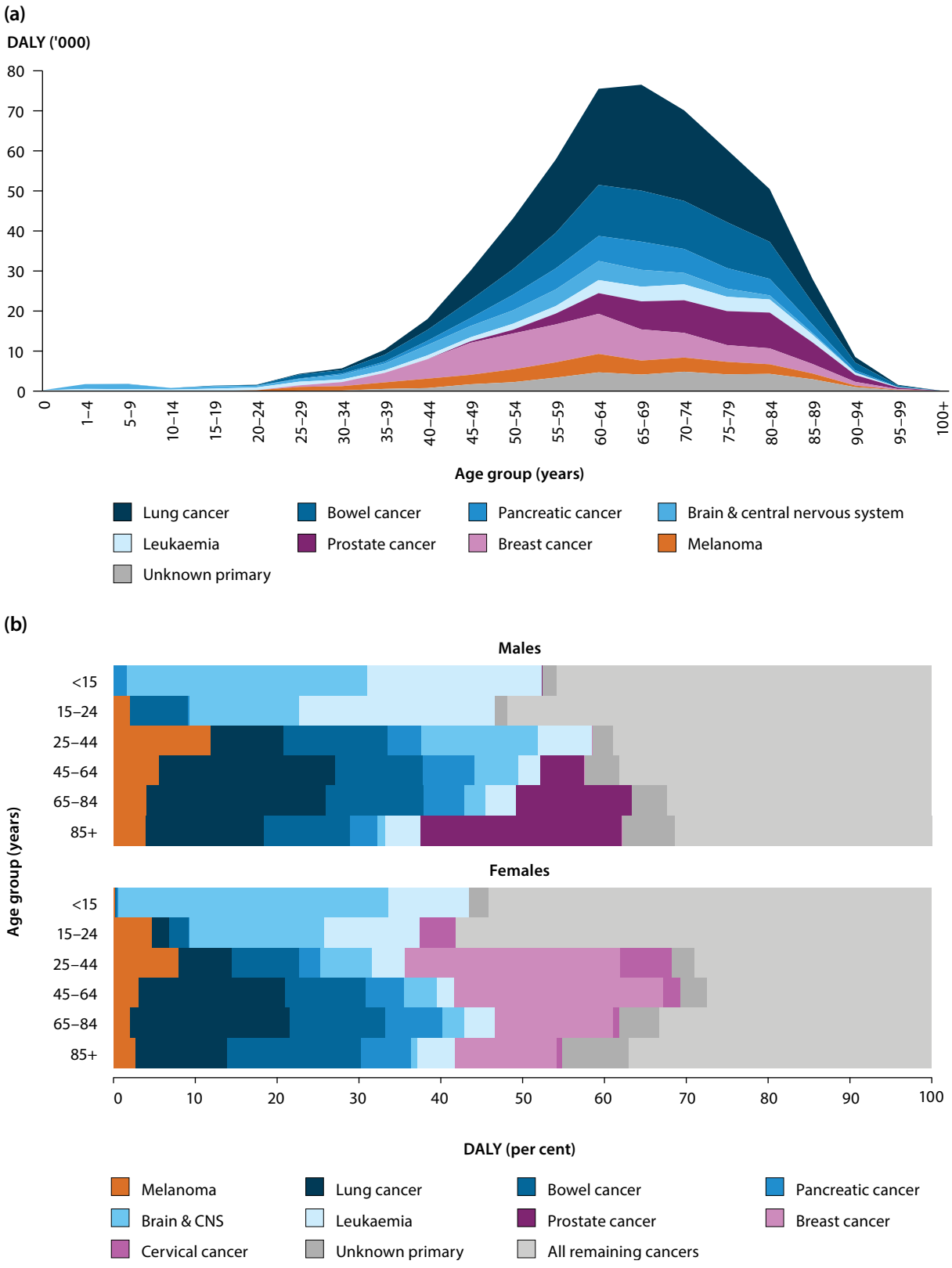
Conversely, prostate cancer accounted for nearly one-fifth (18%) of the non-fatal cancer burden, with breast cancer a further 14% and bowel cancer 13%.

Table 9.2: Top 10 causes of fatal and non-fatal cancer burden, 2011 (%)

Fatal Burden		Non-fatal burden		Total burden	
Type	**Proportion**	**Type**	**Proportion**	**Type**	**Proportion**
Lung cancer	19.3	Prostate cancer	17.8	Lung cancer	18.6
Bowel cancer	11.0	Breast cancer	14.4	Bowel cancer	11.1
Breast cancer	8.1	Bowel cancer	13.0	Breast cancer	8.5
Pancreatic cancer	5.6	Lung cancer	7.2	Prostate cancer	5.9
Prostate cancer	5.1	Melanoma of the skin	5.9	Pancreatic cancer	5.3
Brain & central nervous system cancer	4.4	Other benign, insitu & uncertain neoplasms	4.2	Brain & central nervous system cancer	4.3
Unknown primary	4.4	Non-Hodgkin lymphoma	3.0	Unknown primary	4.3
Melanoma of the skin	4.0	Benign & uncertain brain tumours	2.8	Melanoma of the skin	4.2
Leukaemia	3.7	Leukaemia	2.8	Leukaemia	3.7
Liver cancer	3.7	Other malignant neoplasms (cancers)	2.8	Other malignant neoplasms (cancers)	3.6

How does the burden vary by age and between males and females?

Cancer burden varied by age, depending on the cancer type (figures 9.5a and 9.5b). Breast cancer burden appeared much earlier than the other main cancer types, at around age 30, while prostate cancer burden emerged later, at around age 50 and over. The burden from breast, lung and bowel cancer all peaked at around ages 70–79, while melanoma and prostate cancer peaked at age 95 and over (in males). There was also a small, but noticeable, burden from brain & central nervous system cancers in children.



Note: 'Brain & CNS' refers to 'Brain & central nervous system cancers'.

Figure 9.5: Cancer burden (DALY) by age and disease (a) and proportion by broader age groups in males and females (b), by selected cancers, 2011 (%)

Comparisons of age-specific rates for males and females are in Appendix Table D12. The overall burden was higher in males than females for nearly all cancers (except sex-specific cancers). The exceptions to this were gallbladder and thyroid cancers, which had a higher burden in females. Comparison of ASR showed the extent by which these differ once difference in age structure was taken into account: males had more than 5 times the burden of laryngeal cancer and mesothelioma than females, and more than 3 times the burden of oesophageal, non-melanoma skin, mouth & pharyngeal, bladder and liver cancers than females. The rate difference between males and females was highest for lung cancer.

Risk factors

Evidence was available to quantify the impact of a large number of risk factors for a variety of cancer types. These included tobacco smoking, alcohol use, drug use, high body mass, physical inactivity, air pollution, high sun exposure, occupational exposures & hazards and various dietary risk factors. The joint contribution of these risk factors was 44% of cancer burden.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. Tobacco use was responsible for 22% of the overall cancer burden, for 80% of the lung cancer burden, for 54% of the burden due to oesophageal cancer and for 7.8% of the burden due to bowel cancer (Appendix Table D15).

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

The number of cancer-related DALY increased by 66,000 (8.6%) between 2003 and 2011. This was made up of an increase of around 54,700 YLL and 11,400 YLD.

When the changing age structure of the population was taken into account there was, in fact, a small decrease from 38 to 34 DALY per 1,000 people. This change was driven by a drop in the fatal burden as there was little change to the non-fatal burden.

This drop in YLL was influenced primarily by drops in bowel cancer (ASR down by 1.0 YLL per 1,000 people), lung cancer (0.6 YLL per 1,000 people), breast cancer (0.5 YLL per 1,000 people) and prostate cancer (0.3 YLL per 1,000 people).

Table 9.3: Changes in top 10 causes of fatal and non-fatal cancer burden, 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	2011	2003	2011	2003	2011
Lung cancer	6.7	6.1	0.1	0.1	6.8	6.3
Bowel cancer	4.5	3.5	0.3	0.3	4.8	3.8
Breast cancer	3.1	2.6	0.3	0.3	3.4	2.9
Prostate cancer	1.9	1.6	0.3	0.4	2.1	2.0
Pancreatic cancer	1.7	1.8	<0.1	<0.1	1.8	1.8
Brain & central nervous system cancer	1.6	1.5	0.1	0.1	1.7	1.5
Unknown primary	1.6	1.4	0.1	0.1	1.6	1.4
Leukaemia	1.5	1.3	0.1	0.1	1.6	1.4
Non-Hodgkin lymphoma	1.4	1.2	0.1	0.1	1.5	1.3
Melanoma of the skin	1.3	1.2	0.1	0.1	1.4	1.3
Other malignant neoplasms (cancers)	1.2	32.1	<0.1	2.1	1.2	34.2

The reduction in ASRs of YLL for bowel and lung cancers between 2003 and 2011 was primarily due to a shift toward dying at older ages (Figure 9.6). The reduction in YLL rates of bowel cancer was largest for people aged 60 to 80, with 2011 rates similar to those in 2003 for people 5 to 10 years younger (Figure 9.6a). There was a similar but less dramatic shift in the YLL rate for lung cancer, most apparent in those aged 70 to 80 (Figure 9.6b).

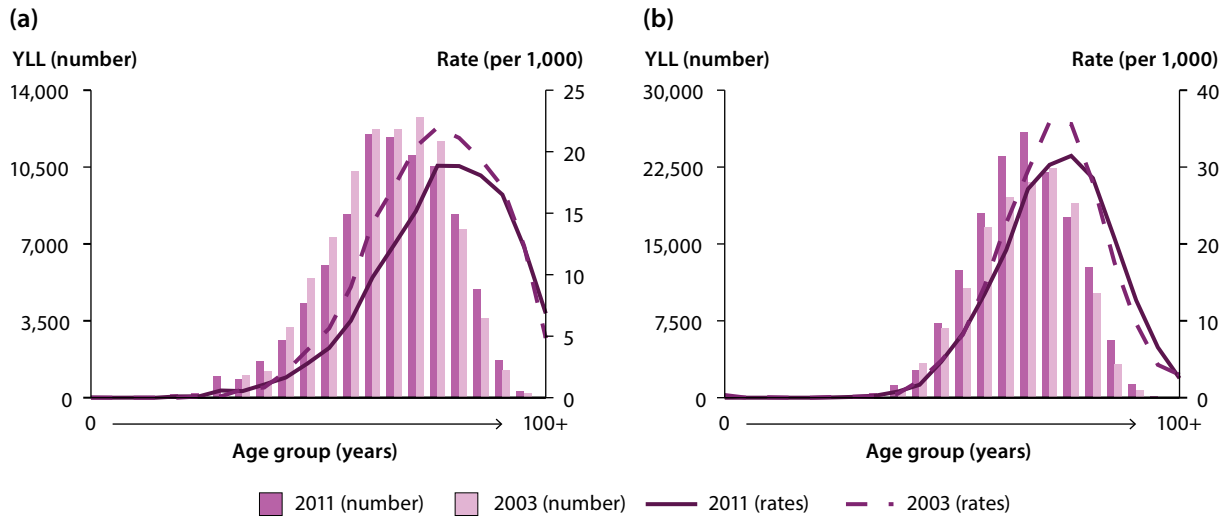


Figure 9.6: Change in fatal burden number and age-specific rates (per 1,000 people) for bowel cancer (a) and lung cancer (b), 2003 and 2011

Data quality

Fatal burden estimates for cancer & other neoplasms were calculated using deaths registered in the National Mortality Database and are considered to be of high quality. Adjustments were made for coding of deaths due to cancers of unknown primary site based on linked data from the Western Australian and South Australian cancer registries.

Data for all non-fatal estimates of malignant neoplasms (except non-melanoma skin cancer) and breast ductal carcinoma in situ were sourced from the Australian Cancer Database, the National Mortality Database and the National Hospital Morbidity Database leading to highly reliable estimates. It should be noted that incidence and prevalence data were available only to 2009 for NSW and ACT (as opposed to 2011 for other jurisdictions); however, due to the stable nature of cancer estimates, and the combination with other data sources, this was assessed as having little impact on the accuracy of the national estimates. Nonetheless, this should be borne in mind when interpreting estimates by state and territory.

Non-fatal estimates for non-melanoma skin cancer were modelled from a combination of Medicare Benefits claims data, admitted hospital data and mortality data. As Medicare Benefits claims data are administrative data, they are not a direct measure of incidence or prevalence of non–melanoma skin cancer; however, they provide a reasonable indication of the level of health loss incurred by this disease. These estimates could be improved with up-to-date Australian estimates of incidence (used in this report to derive prevalence) and prevalence.

Non-fatal estimates for benign and uncertain brain tumours and other non-malignant neoplasms were estimated from national mortality and admitted hospital data and from incidence data from Western Australia, Queensland and Victoria only. While these estimates are reliable for these states, the resulting national estimates were assessed to be of undetermined reliability.

9.3 Cardiovascular diseases

The cardiovascular diseases group includes many different conditions affecting the heart and blood vessels. The main underlying cause of the most common diseases in this group—coronary heart disease and stroke—is atherosclerosis (hardening of the arteries). It is most serious when it results in reduced or blocked blood supply to the heart as part of coronary heart disease, or to the brain (causing a stroke). Other conditions in this disease group include heart and blood vessel conditions from a range of causes. The full list of diseases in this group is given in Figure 9.7 and in Appendix Table A1.

Note that heart failure is not identified separately in this list. Instead, the effects of heart failure are included as a consequence of the various underlying diseases (coronary heart disease, rheumatic heart disease, non-rheumatic valvular disease, cardiomyopathy, hypertensive heart disease and inflammatory heart disease). Heart failure has also been included as a potential consequence of congenital heart disease, which is included in the infant & congenital conditions group.

Overview

Cardiovascular diseases accounted for 15% of all DALY, making it the second most burdensome disease group. This was driven primarily from fatal burden, as it caused 23% of all YLL. The relative non-fatal burden was lower, at 6% of all YLD.

This disease group was dominated by coronary heart disease (accounting for 53% of cardiovascular diseases DALY) and stroke (21% of cardiovascular diseases DALY) (Figure 9.7). In terms of overall DALY,

coronary heart disease caused the most of any disease or injury (7.7% of all DALY), and stroke ranked 8th (3.0% of all DALY).

Overall, 80% of the burden from this disease group was fatal. The diseases that had the highest proportion of fatal burden were aortic aneurysm and hypertensive heart disease (both over 95% fatal burden), while the lowest was atrial fibrillation (32%).

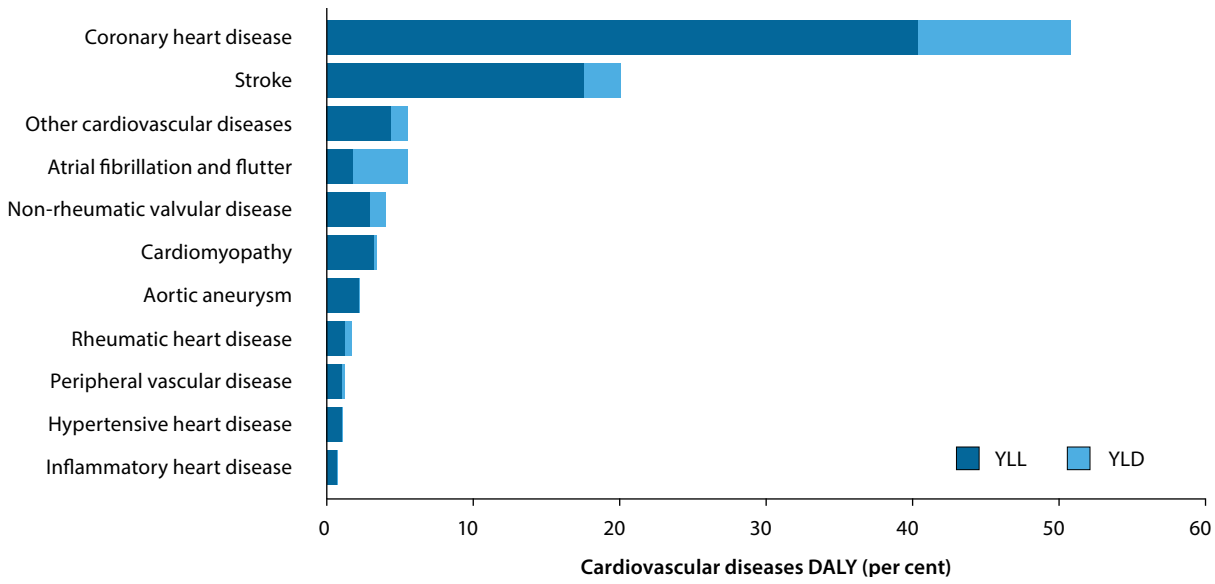
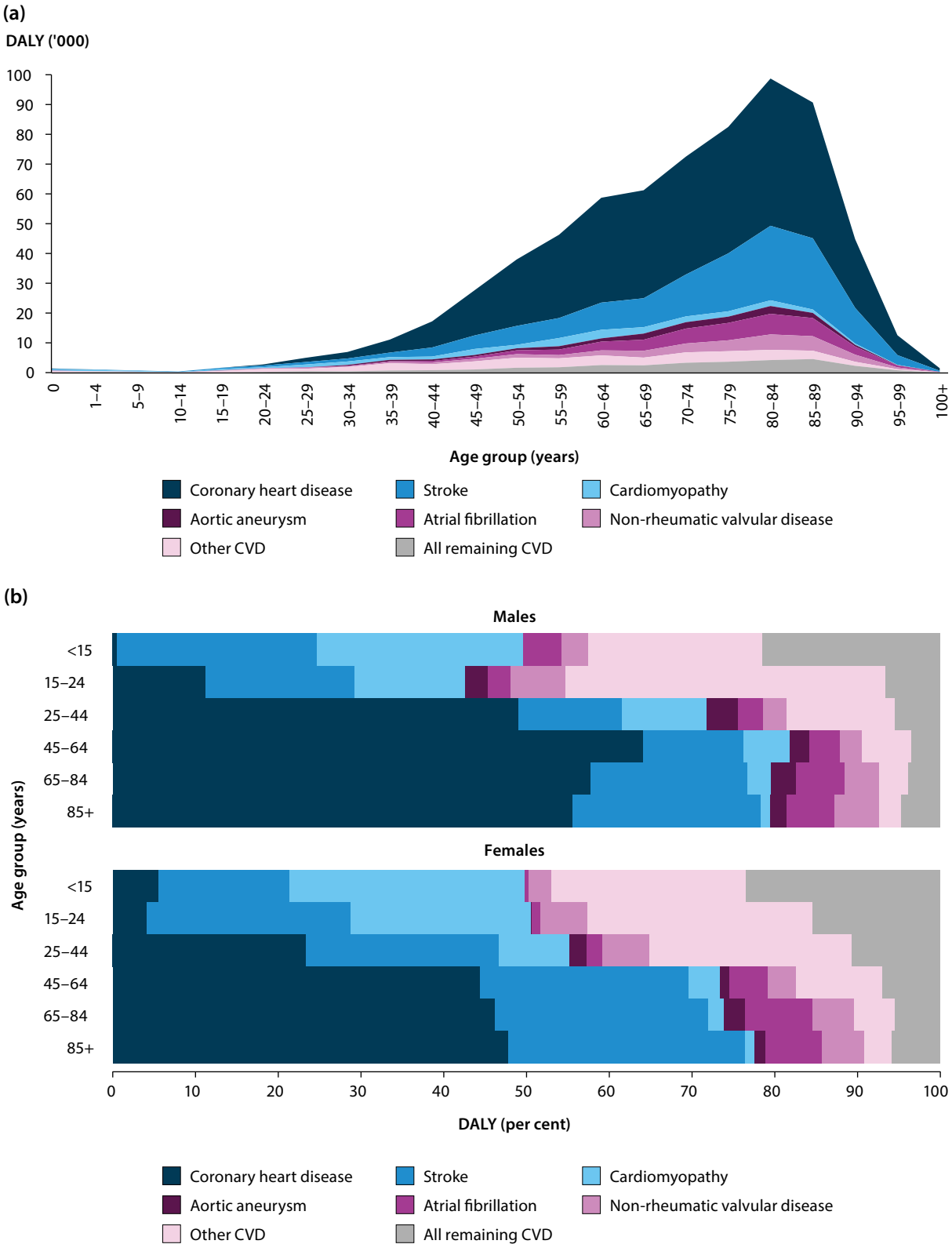


Figure 9.7: Cardiovascular diseases burden (DALY) by disease: proportion due to fatal and non-fatal outcomes, 2011

The burden from cardiovascular diseases was low in childhood then increased from about age 30 (Figure 9.8a). The large burden from coronary heart disease and stroke was evident from age 40 onwards (Figure 9.8a). Burden from coronary heart disease rose steeply to its peak at ages 80–84. For stroke, a steep increase started at about ages 65–69, and the burden also peaked at ages 80–84.

Males experienced a higher proportion of cardiovascular diseases burden from coronary heart disease than females. From 45 years, coronary heart disease accounted for 50%–60% of the cardiovascular diseases burden in males; whereas in females, it accounted for less than 50% and stroke for around 25%.



Note: 'Other CVD' refers to 'Other cardiovascular diseases'; 'All remaining CVD' includes: hypertensive heart disease, inflammatory heart disease and rheumatic heart disease.

Figure 9.8: Cardiovascular diseases burden (DALY) by age and disease (a) and proportion by broader age groups in males and females (b), 2011

The burden from cardiovascular diseases was greater in males, with higher rates than for females for all conditions except rheumatic heart disease (Table 9.4). The three most notable diseases in this regard were aortic aneurysm, cardiomyopathy and coronary heart disease, for which DALY rates for males were over twice those for females. This does not mean that female rates were low. It is important to note that; similar to the situation for men, coronary heart disease was the leading cause of overall DALY for women.

Table 9.4: Comparison of age-standardised rates of cardiovascular diseases burden: males: females, by disease, 2011

	ASR[a]			
Disease	**Males**	**Females**	**Rate ratio[b]**	**Rate difference[c]**
Coronary heart disease	19.9	8.3	2.4	11.6
Stroke	6.0	4.9	1.2	1.0
Other cardiovascular diseases	1.8	1.4	1.3	0.4
Atrial fibrillation and flutter	1.7	1.3	1.4	0.5
Cardiomyopathy	1.4	0.5	2.5	0.9
Non-rheumatic valvular disease	1.3	0.9	1.5	0.4
Aortic aneurysm	0.9	0.4	2.5	0.6
Peripheral vascular disease	0.4	0.3	1.6	0.2
Rheumatic heart disease	0.4	0.5	0.7	–0.1
Hypertensive heart disease	0.3	0.2	1.4	0.1
Inflammatory heart disease	0.3	0.2	1.5	0.1

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate ratio is the relative difference of females compared with males, calculated as male ASR divided by the female ASR.

(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as male ASR minus the female ASR.

Risk factors

Evidence was available to quantify the impact of a large number of risk factors for both coronary heart disease and stroke. These included high blood pressure, physical inactivity, high body mass, high cholesterol, various dietary risk factors, tobacco smoking, alcohol use, high blood plasma glucose and air pollution. Tobacco smoking, alcohol use, high blood pressure and high body mass were also linked to other conditions in this disease group. The joint contribution of these risk factors was 69% of the cardiovascular diseases burden.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. High blood pressure was the risk factor responsible for the most CVD burden—32% of the cardiovascular diseases burden. High blood pressure also caused 41% of the burden due to stroke and 33% of the total burden due to coronary heart disease (Appendix Table D15). Of the remaining cardiovascular diseases linked to high blood pressure, high blood pressure was responsible for between 4.1% of the burden due to inflammatory heart disease and up to 55% of the burden due to hypertensive heart disease.

Physical inactivity was the second highest contributor to the cardiovascular diseases burden (21%) and was responsible for one-third (33%) of the burden due to coronary heart disease and 19% of the burden due to stroke.

Other risk factors that contributed to cardiovascular disease burden included high body mass (21%), high cholesterol (16%), tobacco use (12%), low fruit intake (10%) and a diet low in vegetable (8.9%).

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

There have been substantial reductions in the DALY ASRs for coronary heart disease (32% reduction) and stroke (28% reduction) (Table 9.5). For both, the majority of the gains were in fatal burden (coronary heart disease YLL fell by 35% and stroke YLL by 29%).

There were also good reductions in some of the less common diseases: aortic aneurysm, peripheral vascular disease and hypertensive heart disease. Again, these falls were mostly due to reductions in fatal burden. There were no large increases in burden between 2003 and 2011.

Table 9.5: Age-standardised rates of fatal and non-fatal cardiovascular diseases burden: 2003 and 2011

	Fatal burden (ASR)			Non-fatal burden (ASR)			Total burden (ASR)		
Disease	**2003**	**2011**	**% change**	**2003**	**2011**	**% change**	**2003**	**2011**	**% change**
Coronary heart disease	16.8	11.0	–35.0	3.6	2.8	–21.0	20.4	13.8	–32.0
Stroke	6.7	4.8	–29.0	0.8	0.7	–13.0	7.5	5.4	–28.0
Atrial fibrillation and flutter	0.4	0.5	15.9	0.9	1.0	9.3	1.3	1.5	11.3
Non-rheumatic valvular disease	0.8	0.8	3.7	0.4	0.3	–23.0	1.2	1.1	–5.0
Cardiomyopathy	1.0	0.9	–3.0	0.1	<0.1	–36.0	1.0	1.0	–5.1
Aortic aneurysm	0.9	0.6	–31.0	<0.1	<0.1	–11.0	0.9	0.6	–30.0
Rheumatic heart disease	0.4	0.3	–7.8	0.2	0.1	–25.0	0.5	0.5	–13.0
Peripheral vascular disease	0.4	0.3	–35.0	0.1	0.1	1.0	0.5	0.3	–31.0
Hypertensive heart disease	0.3	0.3	–16.0	<0.1	<0.1	–56.0	0.3	0.3	–17.0
Inflammatory heart disease	0.2	0.2	10.7	<0.1	<0.1	–39.0	0.2	0.2	4.7
Other cardiovascular diseases	1.6	1.3	–21.0	0.3	0.3	–-6.7	1.9	1.6	–18.0

Notes

1. Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
2. Percentage change is calculated as 2011 ASR minus 2003 ASR expressed as a percentage of the 2003 ASR.

The large changes for coronary heart disease and stroke have been examined in more detail.

Changes in coronary heart disease

The number of coronary heart disease YLL decreased between 2011 and 2003 in all age groups, from ages 30–34 to ages 80–84, and some were quite sizable (Figure 9.9a). This resulted in large decreases in age-specific rates, particularly for people in their 70s to mid-90s. Consequently, there was a noticeable shift to the right in the curve. For most age groups, 2011 rates were similar to the rates in 2003 of people aged approximately 5 years younger, and from ages 65–79 years the rates were more like those of people aged 10 years younger. This suggests there has been a postponement in coronary heart disease fatal burden by between 5 and 10 years during this period.

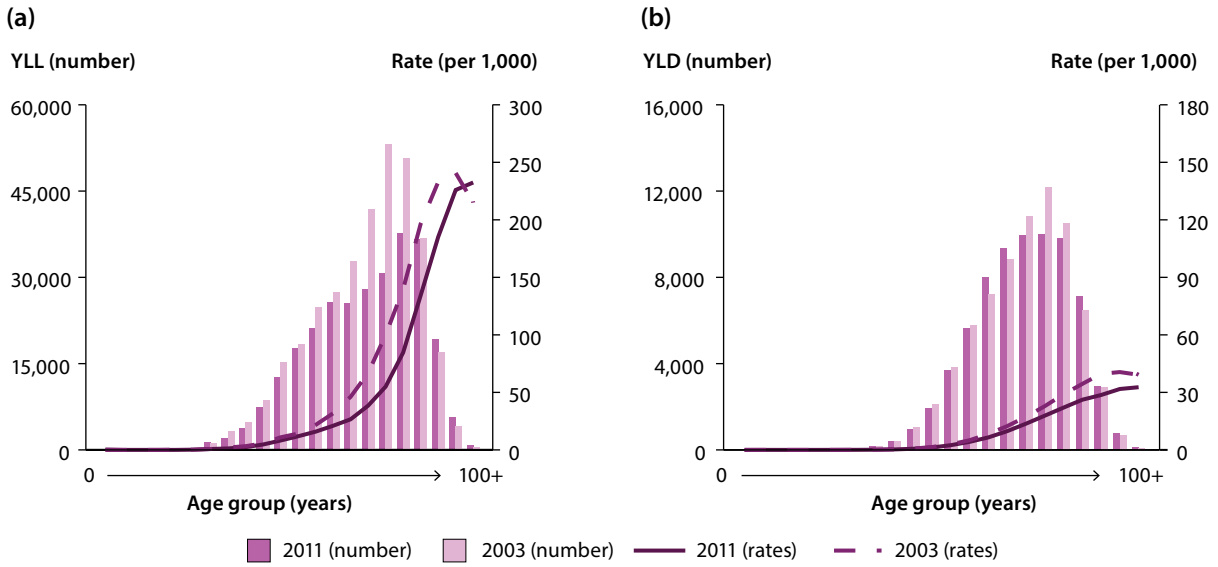


Figure 9.9: Change in number and age-specific rates (per 1,000 people) in coronary heart disease for fatal burden (a) and non-fatal burden (b), 2003 and 2011

In contrast to YLL, there were some increases in the number of coronary heart disease YLDs between 2003 and 2011, particularly for people in their 60s and from age 85 (Figure 9.9b). There have also been population increases during this period (taken into account in the rates), which showed decreases between 2003 and 2011, particularly from age 60 to age 95. The higher rate in the very oldest age group may be due to increased survival for people with coronary heart disease.

Changes in stroke

Similarly to coronary heart disease, the number of YLL for stroke decreased between 2011 and 2003, particularly between age 65–84 (Figure 9.10a). The rate of fatal stroke decreased in 2011 compared with 2003 from age 45 and onwards. This noticeable shift in the curve to the right again suggests a 5–10 year postponement in fatal burden.

An increase in number of stroke YLDs between 2003 and 2011 was evident in most age groups (Figure 9.10b). Age-specific rates indicated this is due to population increases, with a decrease in the rate of stroke non-fatal burden between 2003 and 2011, particularly from age 75–99.

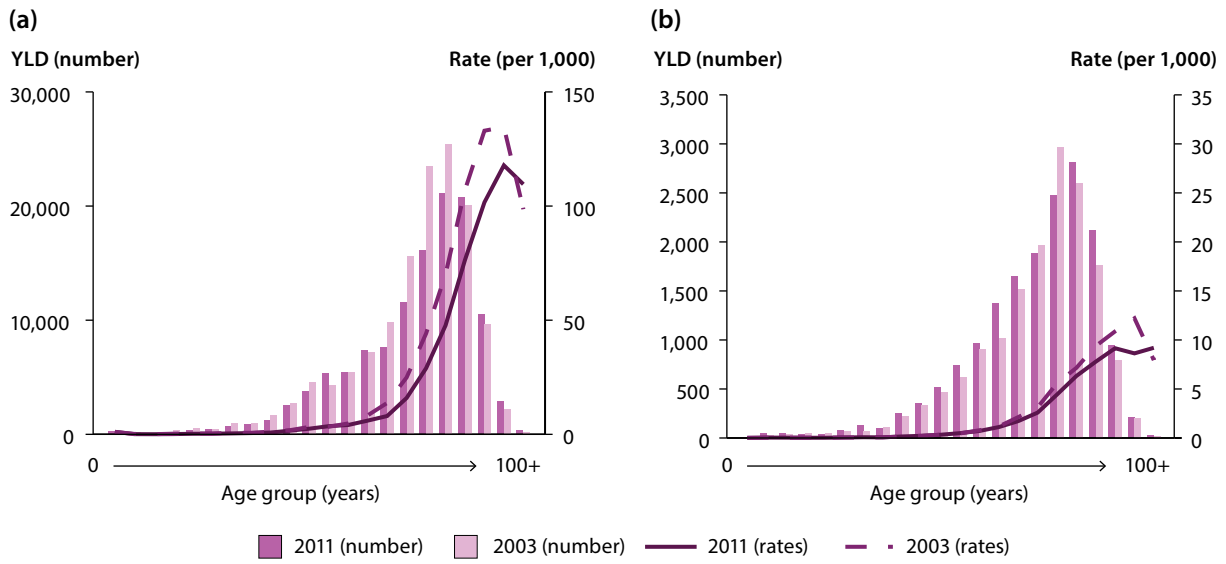


Figure 9.10: Change in number and age-specific rates (per 1,000 people) in stroke for fatal burden (a) and non-fatal burden (b), 2003 and 2011

Data quality

Fatal burden estimates for cardiovascular diseases were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Since people with cardiovascular diseases are often treated in hospital, we were able to use the detailed Australian hospitalisation data to estimate the prevalence of many of the conditions in this disease group. Some prevalence data were based on state linked data from Western Australia subsequently applied to national hospital data, and some came directly from the hospital data. Two smaller diseases (atrial fibrillation and peripheral vascular disease) were based on information from the New Zealand burden of disease study.

9.4 Endocrine disorders

The endocrine disease group contains only two specific diseases:

- diabetes mellitus (diabetes), which includes type 1, type 2 and other diabetes types but not gestational diabetes. Gestational diabetes is included in the reproductive & maternal conditions disease group
- other endocrine disorders, which includes thyroid disorders and disorders of other endocrine glands. Note that it does not include polycystic ovarian syndrome which is included in the reproductive & maternal conditions disease group.

It is important to note that the figures provided here represent the direct impact of endocrine disorders. Diabetes, in particular, is an important risk factor for other diseases such as coronary heart disease and chronic kidney disease. These indirect impacts from diabetes are not included here, but are instead included in the disease group where the disease effects are more immediate—for these examples, in cardiovascular disease and the kidney & urinary disease groups, respectively.

Overview

Endocrine disorders accounted for 2.4% of the total disease burden in 2011 (2.5% of total YLL and 2.2% of the total YLD). This disease group was dominated by one disease: 96% of the burden comes from diabetes. Diabetes caused more burden among males than females, but the burden from other endocrine disorders was higher in females than in males (Figure 9.11).

Diabetes caused slightly more fatal than non-fatal burden: 52% of the burden for males came from YLL, and the corresponding figure for females was 54%. It was ranked eleventh in the list of diseases causing the most burden from dying prematurely in males, and ninth in females. It was also in the top 20 diseases in terms of non-fatal burden: thirteenth for males and sixteenth for females.

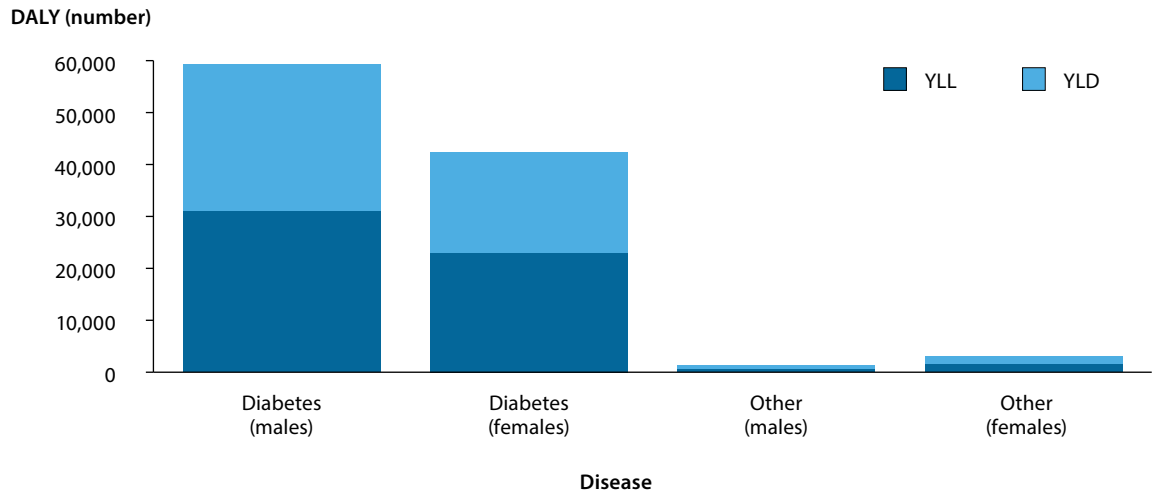


Figure 9.11: Total burden (DALY) for diabetes and other endocrine disorders, 2011

The number of diabetes DALY increased steeply with age in males, from age 30 to ages 65–69 before decreasing fairly quickly. In females, the increase was not as steep, peaking at ages 80–84 at a substantially lower level than for males (Figure 9.12). DALY rates increased sharply from about age 55 in both males and females. The proportion of the burden from YLL showed a steady increase from ages 45–49 in males and ages 60–64 in females.

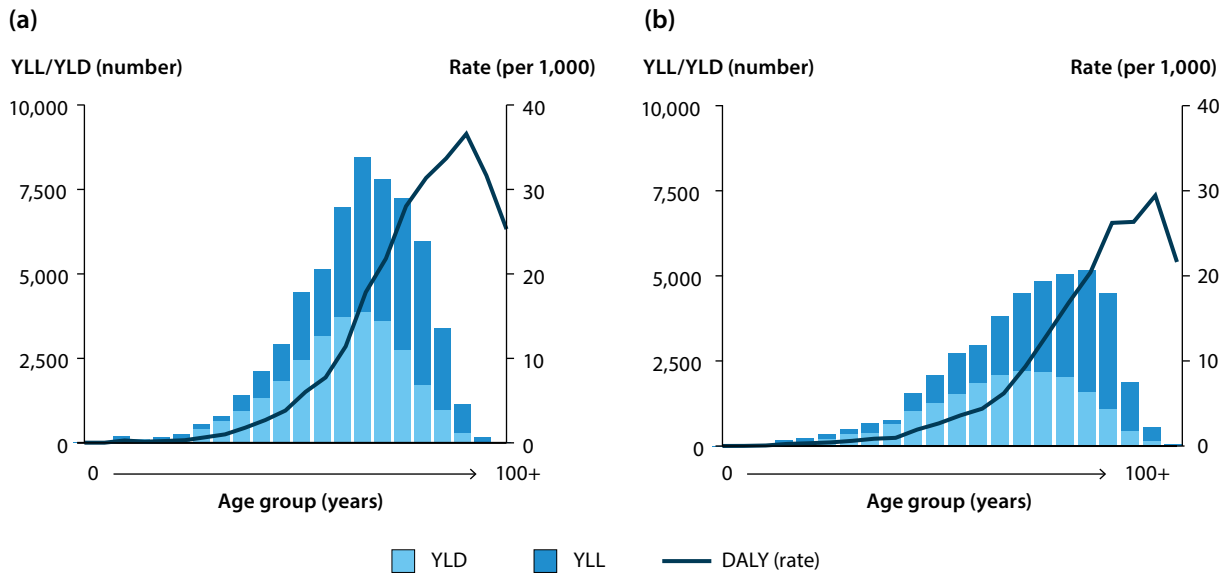


Figure 9.12: Diabetes burden (DALY) and DALY rate (per 1,000 people) by age for males (a) and females (b), 2011

Risk factors

Evidence was available to quantify the impact of a large number of risk factors for diabetes. These included high blood plasma glucose, tobacco smoking, alcohol use, high body mass, physical inactivity and various dietary risk factors. Together the joint contribution of these risk factors was 96% of the endocrine burden.

Each risk factor was analysed independently and the same burden may be attributed to more than one risk factor. High blood plasma glucose levels were responsible for the entire diabetes burden (Appendix Table D15). High body mass was the second leading risk factor contributing to endocrine burden (50%), followed by physical inactivity (30%) and a diet high in sugar-sweetened beverages (10%).

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

There were relatively small changes in the ASR of total burden from diabetes between 2003 and 2011—for males there was a 1.0% decrease and for females a 5.8% increase. However, these small changes masked quite different patterns in the underlying rates of YLL and YLD. For both sexes, there was a notable reduction in YLL rates from dying prematurely from diabetes. In contrast, there was a 24% increase in YLD rates from living with diabetes for males and 27% for females (Table 9.6). This contrast may partly reflect the success in reducing the fatal burden, as there may have been more people living with the condition. Note that there was very little change in the burden from other endocrine disorders between 2003 and 2011.

Table 9.6: Age-standardised rates for burden of diabetes (DALY, YLL and YLD), 2003 and 2011

	2003	2011	Rate difference[(a)]	% change[(b)]
Males				
Fatal burden	3.3	2.7	–0.5	–16.0
Non-fatal burden	2.0	2.4	0.5	24.4
Total burden	5.2	5.2	–0.1	–1.0
Females				
Fatal burden	1.8	1.7	–0.1	–8.0
Non-fatal burden	1.2	1.5	0.3	26.6
Total burden	3.1	3.2	0.2	5.8

(a) Rate differences are 2011 ASR minus 2003 ASR.

(b) Rate difference expressed as a percentage of 2003 ASR.

Note: Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

The improvements in fatal burden occurred across all broad age groups in males (with the largest percentage decrease occurring in the younger age groups), but were more variable for females. The increases in rates of non-fatal burden are seen in all these age groups in both males and females, and ranged from 19% in males under age 45 years to 37% in females aged under 44.

Data quality

Fatal burden estimates for endocrine disorders were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Diabetes prevalence rates in 2011 were drawn from measurement data in the Australian Health Survey based on blood samples from survey respondents which is considered to be the most accurate method. Similar data were not available for 2003, and thus trends from self-reported diabetes status over the same period were used to adjust the 2011 measured diabetes estimate. The 2003 estimates may have been improved if measurement data had been available.

Estimates of diabetes complications (for example, vision loss due to diabetes), which were a component of the diabetes estimates of non-fatal burden, relied on epidemiological studies and national hospital data (where appropriate) to quantify the proportion of people with diabetes with each complication. Consequently, samples were drawn from specific regions of Australia for this purpose, which may have resulted in differences across regions not being identified.

9.5 Gastrointestinal disorders

Gastrointestinal disorders includes burden due to acute and chronic disorders of the digestive system—namely the oesophagus, stomach, small intestine, large intestine and rectum— and the accessory organs of digestion, the liver, gallbladder, and pancreas. It excludes burden due to:

- diseases of the mouth (included in oral disorders)
- congenital gastrointestinal disorders (included in infant & congenital conditions)

- gastrointestinal infections (included in infectious diseases; specifically: salmonella, campylobacter, rotavirus and other gastrointestinal infections)
- gastrointestinal cancers (included in cancer & other neoplasms).

Overview

Gastrointestinal disorders accounted for 143,100 DALY (87,100 YLL; 56,000 YLD) in 2011. This was 3.2% of all DALY, 3.8% of YLL and 2.5% YLD.

Fatal burden accounted for 61% of the gastrointestinal burden. Gastrointestinal disorders were made up of a number of different diseases, many of which had a high fatal burden. In particular, chronic liver disease, which accounted for one-third (33%) of the total burden, was predominantly fatal burden. Conversely, there was also a high burden due to conditions that had predominantly non-fatal burden such as inflammatory bowel disease (14% of gastrointestinal burden), functional gastrointestinal disorders (specifically, irritable bowel syndrome and functional heartburn) (13% of gastrointestinal burden) and gastro-oesophageal reflux disease (8.2%) (Figure 9.13).

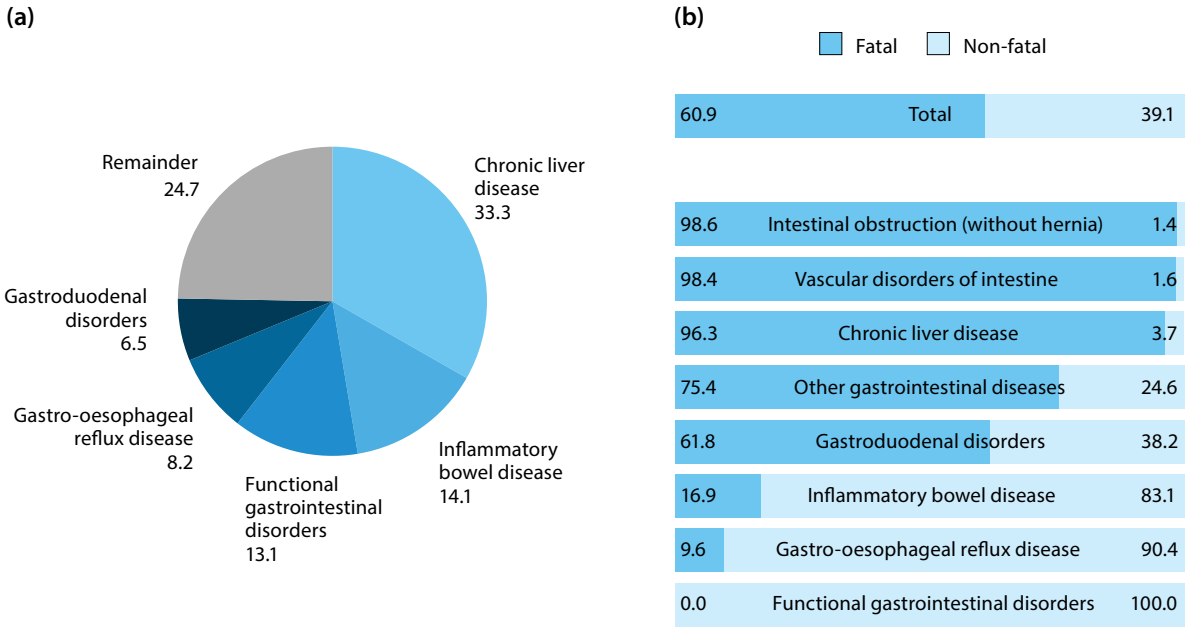
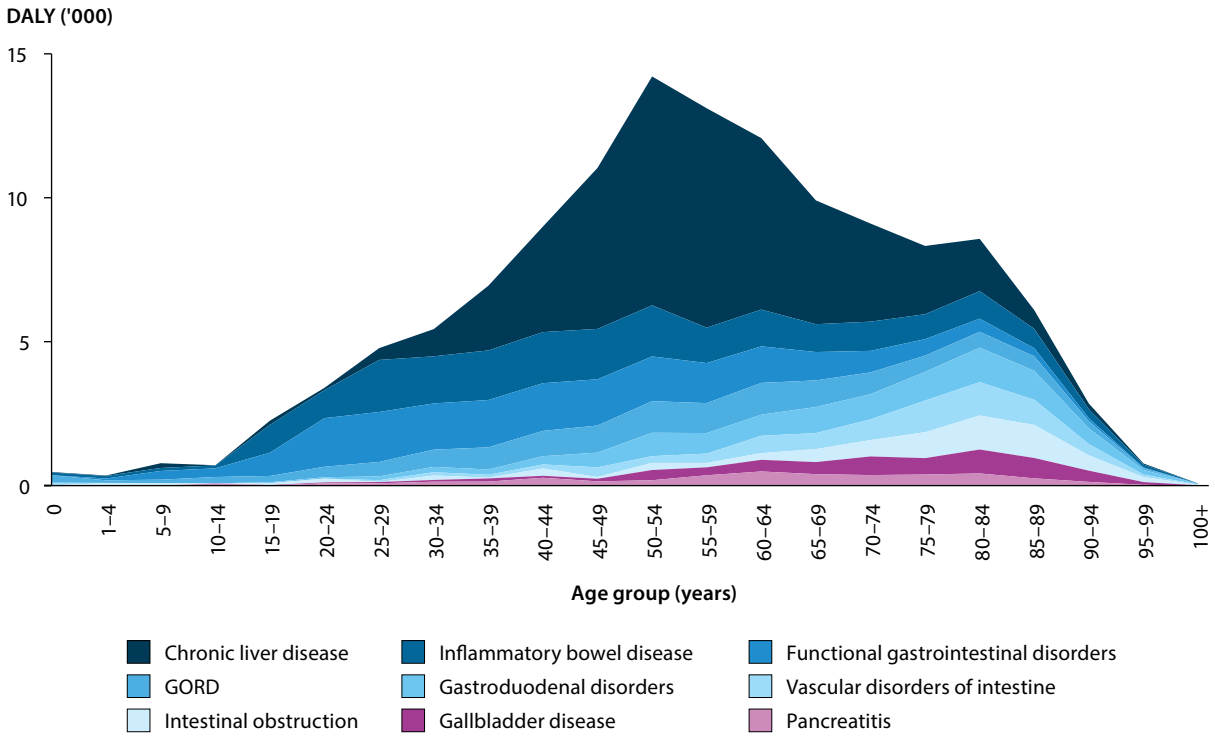


Figure 9.13: Gastrointestinal disorders burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Burden from gastrointestinal disorders varied across the life course. The small amount of burden in children under 15 was mostly due to functional gastrointestinal disorders and gastro-oesophageal reflux disease. Between ages 15 and 29, functional gastrointestinal disorders and inflammatory bowel disease were the major sources of burden. Chronic liver disease was a major source of burden in people aged between 30 and 84. From age 80 onwards, intestinal obstruction, vascular disorders and gastroduodenal disorders were the main sources of burden. Gallbladder disease mostly affected people aged over 45, while the burden from pancreatitis was low but relatively constant from age 50 (Figure 9.14).



Note: 'GORD' refers to 'Gastro-oesophageal reflux disease'.

Figure 9.14: Gastrointestinal disorders burden (DALY) by age and disease, 2011

Risk factors

Evidence was available to quantify the impact of risk factors for gastrointestinal disorders. These included alcohol use, drug use and unsafe sex. The joint contribution of these risk factors was 22% of gastrointestinal disorders burden.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. Drug use was the risk factor responsible for the most gastrointestinal disorders burden, accounting for 52% of the chronic liver disease burden (Appendix Table D15). This was followed by alcohol use, which contributed 24% of chronic liver disease burden and 10% of pancreatitis burden. Unsafe sex also contributed 10% of the burden due to chronic liver disease.

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

There was an overall increase of 14,500 DALY (11%) for gastrointestinal disorders between 2003 and 2011; however, there has been little change in the ASRs —6.4 DALY per 1,000 people in 2003 compared with 6.0 DALY per 1,000 people in 2011. This change was driven by a decrease in fatal burden from 4.0 YLL per 1,000 people in 2003 compared with 3.6 YLL per 1,000 people in 2011.

There have been minor overall decreases in the age-standardised DALY rates of gastroduodenal disorders, pancreatitis, chronic liver disease, diverticulitis and vascular disorders of the intestine (Table 9.7). These decreases were driven by the decrease in YLL for these causes, with little or no increase in accompanying YLD.

Table 9.7: Comparison of age-standardised rates of gastrointestinal disorders, 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	**2011**	**2003**	**2011**	**2003**	**2011**
Abdominal wall hernia	0.1	0.1	0.1	0.1	0.2	0.2
Appendicitis	<0.1	<0.1	<0.1	<0.1	0.1	0.1
Chronic liver disease	4.1	3.9	0.1	0.1	4.2	4.1
Diverticulitis	0.4	0.2	<0.1	<0.1	0.4	0.3
Functional gastrointestinal disorders	<0.1	<0.1	1.6	1.7	1.6	1.7
Gallbladder and bile duct disease	0.4	0.3	0.1	0.1	0.4	0.4
Gastro-oesophageal reflux disease	0.1	0.1	0.9	0.9	1.0	1.0
Gastroduodenal disorders	0.7	0.5	0.3	0.3	0.9	0.8
Inflammatory bowel disease	0.2	0.3	1.5	1.5	1.7	1.8
Intestinal obstruction (without hernia)	0.5	0.5	<0.1	<0.1	0.5	0.5
Other gastrointestinal diseases	0.5	0.4	0.1	0.1	0.6	0.5
Pancreatitis	0.4	0.3	<0.1	<0.1	0.5	0.3
Vascular disorders of intestine	0.7	0.5	<0.1	<0.1	0.7	0.6
All gastrointestinal disorders	**4.0**	**3.6**	**2.4**	**2.4**	**6.4**	**6.0**

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Data quality

Fatal burden estimates for gastrointestinal disorders were calculated using deaths registered in the National Mortality Database and are considered to be of high quality. Minor adjustments were made for deaths due to gastric haemorrhage and peritonitis.

YLD estimates for many gastrointestinal conditions relied on the assumption that, for health loss to be counted, the condition had to be severe enough for the patient to seek medical care (either through a hospital or a general practitioner) and must have been a medically confirmed diagnosis. Conditions that were self-managed in the community via over-the-counter medications were not included in these estimates.

Estimates for acute conditions severe enough to require hospitalisation and surgical care (appendicitis, vascular disorders of the intestine, intestinal obstructions, hernia and gallbladder disease) were sourced directly from national hospital data with a high level of accuracy.

Other long-term conditions, such as gastroduodenal disease and chronic liver disease, which may involve multiple hospital admissions, were also sourced from national hospital data with a reasonable degree of accuracy; however, estimates were adjusted using presentation ratios from Western Australia. Estimates would be improved with access to nationally linked data.

Due to the chronic remitting/recurring nature of inflammatory bowel disease, gastro-oesophageal reflux disease and functional gastrointestinal disorders, their prevalence estimates were sourced from Australian epidemiological studies of medically confirmed conditions, applied to various populations. As these studies were based on small, discrete geographical areas, estimates could be improved with inclusion of studies of wider populations.

9.6 Hearing and vision disorders

Hearing & vision disorders include the burden of visual disorders, hearing loss and auditory system disorders (for example, Ménière's disease). Vision loss due to refractive error, cataract, glaucoma and age-related macular degeneration is collectively referred to as vision loss.

Eye and ear cancers are included in the cancer & other neoplasms group, and eye and ear infections (for example, trachoma and otitis media) in the infectious disease group. Visual impairment caused by trachoma and diabetes are captured in their respective diseases. Vision loss due to eye injuries is included in other visions disorders.

The burden of hearing loss includes all possible conditions leading to long-term hearing impairment.

Overview

Hearing & vision disorders was responsible for 2.2% of the burden of disease in 2011 (97,100 DALY). Conditions in this group did not directly cause death; however it was acknowledged that vision loss was associated with increased mortality (McCarty et al. 2001). Therefore, DALY estimates were equal to the YLD estimates in this disease group.

A total of 4.4% of all non-fatal burden was caused by hearing and vision disorders. Hearing loss accounted for over two-thirds (69%) of this non-fatal burden and 18% was due to vision loss. Other hearing & vestibular disorders (10%) and other vision disorders (2.9%) accounted for the remainder (Figure 9.15a).

Overall, the burden was similar for males and females (52% male; 48% female) (Figure 9.15b). Males experienced a greater proportion of other hearing & vestibular disorders (62%) and hearing loss (54%). Females experienced a slightly higher proportion of vision loss (58%) and other vision disorders (54%); however, this was mainly due to a greater female population in older age groups.

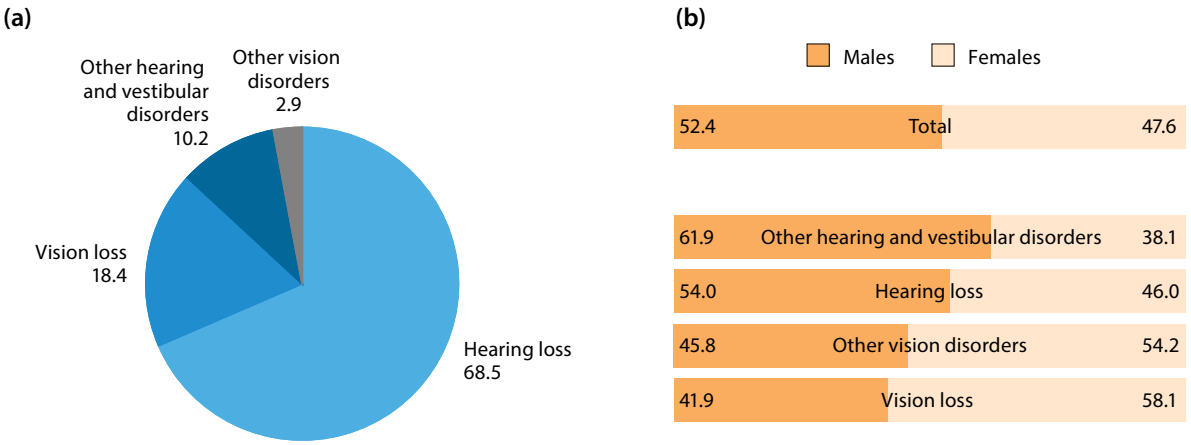


Figure 9.15: Hearing and vision disorders burden (DALY) by disease: proportion of disease group total (a) and proportion for males and females (b), 2011 (%)

Hearing and vision generally declined with age, with 81% of the burden in adults aged over 50 (Figure 9.16). Hearing loss and other hearing & vestibular disorders were the highest contributors to burden from hearing & vision disorders among children and young adolescents (85%). During adult life, the contribution of burden from vision and hearing loss increased. The onset of cataract, age-related macular

degeneration and glaucoma contributed to increased health loss from age 40. The progressive nature of hearing and vision disorders resulted in these conditions ranked in the top 10 causes of overall burden among elderly Australians (85–100+ years).

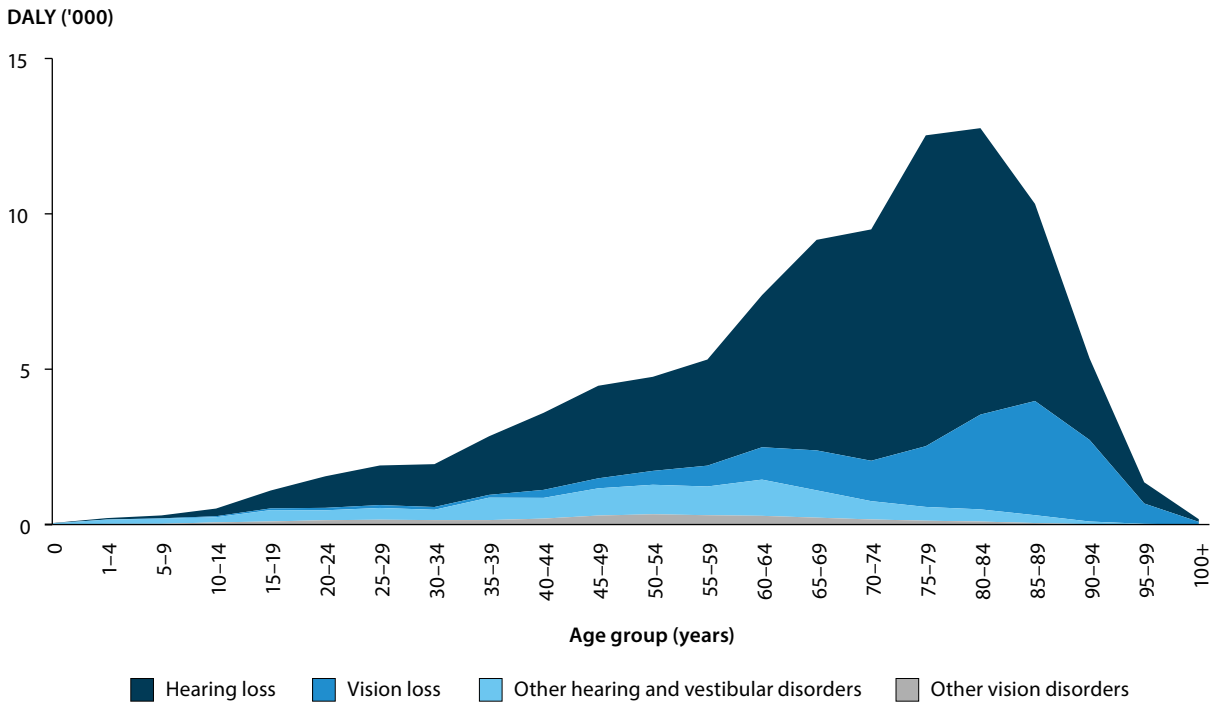


Figure 9.16: Hearing and vision disorders burden (DALY) by age and disease, 2011

Risk factors

Evidence was available to quantify the impact of occupational exposures & hazards for hearing loss. Occupational exposures were responsible for 7.4% of the burden due to hearing loss (5,000 DALY) (Appendix Table D15). Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

Since 2003, burden due to hearing & vision disorders increased by 23%, from 79,200 DALY in 2003 to 97,100 DALY in 2011; however, as the ASRs were similar for 2003 and 2011 (3.9 and 4.0 DALY per 1,000 people, respectively), this increase was primarily due to population increases and ageing.

Data quality

Fatal burden estimates were not calculated for hearing & vision disorders. The few deaths coded to hearing & vision disorders were proportionally redistributed across all other disease groups, as these were not considered the direct plausible cause of mortality. Associated fatal sequelae (such as infections or vascular conditions) were the more likely direct cause of death.

Hearing loss

Administrative data from government-subsidised hearing services and treatments provided an accurate source for estimating hearing loss burden in young Australians. An Australian population-based study on clinically confirmed hearing loss in the elderly was used to estimate this condition in elderly Australians. The study's sample population was nationally representative; however a larger sample size across diverse geographical areas would provide more robust estimates. Remaining estimates were derived from national self-reported survey data. Self-reported data rely on the individual's awareness of and accuracy in reporting their condition and, as a result, mild hearing loss may be underestimated. Severity distribution from the GBD 2010 was used in the analyses.

Vision loss

Vision loss burden was estimated using Australian studies that included ophthalmological examinations to assess eye conditions and subsequent vision loss. Data from these studies achieved response rates over 80% and were representative of the Australian population; however, these studies were conducted over 15 years ago. Estimates would be improved with more recent representative data that reflected changes in population structure and disease prevalence.

9.7 Infant and congenital conditions

The infant & congenital conditions group includes infant conditions that arise during pregnancy, birth and during the first year of life; however, diagnosis may not occur until after this period (such as is the case with some chromosomal abnormalities, particularly if the symptoms are mild). This is the first time cerebral palsy has been included as a disease in an Australian burden of disease study.

Estimates for all infant & congenital conditions have been based on live births, so stillbirths and terminations of pregnancy are not included in this disease group.

Overview

Infant & congenital conditions accounted for 2.7% of the total burden in Australia in 2011 (120,000 DALY). The impact from this disease group primarily occurred during infancy and early childhood.

The leading causes of burden were pre-term & low birthweight complications (21%), birth trauma & asphyxia (including neonatal encephalopathy and seizures) (16%) and cardiovascular defects (10%) (Figure 9.17a).

Premature death was responsible for 84% of the overall burden (Figure 9.17b). This large proportion occurred because most (69%) of these deaths were within the first year of life, which showed the influence of age at death on the measure of fatal burden. Sudden infant death syndrome was included in fatal burden estimates only. There was a high proportion of non-fatal burden from cerebral palsy (45%) and brain malformations (28%), which was largely due to life-long consequences of motor and cognitive impairment.

The proportion of burden varied in newborns, compared with infants aged 1–4 years, with pre-term and low birthweight complications, birth trauma & asphyxia and sudden infant death syndrome accounted for more than half the burden from infant & congenital conditions in newborns (Figure 9.17c).

Males experienced over half of the fatal (56%) and non-fatal (62%) burden of infant & congenital conditions.

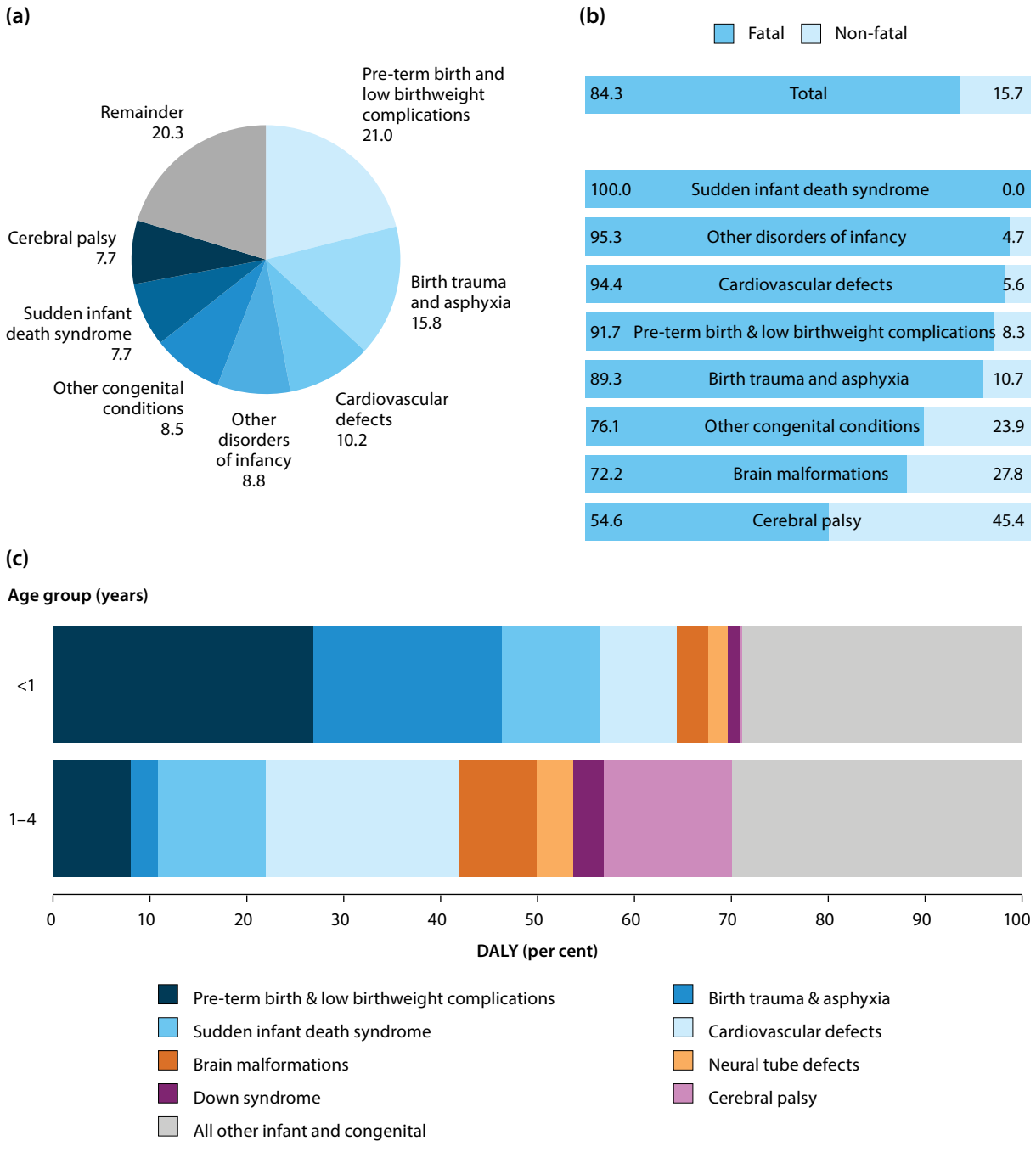


Figure 9.17: Infant and congenital conditions burden (DALY) by disease: proportion of disease group total (a), proportion due to fatal and non-fatal outcomes (b) and proportion by age (c), 2011 (%)

Changes since 2003

Since 2003, the burden due to infant & congenital conditions marginally decreased from 121,100 DALY in 2003 to 120,000 DALY in 2011 (0.9% decline). The decrease was due to a reduction in the number of deaths from birth trauma & asphyxia and brain malformations. A comparison of the DALY ASR by disease (Table 9.8) showed a decline in burden in many infant & congenital diseases, particularly for birth

trauma & asphyxia and cardiovascular defects. Conversely, the ASRs for pre-term birth & low birthweight complications increased, primarily due to increases in fatal burden.

Table 9.8: Age-standardised rates for top 10 infant and congenital conditions (ranked by age-standardised DALY rates in 2003), 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	2011	2003	2011	2003	2011
Birth trauma & asphyxia	2.1	1.5	0.2	0.2	2.3	1.7
Pre-term birth & low birthweight complications	1.8	2.1	0.2	0.2	1.9	2.3
Other disorders of infancy	1.6	0.9	<0.1	<0.1	1.6	0.9
Cardiovascular defects	1.5	1.0	0.1	0.1	1.5	1.1
Other congenital conditions	0.9	0.7	0.2	0.2	1.1	0.9
Sudden infant death syndrome	0.9	0.8	. .	. .	0.9	0.8
Cerebral palsy	0.4	0.5	0.4	0.4	0.8	0.8
Brain malformations	0.5	0.3	0.1	0.1	0.6	0.5
Down syndrome	0.3	0.3	0.1	0.1	0.4	0.4
Other chromosomal abnormalities	0.3	0.3	<0.1	<0.1	0.3	0.4

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Data quality

Fatal burden estimates for infant & congenital conditions were calculated using deaths registered in the National Mortality Database and are considered of high quality.

Key data sources for the non-fatal burden included the National Perinatal Data Collection, the National Hospital Morbidity Database and the Western Australian Register of Developmental Anomalies. These sources were able to provide reliable live birth prevalence estimates from birth to the first year of life. However, there were limited sources to estimate prevalence of the subsequent burden throughout life. Disease modelling was used for some infant & congenital conditions. Owing to limited national data, the distributions of severity were based on a combination of data sources ranging from hospital data to epidemiological studies and international burden of disease studies.

9.8 Infectious diseases

The infectious diseases group includes 32 diseases caused by pathogenic microorganisms, such as viruses, bacteria and parasites. Within the disease group, individual diseases have been defined either by the pathogen responsible for the disease (for example, tuberculosis) or the site of infection (for example, lower respiratory infections). A small number of infections are captured in other disease groups; in particular, skin infections and neonatal infections are captured in the skin disorders and infant & congenital conditions groups respectively.

Overview

Infectious diseases were responsible for 1.6% of the total burden of disease in 2011. Within the disease group, the infections responsible for the largest share of DALY were lower respiratory infections (40%), gastrointestinal infections (17%), HIV/AIDS (7%), upper respiratory infections (4%) and influenza (3%) (Figure 9.18a). The residual other infections category was made up of an extensive list of conditions caused by a diverse range of pathogenic organisms. In total, it accounted for almost 16% of the infectious disease DALY in 2011.

Across the entire infectious disease group, 63% of the burden was due to premature death; however, there was considerable variation in the contribution of fatal and non-fatal outcomes to the total burden by disease (Figure 9.18b). For example, premature death was responsbile for 88% of the burden due to lower respiratory infections but only 14% of the burden from gastrointestinal infections.

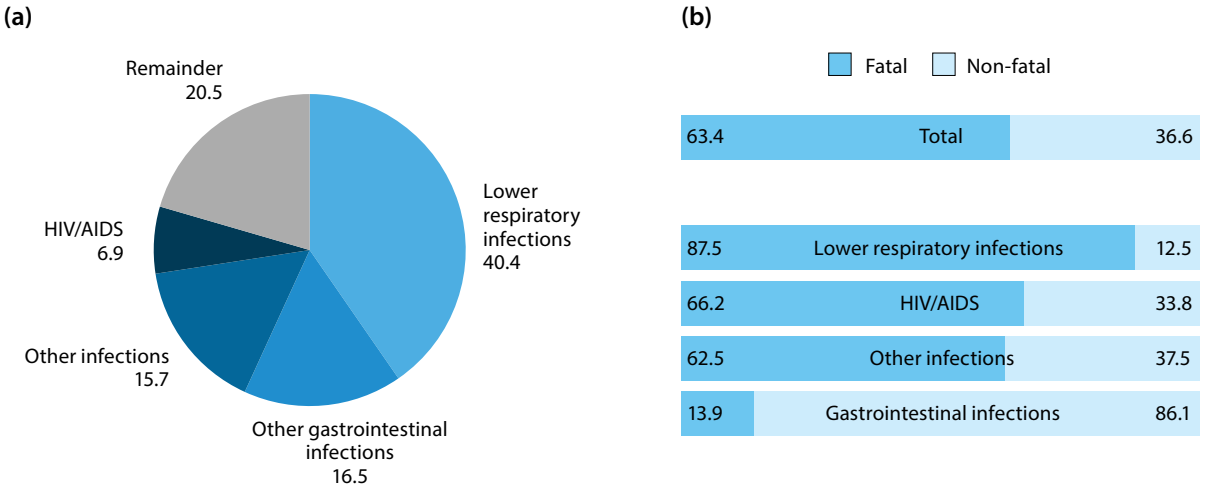


Figure 9.18: Infectious diseases burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Lower respiratory infections accounted for more than half (56%) of the fatal infectious disease burden and 14% of the non-fatal burden. Conversely, gastrointestinal infections contributed to 41% of the non-fatal infectious disease burden but only 4% of the fatal burden. HIV/AIDS accounted for 7% of the fatal infectious disease burden and 6% of the non-fatal burden (7% of total burden) (Table 9.9).

Table 9.9: Top 10 causes of fatal, non-fatal and total infectious disease burden, 2011 (%)

Fatal Burden		Non-fatal burden		Total burden	
Disease	**Proportion**	**Disease**	**Proportion**	**Disease**	**Proportion**
Lower respiratory infections	55.7	Gastrointestinal infections[(a)]	40.7	Lower respiratory infections	40.4
HIV/AIDS	7.2	Lower respiratory infections	13.8	Gastrointestinal infections[(a)]	17.3
Other meningitis and encephalitis	4.7	Upper respiratory infections	9.9	HIV/AIDS	6.9
Influenza	4.2	HIV/AIDS	6.4	Upper respiratory infections	3.8
Gastrointestinal infections[(a)]	3.8	Varicella-zoster	5.9	Influenza	3.4
Pneumococcal disease	2.6	Influenza	2.0	Other meningitis and encephalitis	3.0
Tuberculosis	2.3	Otitis media	1.5	Varicella-zoster	2.6
Meningococcal disease	1.6	Tuberculosis	1.1	Tuberculosis	1.8
Varicella-zoster	0.7	Mosquito-borne infections[(b)]	0.7	Pneumococcal disease	1.6
Hepatitis B (acute)	0.5	Pertussis	0.5	Meningococcal disease	1.0

(a) Gastrointestinal infections include the following causes: campylobacteriosis, salmonellosis, rotavirus and other gastrointestinal infections.

(b) Mosquito-borne infections include the following causes: Ross River virus, Barmah Forest virus, dengue and malaria.

The contribution of individual diseases to the total infectious diseases burden varied with age (Figure 9.19). Gastrointestinal infections were responsible for nearly 38% of all infectious DALY in children aged under 15. The contribution of lower respiratory infections increased with age, reaching almost 80% of the infectious burden amongst the population aged 85 and over. The burden associated with HIV/AIDS was largest between the ages of 30 and 54, where it accounted for 20% of the infectious disease burden.

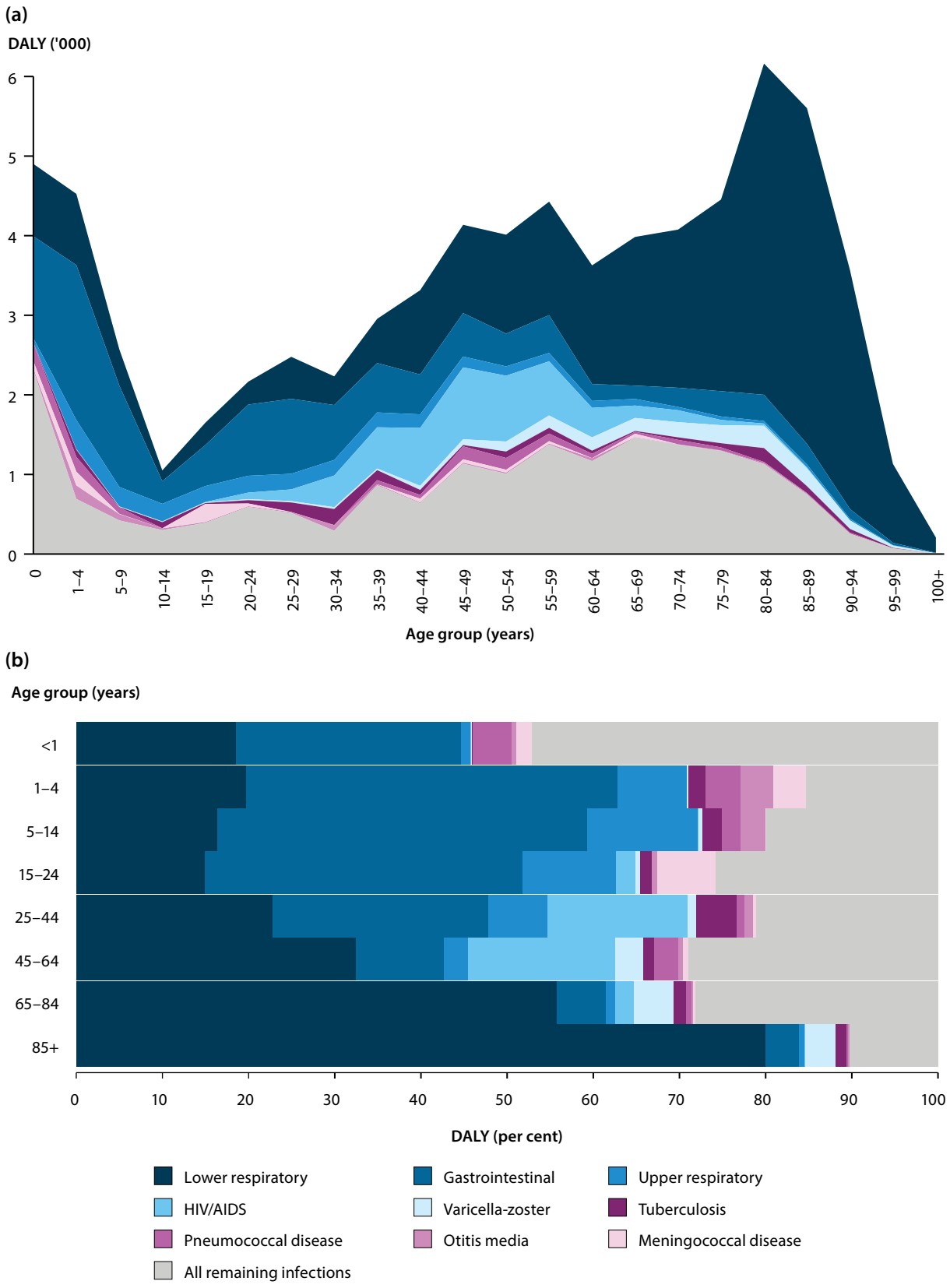


Figure 9.19: Infectious disease burden (DALY): number by age and disease (a) and proportion by age and disease (b), 2011

Risk factors

Evidence was available to quantify the impact of a large number of risk factors for infectious diseases. These included alcohol use, tobacco smoking, drug use, unsafe sex and air pollution. The joint contribution of these risk factors was 10% of the infectious diseases burden.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. Unsafe sex was the risk factor responsible for the most burden, contributing 6.6% of the total infections burden. This was mainly due to the burden of HIV/AIDS. Alcohol use was the second highest risk factor, responsible for 2.7% of the infections DALY. Drug use also contributed to 0.6% of the burden due to infectious diseases.

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

The number of infectious disease DALY fell from 84,800 in 2003 to 73,200 in 2011 (14% reduction). This change was driven by a reduction in the fatal burden, with 13,400 fewer YLL measured in 2011, despite a small increase of 1,800 YLD over the period.

When differences in the size and age structure of the population were taken into account, there was a decrease from 5.1 to 3.6 DALY per 1,000 males and from 3.5 to 2.6 DALY per 1,000 females. A comparison of the ASR of DALY by disease (Table 9.10) showed a decline in total burden in almost all of the leading 10 infectious diseases.

Table 9.10: Top 10 infectious diseases (ranked by age-standardised DALY rates in 2003), 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	2011	2003	2011	2003	2011
Lower respiratory infections	1.86	1.02	0.17	0.16	2.03	1.19
Gastrointestinal infections[(a)]	0.02	0.06	0.56	0.48	0.58	0.54
Other infections	0.27	0.30	0.12	0.18	0.40	0.49
HIV/AIDS	0.24	0.15	0.06	0.08	0.29	0.22
Upper respiratory infections	0.02	<0.01	0.16	0.12	0.18	0.13
Influenza	0.07	0.08	0.05	0.02	0.12	0.11
Other meningitis and encephalitis	0.11	0.10	<0.01	<0.01	0.11	0.10
Pneumococcal disease	0.09	0.01	0.00	0.06	0.09	0.08
Varicella-zoster	0.02	0.05	0.06	0.01	0.08	0.06
Meningococcal disease	0.08	0.05	<0.01	<0.01	0.08	0.05

(a) Gastrointestinal infections include the following causes: campylobacteriosis, salmonellosis, rotavirus and other gastrointestinal infections.

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. Values have been shown in two decimal places to highlight changes between 2003 and 2011.

When comparing results from the two reference years (2003 and 2011), it is important to remember that differences in the burden were affected by both the cyclic epidemics of many diseases (for example, influenza, pertussis and dengue) and changes in disease surveillance and reporting practices.

Nevertheless, a comparison of the ASR by disease (Table 9.10) shows changes that likely reflect expanded vaccination programs (pneumococcal and meningococcal diseases) and reduced risky injecting drug use behaviours (acute hepatitis C). Similarly, the impact of improving survival from HIV/AIDS can be seen in comparing YLL and YLD over the period.

Data quality

Fatal burden estimates for infectious diseases were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Data for non-fatal infectious diseases estimates were sourced from the National Notifiable Diseases Surveillance System, the National Hospital Morbidity Database and the Bettering the Evaluation and Care of Health program. For many diseases, notifications were unlikely to capture all cases. Wherever possible, data have been adjusted for under-notification or validated with alternative data sources. As hospitalisation data can capture multiple admissions for a single person, estimates have been adjusted for this, using Western Australian linked data.

Estimates of the annual incidence of hepatitis B and hepatitis C and of the number of people living with HIV/AIDS have been drawn from published studies (Jansson & Wilson 2012; The Kirby Institute 2013, 2015). Similarly, published estimates of the annual incidence of gastrointestinal infections were used (Hall et al. 2005; Kirk et al. 2010).

Due to the acute nature of most infectious diseases, data were generally reported as incidence. Therefore, durations of health loss were applied to derive point prevalence. Durations of health loss for most causes were sourced from previous global burden of disease studies; while for gastrointestinal infections, durations produced by Kemmeren et al. (2005) were used.

9.9 Injuries

In the ABDS, two perspectives were used to report injury burden:

- **external cause**, which describes the environmental events and circumstances that led to the injury; for example, a road traffic injuries, suicide, self-inflicted injuries, falls or poisoning (such as the toxic effects of medicinal or other substances)
- **nature of injury**, which describes the functional characteristic or the type of injury resulting from trauma; for example, hip fracture, traumatic brain injury or poisoning (such as poisoning by accidental overdose or accidental ingestion of poisonous substances).

Each perspective has policy relevance. Understanding the circumstances (external causes) that give rise to injuries is particularly important for informing public health initiatives to target injury prevention for particular events or circumstances.

The nature of injury perspective similarly offers advantages such as describing the different types of injury and trauma that are most likely to impact on the health system. This can be used to guide policy and planning for health care, (for example, trauma care). It also provides a consistent approach across the ABDS 2011 that was largely reported by body system.

The total burden from injury is the same for each reporting perspective (see Box 9.1) and each perspective is equally comparable to the burden of other diseases in this study.

Box 9.1 Quantifying injury burden by each perspective

Consider a simple list of injuries comprising three external causes: road traffic injuries, falls and assault. Now consider three possible resulting injuries: traumatic brain injury, bone fracture and internal injury.

Suppose there were:

- 1,000 DALY from road traffic injuries where 400 of these DALY were from resulting traumatic brain injury, 300 from fractures and 300 from internal injuries
- 500 DALY from falls where 100 of these DALY were from resulting traumatic brain injury and 400 from fractures
- 500 DALY from assault where 300 of these DALY were from resulting traumatic brain injury and 200 from internal injuries.

Counting DALY by external cause gives 1,000 from road traffic injuries + 500 from falls + 500 from assault = 2,000 injury DALY

Counting DALY by nature of injury gives 800 from traumatic brain injury + 700 from fractures + 500 from internal injuries = 2,000 injury DALY.

The scope of injuries is limited to those incurred from trauma. Health loss associated with surgical amputations due to diabetes, or chronic conditions such as chronic back pain, are covered in relevant other disease groups. The injuries disease group contains accidental poisoning deaths, including deaths due to opioid poisoning.

Non-fatal injuries are restricted to those that are admitted to a hospital or present to an emergency department. Injuries presenting only to a general practitioner and those for which no medical care is sought are excluded. It is assumed that these injuries do not incur sufficient health loss to be included in the ABDS.

For a complete list of individual external causes and injuries used in this study, see Appendix A.

Overview

Overall, injuries was responsible for 8.8% of all DALY (14% of YLL and 3.8% of YLD), making it the fifth most burdensome group of diseases (third for fatal and eighth for non-fatal burden). Most injury burden (79%) was due to early death (fatal burden), with only 21% of the burden due to non-fatal health loss.

By external cause

Using the external cause of injury perspective, suicide accounted for 29% of the total injuries burden, followed by falls (15%), poisoning and road traffic injuries—motor vehicle occupants (13% each) and other unintentional injuries (8%) (Figure 9.20a).

Although fatal burden was generally greater than non-fatal burden for injuries, the non-fatal burden from falls (59%) was greater than that for fatal. Where the cause of injury was suicide or poisoning, the resulting burden was almost all fatal (each 99%) (Figure 9.20b).

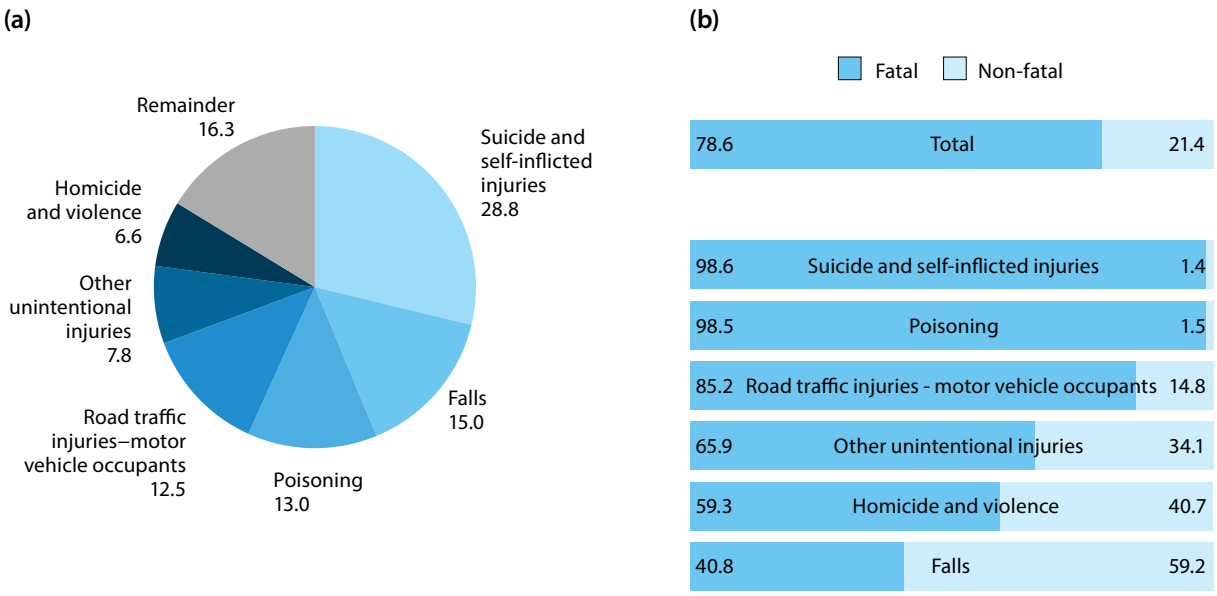
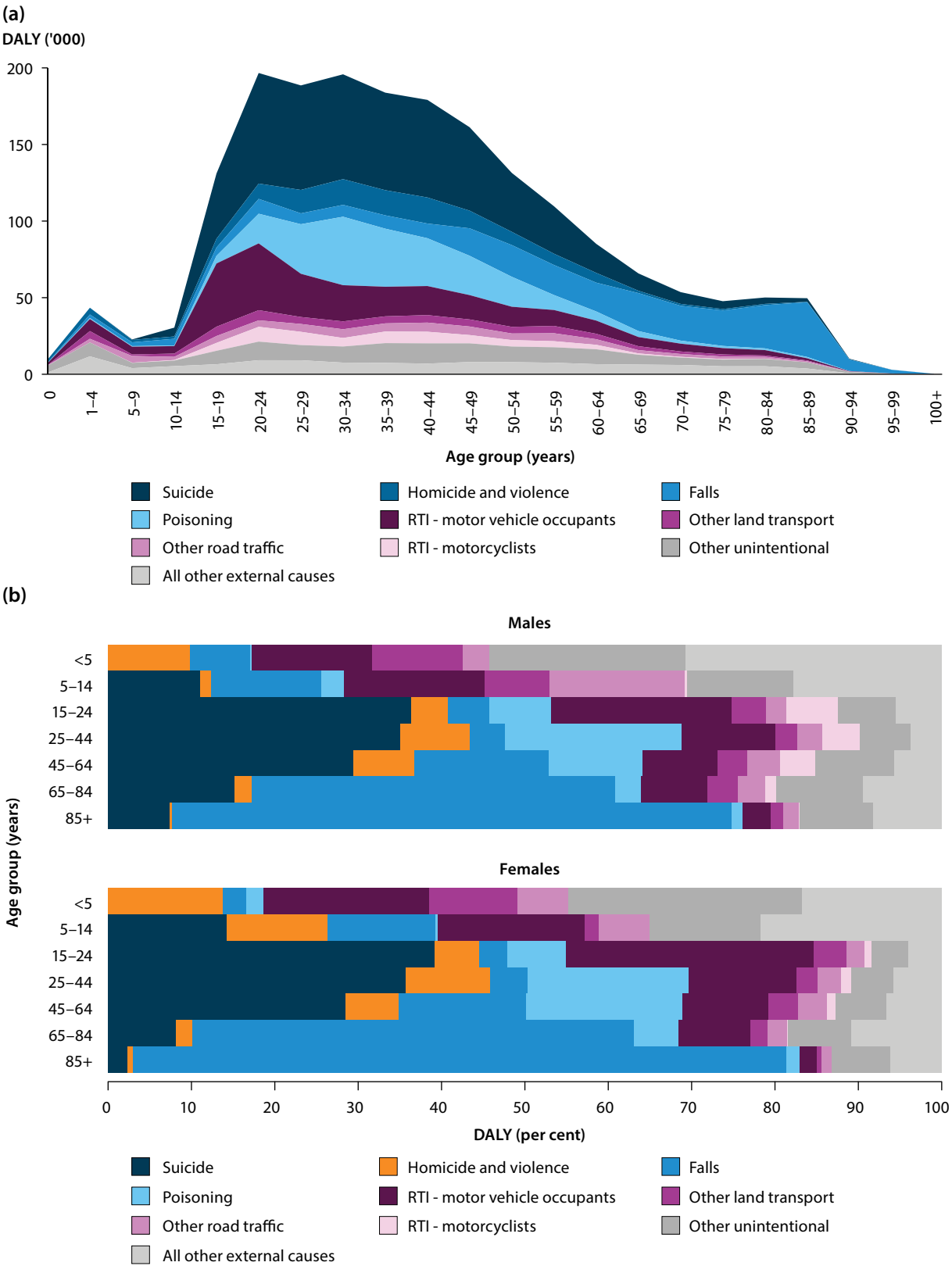


Figure 9.20: Injuries burden (DALY) by external cause of injury: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

The greatest impact of injury burden was between ages 15 and 44. Figure 9.21a shows the impact by external cause and how it varied by age. Substantial impact from suicide, occupants of motor vehicle in road traffic injuries and poisoning was observed from around age 15 up to 54 years. The burden from falls increased from around age 40, becoming the major contributor from age 65.

The impact of burden from injury differed by sex. Figure 9.21b shows that homicide and violence cause proportionally more burden in females than in males aged under 25, while road traffic injuries involving motorcycles caused proportionally more burden in males.



Note: 'RTI' refer to 'Road traffic injuries'.

Figure 9.21: Injuries burden (DALY), number by age and external cause (a) and proportion by age and sex (b) 2011

By nature

Using the nature of injury perspective, the broad group of other injuries accounted for almost half (46%) of the total injury burden, followed by poisoning (21%) and traumatic brain injury (18%) (Figure 9.22a). The other injuries group comprised all injuries not assigned to a specific injury cause. It included injuries such as amputations, open wounds and nerve injuries. The fatal burden component of injuries by nature of injury relied on data transformations that can affect data quality (see section on 'Data quality' for more details).

Fatal burden was much greater than non-fatal burden for poisoning (98%) and other injuries (97%) (Figure 9.22b). Non-fatal burden was greater for some injuries due to the very large burden from the long-term impact of the injury, such as traumatic brain injury (76%). For soft tissue injuries and dislocations—and tibia, ankle and humerus fractures—all burden was non-fatal (not shown in graph).

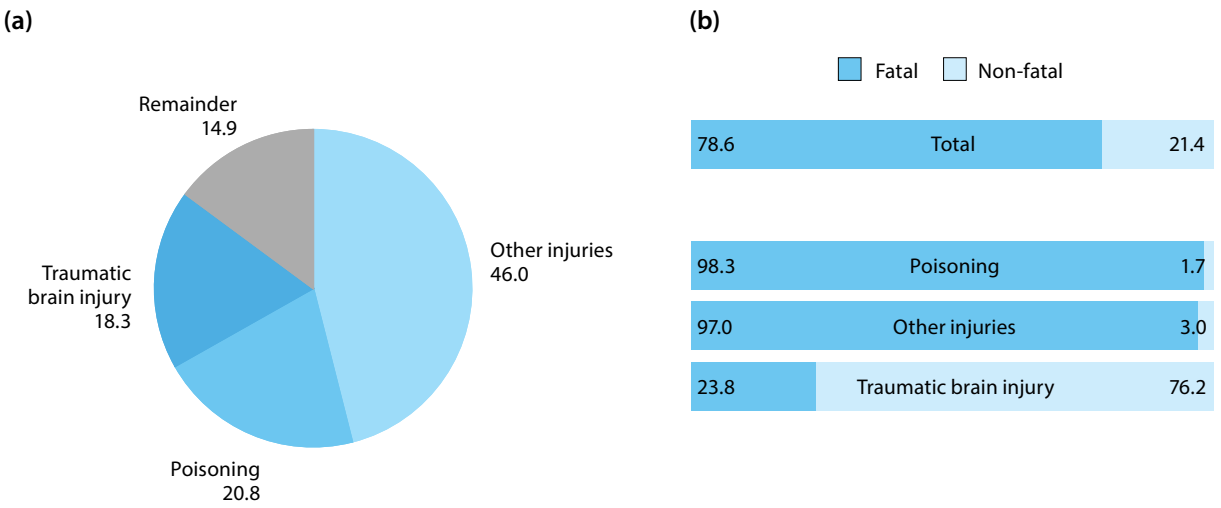


Figure 9.22: Injuries burden (DALY) by nature of injury: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

The specific types of injury giving rise to the most burden between ages 15 and 79 were traumatic brain injury, poisoning and other injuries (Figure 9.23). Other injuries and traumatic brain injuries contributed a considerable amount to burden in all age groups, while drowning was a major contributing factor in younger ages (up to age 14) and hip fracture in the older age groups.

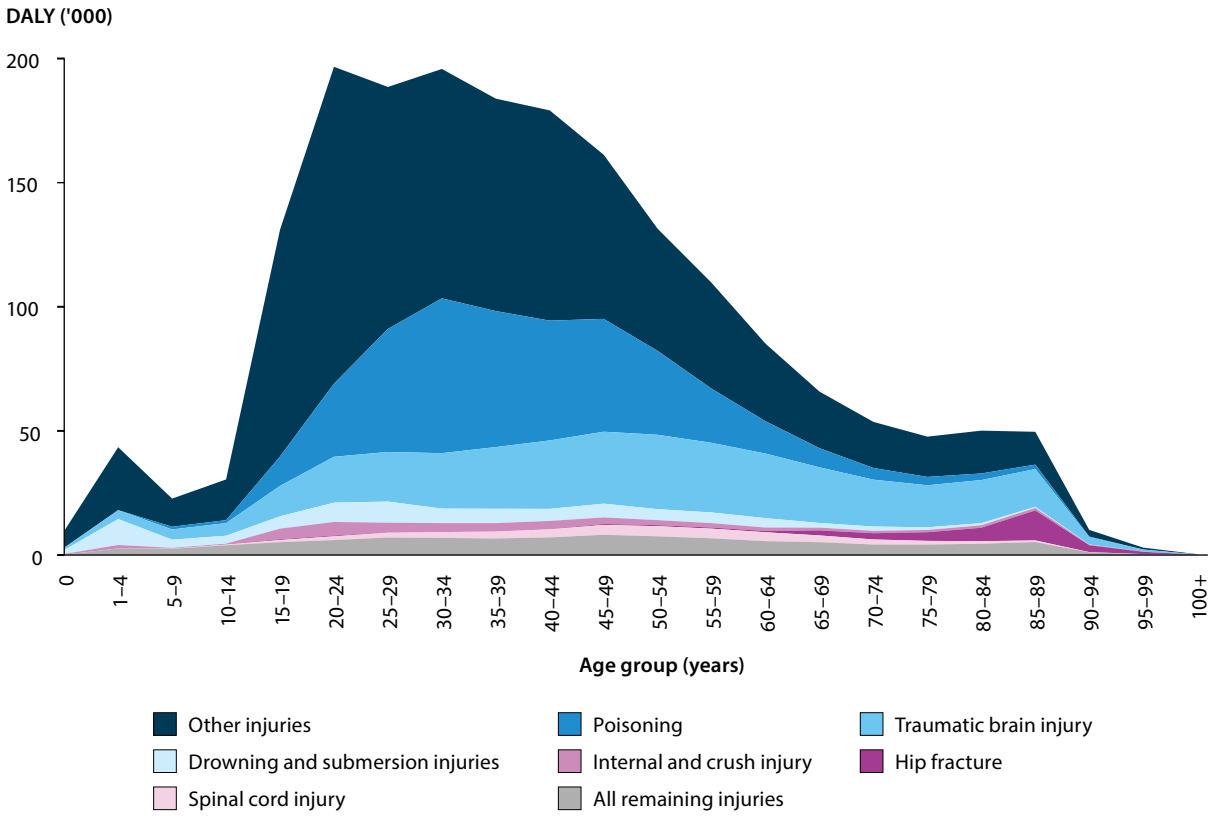


Figure 9.23: Injuries burden (DALY) by age and nature of injury, 2011

Males had greater injury burden—both fatal and non-fatal—for almost all types of injury when comparing ASRs (Appendix Table D14). This was particularly noticeable in non-fatal burden from spinal cord injury, traumatic brain injury, other injuries and other fractures, and in fatal burden from spinal cord injury, internal & crush injury and drowning. Females experienced greater non-fatal burden from hip fracture and poisoning than males.

External cause and nature of injury perspective for males and females

By external cause

Falls (38%), homicide and violence (15%) and other unintentional injuries (14%) resulted in the most non-fatal burden for males (Table 9.11). For females, these causes were falls (51%), road traffic injuries—motor vehicle occupants (9%) and other unintentional injuries (9%).

Suicide, poisoning and road traffic injuries – motor vehicle occupants caused the most fatal injury burden for males (38%, 17% and 13% respectively) and females (32%, 16% and 15%, respectively).

Table 9.11: Top 5 ranked causes of non-fatal and fatal injuries, by external cause, males and females, 2011

Non-fatal burden	Per cent YLD	Rank	Fatal burden	Per cent YLL
		Males		
Falls	37.7	**1**	Suicide and self-inflicted injuries	37.8
Homicide and violence	14.8	**2**	Poisoning	16.6
Other unintentional injuries	13.9	**3**	Road traffic injuries—motor vehicle occupants	13.0
Road traffic injuries—motor vehicle occupants	8.6	**4**	Other unintentional injuries	6.6
Other land transport injuries	7.0	**5**	Falls	6.3
		Females		
Falls	51.2	**1**	Suicide and self-inflicted injuries	31.7
Road traffic injuries—motor vehicle occupants	9.0	**2**	Poisoning	15.7
Other unintentional injuries	8.7	**3**	Road traffic injuries—motor vehicle occupants	15.1
Homicide and violence	7.1	**4**	Falls	11.5
Other land transport injuries	6.1	**5**	Homicide and violence	6.7

By nature of injury

The types of injuries resulting in most non-fatal burden for males and females were traumatic brain injury (66% and 62%, for males and females respectively), followed by spinal cord injury (9%) and other fractures (8%) for males, and other fractures (8%) and burns (7%) for females (Table 9.12).

For fatal burden, the types of injuries resulting in most burden were other injuries (58% and 53% for males and females, respectively) and poisoning (25% and 28%, respectively), followed by drowning and traumatic brain injury (5% for each injury type) for males and traumatic brain injury (7%) for females.

Table 9.12: Top 5 ranked causes of non-fatal and fatal injuries, by nature of injury, males and females, 2011

Non-fatal burden	Per cent YLD	Rank	Fatal burden	Per cent YLL
		Males		
Traumatic brain injury	66.4	**1**	Other injuries	58.4
Spinal cord injury	9.0	**2**	Poisoning	25.3
Other fractures	8.1	**3**	Drowning and submersion injuries	5.2
Burn injuries	6.8	**4**	Traumatic brain injury	5.1
Other injuries	5.9	**5**	Internal and crush injury	2.6
		Females		
Traumatic brain injury	62.3	**1**	Other injuries	52.7
Other fractures	7.8	**2**	Poisoning	27.6
Burn injuries	7.4	**3**	Traumatic brain injury	6.6
Spinal cord injury	6.0	**4**	Drowning and submersion injuries	4.4
Other injuries	5.6	**5**	Hip fracture	3.4

Risk factors

Evidence was available to quantify the impact of a number of risk factors for injuries. These included alcohol use, drug use, low bone mineral density, childhood sexual abuse, intimate partner violence and occupational exposures & hazards. The joint contribution of these risk factors was 30% of injuries burden and the majority of the burden attributable to risk factors was fatal.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. Alcohol use was the risk factor responsible for the most injuries—contributing to 21% of the overall injuries burden. It caused 23% of the burden due to suicide & self-inflicted injuries and 20% of the burden due to poisoning (Appendix Table D15). It also contributed to the burden from various road, land and transport injuries: road traffic injuries involving motorcyclists (33%) and motor vehicle occupants (28%), other road traffic injuries (26%) and other land transport injuries (31%).

Further information on risk factors and their contribution to burden can be found in chapters 6 and 10.

Changes since 2003

Overall, the number of injury-related DALY increased by 24,200 (6.5%) between 2003 and 2011: from 370,300 in 2003 to 394,500 in 2011. This change comprised an increase of around 6,700 YLL and 17,500 YLD.

Considering the changing age structure of the population, these changes were reflected as a decrease from 19 to 18 DALY per 1,000 people from 2003 to 2011. This change was driven by a decrease in the rate of fatal burden (from 15 to 14 YLL per 1,000 people) while the non-fatal injury burden was similar in each year (3.4 and 3.6 YLD per 1,000 people for 2003 and 2011, respectively).

ASRs of burden in 2011 compared with those for 2003 are shown in Table 9.13 by external cause and nature of injury.

Table 9.13: Age-standardised fatal and non-fatal burden rates, by external cause and nature of injury, 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
Disease	**2003**	**2011**	**2003**	**2011**	**2003**	**2011**
External cause						
Suicide & self-inflicted injuries	5.2	5.0	0.1	0.1	5.3	5.1
Road traffic injuries—motor vehicle occupants	3.0	1.9	0.3	0.3	3.3	2.2
Falls	0.9	1.0	1.3	1.5	2.1	2.4
Poisoning	1.8	2.3	<0.1	<0.1	1.9	2.4
Other unintentional injuries	1.2	0.9	0.5	0.5	1.7	1.3
Homicide and violence	0.8	0.7	0.5	0.5	1.3	1.2
Other road traffic injuries	0.6	0.4	0.2	0.2	0.7	0.6
Road traffic injuries—motorcyclists	0.5	0.4	0.1	0.1	0.6	0.6
Drowning	0.6	0.5	<0.1	<0.1	0.6	0.5
Other land transport injuries	0.3	0.3	0.2	0.3	0.6	0.6
Fire, burns and scalds	0.2	0.2	0.2	0.2	0.4	0.3
All other external causes of injury	0.2	0.2	0.1	0.1	0.3	0.3
All injuries	**15.4**	**13.8**	**3.4**	**3.6**	**18.8**	**17.5**
Nature of injury						
Poisoning	3.3	3.7	0.1	0.1	18.8	17.5
Traumatic brain injury	0.8	0.7	2.1	2.4	3.3	3.7
Drowning and submersion injuries	0.9	0.7	<0.1	<0.1	2.9	3.1
Burn injuries	0.2	0.2	0.2	0.2	0.9	0.7
Internal and crush injury	0.4	0.3	<0.1	<0.1	0.4	0.4
Other fractures	0.1	0.1	0.3	0.3	0.4	0.3
Spinal cord injury	<0.1	<0.1	0.3	0.3	0.4	0.4
Hip fracture	0.1	0.2	0.1	0.1	0.4	0.3
Tibia and ankle fracture	—	—	<0.1	<0.1	0.2	0.3
Soft tissue injuries	—	—	<0.1	<0.1	<0.1	<0.1
Dislocations	—	—	<0.1	<0.1	<0.1	<0.1
Humerus fracture	—	—	<0.1	<0.1	<0.1	<0.1
Other injuries	9.5	7.9	0.2	0.2	<0.1	<0.1
All injuries	**15.4**	**13.8**	**3.4**	**3.6**	**18.8**	**17.5**

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

By external cause

The overall change in injuries DALY rates between 2003 and 2011 was mainly influenced by a reduction in YLL burden per population from road traffic injuries of motor vehicle occupants and other unintentional injuries. The large gain was offset by an increase in the burden rate from poisoning which showed a relatively large rise from 2003 to 2011. The rate of life lost due to falls also increased between the two periods and was slightly greater in 2011 than in 2003.

Rather than large changes in any one cause, there were small changes in the YLD rate for most external causes.

By nature of injury

There was a small reduction in age-standardised DALY and YLL between 2003 and 2011 from other injuries, while burden rates for poisoning and traumatic brain injury were higher in 2011 than in 2003.

For YLD, there was little change in the overall rate; however, there was a small increase in the non-fatal burden rate for traumatic brain injury.

Box 9.2 Increase in poisoning YLL

The increased YLL for poisoning seen here may be influenced by factors such as changes in coding practices or drug epidemics. Before 2006, deaths involving poisoning may have been coded with an underlying cause related to mental & substance use disorders; since 2006 deaths determined as accidental poisoning are coded to an external cause of death. Further, it can be difficult to determine the intent in a death involving pharmaceutical drugs. The use of the coronial information system in Australia facilitated the coding of cause of death from 2007 onwards. This represents a change in coding practice between the two periods reported here. This change is most applicable to injury deaths which largely represent the group of deaths that are reported to a coroner in Australia. Details of changes to the ICD-10 classification and coding practices are presented in substantial detail elsewhere (Harrison & Henley 2015), including the types of injury deaths that are likely to be influenced by these changes.

Data quality

YLL estimates for injuries were sourced directly from registered deaths held in the National Mortality Database and were considered extremely robust. Some adjustments were made for injury causes of death that did not align to the ABDS disease and injury list; namely deaths where the intent was undetermined and deaths coded to unspecified factors. More detail on redistribution of deaths data is provided at Appendix A.

Non-fatal injury burden comprised three components as follows:

- admitted cases based directly on hospital admission data and therefore considered robust
- non-admitted cases estimated from emergency care data. A substantial proportion (52%) of the data for emergency department presentations were not used due to variations in coding classifications used to report the diagnosis. Consequently, the resulting patterns of non-admitted injury cases are assumed to be reflected in the data that were used
- prevalence of long-term sequelae, which was estimated directly using a portion of admitted cases

according to previous burden studies. These cases were modelled in DISMOD II (WHO disease modelling software) to obtain the prevalence of long-term sequelae of injury.

Injury deaths have the external cause as the underlying cause of death, while hospital data used for the non-fatal burden has nature of injury as the principal diagnosis. Therefore, each had to be transformed to the other perspective to enable comparisons between fatal and non-fatal impacts, and for DALY to be calculated. Consequently, this reduces the quality of injury deaths reported by nature of injury.

9.10 Kidney and urinary diseases

The kidney & urinary disease group includes chronic kidney disease, enlarged prostate, kidney stones and the residual other kidney & urinary diseases group.

It is important to note that the results provided here represent the direct impact of kidney and urinary diseases. Chronic kidney disease, in particular, is an important risk factor for other diseases such as coronary heart disease. These indirect impacts are not included here, but are instead included in the disease group where the disease effects are more immediate—for this example, in cardiovascular diseases.

Overview

Kidney & urinary diseases accounted for 1.3% of the total disease burden in 2011 (1.7% of total YLL and 0.9% of the total YLD). This disease group was dominated by one disease: 72% of the burden came from chronic kidney disease (36% for both males and females). Enlarged prostate caused 4.5% of the kidney & urinary burden, and other kidney & urinary diseases 23%; however this varied by age (Figure 9.24).

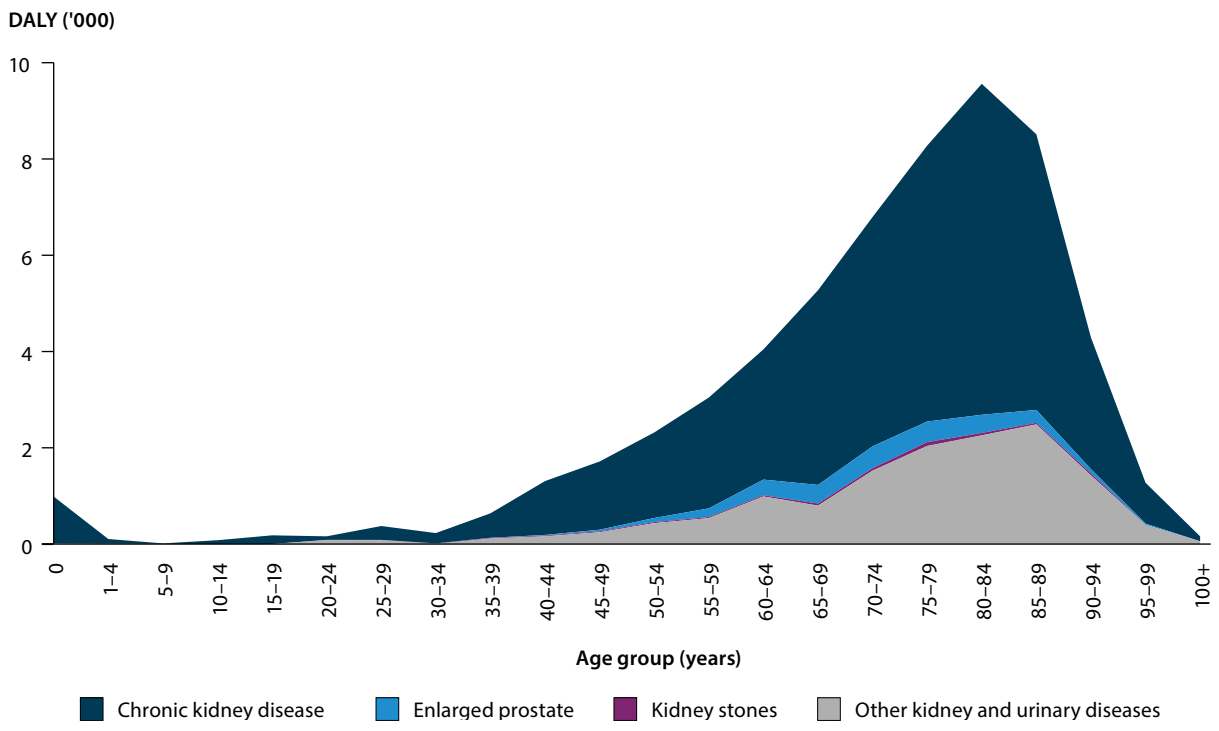


Figure 9.24: Kidney and urinary disease burden (DALY) by age and disease, 2011

Unlike many other diseases, chronic kidney disease caused very similar levels of total burden among males and females. The fatal burden from chronic kidney disease was slightly higher in males than in females.

Chronic kidney disease was one of the 10 most burdensome diseases for:

- total burden for both males and females aged 85 and over (see figures 3.6 and 3.7)
- fatal burden for males and females aged 75 and over (see figures 5.5 and 5.6)
- *Very remote* areas (see Figure 8.5).

Risk factors

Evidence is available to quantify the impact of a number of risk factors for chronic kidney disease. This included high blood pressure, high body mass and high blood plasma glucose levels. The joint contribution of these risk factors was 42% of the kidney & urinary burden.

Each risk factor was analysed independently and the same burden may be attributed to more than one risk factor. High body mass was responsible for 38% of the burden due to chronic kidney disease (Appendix Table D15). This was followed by high blood pressure (30%) and high blood glucose levels (4.1%). Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

There were some changes in the total burden from chronic kidney disease between 2003 and 2011—for males there was a 3.1% decrease in the ASRs and for females a 6.0% increase (Table 9.14). However, these mask quite different patterns in the underlying YLL and YLD. For males, there was a notable reduction (8.5%) in the rate from dying prematurely from chronic kidney disease but an increase (16.0%) in the rate from living with the disease. For females, there was a small increase (2.8%) in the ASRs of fatal burden along with an increase in the non-fatal burden (14%). For males, the increase in the non-fatal burden may partly reflect the success in reducing the fatal burden, as there may be more people living with the condition.

Table 9.14: Age-standardised rates for chronic kidney disease (DALY,YLL and YLD), 2003 and 2011

	2003	2011	Rate difference[a]	Rate difference (%)[b]
Males				
Fatal burden	1.6	1.4	–0.1	–8.5
Non-fatal burden	0.4	0.5	0.1	16.0
Total burden	2.0	1.9	–0.1	–3.1
Females				
Fatal burden	1.1	1.1	0.0	2.8
Non-fatal burden	0.4	0.5	0.1	14.2
Total burden	1.5	1.5	0.1	6.0

(a) Rate differences are 2011 ASR minus 2003 ASR.

(b) Rate difference expressed as a percentage of 2003 ASR.

Note: Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

The improvements in fatal burden of chronic kidney disease for males largely occurred in the age groups around 75–84 (Figure 9.25). The increases in non-fatal burden are seen across a wide age range in both males and females.

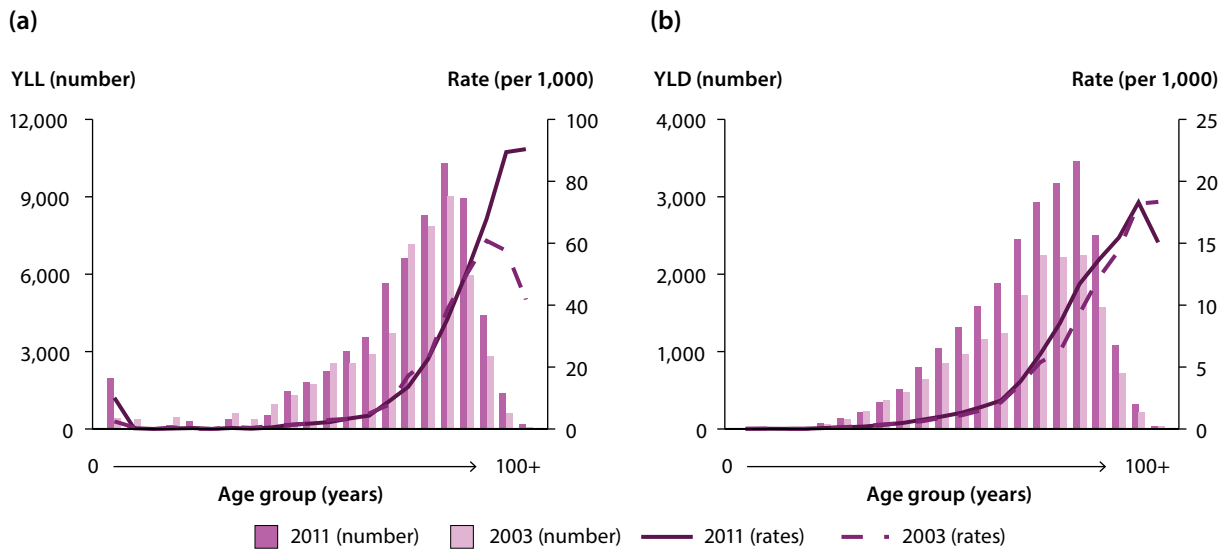


Figure 9.25: Chronic kidney disease number and rates (per 1,000 people), by age for 2003 and 2011: fatal burden (a) and non-fatal (b) burden, 2011

Note that there was little change in the other diseases in this group between 2003 and 2011.

Data quality

Fatal burden estimates for kidney & urinary diseases were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Chronic kidney disease prevalence rates in 2011 for different stages of the disease were drawn from a number of data sources all of very high quality:

- measurement data in the Australian Health Survey based on blood samples from survey respondents for the earlier stages of chronic kidney disease
- the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA) register of people with treated end-stage kidney disease (on dialysis or living with a kidney transplant)
- linked data from national mortality and ANZDATA databases to determine the number of people with end-stage kidney disease not receiving dialysis or living with a kidney transplant.

Similar data were available for 2003 for the second and third of these sources. However, measurement data were not available to estimate the 2003 prevalence for the earlier stages of the disease, so trends in the later stages of the disease using ANZDATA were applied.

9.11 Mental and substance use disorders

The disease group mental & substance use disorders encompasses a broad range of conditions, including bipolar affective disorder, anxiety, substance use, behavioural and developmental disorders, schizophrenia and intellectual disability.

Suicidal behaviour, self-harm, drug poisoning and drug overdose were captured under the injuries group. Dementia, a condition affecting the nervous system, is included in the neurological conditions group.

In this disease group, intellectual disability only included cases where the underlying cause was unknown or was not modelled elsewhere in the study; otherwise, it was included with the underlying cause (for example, Down syndrome).

Estimates for this disease group aimed to reflect the burden of mental & substance use disorders that correspond to clinical definitions (for example, major depressive disorder) rather than broader measures of mental health, such as psychological distress. For substance use disorders, burden was estimated for clinical drug/alcohol dependence only.

Overview

Mental & substance use disorders was responsible for almost 12% of total burden in Australia in 2011, making it the third most burdensome group of diseases behind cancer and cardiovascular diseases. It was also the leading cause of non-fatal burden, accounting for almost one-quarter (24%) of all YLD.

Just over one-quarter (26%) of the burden due to mental & substance use disorders was attributed to anxiety disorders, and a similar proportion (24%) to depressive disorders. A further 12% was attributed to alcohol use disorders (Figure 9.26a).

Fatal burden

Only a very small proportion (3.3%) of burden in this disease group was fatal (Figure 9.26b). Alcohol dependence (44% of fatal burden for mental & substance use disorders), drug use disorders (20%) and

other mental & substance use disorders (18%) were the main causes of fatal burden. Fatal burden peaked in people aged 50–54. It was twice as high for men as it was for women (ASR 1.1 and 0.5 per 1,000 people, respectively).

Non-fatal burden

The main causes of non-fatal burden were anxiety disorders (27%), depressive disorders (24%) and alcohol use disorders (11%). Non-fatal burden due to mental & substance use disorders peaked in adults aged 25–29. The ASR of non-fatal burden were higher in men than in women (25 and 23 per 1,000, respectively).

There were notable differences between the sexes. Women contributed to a greater proportion of non-fatal burden for mood disorders (depressive disorders and bipolar affective disorder), anxiety disorders, eating disorders and other mental & substance use disorders. Men shared a greater proportion of non-fatal burden for substance use disorders (alcohol and drug dependence), schizophrenia and disorders that typically begin in childhood.

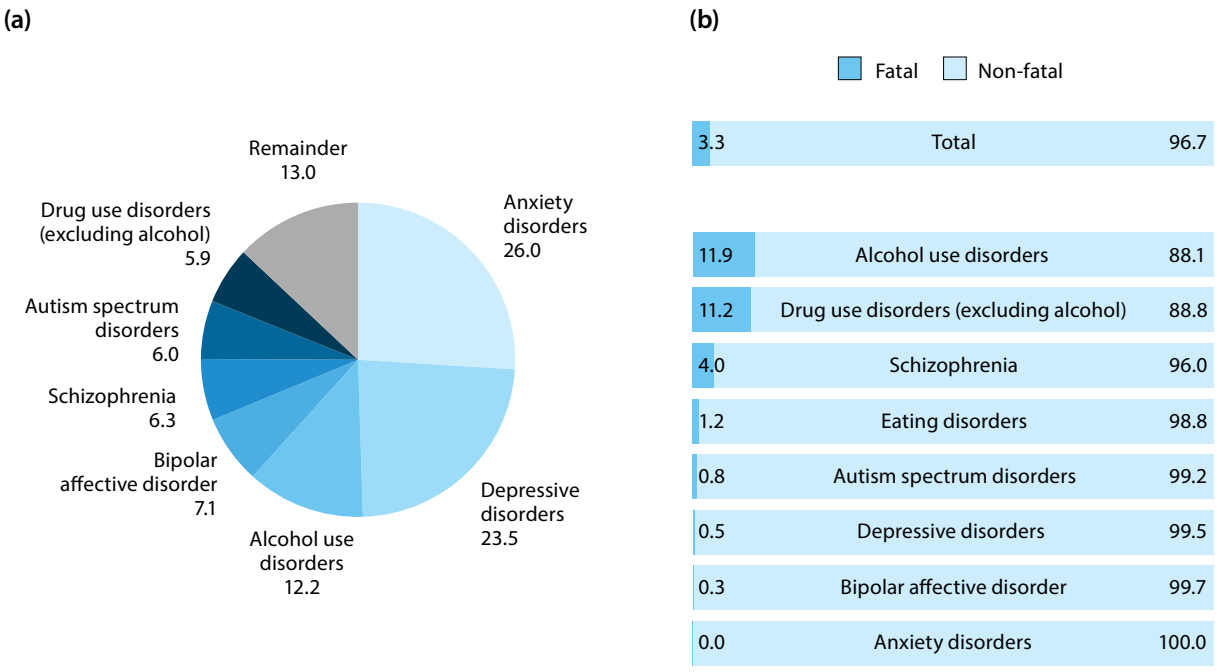


Figure 9.26: Mental and substance use disorders burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Burden due to mental & substance use disorders peaked at ages 25–29 and was higher for men than for women, with ASR around 26 and 23 per 1,000 people, respectively. However, the proportion contributed by each condition differed by age and sex. Most notably, anxiety and depressive disorders made up a greater proportion of mental & substance use burden for women (61%) than for men (39%) whereas alcohol and drug use disorders made up a smaller proportion of burden for women (9.9%) than for men (25.5%). Burden due to alcohol and drug use disorders peaked between the ages of 15 and 44 (Figure 9.27).

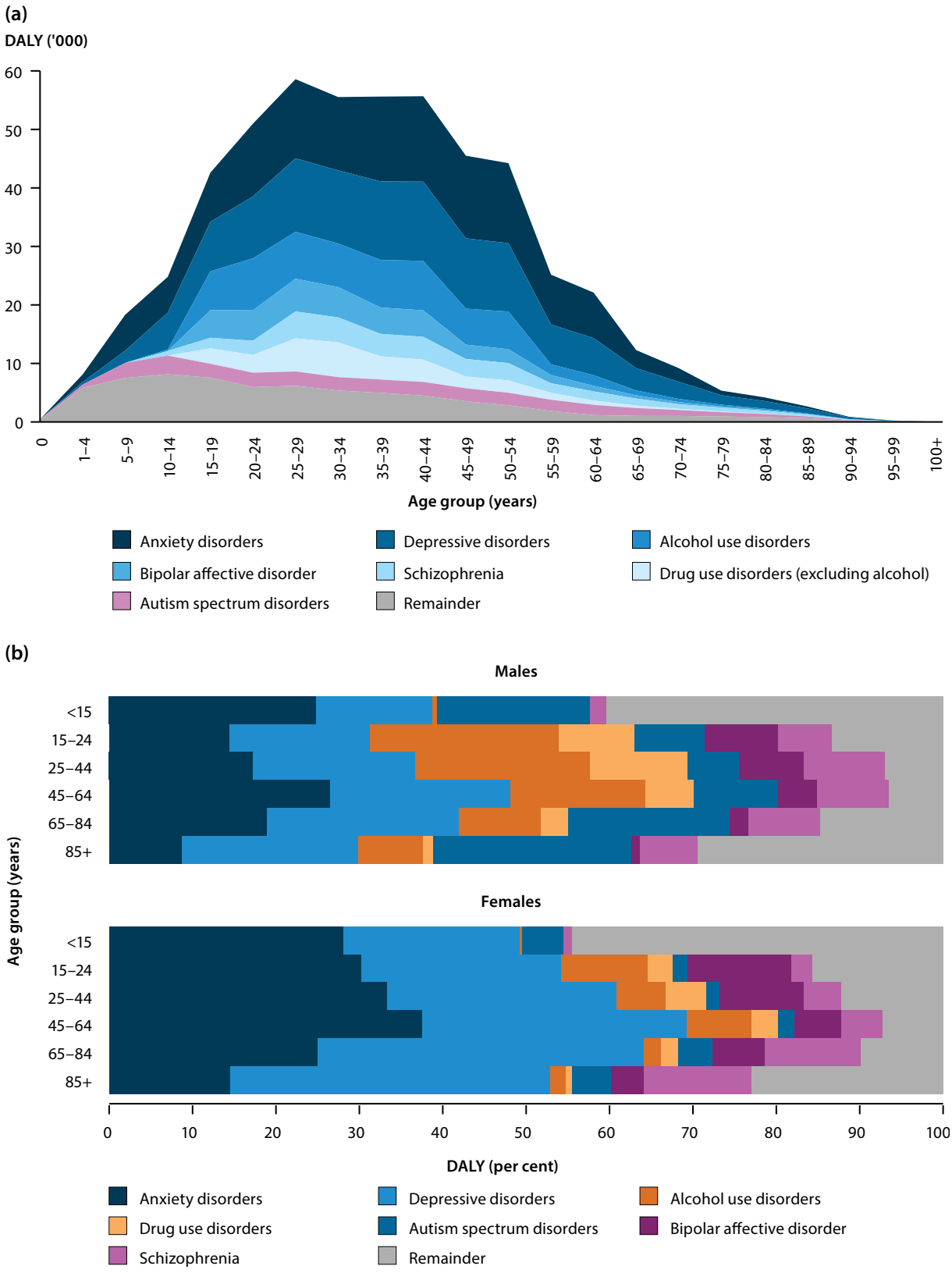


Figure 9.27: Mental and substance use disorders burden (DALY), by age and disease (a); and proportion of burden (DALY) due to mental and substance use disorders by life stage and sex (b), 2011

Risk factors

Evidence was available to quantify the impact of a number of risk factors for mental & substance use disorders. These included alcohol use, drug use, childhood sexual abuse and intimate partner violence. The joint contribution of these risk factors was 21% of mental & substance use disorders burden.

Each risk factor was analysed independently and the same burden may have been attributed to more than one risk factor. Hence, the attributable burden for the individual risk factors do not add up to the joint contribution. Alcohol was the risk factor responsible for the most mental & substance use disorders burden, contributing to 12% of the total burden. Drug use, childhood sexual abuse and intimate partner violence each contributed less than 10% of the burden.

Alcohol use was responsible for the entire burden due to alcohol use disorders (66,000 DALY) (Appendix Table D15). Similarly, drug use was responsible for the entire burden due to drug use disorders (excluding alcohol) (32,000 DALY). Childhood sexual abuse was responsible for 5.3% of the burden due to depressive disorders and 6.8% of burden due to alcohol use disorders. Intimate partner violence was responsible for 11.9% of the female burden due to depressive disorders.

Further information on risk factors and their contribution to burden is found in chapters 6 and 10.

Changes since 2003

Between 2003 and 2011 total burden from mental & substance use disorders increased by 13%, from 480,700 to 542,600 DALY. During this period, the ASR of total burden due to mental & substance use disorders increased by 0.6%, rates of fatal burden decreased by 8.8% and non-fatal burden increased by 1.0% (Table 9.15).

Table 9.15: Age-standardised rates for burden of mental and substance use disorders (DALY, YLL and YLD), 2003 and 2011

Burden type	2003	2011	Rate difference[(a)]	Rate difference (%)[(b)]
Fatal burden	0.8	0.8	– 0.1	– 8.8
Non-fatal burden	23.6	23.8	0.2	1.0
Total burden	**24.5**	**24.6**	**0.2**	**0.6**

(a) Rate differences are 2011 ASR minus 2003 ASR.

(b) Rate difference expressed as a percentage of 2003 ASR.

Note: Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

For non-fatal burden, almost all prevalence rates by sex and age in this disease group (except drug use disorders excluding alcohol, and other mental & substance use disorders) were assumed to be stable between 2003 and 2011, as previous analyses had indicated little change in prevalence in Australia during this period (Ferrari, 2015 pers. comm., 19 June; Hall, 2015, pers. comm., 23 July). As a result, any changes in non-fatal burden in these conditions can be attributed to changes in population size or ageing.

The ASR of burden from drug use disorders increased by 5.6% between 2011 and 2003, with the age-specific rates of burden generally shifting by approximately 10 years (Figure 9.28). This pattern suggested that the increase in ASR of burden for drug use disorders was driven by a cohort effect.

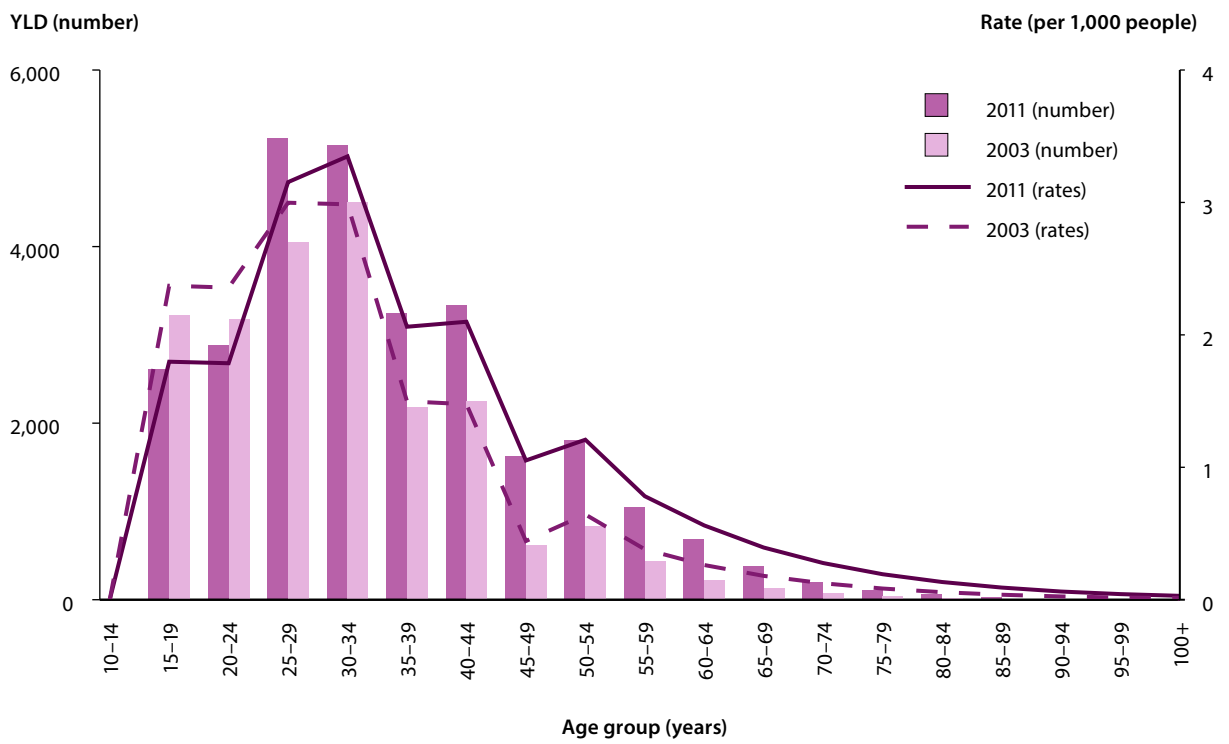


Figure 9.28: Changes in non-fatal burden by age (number and rate per 1,000 people) in drug use disorders, 2003 and 2011

Data quality

Fatal burden estimates for mental & substance use disorders were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Overall, estimates of the non-fatal burden of mental & substance use disorders were based on high-quality data. Estimates were based on four key Australian data sources: the 2007 National Survey of Mental Health and Wellbeing, the 2013–14 Young Minds Matter Survey, the 2010 Study of High Impact Psychosis, and the Western Australian Intellectual Disability Exploring Answers (IDEA) database. The first two data sources listed above used diagnostic criteria to assess mental disorders and therefore provide more accurate results than self-report. The IDEA database source was used mainly to calculate estimates of intellectual disability and childhood autism. It required substantial modelling in people over the age of 30. Opioid and amphetamine dependence estimates were based on a combination of Australian treatment services, hospitalisations and pharmacotherapy data as analysed by the National Drug and Alcohol Research Centre.

9.12 Musculoskeletal conditions

Musculoskeletal conditions are among the most common chronic conditions in Australia. They are diseases and disorders of the bones, muscles and their attachments (for example, joints and ligaments). This disease group includes osteoarthritis, gout, rheumatoid arthritis, back pain & problems, along with the residual other musculoskeletal conditions. Osteoporosis was considered a risk factor and the burden attributed to this risk factor was analysed; see chapter 6.

Overview

Musculoskeletal conditions were responsible for 12% of all DALYs. Most of this was due to other musculoskeletal conditions and back pain & problems, which accounted for 35% and 31% respectively of the burden due to musculoskeletal conditions (Figure 9.29a). Other musculoskeletal conditions include other and ill-defined arthritis; chronic pain in joints, muscles and other soft tissue; and systemic lupus erythematosus.

As musculoskeletal conditions are often chronic, the burden for each disease was mostly non-fatal, accounting for 94–99% of the musculoskeletal burden. In 2011, other musculoskeletal conditions and back pain & problems were the two diseases causing the most non-fatal burden (YLD) for males and in the top three diseases causing the most non-fatal burden for females.

Females experienced more (55%) of the burden due to musculoskeletal conditions than males (45%). Females experienced around two-thirds of the burden from osteoarthritis (66%) and rheumatoid arthritis (64%); males experienced a much greater share (83%) of the burden from gout (Figure 9.29b).

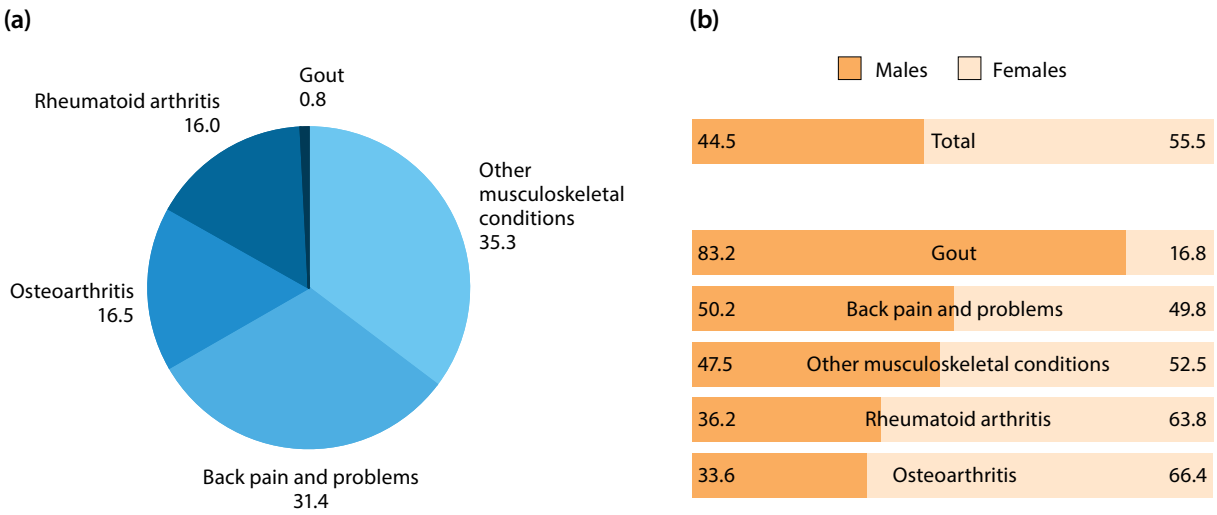
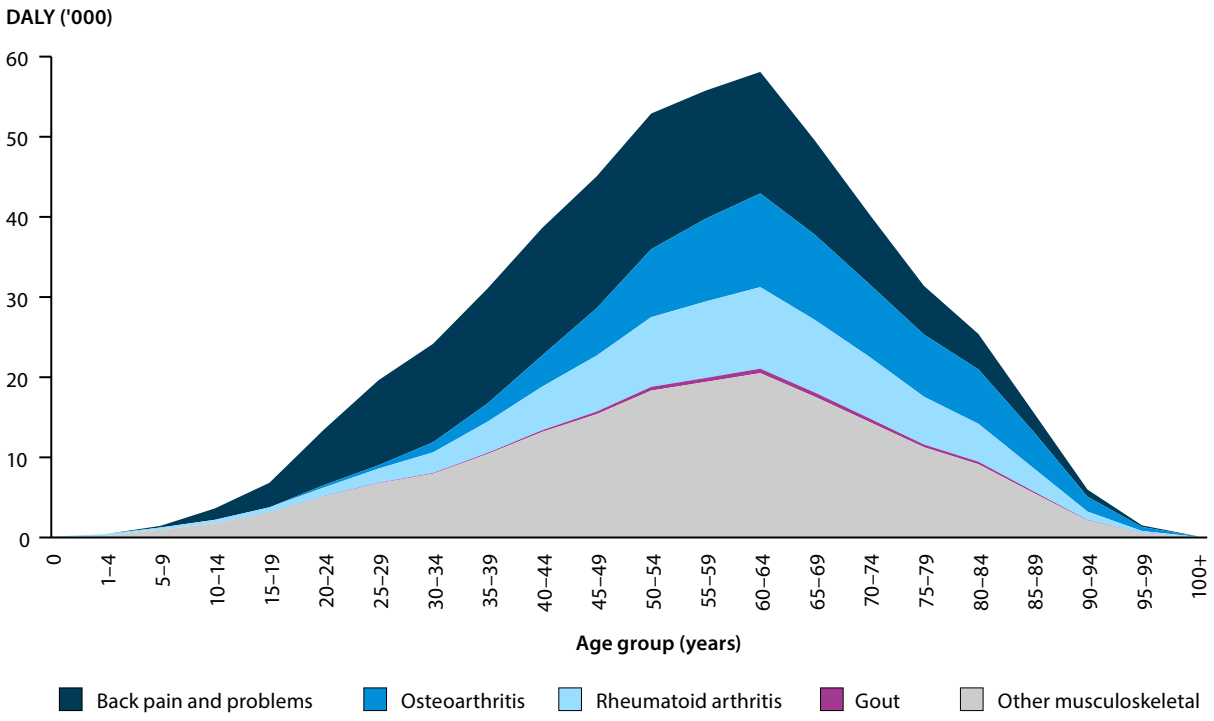


Figure 9.29: Musculoskeletal conditions burden (DALY) by disease: proportion of disease group total (a) and proportion for males and females (b), 2011 (%)

The number of DALY peaked at ages 60–64 for males and females (Figure 9.30). Over two-thirds of the overall burden due to musculoskeletal conditions (71%) occurs between the ages of 35 and 74.



Note: 'Other musculoskeletal' refers to 'Other musculoskeletal conditions'.

Figure 9.30: Musculoskeletal conditions burden (DALY) by age and disease, 2011

Changes since 2003

There was a small decrease (0.6%) in overall burden between 2003 and 2011. The number of DALY from musculoskeletal conditions decreased by 3,100 (composed of 1,100 more YLL and 4,300 fewer YLD) between 2003 and 2011. This overall decrease was mainly due to lower non-fatal burden for other musculoskeletal conditions which decreased by 19% from 2003.

A comparison of the ASR of total burden by disease (Table 9.16) showed a reduced burden in gout, other musculoskeletal conditions and rheumatoid arthritis. The ASR of DALY increased for back pain & problems and slightly for osteoarthritis between 2003 and 2011.

Table 9.16: Age-standardised rates for musculoskeletal conditions (ranked by age-standardised DALY rates in 2003), 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	2011	2003	2011	2003	2011
Back pain & problems	0.0	0.1	6.8	7.0	6.8	7.1
Rheumatoid arthritis	0.1	0.1	4.3	3.4	4.4	3.5
Osteoarthritis	<0.1	<0.1	3.5	3.5	3.5	3.5
Gout	<0.1	<0.1	0.3	0.2	0.3	0.2
Other musculoskeletal conditions	0.5	0.4	10.7	7.4	11.2	7.8
All musculoskeletal conditions	**0.7**	**0.6**	**25.5**	**21.5**	**26.2**	**22.1**

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Data quality

Fatal burden estimates for musculoskeletal conditions were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

The key data source for the non-fatal burden is the 2011 Australian Health Survey and the 2004–05 National Health Survey (for 2003 estimates). These sources provided self-reported estimates of prevalence that were deemed suitable for quantifying health loss. Except for gout, the severity distribution was derived from self-reported information on pain captured in the health surveys. The proportions in each severity level of gout were derived from the GBD 2013.

9.13 Neurological conditions

Neurological conditions are diseases and disorders of the central and peripheral nervous system. These include epilepsy, dementia, Parkinson disease, multiple sclerosis, motor neurone disease (which includes amyotrophic lateral sclerosis), migraine and Guillain-Barré syndrome, along with the residual other neurological conditions. Infections of the nervous system are captured under infections and cerebral palsy is included in infant & congenital conditions.

Overview

The neurological conditions group was responsible for 6.8% of all DALY in 2011. Most of this was due to dementia and epilepsy which, combined, accounted for 64% of the burden due to neurological conditions (Figure 9.31a).

Neurological conditions have slightly higher non-fatal burden than fatal burden. This pattern was mostly due to the high non-fatal burden of epilepsy and migraine (Figure 9.31b).

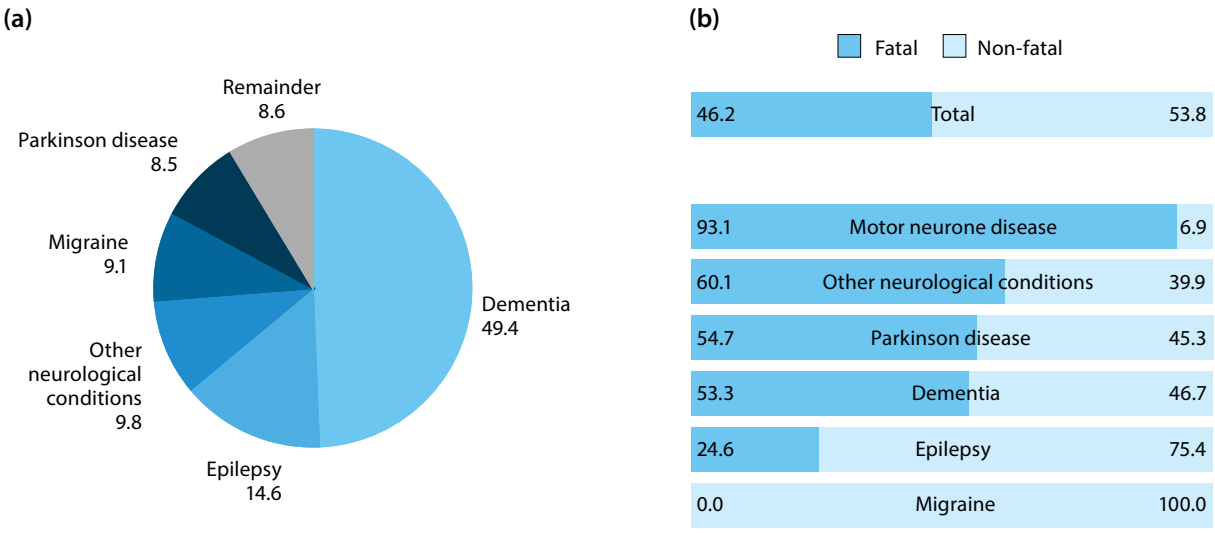


Figure 9.31: Neurological conditions burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Overall, neurological conditions caused more burden among females than males. This was mainly due to dementia, migraine and multiple sclerosis causing greater burden in females than in males. However, the burden from epilepsy, Parkinson disease and motor neurone disease was higher in males than in females.

The overall burden due to neurological conditions generally increased with age. The number of DALY peaked at ages 80–84. The decrease in DALY after these ages was due to the smaller number of people still alive in these age groups (Figure 9.32).

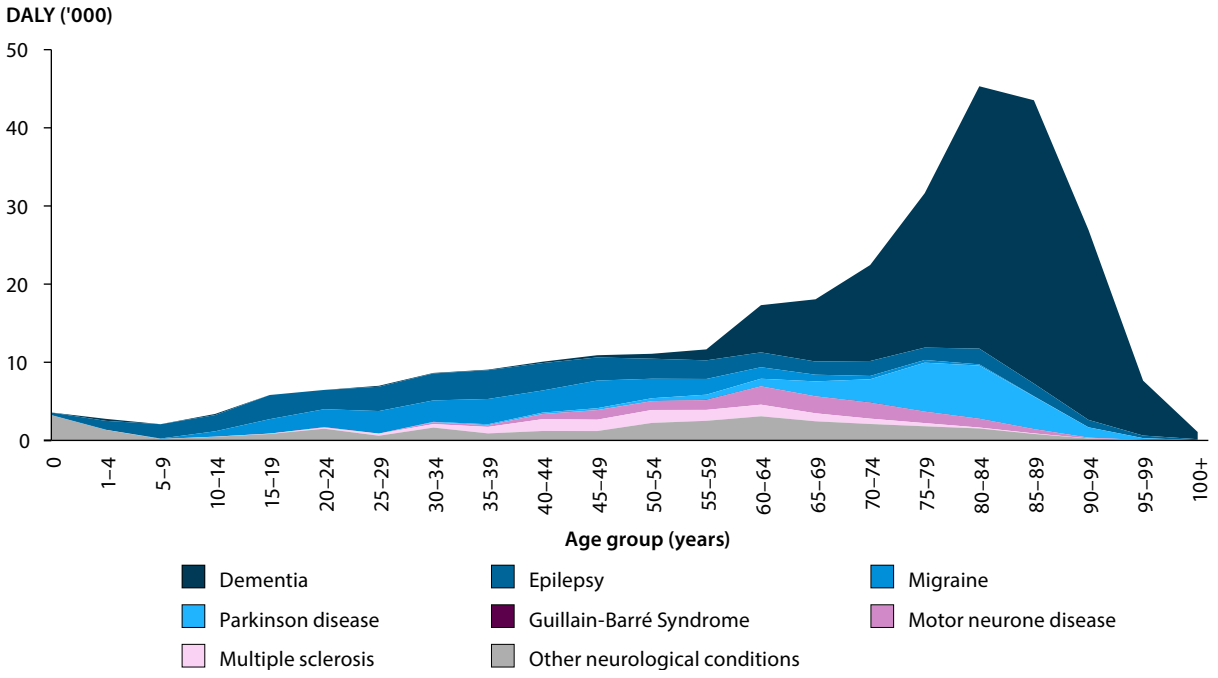


Figure 9.32: Neurological conditions burden (DALY), by age and disease, 2011

The age pattern found in DALY can be explained by looking more closely at specific conditions in the disease group. Dementia, which caused more burden than any other neurological condition, occurred more commonly in the older age groups. This is reflected in Figure 9.33, which showed that dementia contributed the highest proportion of neurological conditions DALY in Australians aged 65 and over (63% in those aged 65–84 and 87% in those aged 85 and over). Parkinson disease was similar to dementia in that it also contributed more burden in the older age groups. Conversely, epilepsy (46%) and other neurological conditions (44%) contributed the highest proportion of DALY in children aged under 15. Epilepsy continued to contribute the highest proportion of DALY in adolescents and young adults age 15–24 (45%) and in adults age 25–44 (40%). Migraine also caused considerable burden in females between ages 15 and 64.

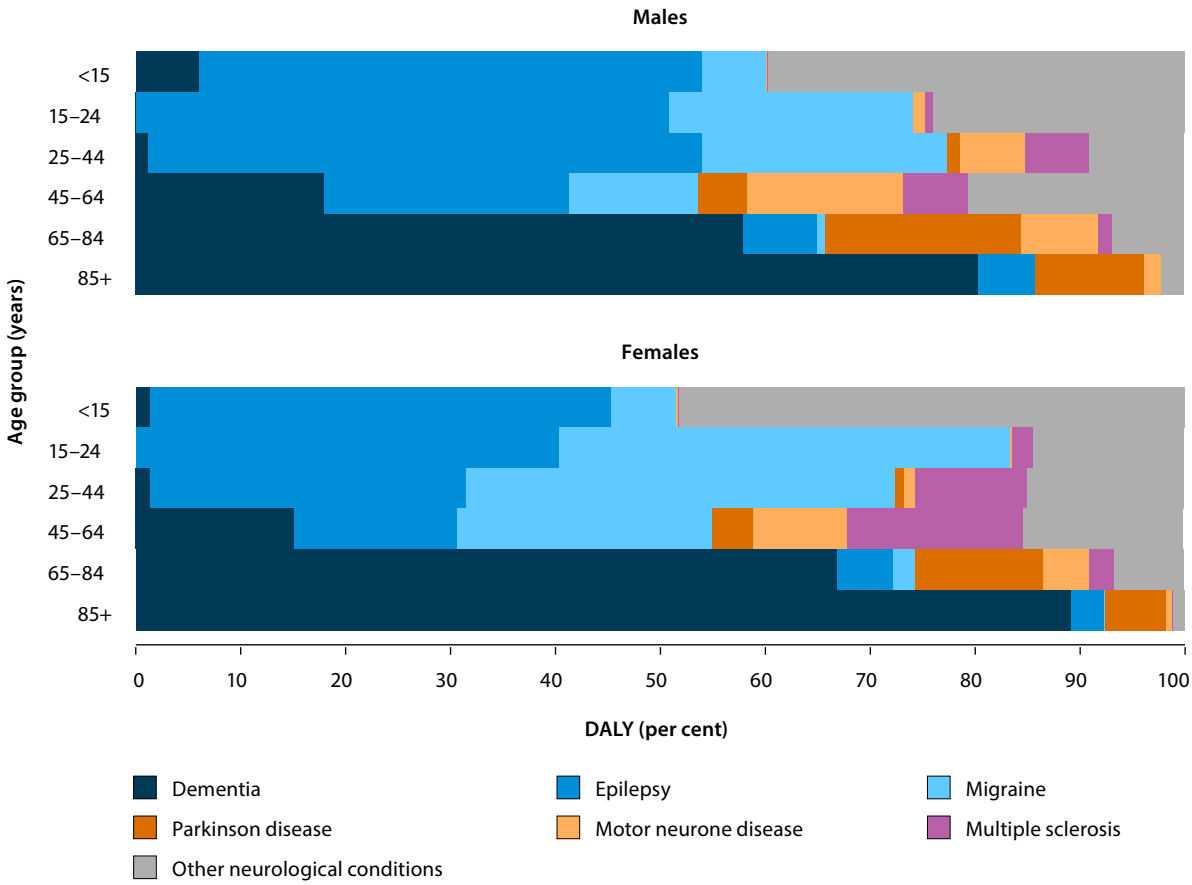


Figure 9.33: Proportion of neurological conditions burden (DALY) by age and disease, 2011

Risk factors

Evidence was available to quantify the impact of alcohol use on epilepsy burden. Alcohol use was responsible for 13% of the total burden due to epilepsy (Appendix Table D15). Further information on risk factors and their contribution to burden can be found in chapters 6 and 10.

Changes since 2003

The number of DALY from neurological conditions increased between 2003 and 2011 by 90,200 (composed of 39,700 YLD and 50,500 YLL). When taking the changing age structure of the population into account, there remained a small increase from 10.8 to 12.4 DALY per 1,000 people. This increase in DALY was mainly due to the increase in dementia-related YLL: dementia showed a substantially higher YLL (by 41,900) in 2011 compared with 2003, influenced by a large increase in the number of deaths due to dementia. Factors influencing this change are explained in Chapter 7 (Box 7.1).

Aside from dementia, there were only relatively small changes in the burden due to the other causes in the neurological conditions group.

Data quality

Fatal burden estimates for neurological conditions were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

The non-fatal estimates were derived from a variety of sources, including the National Hospital Morbidity Database, linked Western Australian hospital and deaths data and the Australian Health Survey. For diseases where there were no recent Australian data, estimates were based on international studies. As such, the robustness of the non-fatal estimates is mixed.

Non-fatal burden for dementia and Parkinson disease, which contributed the greatest share of non-fatal burden in older ages, was derived from prevalence estimates based on international studies, as there were no recent Australian data. These estimates could be improved with more direct prevalence estimates, and should be interpreted with this in mind. More information on the quality of estimates is included at Appendix B.

9.14 Oral disorders

Oral disorders cover a range of conditions that include dental caries, periodontal disease, tooth loss, embedded and impacted teeth, and diseases of salivary glands, lips, oral mucosa and tongue. The ABDS 2011 specifically estimated the burden of dental caries & pulpitis, periodontal disease and severe tooth loss (fewer than 10 teeth). Dental caries & pulpitis also includes burden due to failed restorations (for example, when a filling fails and the original decay is re-exposed).

The burden of injuries to the jaw and oral cavity are captured under injuries and cancers of the mouth and oral cavity are captured under cancer & other neoplasms.

Overview

Overall, oral disorders made up 2.2% of total health burden, 0.02% of all fatal burden and 4.4% of all non-fatal burden. Disease groups that contributed a similar proportion of total burden included endocrine disorders and hearing & vision disorders.

This disease group was characterised by very low mortality (few deaths are caused by these oral disorders) and relatively little health loss for each individual. However, as oral disorders were highly prevalent in the Australian community, the non-fatal burden of oral disorders was considerable.

Fatal burden

There were very few deaths in 2011 due to oral disorders and so there was very little fatal burden (0.3% of total burden for oral disorders). There was no fatal burden of oral disorders in people aged under 50.

Non-fatal burden

The largest contributors to non-fatal burden of oral disorders were dental caries (37%) and severe tooth loss (36%). Periodontal disease made up 27% of YLD and other oral disorders less than 1%.

Total non-fatal burden due to oral disorders was similar in men and women (50,700 YLD and 48,300 YLD, respectively). For men the largest proportion of non-fatal burden was attributed to dental caries & pulpitis (40%), and periodontal disease and severe tooth loss contributed equally (31% and 29%, respectively). For women severe tooth loss was the largest contributor to non-fatal burden (42%), followed by dental caries (35%) and periodontal disease (22%).

The rate of non-fatal burden due to oral disorders increased with age. This can be attributed to large increases in severe tooth loss in older Australians.

As shown in Figure 9.34, the vast majority of non-fatal burden in children was due to dental caries & pulpitis. Through adulthood, the relative proportion of non-fatal burden due to dental caries & pulpitis decreased as rates of periodontal disease increased. This was followed by increases in severe tooth loss in the older age groups. This reflects the natural history of dental caries and periodontal disease as both conditions may result in tooth loss or treatment that involves removal of teeth.

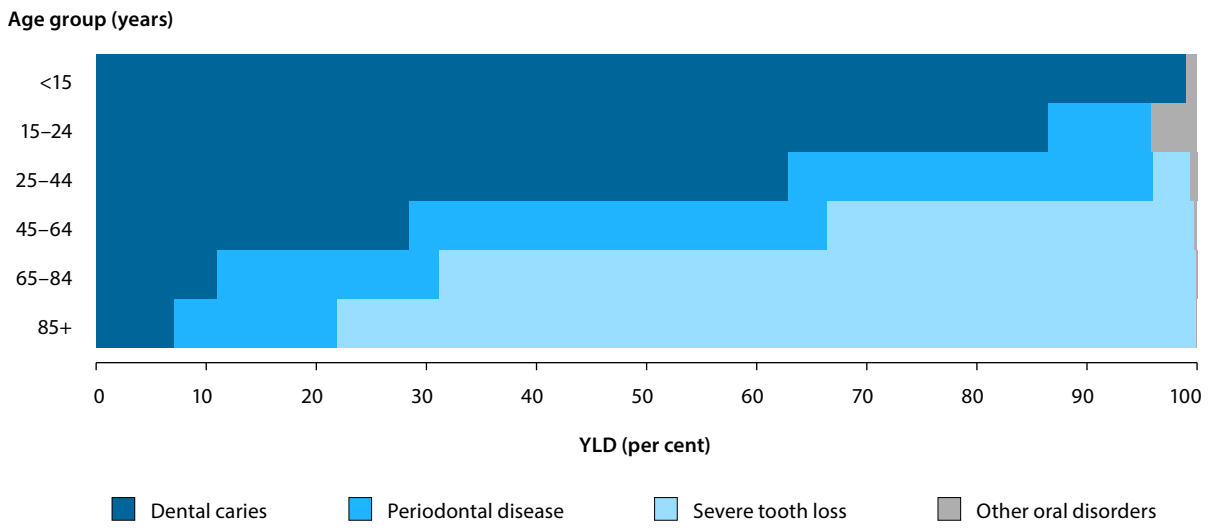


Figure 9.34: Proportion of non-fatal burden (YLD) due to oral disorders, by age and disease, 2011

Changes since 2003

The same key data source was used to estimate non-fatal burden due to oral disorders in 2003 and 2011. Between 2003 and 2011 there was a 17% increase in oral disorders DALY, with almost half (46%) of the additional burden attributed to severe tooth loss. There were no differences in age-specific rates, therefore, changes in burden during this time can be mainly attributed to an ageing population.

Data quality

Fatal burden estimates for oral disorders were calculated using deaths registered in the National Mortality Database and are considered to be of high quality.

Estimates of non-fatal burden for adults were based on the 2004–06 National Survey of Adult Oral Health. This large national survey provided clinically diagnosed estimates of dental caries & pulpitis, periodontal disease and severe tooth loss in the population with their own teeth, and self-reported complete tooth loss. Estimates could be improved by an updated survey. Data to estimate the prevalence of failed restorations and the proportion of cases that were symptomatic were based on an Australian epidemiological study (Brennan & Spencer 2004). Proportion of symptomatic cases for dental caries was based on analysis of 2004–06 National Survey of Adult Oral Health data.

9.15 Reproductive and maternal conditions

Burden due to reproductive & maternal conditions includes disorders affecting reproductive systems (in both men and women) and conditions arising during pregnancy or delivery. Sexually transmitted infections, benign prostatic hypertrophy, reproductive cancers (excluding uterine fibroids) and health loss experienced by the infant but caused by a maternal condition are included in other relevant disease groups.

Infertility does not include health loss from infertility due to endometriosis, polycystic ovarian syndrome, uterine fibroids or sexually transmitted infections. These are captured in their individual diseases.

Overview

Reproductive & maternal conditions contributed less than 1% of total health loss in Australia (39,100 DALY). Most (95%) of this burden was due to reproductive conditions. The majority of conditions do not result in death (97% YLD; 3% YLL).

Reproductive conditions

Overall, 88% of burden is attributable to two conditions: genital prolapse (49%) and polycystic ovarian syndrome (38%). Conditions classified as other reproductive conditions (for example, menstrual disorders and inflammatory genital conditions) accounted for the majority of the remaining burden (8.5%) (Figure 9.35a). This burden was predominantly non-fatal.

Burden from reproductive conditions was most evident during the reproductive years, with DALY peaking between the ages of 25 and 29. Burden from polycystic ovarian syndrome was greatest between adolescence and menopause, while burden from genital prolapse was highest from age 40 onwards. Burden from endometriosis, infertility and uterine fibroids mostly affected women between the ages of 20 and 49 (Figure 9.35b).

Asymptomatic individuals were considered not to suffer health loss and excluded from estimates. Similarly, individuals with infertility but not seeking to have a child at the time were excluded. Genital prolapse, infertility and other reproductive conditions were the only conditions in this group experienced by males and females. Over half of the health loss in males was due to due to genital prolapse (2,600 DALY).

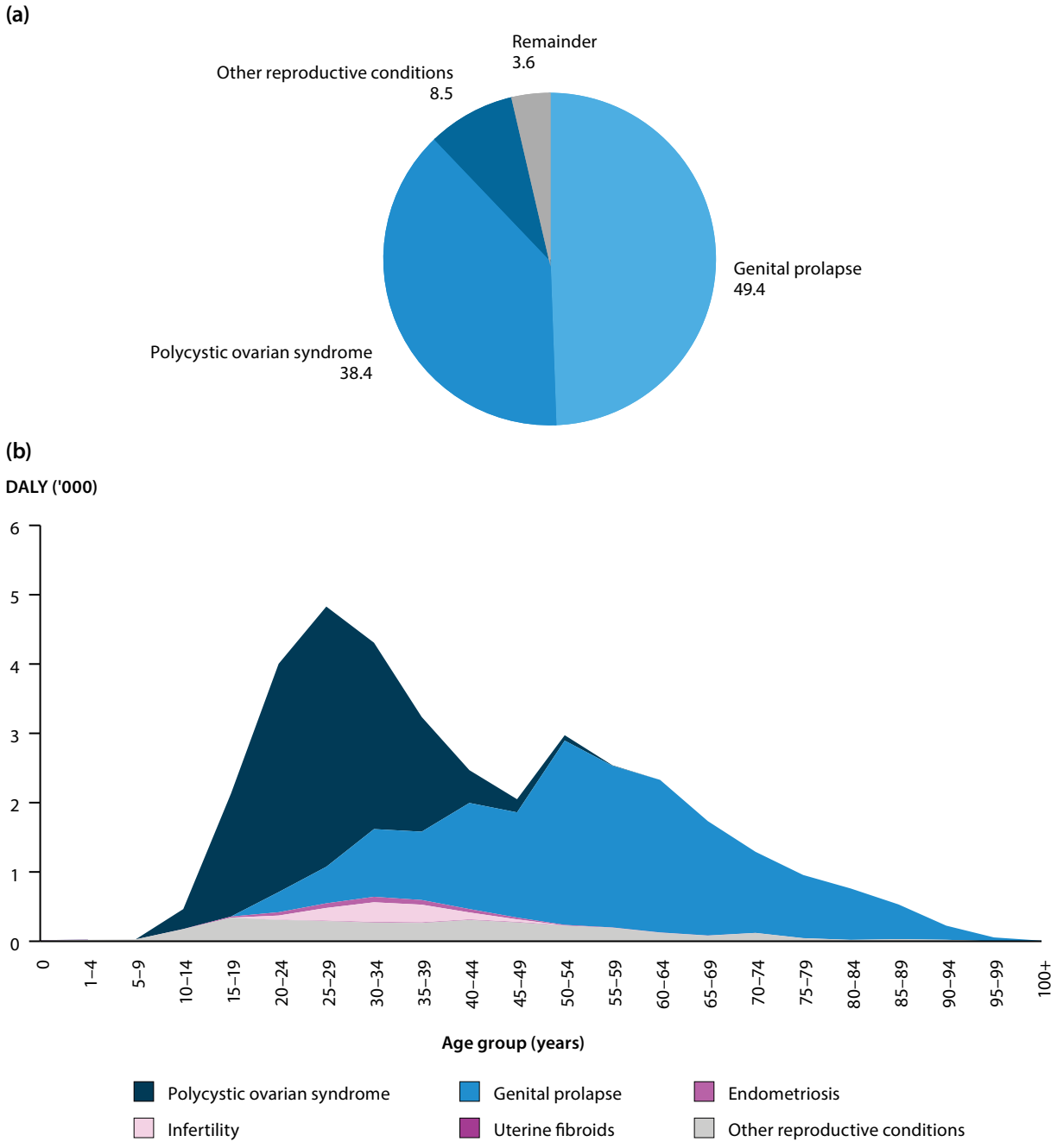


Figure 9.35: Reproductive conditions burden (DALY): proportion of disease group total (a) and by age and disease (b), 2011

Maternal conditions

Maternal conditions contributed 5.5% of the total burden, and 3.7% of the non-fatal burden from all reproductive & maternal conditions. The burden from maternal conditions was small as it was experienced only by expectant or recently delivered mothers.

Hypertensive disorders of pregnancy, other maternal conditions, early pregnancy loss and gestational diabetes were the leading contributors to maternal burden. Burden varied with age, with the majority of burden between ages 25 and 34. As shown in Figure 9.36, the proportional contribution of gestational

diabetes to non-fatal burden increased with age, while the proportional contributions of obstructed labour, maternal haemorrhage and maternal infections to maternal burden decreased with age. Early pregnancy loss was the greatest cause of maternal burden in older mothers (aged 45–59).

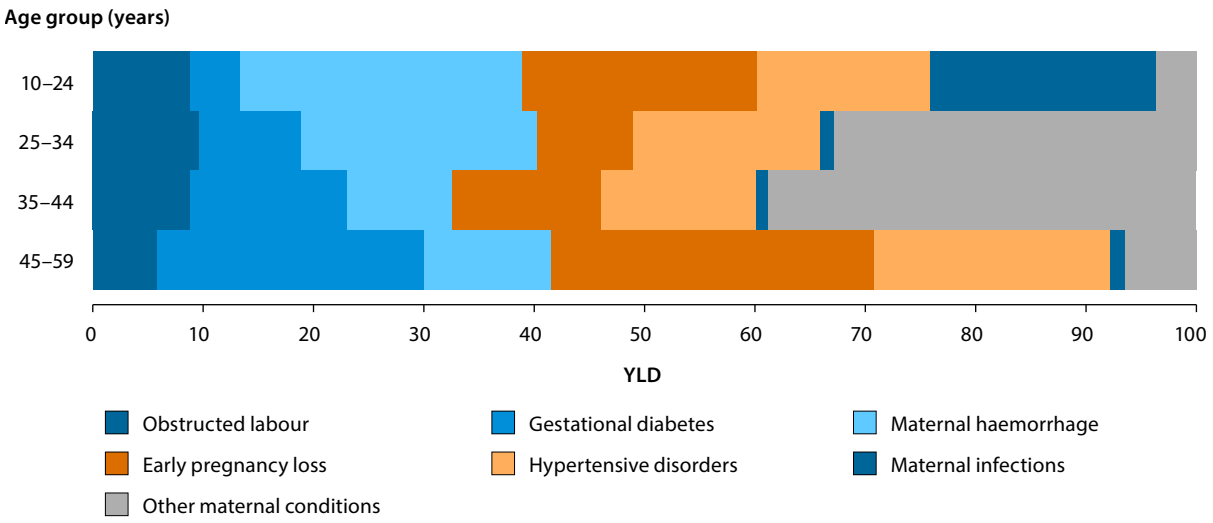


Figure 9.36: Maternal non-fatal burden (YLD) proportion, by age and disease, 2011 (%)

There were few maternal deaths in 2011; however, this contributed to 83% of the fatal burden from reproductive & maternal conditions. The leading contributor of maternal fatal burden was other maternal conditions, a group of conditions that included thromboembolism and amniotic fluid embolism. Maternal infections, other maternal conditions and maternal haemorrhage contributed more fatal burden than non-fatal (Figure 9.37).

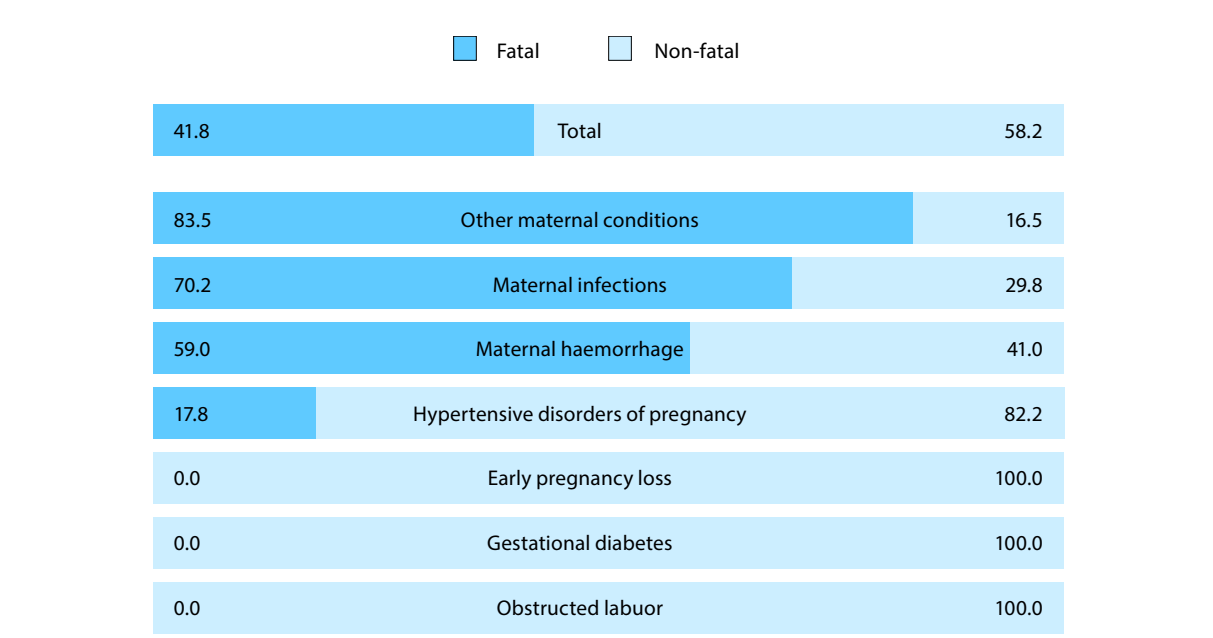


Figure 9.37: Maternal burden proportion (DALY) due to fatal and non-fatal outcomes, 2011 (%)

Changes since 2003

Burden due to reproductive & maternal conditions increased by 15% from 34,100 DALY in 2003 to 39,100 DALY in 2011. As there was little difference in age-standardised DALY rates for 2003 and 2011 across all reproductive & maternal conditions, this increase was mainly due to increases in population.

As there were only a small number of deaths each year due to reproductive & maternal conditions, differences in fatal burden between 2011 and 2003 do not necessarily reflect changes in disease rates.

Data quality

Fatal burden estimates for reproductive & maternal conditions were calculated using deaths registered in the National Mortality Database and are considered to be of high quality. The few deaths coded to reproductive & maternal conditions that were not considered the direct plausible cause of mortality for burden of disease analyses were redistributed across other disease groups.

Maternal YLD estimates were calculated based on hospital admissions, as the majority of births occur in hospitals. Abortive procedures performed in non-hospital settings were also included; these were adjusted for state and territory variances using Australian epidemiological studies that provided more robust estimates for early pregnancy losses.

Reproductive YLD estimates were derived from a variety of data sources. Polycystic ovarian syndrome, uterine fibroids and endometriosis prevalence estimates were derived from national, self-reported surveys, general practitioner visits and hospital admission data, which all rely on diagnosis of the condition. YLD estimates for females with infertility or genital prolapse were predominantly sourced from epidemiological studies.

Estimates for infertility and genital prolapse for males were largely modelled and therefore were not as reliable as female estimates. This could be improved with more comprehensive data of these conditions in males within the community.

9.16 Respiratory diseases

Respiratory diseases are those that affect the air passages, including the nasal passages, the bronchi and the lungs (WHO 2015). They range from acute infections to chronic conditions. The diseases in this group are mainly chronic in nature and include:

- asthma
- COPD
- sarcoidosis (with lung involvement)
- interstitial lung disease
- pneumoconiosis
- upper respiratory conditions (mainly allergic rhinitis—also known as hay fever)
- other respiratory diseases (contains various conditions such as bronchiectasis and respiratory disease due to inhalation of chemicals, gases, fumes and vapours).

This disease group excludes any acute respiratory infections, influenza or pneumonia—which are part of the infections group—and nasal skin infections—which are part of the skin disorders group.

Overview

Respiratory diseases were responsible for 8.3% of total burden of disease and injury in Australia in 2011. The contributions to the overall fatal and non-fatal burden in Australia from the respiratory diseases group were 4.9% and 12%, respectively.

COPD (43%), asthma (29%) and upper respiratory conditions (20%) accounted for most of the burden from respiratory disease (Figure 9.38a).

The burden from this disease group was mostly non-fatal, accounting for 70% of the overall burden due to respiratory conditions; however, this varied for individual diseases. For example, 93% of the total burden for asthma was non-fatal burden, whereas only 8% of the burden due to pneumoconiosis was due to non-fatal burden (Figure 9.38b).

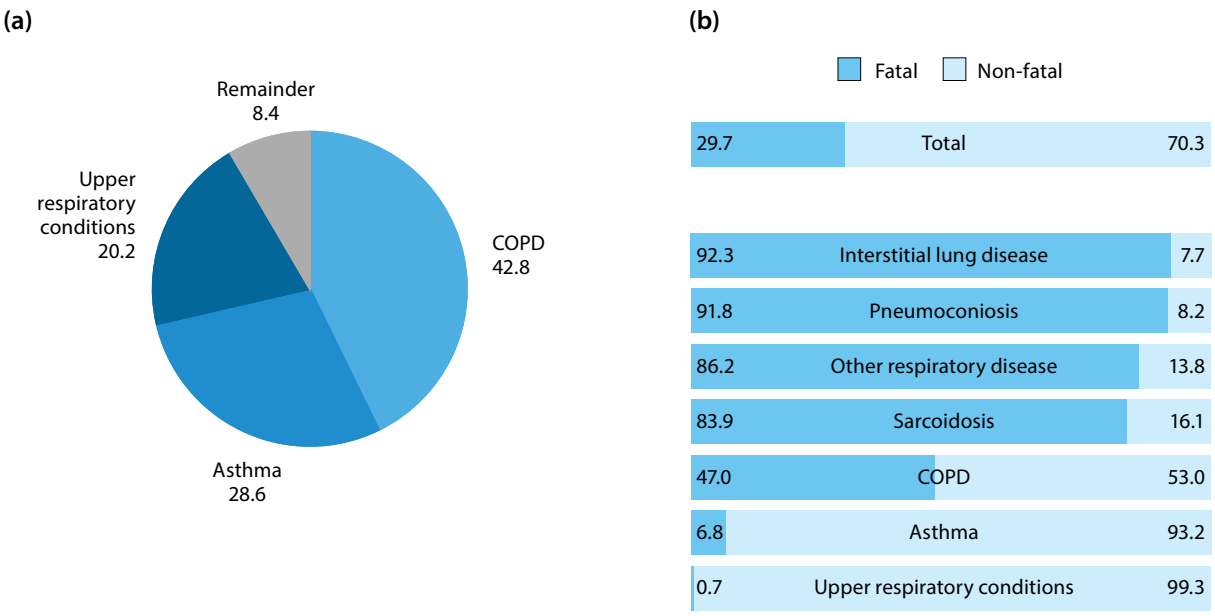


Figure 9.38: Respiratory diseases burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

The burden due to respiratory diseases differed by age for individual diseases. Asthma and upper respiratory conditions affected all ages, and accounted for, on average, about 5 and 3 DALY per 1,000 people respectively from age 10 onwards (Figure 9.39). In contrast, COPD contributed to the total respiratory burden from the age of 40, where DALY steadily increased by age

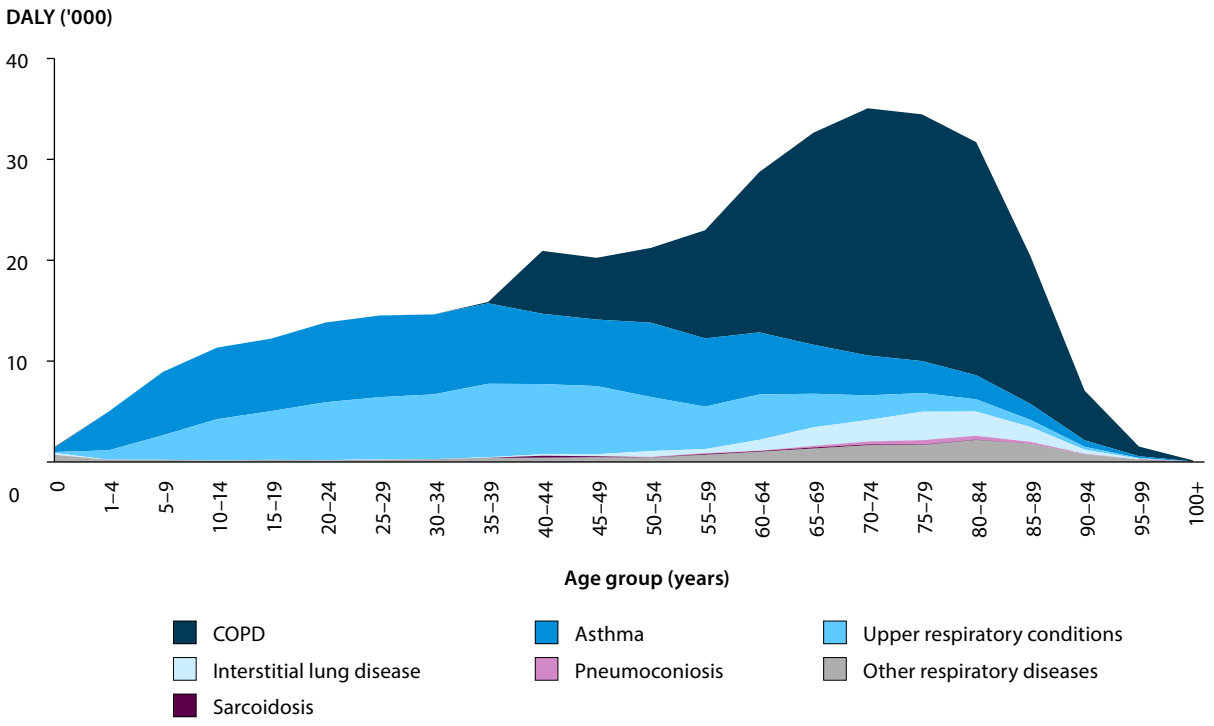
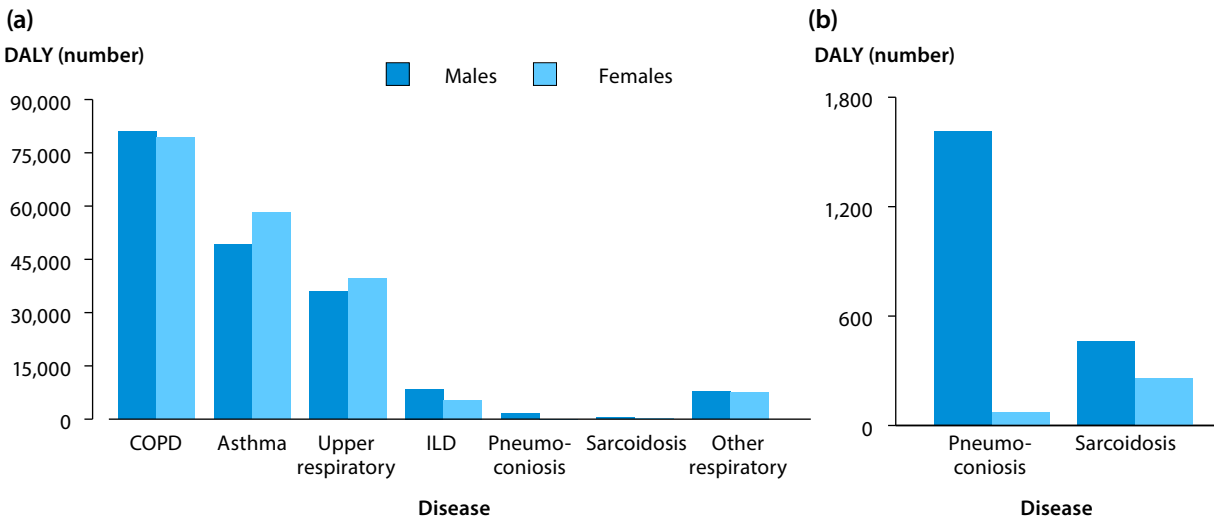


Figure 9.39: Respiratory diseases burden by age and disease, 2011

The burden of disease due to respiratory disease generally did not differ by sex, except for pneumoconiosis, where DALY was much higher in males than in females (Figure 9.40b). This was largely due to the male-dominated occupations (mainly mining) that related to the development of these diseases.



Note: 'ILD' refers to 'Interstitial lung disease'; 'Other respiratory' refers to 'other respiratory diseases'; 'Upper respiratory' refers to 'Upper respiratory conditions'.

Figure 9.40: Respiratory diseases burden (DALY): by sex (a), and pneumoconiosis and sarcoidosis by sex (b), 2011

Changes since 2003

The number of DALY due to respiratory diseases increased by 9.3% from 343,100 in 2003 to 375,000 in 2011. When the changing size and age structure of the population was taken into account, overall there was a slight decrease between 2003 and 2011 (Table 9.17).

Table 9.17: Comparison of age-standardised rates of respiratory diseases burden, 2003 and 2011

	Fatal burden (ASR)		Non-fatal burden (ASR)		Total burden (ASR)	
	2003	2011	2003	2011	2003	2011
COPD	3.6	3.0	3.5	3.5	7.2	6.5
Asthma	0.4	0.3	5.1	4.5	5.4	4.8
Upper respiratory conditions	<0.1	<0.1	3.3	3.3	3.3	3.3
Interstitial lung disease	0.5	0.5	<0.1	<0.1	0.5	0.6
Pneumoconiosis	0.1	0.1	<0.1	<0.1	0.1	0.1
Sarcoidosis	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other respiratory diseases	0.7	0.5	<0.1	0.1	0.7	0.6
All respiratory diseases	5.2	4.5	12.0	11.5	17.2	16.0

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Risk factors

Evidence was available to quantify the impact of risk factors for respiratory diseases. These included tobacco use, air pollution and occupational exposures & hazards. The joint contribution of these risk factors was 39% of the respiratory diseases burden.

Tobacco use was the risk factor responsible for the most respiratory diseases burden (36%), mainly due to the burden from COPD. Tobacco use was responsible for 75% of the COPD burden, 22% of the interstitial lung disease burden and 19% of burden due to other respiratory diseases (Appendix Table D15). Further information on risk factors and their contribution to burden can be found in chapters 6 and 10.

Data quality

Fatal burden estimates for respiratory conditions were calculated using deaths registered in the National Mortality Database and are considered to be of high quality. Deaths from pneumonitis are considered intermediate causes of death and were redistributed to disease groups containing the most likely direct cause.

YLD estimates were sourced from multiple sources of data. Prevalence estimates for asthma and upper respiratory disease were calculated from self-reported data collected by population health surveys and were considered to be reasonably accurate. Data for the prevalence of COPD were sourced from the results of a clinical study, and therefore were considered to be of high quality and more accurate than self-reported data. The prevalence for sarcoidosis, interstitial lung disease and pneumoconiosis were derived using deaths and hospitalisation data. These data sets were considered to be of very high quality, as both were complete national registers of deaths and hospitalisations, and were consistently coded using international standards. Because national hospitalisation admission data do not identify individual

patients, it was not possible to ascertain the number of patients being admitted for an individual disease at the national level. Linked Western Australian hospital admission data were used to inform adjustments to national data.

9.17 Skin disorders

The skin disorders disease group includes burden due to chronic and acute skin disorders, including skin infections. It excludes burden due to skin neoplasms (which is included in cancer & other neoplasms).

Overview

Overall, skin disorders made up 1.7% of the total health burden, 0.2% of all fatal burden and 3.2% of all non-fatal burden. This disease group was characterised by low mortality and relatively little health loss for each individual. However, as skin disorders were highly prevalent in the Australian community, the non-fatal burden of skin disorders was considerable.

The three largest contributors to burden due to skin disorders, which together accounted for 80% of the total burden for skin disorders, were dermatitis & eczema (41%), acne (20%) and psoriasis (18%) (Figure 9.41a). The burden due to these three causes was almost entirely non-fatal (Figure 9.41b).

Fatal burden made up 6.9% of the total burden due to skin disorders (Figure 9.41b). Three causes contributed almost all (98%) of the fatal burden due to skin disorders: skin infections (65%), ulcers (27%) and other skin disorders (6.2%).

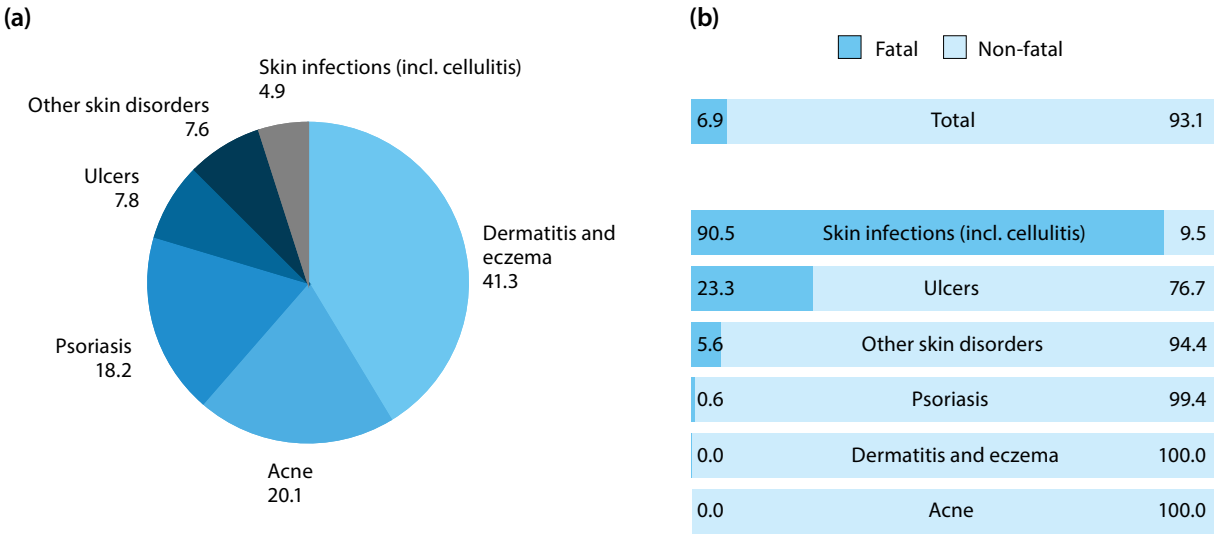


Figure 9.41: Skin disorders burden (DALY) by disease: proportion of disease group total (a) and proportion due to fatal and non-fatal outcomes (b), 2011 (%)

Total non-fatal burden due to skin disorders was slightly higher in women than in men (37,600 and 34,100 YLD, respectively). For both men and women the largest contributor to non-fatal burden was dermatitis & eczema (46% and 43%, respectively). For men, acne was the second highest contributor to non-fatal burden, followed by psoriasis (22% and 17%, respectively). For women, similar proportions of non-fatal burden were attributed to psoriasis and acne (22% and 21%, respectively).

As shown in Figure 9.42, the burden due to skin disorders varied by age, depending on the disease type. Acne burden was most prominent in adolescents and young adults with little to no burden in children and older adults. Whereas, in general, burden due to ulcers and skin infections increased with age.

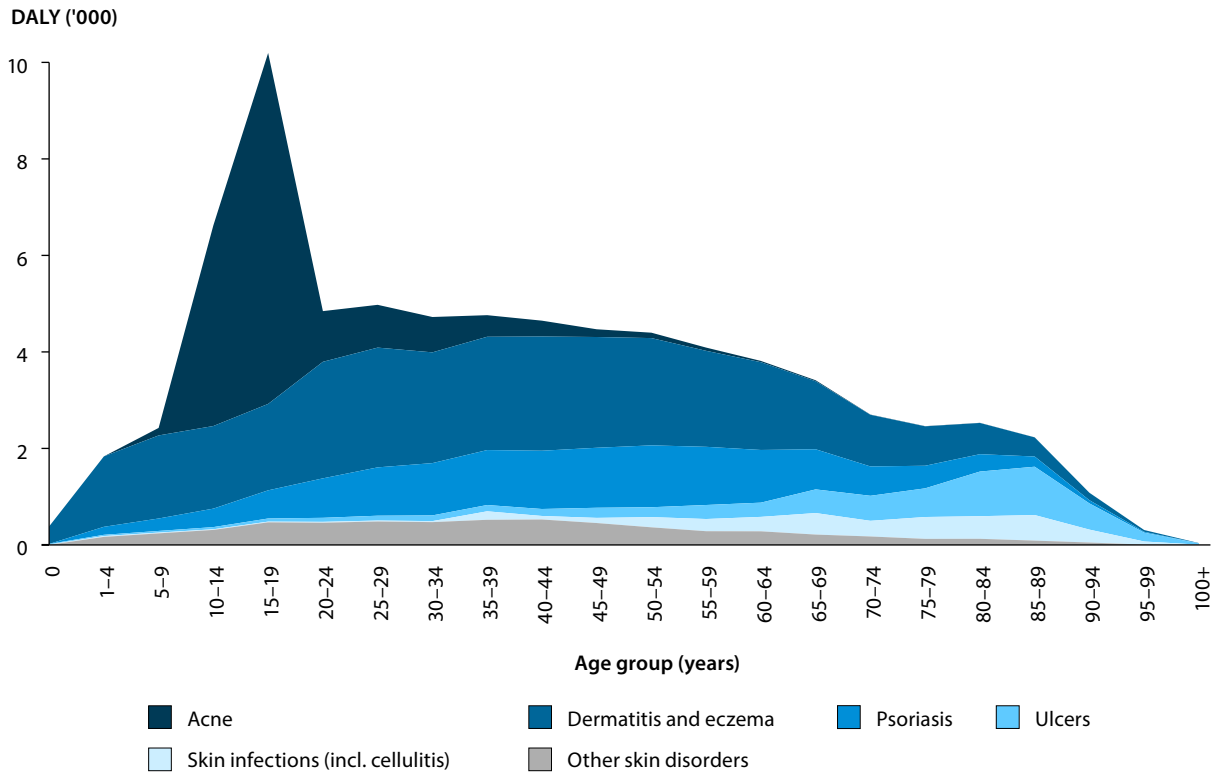


Figure 9.42: Skin disorders burden (DALY) by age and disease, 2011

Changes since 2003

There was an overall increase of 10,400 DALY (1,500 YLL; 9,000 YLD) for skin disorders between 2003 and 2011. However, once the differences in the size and age structure of populations for the two years were taken into account, there was no difference in the age-standardised DALY rates (3.4 per 1,000 people for both 2003 and 2011).

Data quality

Fatal burden estimates for skin disorders were calculated using deaths registered in the National Mortality Database and were considered to be of high quality.

The data quality of the non-fatal estimates for skin disorders was mixed across the various diseases. Prevalence data were modelled from a variety of sources, including epidemiology studies (for example, for dermatitis & eczema and acne), national health surveys (for example, for psoriasis), hospitalisation data (for example, for skin infections) or a combination of sources (for example, for ulcers).

Data for the two causes with the greatest burden—dermatitis & eczema and acne—were based on older clinical examination epidemiology studies (Kilkenny et al. 1998; Plunkett et al. 1999), with assumptions made about the applicability of the data to the 2011 population. Estimates for these causes could be improved with the availability of more recent data.

10 Overview of results by risk factor

Overview

Analysis of the burden due to various risk factors is available for the following groups:

- Behavioural risks
- Metabolic risks
- Environmental risks
- Dietary risks

This chapter presents more details on the burden attributable to each risk factor including non-fatal, fatal and total burden by linked disease. When interpreting this information it is important to note that each risk factor was calculated independently and it is not possible to add them together due to overlaps between the risk factors. The diseases linked to each risk factor were adopted from other studies, notably the GBD 2010. Some more detailed estimates are included in Appendix Table D15. More information on the methods is included at Appendix A and the quality of estimates is included at Appendix B.

Behavioural risks

Behavioural risk factors include alcohol use, tobacco use, drug use, unsafe sex, physical inactivity, childhood sexual abuse and intimate partner violence. This section presents the burden attributable to these risk factors in 2011. These include behavioural risk factors that are modifiable by changes in the behaviour of an individual.

10.1 Tobacco use

Tobacco use was responsible for 9.0% of the total burden of disease and injury in 2011 making it the most burdensome risk factor (Table 6.1). This included the risks associated with past tobacco use, current use, and exposure to second-hand smoke. Tobacco use contributed to the burden for a large number of linked diseases.

Tobacco use was responsible for 80% of lung cancer DALY (Figure 10.1). Similarly, it was responsible for 75% of the COPD DALY. Around half of the total burden of oesophageal cancer (54%) and nearly half of the mouth & pharyngeal cancer (46%) burden was attributed to tobacco.

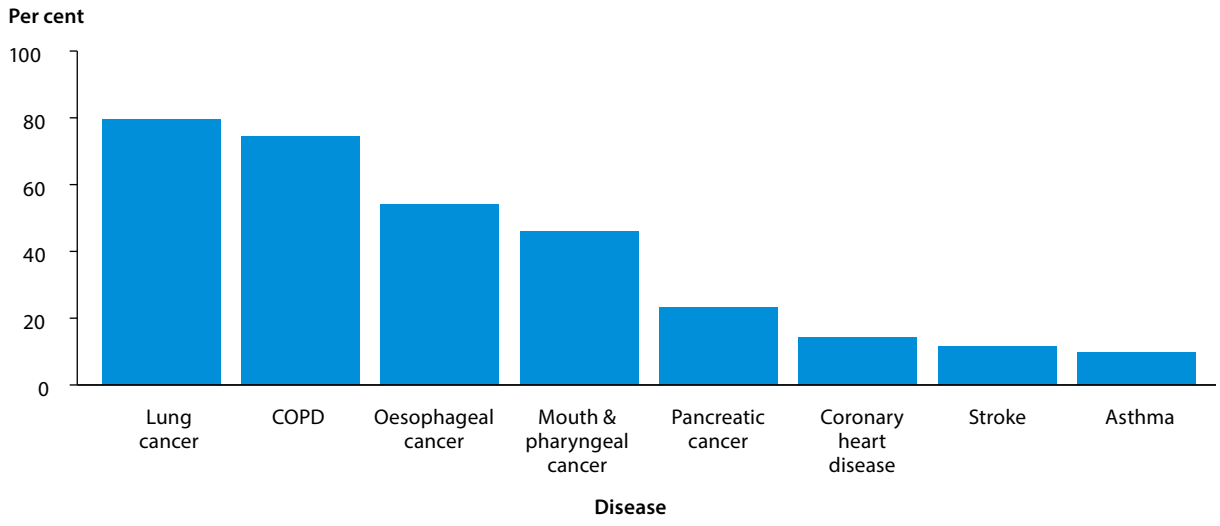


Figure 10.1: Burden (percentage of linked disease) attributable to tobacco use, top eight diseases, 2011

Across all these disease outcomes, 76% of the burden attributable to tobacco use was due to premature mortality, however this varied by disease outcome. Over 97% of the attributed pancreatic, lung and oesophageal cancer burden was due to fatal outcomes (Figure 10.2a).

Around 60% of the disease burden attributed to tobacco was experienced by males (Figure 10.2b), reflecting historically higher smoking rates among males (AIHW 2014d).

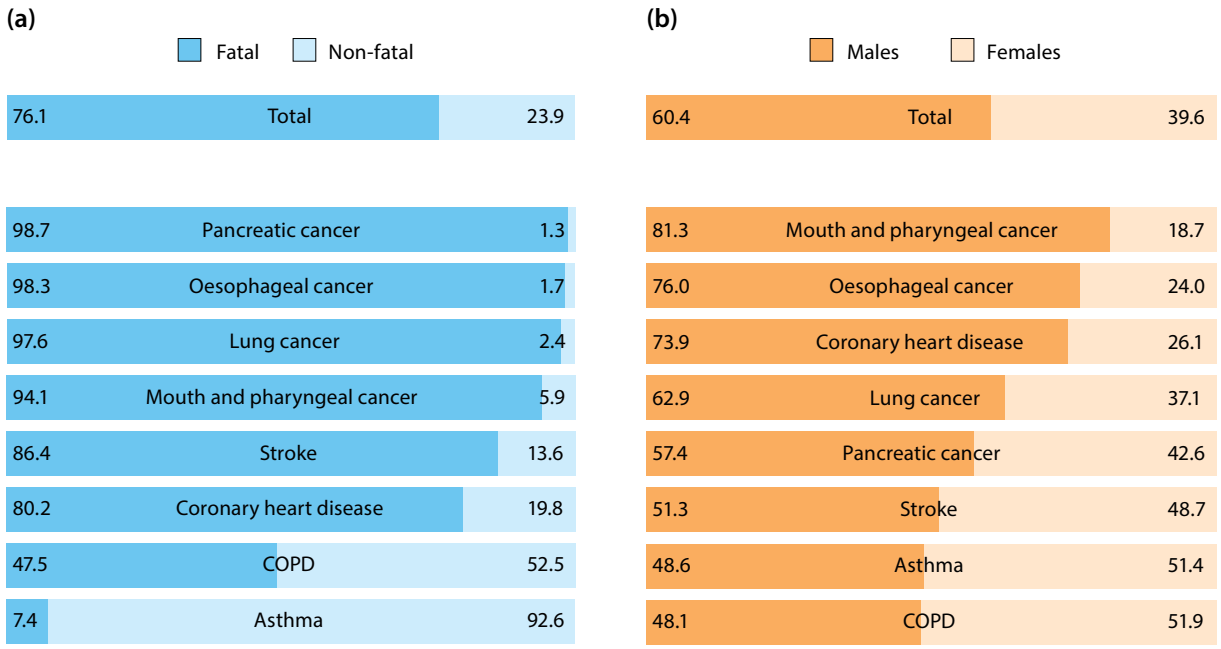
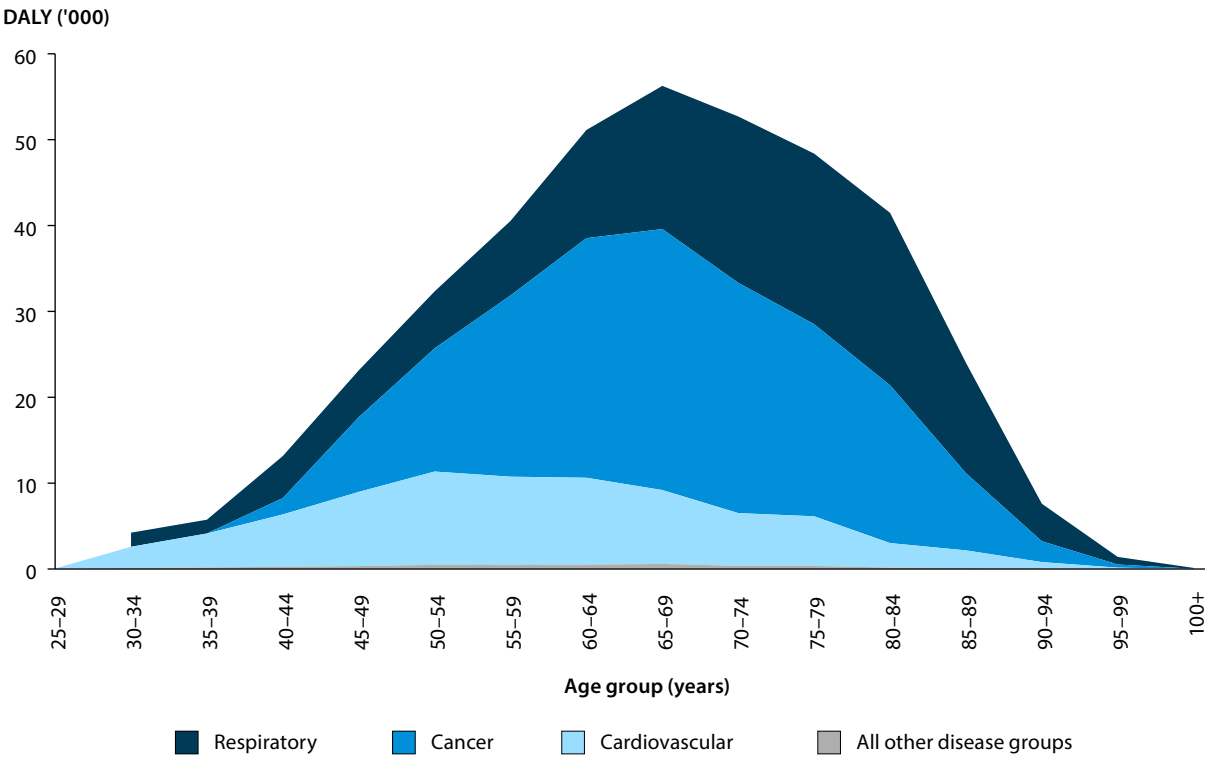


Figure 10.2: Proportion (%) of burden attributable to tobacco use (top eight diseases), by fatal versus non-fatal burden (a) and sex (b), 2011

Figure 10.3 shows the chronic disease burden attributed to tobacco in people aged 25 and over, reflecting the ages at which most of the attributable burden was experienced in the population. Cancers contributed over 50% of the disease burden attributed to tobacco between ages 55 and 74 (Figure 10.3). Cardiovascular diseases were responsible for the majority of the smoking burden below age 40 and respiratory diseases were responsible for the majority in ages 80 and over.



Note: 'All other disease groups' includes endocrine disorders and infectious diseases.

Figure 10.3: Burden (DALY) attributable to tobacco use by age and disease group, 2011

10.2 Alcohol use

Alcohol use was responsible for 5.1% of the total burden of disease and injury in 2011 making it the third most burdensome risk factor (Table 6.1). Alcohol use contributed to the burden for a large number of linked diseases and injuries. It was responsible for the entire burden due to alcohol use disorders, 28% of the burden due to road traffic injuries (road traffic injuries—motor vehicle occupants), 24% of the burden due to chronic liver disease and 23% of the burden due to suicide and self-inflicted injuries (Figure 10.4).

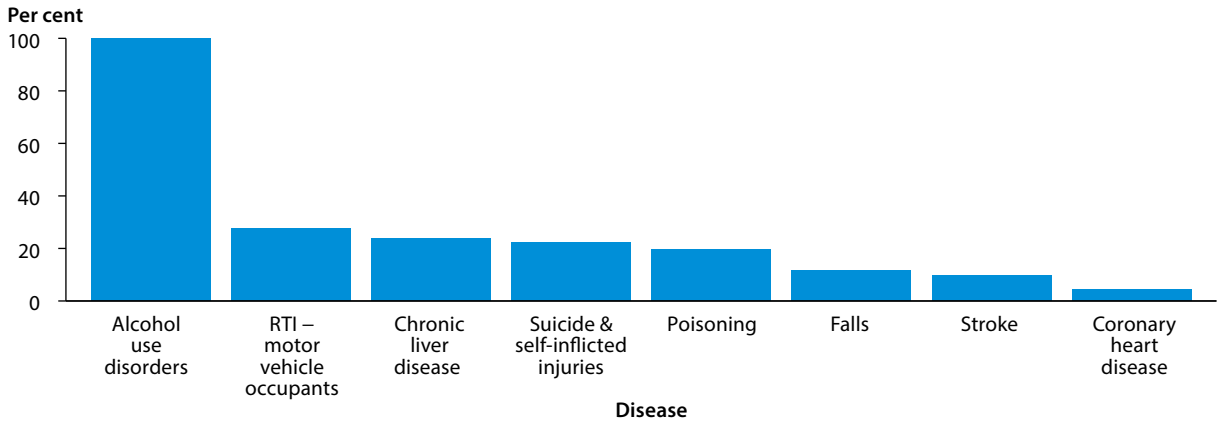


Figure 10.4: Burden (percentage of linked disease) attributable to alcohol use, top eight diseases, 2011

Across all disease outcomes, 61% of the alcohol use attributable burden was due to premature mortality; however, this varied substantially by disease (Figure 10.5a). For example, almost 100% of the attributed poisoning, suicide & self-inflicted injuries and stroke burden were due to fatal outcomes, compared with only 36% of falls and 12% of alcohol use disorders.

Overall, males experienced 71% of the burden attributed to alcohol use. This proportion, however, was much higher in suicide & self-inflicted injuries (89%) and poisoning (88%), falls (86%), road traffic injuries—motor vehicle occupants (78%) and chronic liver disease (69%). Females accounted for a much greater proportion of the stroke and coronary heart disease burden attributable to alcohol use (63% and 69% respectively) (Figure 10.5b).

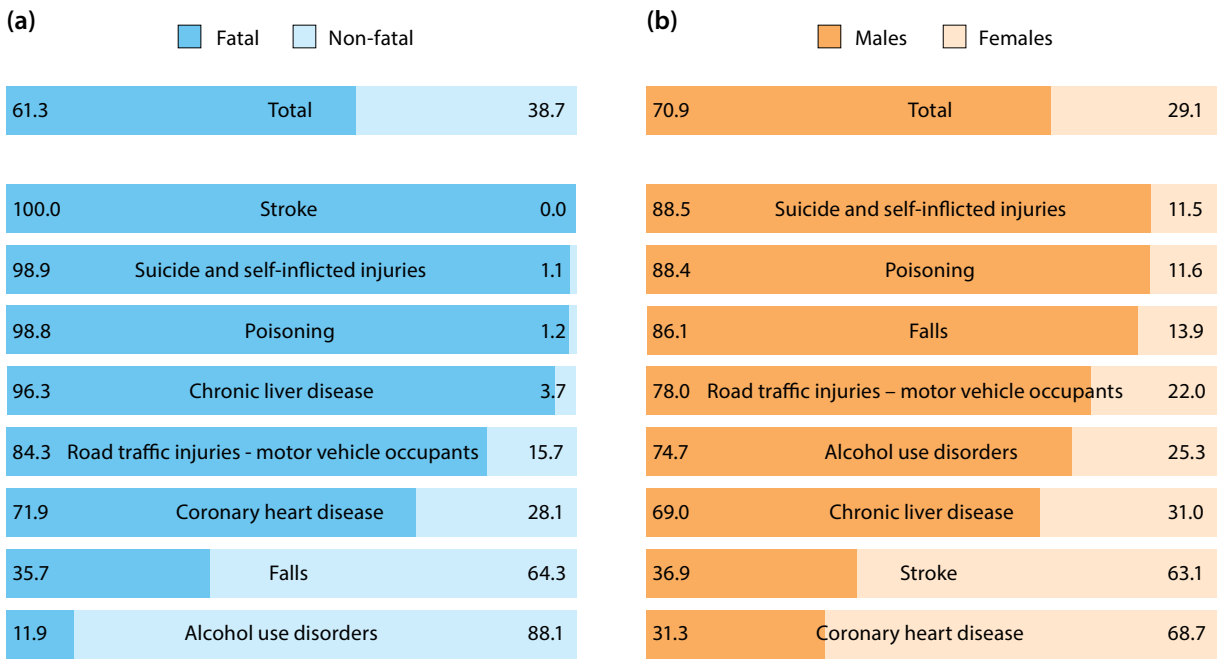
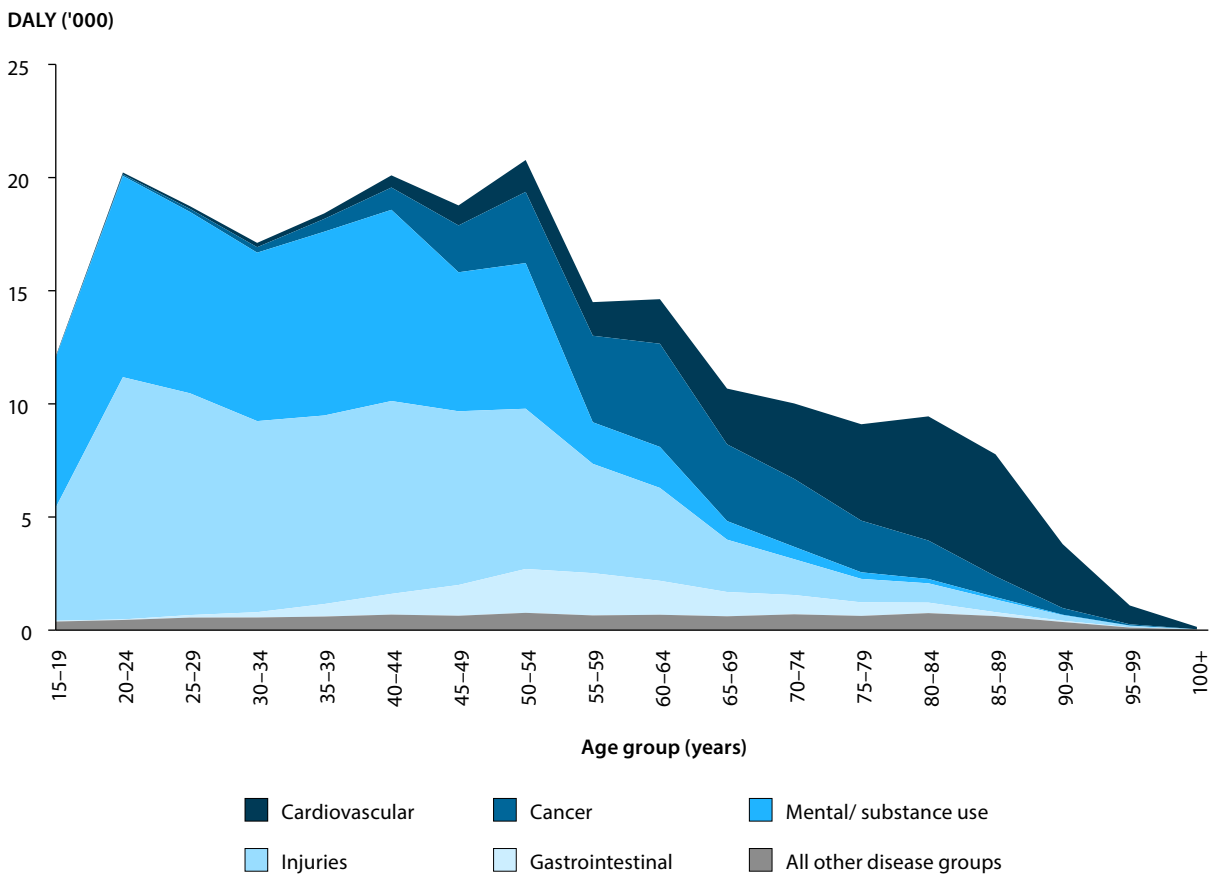


Figure 10.5: Proportion (%) of burden attributable to alcohol use, (top eight diseases) by fatal versus non-fatal burden (a) and sex (b), 2011

The burden attributed to alcohol was measured in people aged 15 years and over. Injuries contributed to over 50% of the disease burden attributed to alcohol between the ages 20 and 29. Mental & substance use disorders made up over 40% of the alcohol attributable burden in all age groups under age 45. The share of the alcohol attributable burden due to cardiovascular diseases increased with age, responsible for the majority of the burden after age 75 (Figure 10.6).

When the total attributable burden was compared as a rate, males experienced the alcohol-related burden at a rate that was 1.3 times the female burden rate.



Note: 'All other disease groups' includes infectious diseases, endocrine disorders and neurological conditions.

Figure 10.6: Burden (DALY) attributable to alcohol use by age and disease group, 2011

10.3 Physical inactivity

Physical inactivity accounted for 5.0% of the total burden of disease and injury in Australia in 2011, ranking as the fourth most burdensome risk factor (Table 6.1). It was responsible for 33% of the total burden due to coronary heart disease (Figure 10.7).

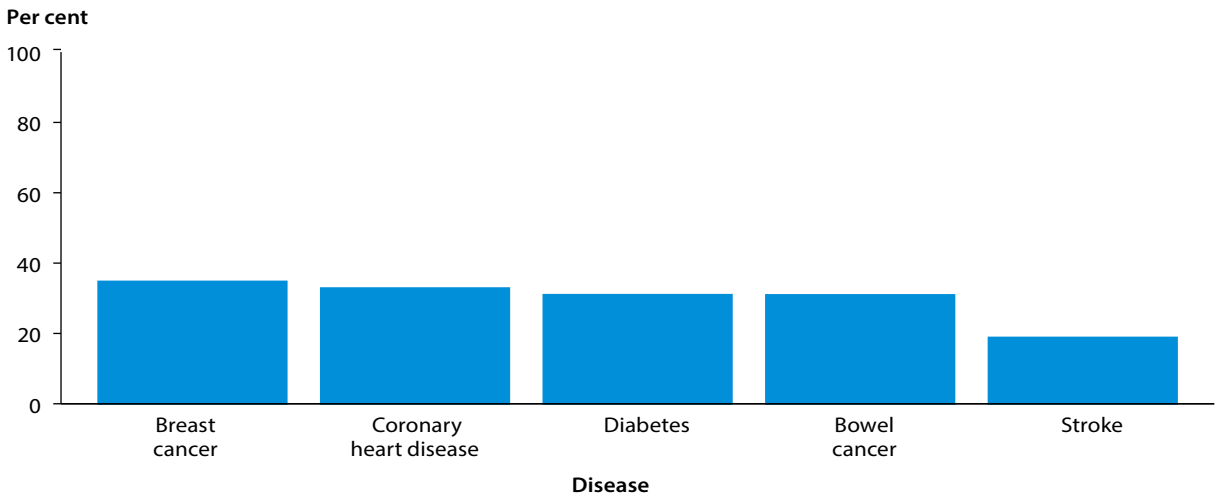


Figure 10.7: Burden (percentage of linked disease) attributable to physical inactivity, 2011

A total of 79% of the attributable burden from physical inactivity was fatal burden. This varied by disease outcome; as high as 93% of attributable bowel cancer burden and as low as 50% of attributable diabetes burden (Figure 10.8a).

Overall, males experienced just over half (56%) of the burden attributed to physical inactivity, but this proportion was higher for coronary heart disease (69%) and diabetes (59%) (Figure 10.8b).

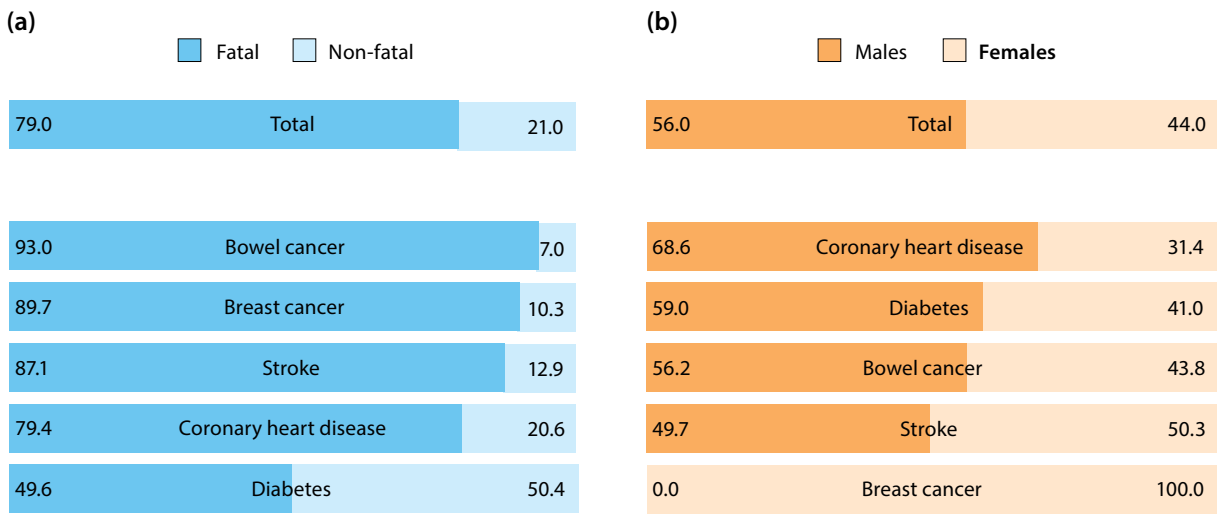


Figure 10.8: Proportion (%) of burden attributable to physical inactivity, by fatal versus non-fatal burden (a) and sex (b), 2011

The burden attributable to physical inactivity was measured in people aged 25 and over to capture the ages at which most of the attributable burden was experienced in the population. The burden was low in people ages 25–39 but increased with age, peaking at around age 60 (Figure 10.9). The burden then decreased rapidly after age 80 with the declining population.

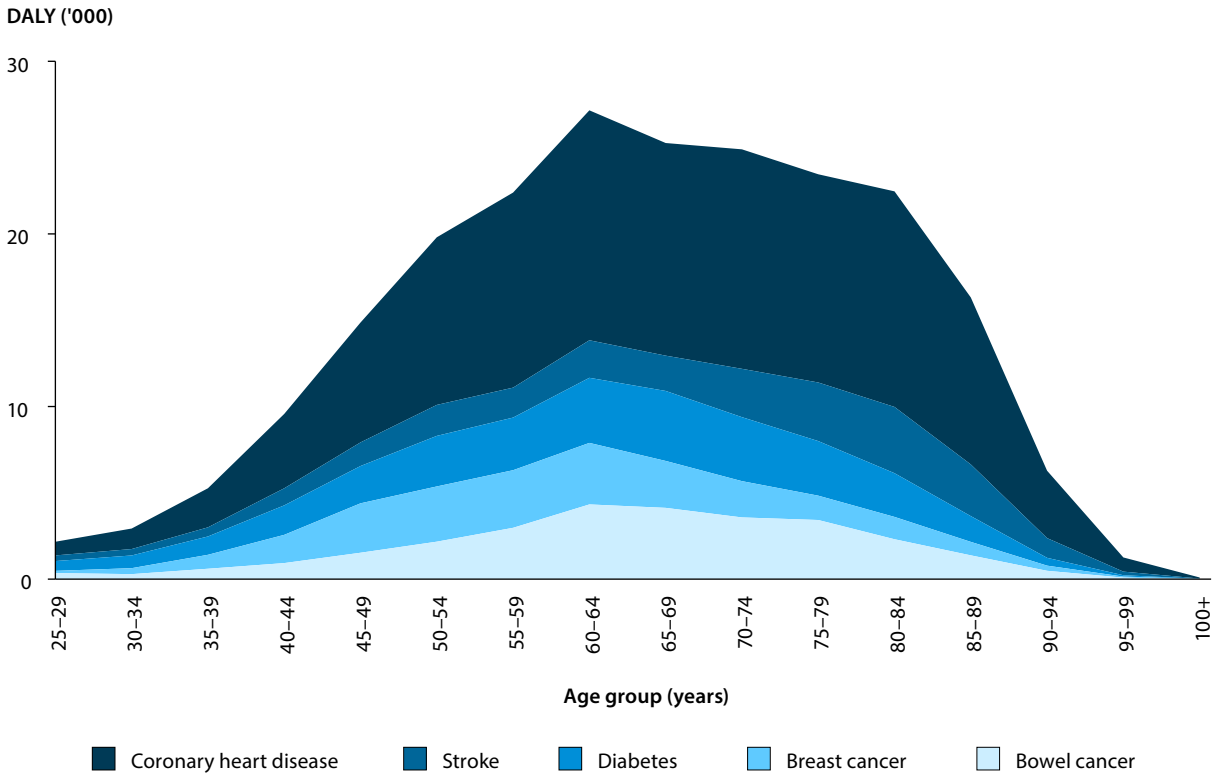


Figure 10.9: Burden attributable (DALY) to physical inactivity by age and disease, 2011

10.4 Drug use

Drug use was responsible for 1.8% of the total burden of disease and injury in 2011 (Table 6.1). This included the impact of injecting drug use; and cocaine, opioid, amphetamine and cannabis dependence.

Drug use was responsible for the entire disease burden due to drug use disorders. In addition, drug use accounted for 55% of the liver cancer burden, 52% of the chronic liver disease burden and 5% of the HIV/AIDS burden (Table 10.1).

Table 10.1: Burden (number and percentage of linked disease) attributable to drug use, by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Drug use disorders (excluding alcohol)	31,951	100.0
Chronic liver disease	24,531	51.5
Liver cancer	16,257	55.3
Suicide and self-inflicted injuries	6,594	5.8
HIV/AIDS	252	5.0
Hepatitis B (acute)	107	44.6
Hepatitis C (acute)	49	82.5
Total	**79,741**	**1.8**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Figure 10.10a compares the fatal and non-fatal disease burden attributable to drug use. Across all disease outcomes, 63% of the burden was due to premature mortality; however, this varied by disease outcome. For example, 99% of the attributed liver cancer and suicide & self-inflicted injuries burden were due to fatal outcomes, compared with 11% of drug use disorders.

Overall, males experienced 75% of the burden attributed to drug use, but this proportion was much higher in suicide & self-inflicted injuries (89%), acute hepatitis C (87%) and HIV/AIDS (85%) (Figure 10.10b).

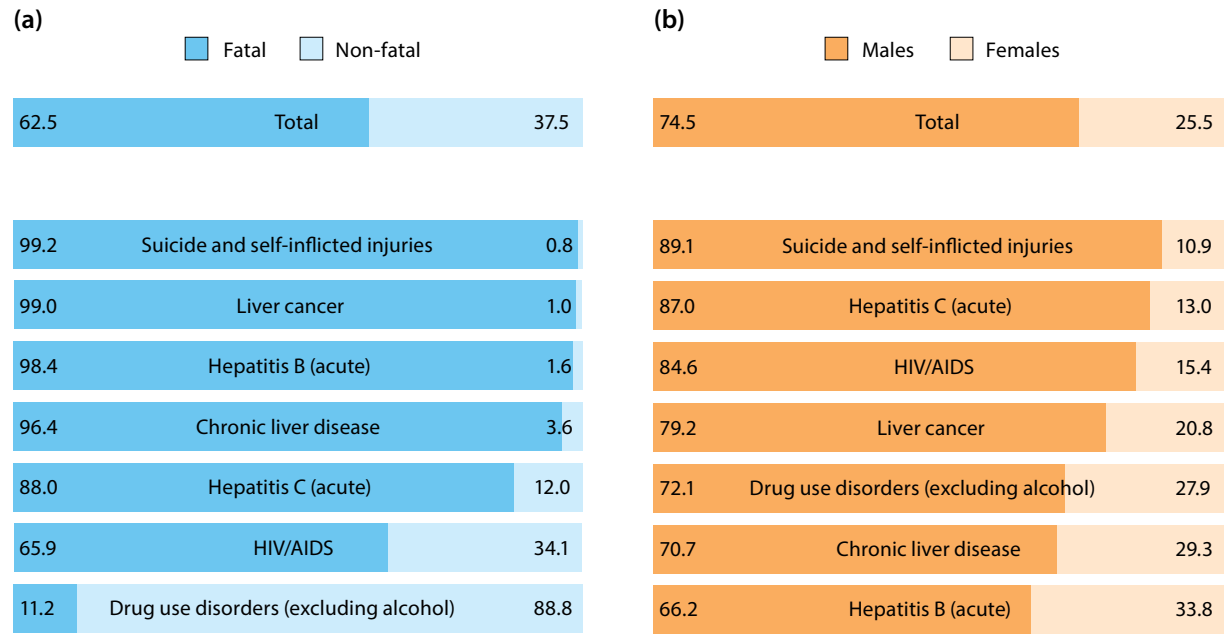
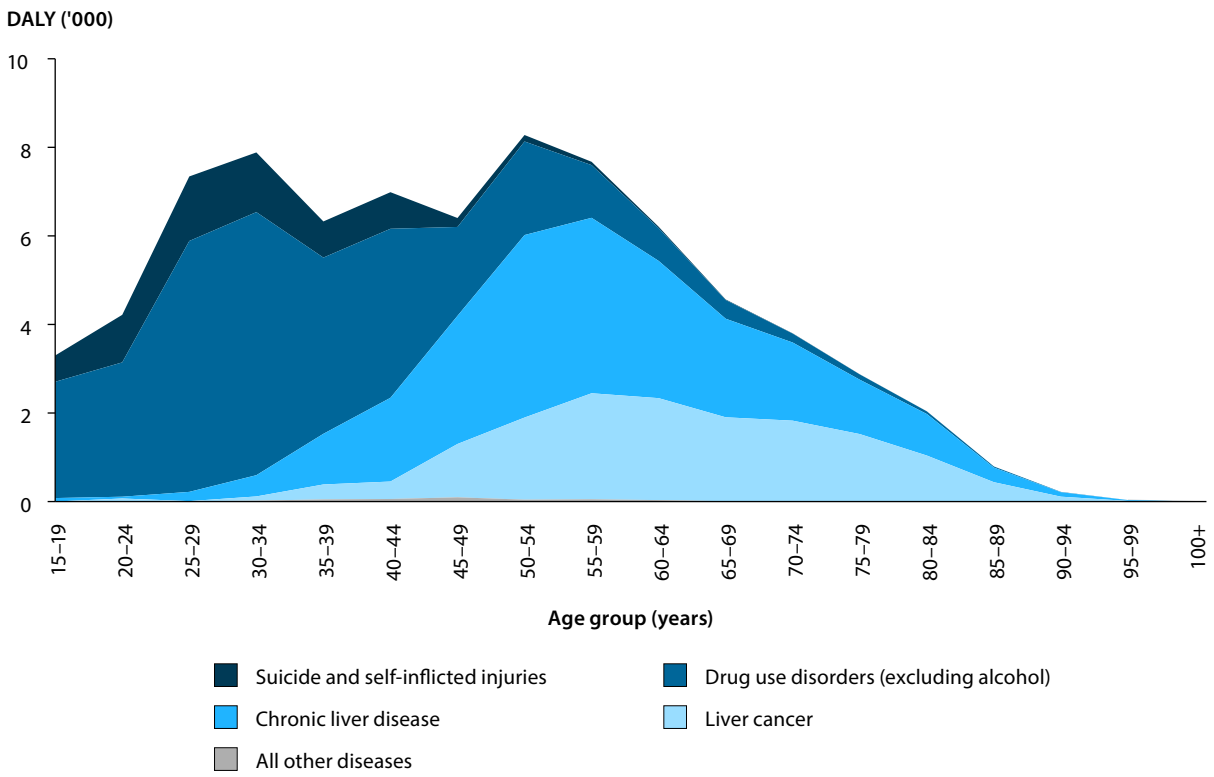


Figure 10.10: Proportion (%) of burden attributable to drug use, by fatal versus non-fatal burden (a) and sex (b), 2011

The burden attributed to drug use was measured in people aged 15 and over. The attributable burden in terms of total DALY was highest between the ages of 25 and 54, after which it began to fall (Figure 10.11).



Note: 'All other diseases' includes: hepatitis B (acute), hepatitis C (acute) and HIV/AIDS.

Figure 10.11: Burden (DALY) attributable to drug use by age and disease, 2011

10.5 Other behavioural risk factors

Intimate partner violence

Intimate partner violence accounted for 1.0% of the total burden in females (Table 10.2), and 0.5% of the overall burden of disease and injury in 2011 (Table 6.1). In this section, the burden proportions due to intimate partner violence represent the proportion of burden experienced in females only.

Intimate partner violence accounted for 14% of the burden due to early pregnancy loss, 36% of the suicide & self-inflicted injuries burden, 35% of the homicide & violence burden, and 12% of the depressive disorders burden in females (Table 10.2).

Table 10.2: Burden (percentage of linked disease in females only) attributable to intimate partner violence, by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Suicide and self-inflicted injuries	10,215	35.8
Depressive disorders	8,718	11.9
Homicide and violence	2,638	35.0
Early pregnancy loss	37	14.3
Total	**21,608**	**1.0**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

A slightly higher proportion of burden attributable to intimate partner violence was due to fatal outcomes (56%). The burden attributable to intimate partner violence was measured in people aged 15 and over. The burden was high in people aged 25–60 increasing with age, and peaked at ages 40–50. The burden then decreased rapidly after age 60.

Further work is being undertaken by AIHW, with Australia's National Research Organisation for Women's Safety (ANROWS) to assess the methodological inputs to calculate attributable burden due to exposure to intimate partner violence in Australian women. This work will result in revised estimates that are anticipated to be published in late 2016.

Unsafe sex

Unsafe sex accounted for 0.4% of the total burden of disease and injury in Australia in 2011 (Table 6.1).

Unsafe sex accounted for the entire disease burden due to cervical cancer and sexually transmitted infections (Table 10.3). In total, 90% of HIV/AIDS DALY was attributable to unsafe sex. Unsafe sex contributed to 9.9% of the chronic liver disease burden and 8.7% of the liver cancer burden in 2011. Sexually transmitted infections include syphilis, chlamydia, gonorrhoea and other sexually transmitted infections.

Table 10.3: Burden (number and percentage of linked disease) attributable to unsafe sex, by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Cervical cancer	6,555	100.0
Chronic liver disease	4,724	9.9
HIV/AIDS	4,567	90.0
Liver cancer	2,552	8.7
Sexually transmitted infections[(a)]	210	100.0
Blood borne viruses[(b)]	65	21.7
Total	**18,673**	**0.4**

(a) Sexually transmitted infections include syphilis, chlamydia, gonorrhoea and other sexually transmitted infections.
(b) Blood-borne viruses include hepatitis B (acute) and hepatitis C (acute).
Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Across all these disease outcomes, 88% of the burden was due to premature mortality. Overall, the total burden attributable to unsafe sex was similar for males and females, however males experienced a greater proportion of the burden for HIV/AIDS (91%), syphilis (72%), liver cancer (70%), acute hepatitis B and C (70% and 65% respectively) and chronic liver disease (64%).

The total burden attributed to unsafe sex was greatest between the ages of 40 and 64, after which unsafe sex DALY decreased for all causes. Note that this reflects the age at which people experienced the disease outcomes, not the age at which the infection was acquired.

Childhood sexual abuse

Childhood sexual abuse accounted for 0.4% of the total burden of disease and injury in 2011 due to three diseases: depressive disorders, alcohol use disorders and suicide & self-inflicted injuries. Childhood sexual abuse contributed to 6.8% of the burden (DALY) due to alcohol use disorders, 5.3% of depressive disorders burden and 5.1% of suicide & self-inflicted injuries burden (Table 10.4).

Table 10.4: Burden (number and percentage of linked disease) attributable to childhood sexual abuse, by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Depressive disorders	6,794	5.3
Suicide and self-inflicted injuries	5,762	5.1
Alcohol use disorders	4,466	6.8
Total	**17,022**	**0.4**

Around 63% of the burden attributable to childhood sexual abuse was non-fatal. More of the burden from childhood sexual abuse was experienced by females (62%).

The burden attributable to childhood sexual abuse was measured in people aged 15 and over. The burden increased with age, gradually peaking at age 40. The burden then decreased rapidly after age 60.

Metabolic risks

Metabolic risk factors include high blood pressure, high cholesterol, high blood plasma glucose, iron deficiency, high body mass and low bone mineral density. This section presents the burden attributable to these risk factors in 2011.

10.6 High body mass

High body mass was measured using the body mass index (BMI) which is an indicator of an individual's body fat levels, calculated using body weight and height measurements. High body mass contributed 5.5% of all disease and injury burden in 2011, ranking as the second risk factor with the most attributable burden (Table 6.1). High body mass contributed to the burden for a large number of linked diseases.

High body mass was responsible for 52% of diabetes burden, 38% of chronic kidney disease burden, 23% of coronary heart disease burden and 17% of stroke burden (Figure 10.12).

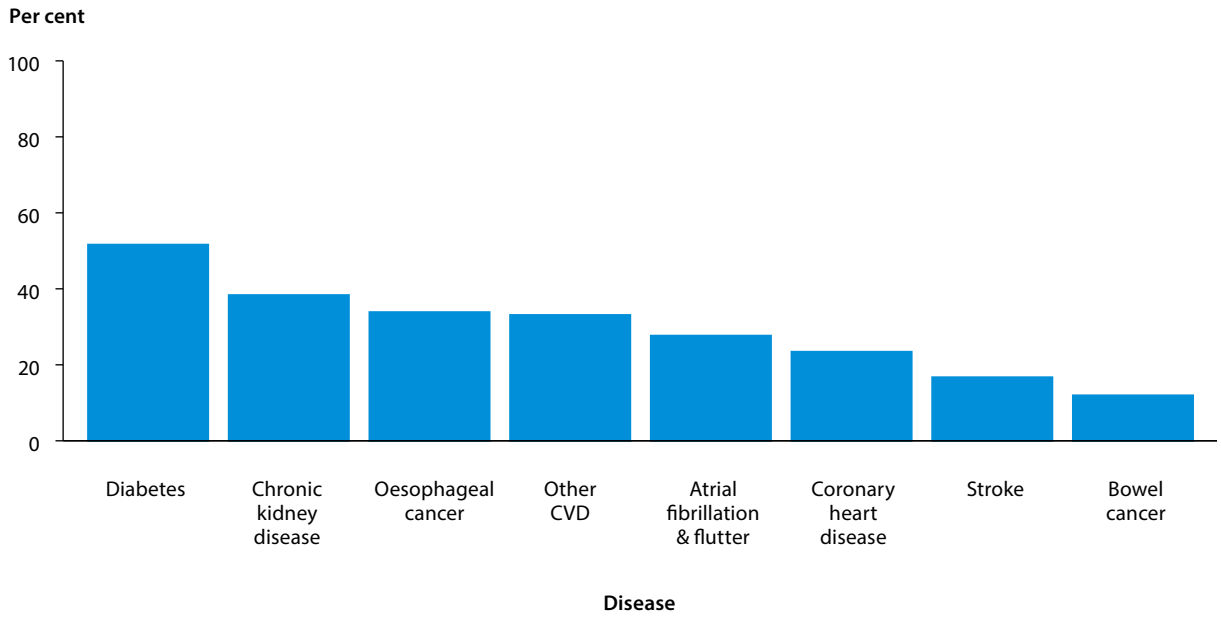


Figure 10.12: Burden (percentage of linked disease) attributable to high body mass, top eight diseases, 2011

Around 74% of the DALY attributable to high body mass was fatal burden (Figure 10.13a). The majority of disease outcomes had a greater proportion of fatal burden, except for diabetes—which showed a similar contribution—and atrial fibrillation & flutter, which had a smaller proportion of fatal burden (27%).

Males experienced nearly 60% of the burden due to high body mass (Figure 10.13b). Males made up a greater proportion of the burden for most conditions.

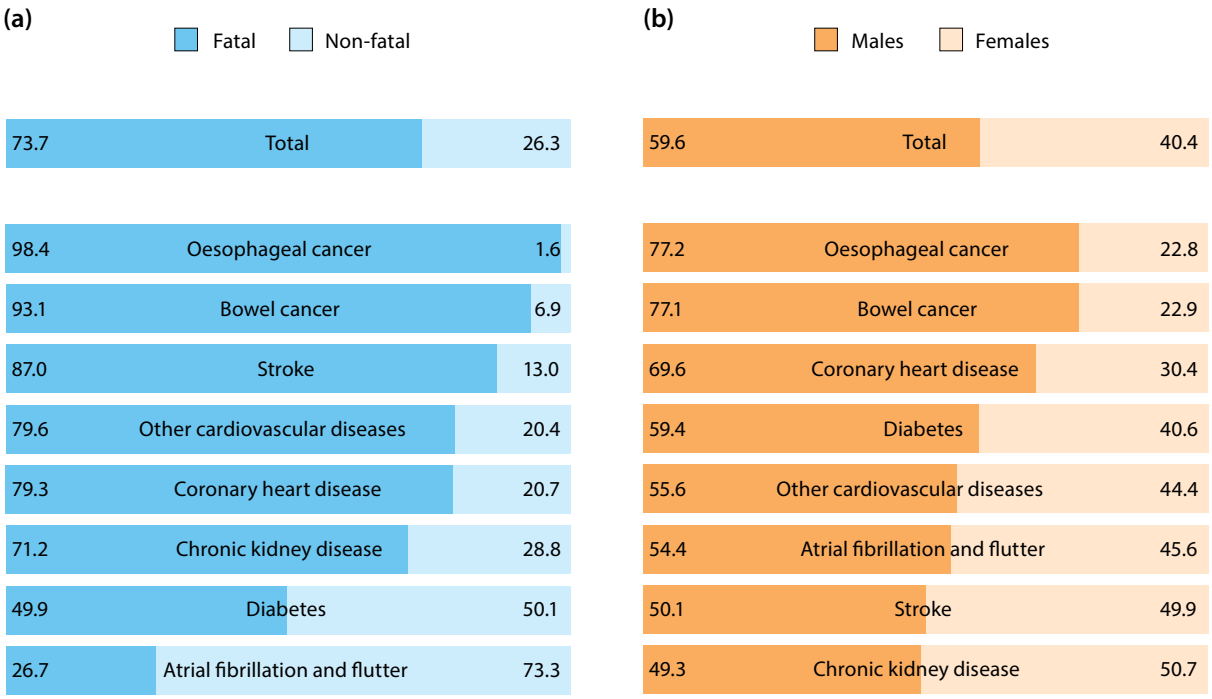
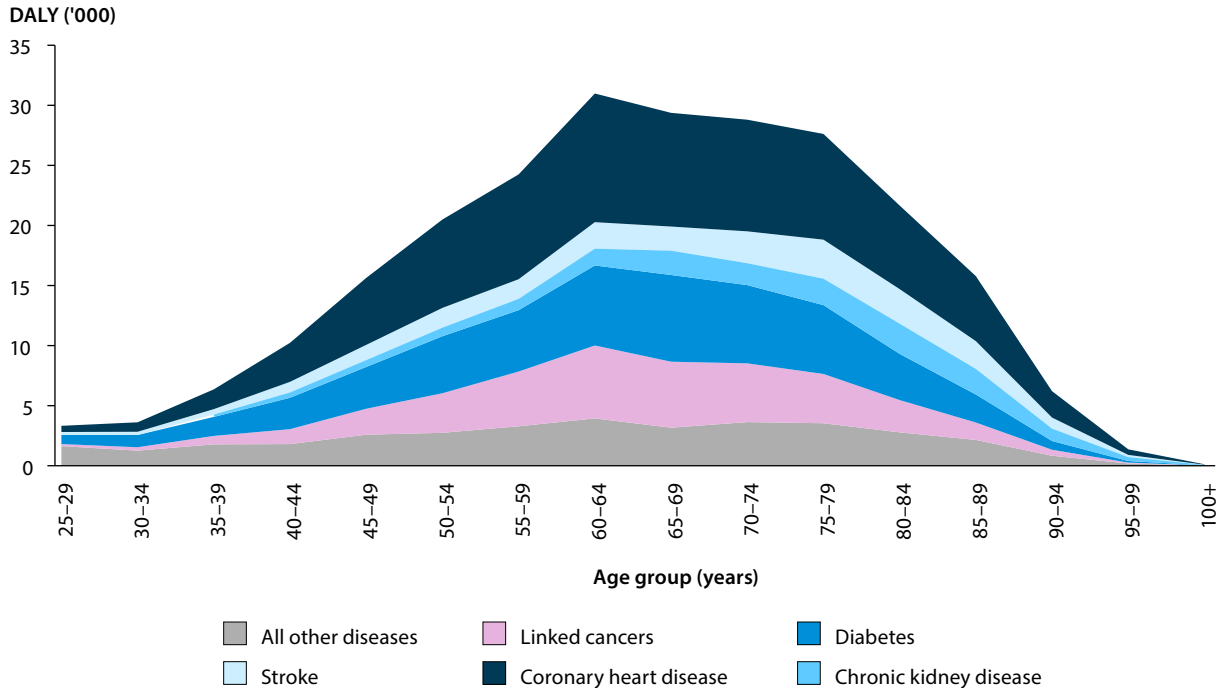


Figure 10.13: Proportion (%) of burden attributable to high body mass (top eight diseases), by fatal versus non-fatal burden (a) and sex (b), 2011

The contribution of high body mass to disease burden was estimated for individuals aged 25 years and older. The top diseases attributable to high body mass showed a similar health loss contribution by age (Figure 10.14). Health loss increased with advancing age, reaching a peak at ages 60–64. Burden slightly decreased for most conditions from ages 65–89.



Notes:
1. 'All other diseases' includes atrial fibrillation & flutter, back pain & problems, cardiomyopathy, hypertensive heart disease, inflammatory heart disease, osteoarthritis, other cardiovascular diseases and peripheral vascular disease.
2. 'Linked cancers' includes bowel cancer, breast cancer, gallbladder cancer, kidney cancer, oesophageal cancer, pancreatic cancer and uterine cancer.

Figure 10.14: Burden (DALY) attributable to high body mass by age and disease, 2011

10.7 High blood pressure

High blood pressure accounted for 4.9% of all disease and injury burden in 2011, ranking as the fifth most burdensome risk factor (Table 6.1).

High blood pressure accounted for 41% of the burden due to stroke and 33% of the burden due to coronary heart disease, and 30% of the burden due to chronic kidney disease (Figure 10.15).

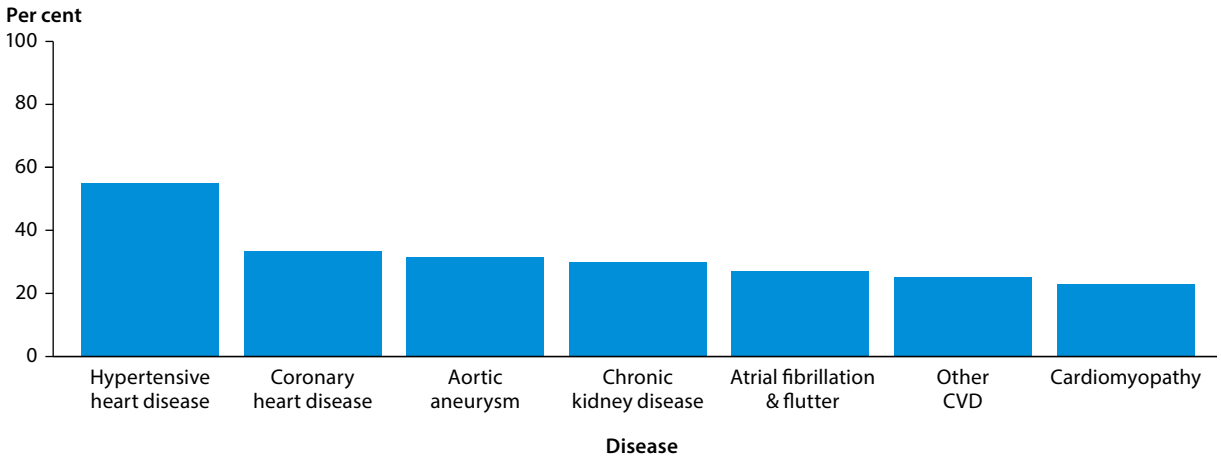


Figure 10.15: Burden (percentage of linked disease) attributable to high blood pressure, 2011

Fatal outcomes were responsible for 80% of the overall burden attributed to high blood pressure (Figure 10.16a). A higher proportion of fatal burden was evident in most disease outcomes except for atrial fibrillation and flutter (31% fatal).

Figure 10.16b shows the sex contribution of burden attributed to high blood pressure. Males experienced a greater proportion of this burden for the leading contributor to burden—coronary heart disease.

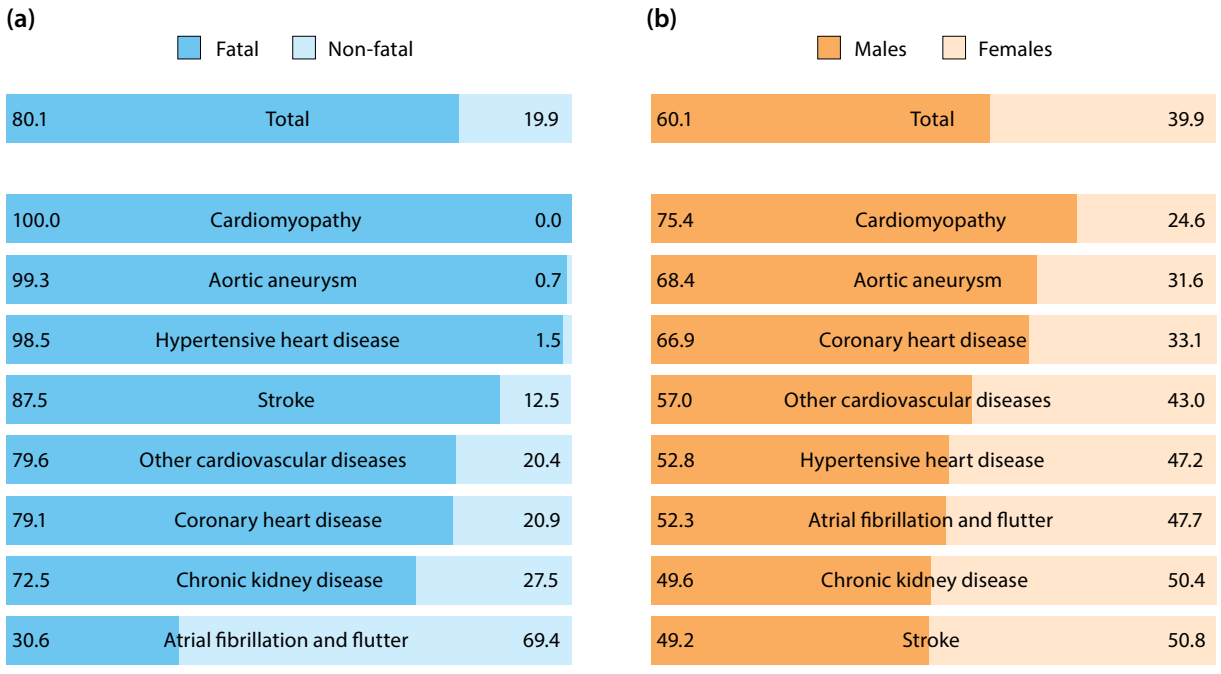


Figure 10.16: Proportion (%) of burden attributable to high blood pressure, by fatal versus non-fatal burden (a) and sex (b), 2011

High blood pressure attributable burden increased with age (Figure 10.17). The majority occurred between the ages of 75 and 89. This was mainly the result of premature deaths due to cardiovascular and chronic kidney disease. Attributable burden decreased in the very elderly, due to smaller population sizes.

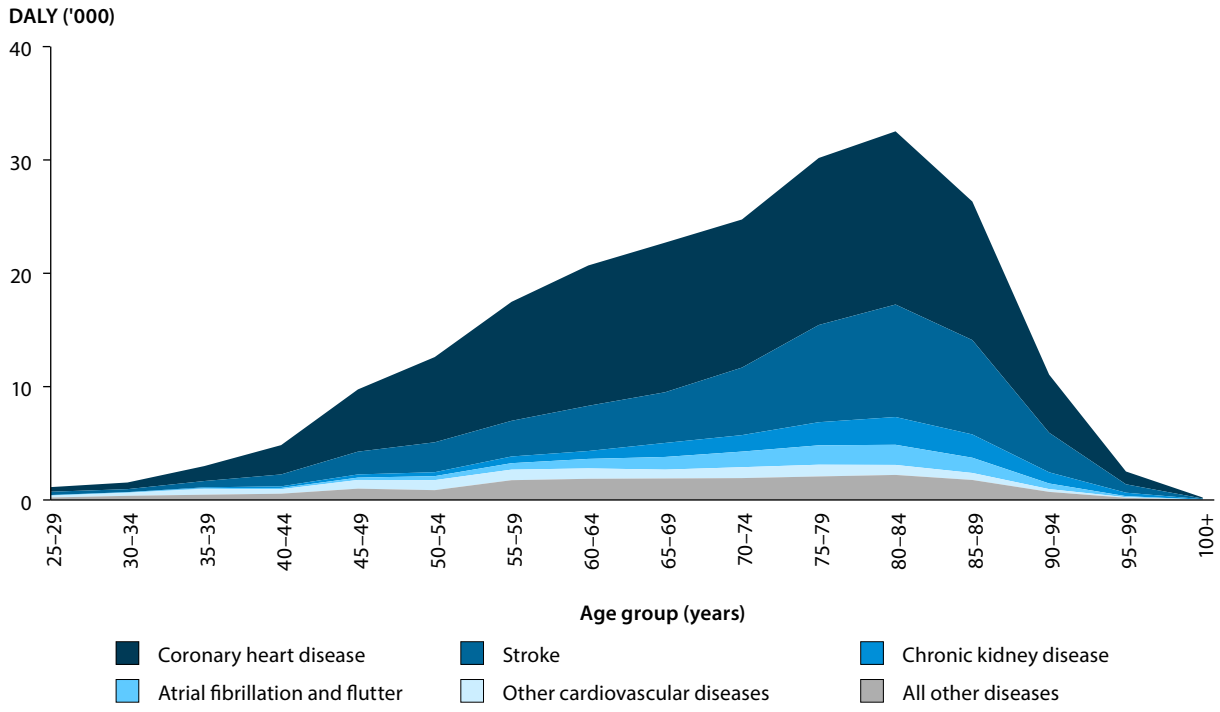


Figure 10.17: Burden (DALY) attributable to high blood pressure by age and disease, 2011

10.8 High blood plasma glucose

High blood plasma glucose was responsible for 2.7% of total burden in Australia in 2011 (Table 6.1). High blood plasma glucose was responsible for the entire burden from diabetes.

Exposure to high blood plasma glucose at levels that indicate a risk of diabetes or with diabetes was responsible for 4.1% of the burden due to chronic kidney disease, 3.9% of the coronary heart disease burden and 3.5% of the stroke burden (Figure 10.18).

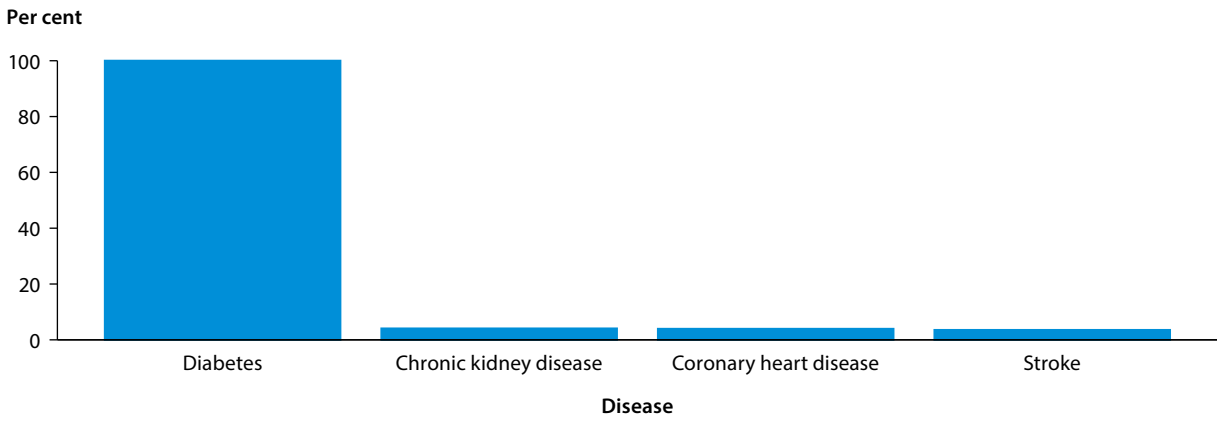


Figure 10.18: Burden (percentage of linked disease) attributable to high blood plasma glucose levels, 2011

Overall, fatal burden due to high blood plasma glucose levels was responsible for more fatal burden than non-fatal burden (58%); however, there was a much greater proportion for stroke (87%), coronary heart disease (79%) and chronic kidney disease (72%) (Figure 10.19a).

Males experienced 60% of the total attributable burden due to high blood plasma glucose levels (Figure 10.19b). This proportion varied depending on the disease outcome, ranging from 58% of chronic kidney disease and diabetes burden to 77% of coronary heart disease burden.

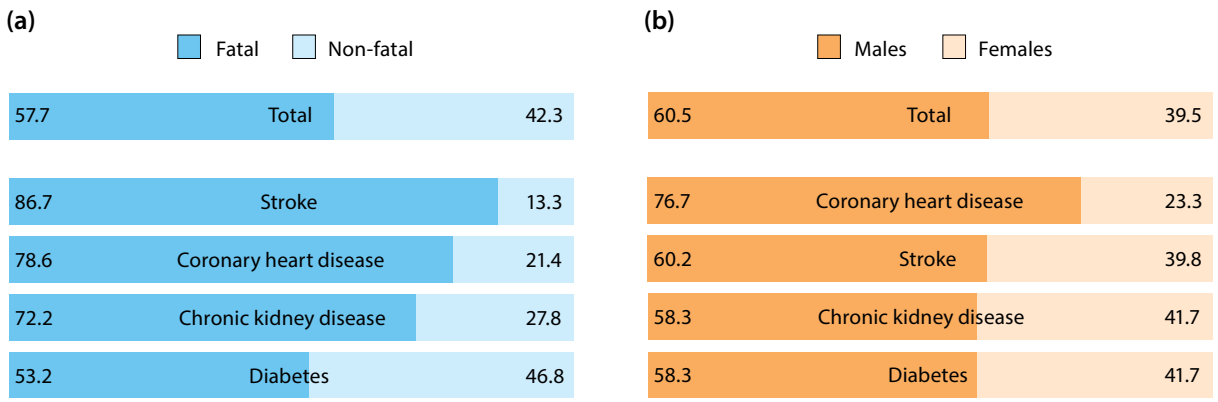


Figure 10.19: Proportion (%) of burden attributable to high blood plasma glucose levels, by fatal versus non-fatal burden (a) and sex (b), 2011

The overall attributable disease burden from high blood plasma glucose levels increased with age, reaching a peak at ages 65–69 years (Figure 10.20). As diabetes caused the vast majority of the burden, the overall attributable burden by age reflected the diabetes burden.

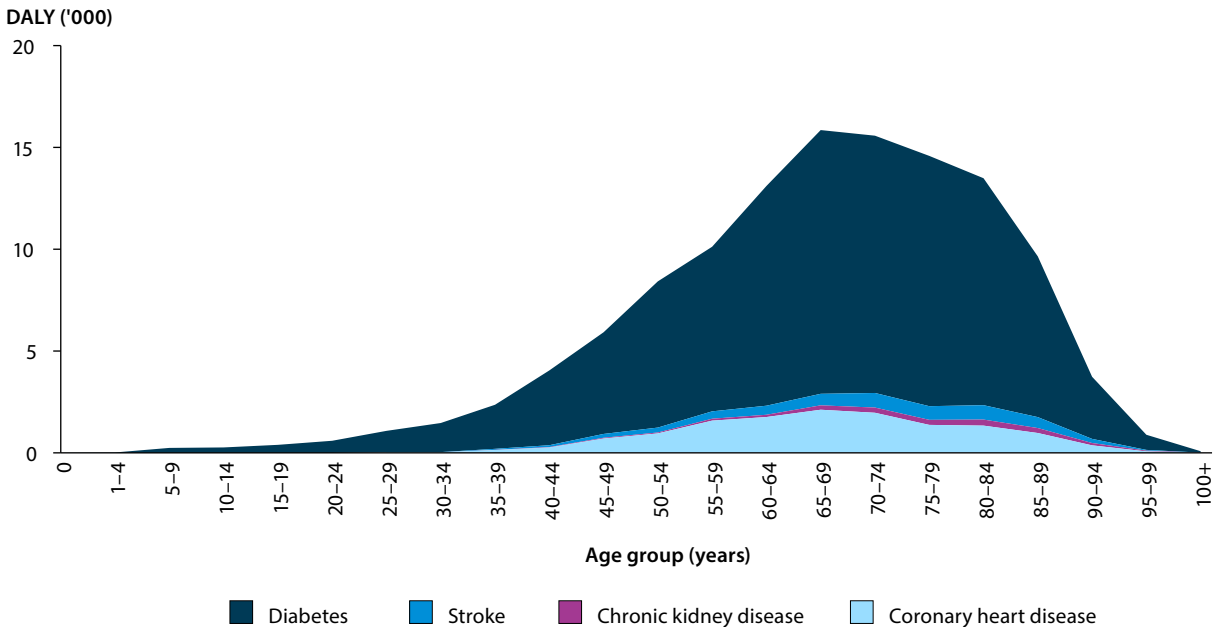


Figure 10.20: Burden (DALY) attributable to high blood plasma glucose levels by age and disease, 2011

10.9 High cholesterol

High cholesterol accounted for 2.4% of the total burden of disease and injury in 2011 (Table 6.1). High cholesterol accounted for 28% of the DALY due to coronary heart disease and 7.2% of DALY due to stroke (Table 10.5).

Table 10.5: Burden (number and percentage of linked disease) attributable to high cholesterol, by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	96,281	27.8
Stroke	9,870	7.2
Total	**106,151**	**2.4**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Around 80% of the attributable burden from high cholesterol was fatal burden and the proportion was slightly higher for stroke (86%), but similar for coronary heart disease (80%) (Figure 10.21a).

A greater proportion of the attributable burden from high cholesterol was experienced by males (65%) than females (Figure 10.21b). Males experienced 66% of the burden attributed to high cholesterol for coronary heart disease and 54% of the attributed stroke burden.

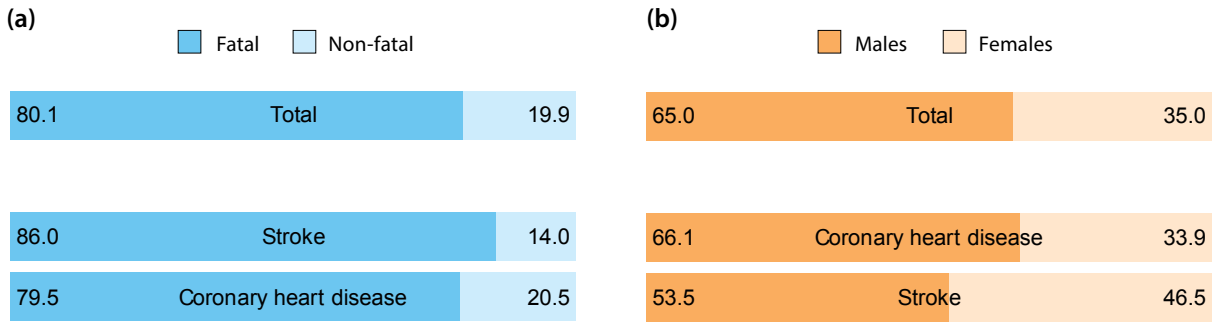


Figure 10.21: Proportion (%) of burden attributable to high cholesterol, by fatal versus non-fatal burden (a) and sex (b), 2011

The burden attributable to high cholesterol was measured in people aged 25 and over. The burden was low in people aged 25–39 but increased with age, peaking at around age 60–64 (Figure 10.22). The burden then decreased rapidly after age 80, with the declining population. The rate of DALY attributable to high cholesterol increased with age.

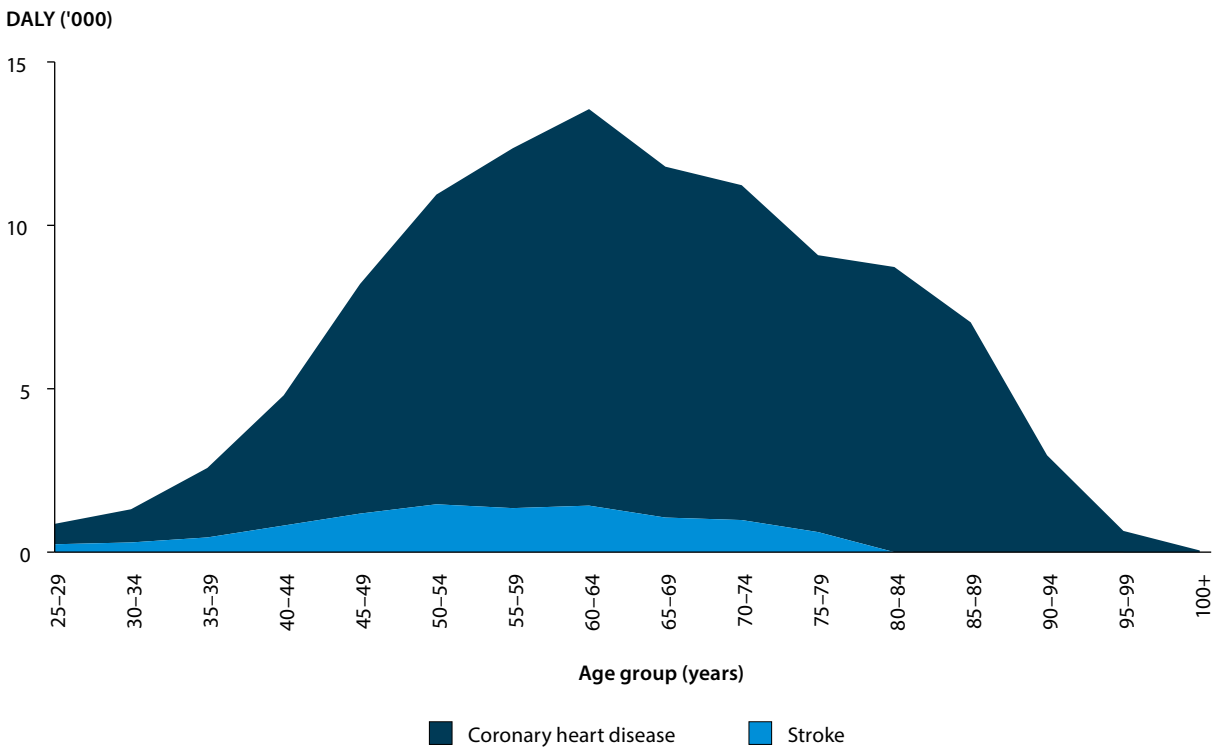


Figure 10.22: Burden (DALY) attributable to high cholesterol by age and disease, 2011

10.10 Other metabolic risk factors

Iron deficiency

Overall, iron deficiency was responsible for 0.3% of all disease and injury burden in 2011 (Table 6.1). Iron-deficiency accounted for the entire attributable burden due to iron deficiency anaemia (Table 10.6).

Table 10.6: Burden (number and percentage of linked disease) attributable to iron deficiency, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Iron-deficiency anaemia	11,477	100.0
Total	**11,477**	**0.3**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Overall, non-fatal burden was the vast majority of the attributable burden (99%) due to iron deficiency. The attributable burden due to iron deficiency reached several peaks with increasing age; however, the majority of attributable burden was between ages 30–54. After age 55 the burden declined steeply.

Low bone mineral density

Low bone mineral density accounted for 0.1% of the total burden and 5.4% of the injury burden in 2011 (Table 6.1). Low bone mineral density was responsible for 10% of the overall burden resulting from falls.

By nature of injury, these falls resulted in different types of fractures. Low bone mineral density was responsible for 58% of the total burden due to hip fractures, 20% of humerus fractures, 18% of other fractures and 14% of the total burden from tibia and ankle fractures (Table 10.7).

Table 10.7: Burden (number and percentage of linked disease) attributable to low bone mineral density by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
External cause		
Falls	6,050	10.2
Nature of injury		
Hip fracture	4,073	58.4
Other fractures	1,889	18.2
Tibia and ankle fracture	60	14.2
Humerus fracture	28	19.5
Total	**6,050**	**0.1**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Most of the burden attributed to low bone mineral density was fatal (92%), and females experienced a slightly higher proportion of fractures due to low bone mineral density than males (54% fatal; 46% non-fatal).

The burden attributable to low bone mineral density was measured in people aged 40 and over. The total burden increased markedly from ages 75–79, peaking in the 85–89 age group.

Environmental risks

Environmental risk factors include air pollution, high sun exposure, and occupational exposures & hazards. This section presents the burden attributable to these risk factors in 2011.

10.11 Occupational exposures and hazards

Occupational exposures & hazards was responsible for 1.9% of the total burden of disease and injury in 2011. This included the impact of exposure to carcinogens, asthmagens, noise, ergonomic stressors, injury, and to particulate matter, gases and fumes in the workplace. It was responsible for 81% of the burden due to mesothelioma, 43% of the burden from fires, burns & scalds and 17% of the burden from back pain & problems (Figure 10.23).

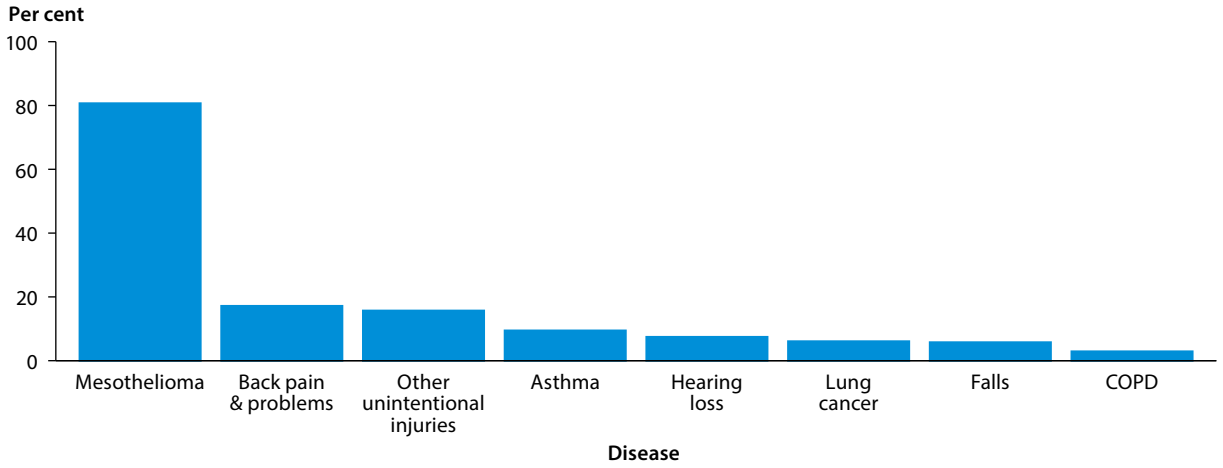


Figure 10.23: Burden (percentage of linked disease) attributable to occupational exposures and hazards, top eight diseases, 2011

Of the burden attributed to occupational exposures & hazards, 36% was fatal; however, this varied by disease (Figure 10.24a). Over 90% of cancers and pneumoconiosis were due to the fatal burden, while hearing loss and back pain & problems were entirely non-fatal (only top eight diseases shown in Figure 10.24).

Almost three-quarters (72%) of the burden attributed to occupational exposures was experienced by males, reflecting both a higher labour force participation rate and employment in industries more likely to expose workers to hazards (Figure 10.24b). The male share of the burden differed by cause, ranging from 63% of back pain & problems to 89% of other unintentional injuries. Notably, 96% of the attributed pneumoconiosis burden was experienced by males.

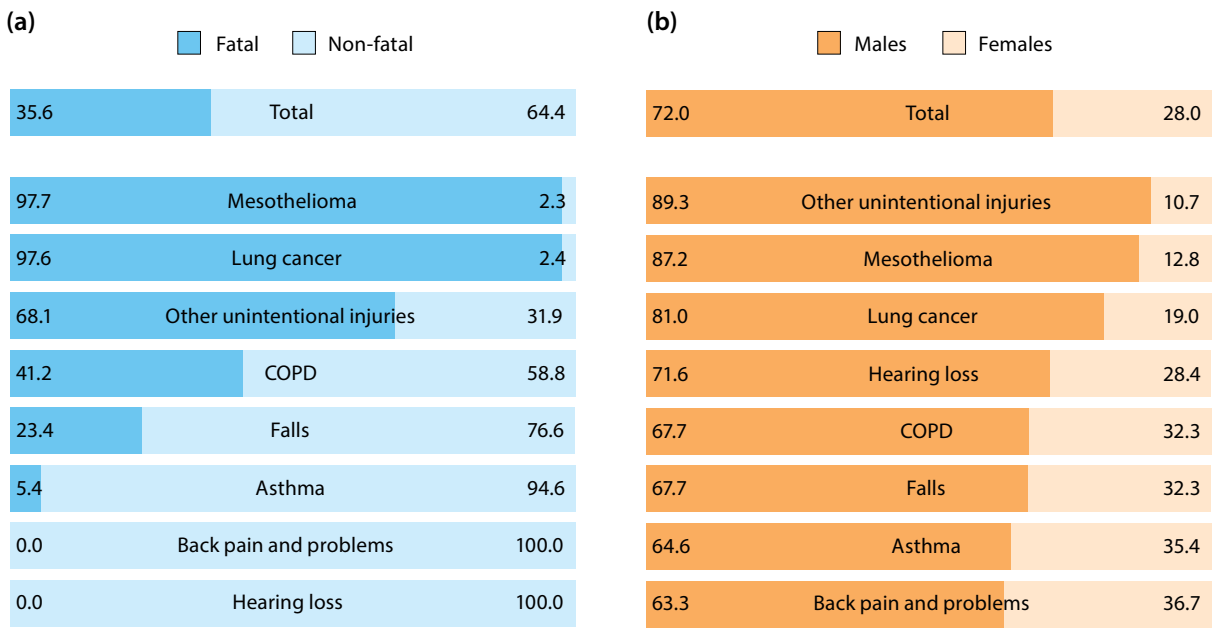
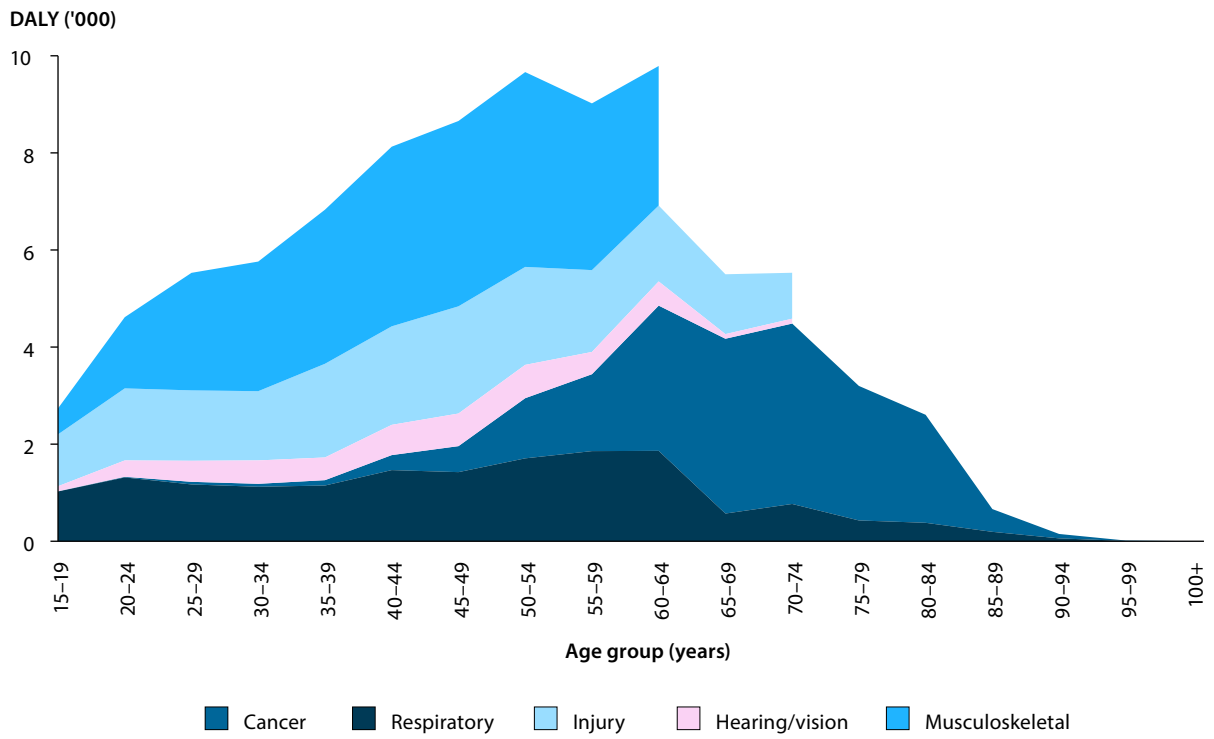


Figure 10.24: Proportion (%) of burden attributable to occupational exposures and hazards (top eight diseases), by fatal versus non-fatal burden (a) and sex (b), 2011

The burden of occupational exposures was measured in individuals aged 15 years and over. Burden was only measured to 65 years for musculoskeletal conditions, and 75 years for injury and hearing and vision disorders because of data available to measure exposure in these age groups.

Injuries accounted for more than one-quarter of the burden attributed to occupational exposures in ages 15–49 (Figure 10.25). Musculoskeletal disorders were responsible for almost half (49%) of the burden between ages 30 and 39. In older ages, the cancer burden attributable to occupational exposures grew (peaking in ages 70–74), due to a lag of up to 40 years between exposure to some carcinogens and disease outcomes.



Note: Attributable burden was only measured in people aged 15–64 years for musculoskeletal conditions and 15–74 years for injuries and hearing & vision disorders.

Figure 10.25: Burden (DALY) attributable to occupational exposures and hazards by age and disease group, 2011

10.12 Other environmental risk factors

High sun exposure

High sun exposure accounted for 0.8% of the total burden of disease and injury in 2011 due to two diseases: melanoma and non-melanoma skin cancer. High sun exposure accounted for 90% of the DALY due to melanoma and 70% of the DALY due to non-melanoma skin cancer (Table 10.8).

Table 10.8: Burden (number and percentage of linked disease) attributable to high sun exposure, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Melanoma of the skin	31,189	90.0
Non-melanoma skin cancer	6,558	70.0
Total	**37,747**	**0.8**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Of the burden attributable to high sun exposure, 90% was fatal. The proportion was similar for melanoma (91%) and non-melanoma skin cancer (86%). More of the burden from high sun exposure was experienced by males (69%) than females; this was similar in both linked conditions.

The burden due to sun exposure was low in people aged 25–40 but increased with age, peaking at age 60–64. The burden then decreased rapidly after age 80.

Air pollution

Air pollution accounted for 0.6% of all disease and injury burden in 2011 (Table 6.1). For the purposes of this study, health loss due to air pollution was only linked to fatal burden; therefore, the DALY was equivalent to YLL.

Overall, 1.3% of all fatal burden was attributable to air pollution. Less than 6% of the burden due to coronary heart disease (5.9%) and stroke (4.8%) were attributable to air pollution (Table 10.9).

Table 10.9: Burden (number and percentage of linked disease) attributable to air pollution by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	20,578	5.9
Stroke	6,527	4.8
Lung cancer	1,117	0.7
COPD	434	0.3
Lower respiratory infections	12	0.0
Total	**28,667**	**0.6**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Males experienced the majority of health loss due to air pollution for the majority of disease outcomes, except for stroke which showed a similar contribution by sex.

Air pollution contributed to burden for people of all ages. Burden steadily increased with age in the majority of conditions. Between ages 60–70, burden attributable to air pollution steeply increased, reaching a peak at ages 65–69.

Dietary risks

There are 13 dietary risk factors. These include those where an adequate amount in the diet is required to prevent health loss, such as a diet low in fruit, vegetables, fibre, milk, nuts and seeds, calcium, whole grains and omega-3 fatty acids. The other dietary risk factors relate to high consumption causing health loss, such as a diet high in sodium, saturated fat, red meat, sweetened beverages and processed meat.

10.13 Diet low in fruit

A diet low in fruit was responsible for 2.0% of all disease and injury burden in 2011 (Table 6.1). Diet low in fruit was responsible for 20% of the burden due to mouth & pharyngeal cancer, oesophageal cancer and laryngeal cancer. Diet low in fruit also contributed to 18% of stroke burden and 12% of coronary heart disease burden. (Figure 10.26).

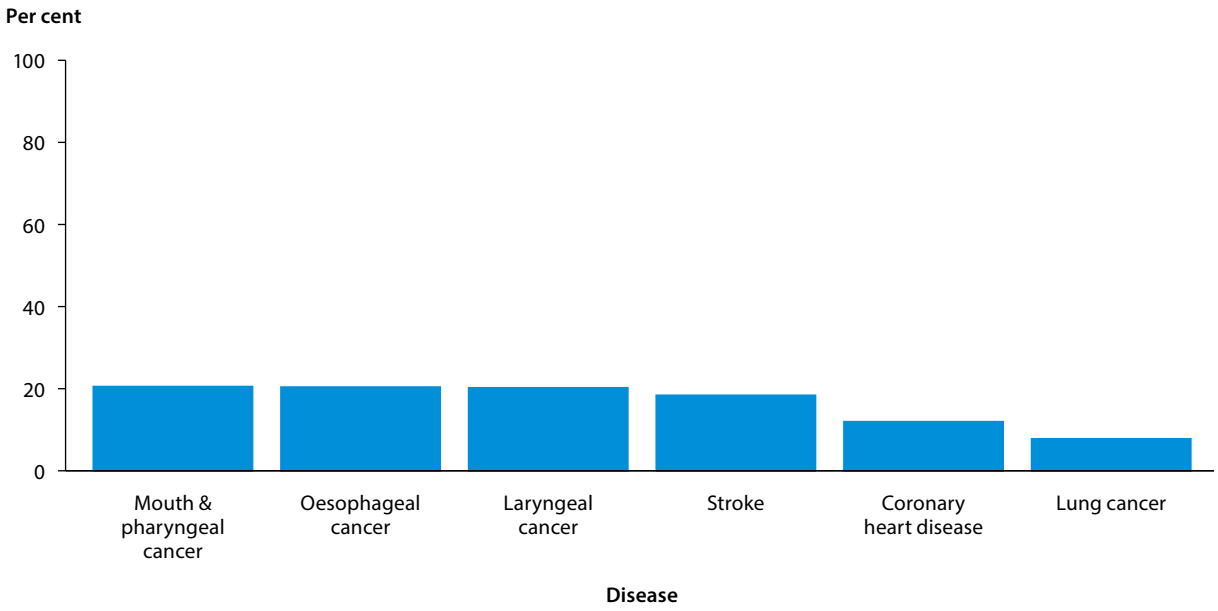


Figure 10.26: Burden (percentage of linked disease) attributable to a diet low in fruit, by disease, 2011

Overall, 86% of the attributable burden of a diet low in fruit was due to fatal burden; however, this varied by disease outcome (Figure 10.27a). This ranged from 80% of attributable coronary heart disease fatal burden, up to 98% for oesophageal cancer. Over 93% of the attributable burden for cancer outcomes was fatal burden.

Nearly two-thirds (65%) of the disease burden attributed to a diet low in fruit was experienced by males; however, this varied by disease outcome (Figure 10.27b). Males experienced 71% of coronary heart disease attributable to a diet low in fruit. Of the attributable cancer outcomes, the male burden proportion ranged from 62% of lung cancer to 85% of laryngeal cancer. A similar proportion of attributable burden due to stroke was evident in males and females.

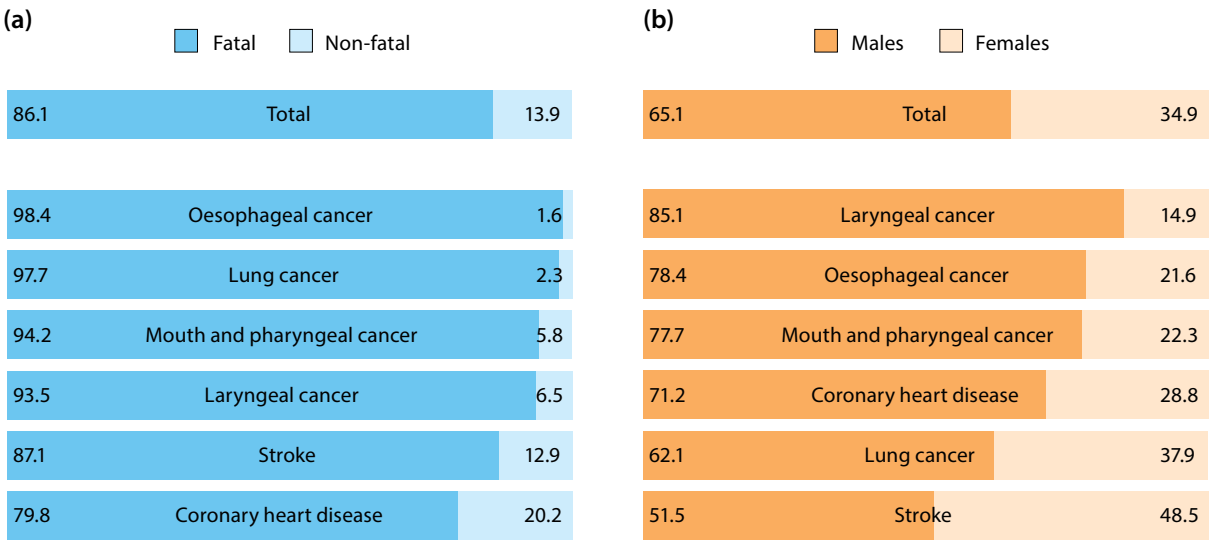


Figure 10.27: Proportion (%) of burden attributable to a diet low in fruit, by fatal versus non-fatal burden (a) and sex (b), 2011

The burden attributable to diet low in fruit was measured in people aged 25 and over. Cardiovascular diseases made up the majority of the burden attributable to a diet low in fruit across all ages (Figure 10.28). The overall burden increased with advancing age, and peaked at ages 60–64 . Overall burden decreased slightly after age 65, before decreasing dramatically from age 85 years.

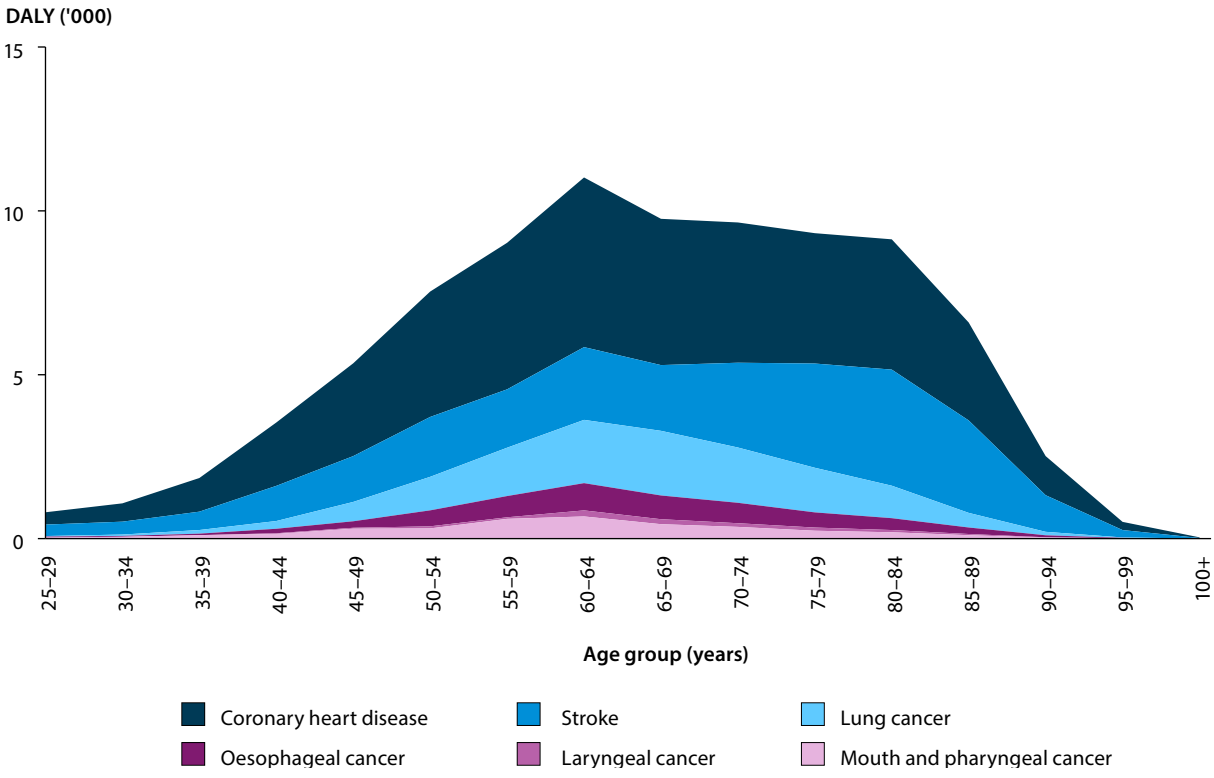


Figure 10.28: Burden (DALY) attributable to a diet low in fruit by age and disease, 2011

10.14 Diet low in vegetables

A diet low in vegetables was responsible for 1.4% of all disease and injury burden in 2011. Diet low in vegetables was responsible for 21% of the total burden due to laryngeal, mouth and pharyngeal cancer. It was also responsible for 17% of stroke burden and 10% of coronary heart disease burden (Figure 10.29).

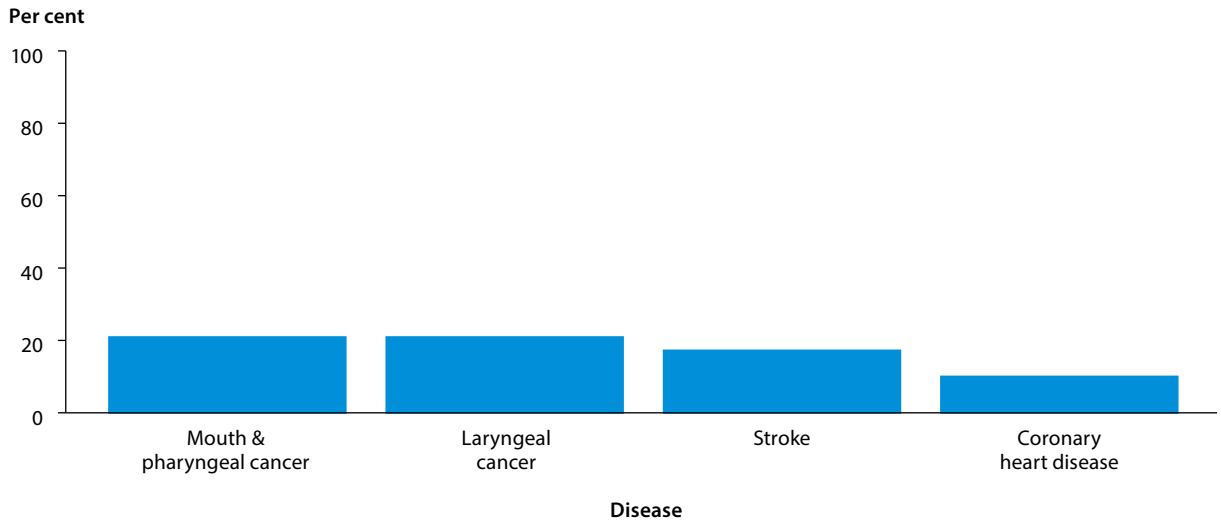


Figure 10.29: Burden (percentage of linked disease) attributable to a diet low in vegetables, by disease, 2011

Fatal burden was responsible for 83% of the total burden attributable to a diet low in vegetables, however this varied by disease outcome (Figure 10.30a). Around 94% of attributable burden from mouth & pharyngeal cancer and laryngeal cancer, 87% of stroke and 80% of coronary heart disease was due to fatal burden.

Around 62% of the disease burden attributed to a diet low in vegetables was experienced by males; however, this also varied by cause (Figure 10.30b). Around 68% of coronary heart disease was apparent in males. Of the attributed cancer outcomes, males accounted for 76% of mouth & pharyngeal cancer and 84% of laryngeal cancer burden. Stroke was the only disease outcome where the contribution to burden was similar for males and females.

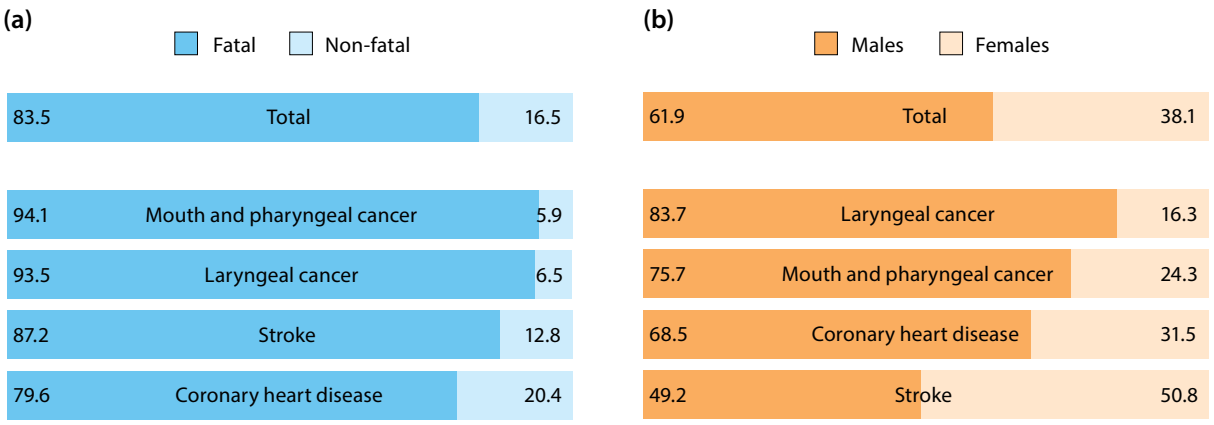


Figure 10.30: Proportion (%) of burden attributable to a diet low in vegetables, by fatal versus non-fatal burden (a) and sex (b), 2011

Cardiovascular diseases made up the majority of the burden attributable to a diet low in vegetables across all ages (Figure 10.31). The overall burden increased with advancing age, with an initial peak at ages 60–64. Overall burden decreased slightly, prior to reaching a second peak at age 80–84. The overall burden decreased dramatically after age 84, coinciding with a decrease in the population.

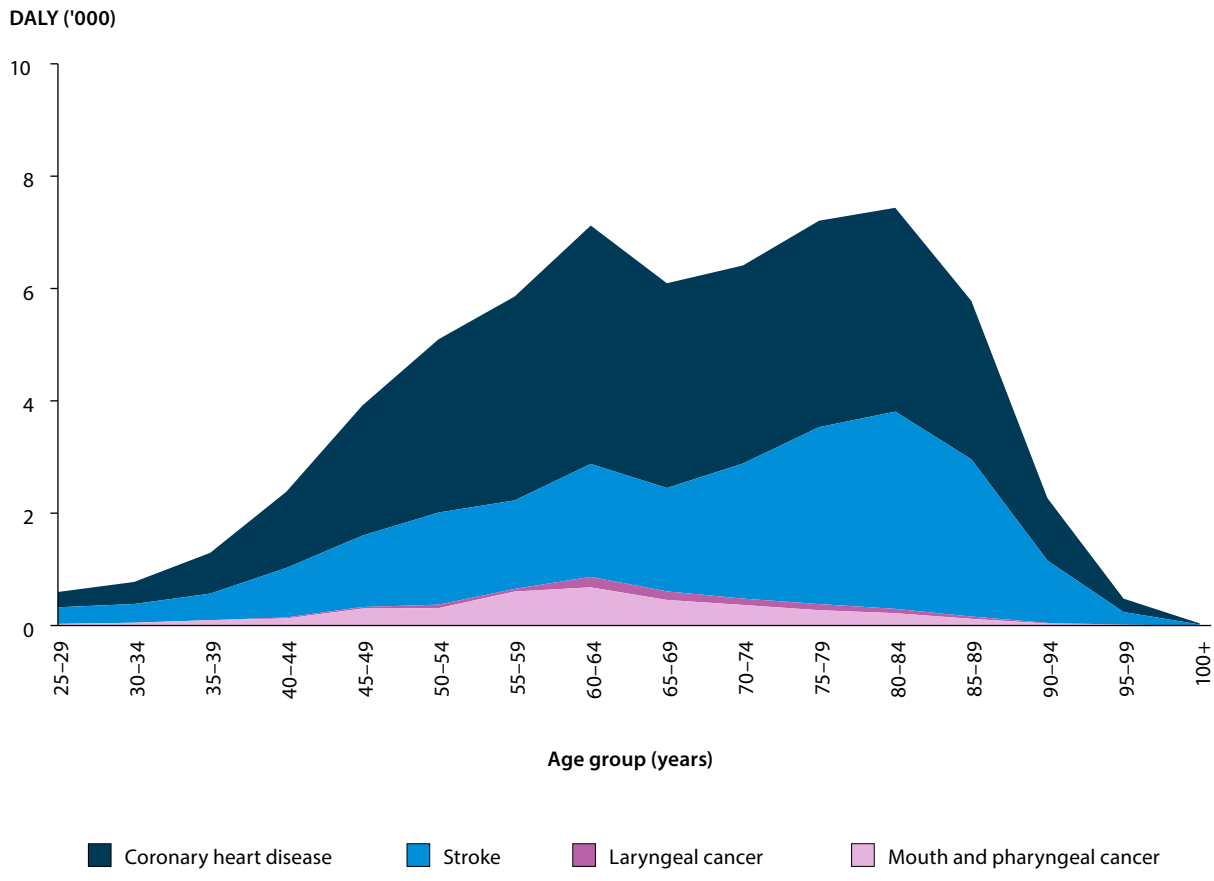


Figure 10.31: Burden (DALY) attributable to a diet low in vegetables by age and disease, 2011

10.15 Other dietary risk factors

Diet high in processed meat

A diet high in processed meat accounted for 1.4% of all disease and injury burden in 2011, responsible for 14% of the coronary heart disease burden, 8.7% of the total diabetes burden and 7.7% of the bowel cancer burden (Table 10.10).

Table 10.10: Burden (number and percentage of linked disease) attributable to diet high in processed meat by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	49,197	14.2
Diabetes	8,800	8.7
Bowel cancer	7,124	7.7
Total	**65,121**	**1.4**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Overall, fatal burden due to diet high in processed meat contributed more burden than non-fatal burden (71%), and males experienced 75% of the attributable burden.

The attributable burden due to a diet high in processed meat increased with age, peaking at ages 80–84—most noticeably in coronary heart disease burden. After the age of 85, the attributable burden declined with advancing age.

Diet low in nuts and seeds

A diet low in nuts and seeds accounted for 1.4% of all disease and injury burden in 2011, responsible for 16% of burden from coronary heart disease and 7.4% of burden from diabetes (Table 10.11).

Table 10.11: Burden (number and percentage of linked disease) attributable to diet low in nuts and seeds by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	55,294	16.0
Diabetes	7,485	7.4
Total	**62,779**	**1.4**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Over three-quarters (79%) of the attributable burden from a diet low in nuts and seeds was caused by fatal burden, and males experienced a slightly higher proportion of the attributable burden (69%).

The attributed burden due to a diet high in nuts and seeds rose quickly with age, peaking at ages 80–84—noticeably in coronary heart disease burden. After the age of 85, the attributable burden declined with advancing age.

Diet low in whole grains

A diet low in whole grains accounted for 1.1% of all disease and injury burden in 2011, responsible for 12% of the total diabetes burden, 8.4% of the coronary heart disease and 7.5% of the stroke burden (Table 10.12).

Table 10.12: Burden (number and percentage of linked disease) attributable to diet low in whole grains by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	29,188	8.4
Diabetes	12,144	11.9
Stroke	10,312	7.5
Total	**51,644**	**1.1**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Nearly three-quarters (74%) of the attributable burden from a diet low in whole grains was caused by fatal burden, and males experienced a higher proportion (64%) of the attributable burden than did females. The attributable burden increased with age, noticeably for cardiovascular disease outcomes.

Diet low in fibre

A diet low in fibre accounted for 1.0% of all disease and injury burden in 2011, responsible for 10% of burden due to bowel cancer and 10% burden from coronary heart disease (Table 10.13).

Table 10.13: Burden (number and percentage of linked disease) attributable to diet low in fibre by disease, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	34,206	9.9
Bowel cancer	8,982	9.7
Total	**43,188**	**1.0**

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row.

Fatal burden contributed 86% of the overall burden attributable to a diet low in fibre; however, this varied by disease outcome. Over 92% of the attributable burden from bowel cancer and 80% of the attributable coronary heart disease burden was due to premature deaths. Nearly two-thirds of the burden attributable to a diet low in fibre was experienced by males (65%).

11 Developments, limitations and international comparisons

11.1 Method changes and development

Key method changes since the last Australian study are a new standard life table, prevalent YLD and new disability weights. The main method developments in the ABDS 2011 are new diseases and risk factors, improvements in death redistribution, review of disease models in conjunction with Australian experts, and the development of a quality framework.

The majority of the estimates in the ABDS 2011 are based directly on high-quality Australian data, using detailed, unit record or linked data in many cases. Following comprehensive assessment of requirements for each disease group in conjunction with Australian experts, the appropriate data were sourced. In some cases, a single, high-quality data source was identified as being appropriate for the Australian context (such as the mortality data for the fatal burden estimates); in other cases, multiple data sources were used (such as the prevalence estimates for coronary heart disease). As such, no new meta-analyses (the statistical combination of findings from independent studies) were needed for the study. Such use of detailed local data sources has resulted in less reliance on modelling than in the GBD and the previous Australian studies.

The main methodological changes between the 2003 Australian Burden of Disease Study and the current study are outlined in Chapter 1 (Box 1.2). Of note, is the new standard life table that has substantially lengthened the 'ideal' life span—this has influenced both the number of YLL and DALY, and the ranking of diseases (Chen et al. 2015). A simpler DALY is also used with no discounting or age weighting and YLD is calculated using a prevalence rather than an incidence approach, consistent with current international practice. The disability weights used in this study were sourced from the GBD 2013, and have been designed to reflect the general population's valuation of different health states rather than being based on health experts' judgement. Further details on these aspects can be found at Appendix A.

A number of developments in methods have been undertaken as part of the ABDS 2011. The study has included diseases and risk factors not in previous Australian studies or the GBD. Examples are cancer of unknown primary site as a disease, and sun exposure as a new risk factor.

For the fatal burden component, improvements were made to the methods to redistribute deaths not appropriate for the burden of disease analysis. New methods included use of direct evidence for some diseases, notably cancer and heart failure deaths, and use of Australian multiple causes of death data for other high-volume diseases.

For the non-fatal component, the conceptual models for each disease were reviewed and revised, with advice from Australian experts. This included review of relevant data sources and assumptions. The ABDS 2011 has made more extensive use of linked data, notably state-level linked hospital and deaths data, following developments made as part of the NZBDS.

For the risk factor analysis, in some cases it was possible to use direct evidence to quantify the proportion of diseases resulting from the risk factor. This was the case for homicide from intimate partner violence, for various infectious diseases and for some other risk–outcome pairs.

Uncertainty bounds have not been included in this study for a number of reasons. Advice from the Expert Advisory Group was that such estimation of uncertainty would need to take account of the complex

analysis and manipulation needed to align the input data to the preferred epidemiological variables, disease definitions, population, time period and so on. This would require a combination of assumptions, models and judgments. Thus, measures of uncertainty would need to take account of uncertainties in both the data (such as standard errors from surveys, and misalignment with our preferred case definition) and the models and transformations (such as estimating prevalence from incidence and estimating sub-national estimates). It was not practical to incorporate all imperfections and uncertainties into a single measure, such as an uncertainty interval. Instead, a quality framework was developed which includes key information about the estimates (see Appendix B) covering all aspects affecting quality, so that users of the ABDS 2011 can judge the estimates' appropriateness (or otherwise) for particular purposes.

Given the study's aim to be transparent in the data sources, assumptions and methods, detailed methods information will be published in the coming months. See Appendix A for further detail.

11.2 Limitations

The ABDS 2011 is based on the best current knowledge, methods and available data, as suited to the Australian context. Nevertheless, there are some limitations. While Australia has very good quality deaths data, the method for estimating the fatal burden uses information on the underlying cause of death only—extra information contained in the associated causes of death is not currently used to assign the fatal burden. The current method assigns the entire burden to one cause of death, and therefore cannot take account of the more complex situation where multiple causes contribute to the death. It also relies on accurate allocation of the underlying cause of death. Further development work may provide alternative methods. One approach is to quantify the indirect burden from particular diseases using the 'diseases-as-risks' approach. This approach is currently being investigated using the ABDS 2011 system.

For the non-fatal component, the ABDS 2011 was able to use detailed Australian data for many diseases and injuries, including unit record data and linked data combining separate data sets. However, where some data gaps remain, overseas data or old Australian data had to be relied on. For example, the dementia estimates are based on a published international meta-analysis, and thus the assumption was made that these rates apply in Australia. Further, while linked data have been used in the ABDS 2011, the majority was from state-level linked data from one state. It would be a notable improvement if linked data were accessible at the national level.

The method used to derive the disability weights remains the subject of international discussion and debate (Haagsma et al. 2015; Nord 2013; Voigt & King 2014). The set of disability weights used in this study come from the GBD 2013, which are based on surveys of populations in a number of countries as well as on an internet survey (Salomon et al. 2015). Analysis of the results suggested that there was little variation between countries in these valuations. However, to date, no specific validation in the Australian context has been undertaken. This would be useful to undertake in the future.

Another general area where improvements could be made is the 'severity distributions', which represents the proportion of people with a given disease by levels of severity. The ABDS was able to use Australian data for some of these, but relied on the GBD distributions for others. For many of these, the GBD had used data from United States and Australian surveys, meaning the distributions are likely to be suitable for Australia. While the global distribution will be appropriate in some cases, others may be improved with Australian-specific data.

Only those risk factors that had sufficient evidence of the increased risk of a disease were included in this study. The starting point for this analysis was the GBD 2010 relative risks and risk outcome pairs.

Assessment of the relative risks and risk outcome pairs as inputs was not within the scope of this study. However, where possible additional direct evidence for Australia were used and where needed relative risks from the GBD 2013 were used.

It is likely that further risk factors could be included in future analysis, including socioeconomic factors. The ABDS 2011 used an attenuation factor to derive joint effects from the risk factors (see Appendix A for more information). Further developments in this area may also be possible in the future.

While these limitations remain and various assumptions needed to be made to overcome them in this study, it is important to note that the vast majority of estimates presented here are based on very strong data and methods (see Appendix B for more information). The small number of estimates that are based on lesser quality data or methods are provided to inform the knowledge base and highlight where data gaps exist. It is expected that further developments in data and methods will continue in future burden of disease analyses.

11.3 Opportunities to use and improve the estimates

There are a number of opportunities to further use and explore the vast quantity of estimates that underpin those presented in this report. This includes many potential policy-relevant analyses that could be undertaken using the results from the ABDS 2011.

During consultation with stakeholders, the AIHW identified a range of potential deeper analyses that could be undertaken: of particular diseases and disease groups (for example, kidney disease), of particular risk factors (for example, nutrition, intimate partner violence) and of population groups. With appropriate data, further work could be undertaken to disaggregate sub-national estimates (for example, state by remoteness) or to explore the burden at local levels (for example, by Primary Health Networks). Further work could also provide alternative groupings of diseases within and across disease groups (for example, vascular diseases, septicaemia) or with diseases as risk factors (for example, diabetes and chronic kidney disease). Some of this work is being currently undertaken as separate projects, but was out of scope for this current study.

There is further opportunity to explore the estimates for population health monitoring, including more in-depth expansion of morbidity estimates (for example, analysis in relation to chronic conditions using sequela-level information that distinguishes acute and chronic effects, or detail across age/sex and sub-national groups) or to answer specific research questions (for example, burden in the last year of life for cancer, the health of the working age population). Similarly, the estimates could contribute to health impact assessment of new policies before decision making.

One of the key ways in which the ABDS 2011 estimates could be further used is to assess how resource allocation aligns to health priorities and disease burden. This could be done by comparing burden of disease estimates with disease expenditure data. Further, estimates could be a component of cost-effectiveness analysis, where the change in DALYs is compared with the corresponding change in expenditure.

While this report includes estimates for both 2003 and 2011, data from additional reference periods could be added, both in the past and future, to examine historical trends and to construct future projections. There would be value in undertaking regular updates to the estimates as major data sources are refreshed. Now that the necessary infrastructure to develop Australian-specific estimates is in place, regular updates would enable future iterations to produce estimates closer to the current date, increasing currency and

relevancy. Another option would be to produce projections from the data, such as short projections to the current year. Longer term projections would also be useful for other purposes.

Likewise, there are opportunities to improve the estimates from the ABDS 2011. One of the key benefits from conducting a burden of disease study in Australia is a more complete understanding of the data sources, assumptions and model structures that underpin the estimates. This process was to identify a number of data gaps—particularly in the prevalence of diseases (for example, diseases treated in primary health care) and some risk factors—and Australian-specific severity distributions. There are also various areas where refining our current methods (for example, validating comorbidity adjustment, uncertainty estimation, incorporating multiple causes of death into YLL calculations) would be beneficial. There is also potential for work to explore Australian-specific disability weights, based on more extensive data collections within Australia.

Social factors (such as income/poverty, education and employment) play an important role in determining the health of a population, and they often have a strong association with health outcomes and health behaviours. Further, their association with Indigenous health—and the health gap between Indigenous and non-Indigenous Australians—is well documented. The ABDS 2011 disaggregated the fatal, non-fatal and total burden estimates by a measure of socioeconomic position as a way to quantify disparities in fatal and non-fatal burden across different social and economic groups. It was not feasible to include social determinants of health as risk factors in the ABDS 2011 due to the resources needed to undertake the body of work that would be required (such as developing appropriate definitions and sourcing disease-specific relative risks). Nonetheless, the AIHW recognises this is an important area of work to progress for future burden of disease studies.

There have been clear benefits from building on and sharing knowledge between experts and researchers to advance burden of disease analysis and estimates. The AIHW continues to monitor the methods used in other burden of disease studies. It will also incorporate developments into future iterations of the ABDS as appropriate in the Australian context, and to contribute to the body of knowledge and international expertise in this area.

11.4 International comparisons

International comparisons are important and can provide a useful perspective of global disease burden. However, comparing the health of populations between countries is complex, and many factors are important. These factors include, but are not limited to, health spending, life expectancy, geography, the type and amount of public health interventions and other societal characteristics. The GBD studies and the WHO Global Health Estimates help to inform comparisons that show how health challenges differ globally and regionally. Emerging from these global studies was a call to improve capacity for health data analysis and to address data gaps at a country level (Boerma & Mathers 2015).

Comparisons are best made with data that are based on consistent definitions and have similar collection methods and population coverage. All these aspects must be carefully considered when interpreting the results (AIHW 2012a). International comparisons can be made between countries when the data and methods used to derive the estimates are comparable; that is, when the data have been compiled systematically (using the same disease and injury list) and the estimates are made using the same methods. The outcome of any variations between studies in any of these aspects can result in different rankings of diseases.

In practice, this means that results are comparable within a study but not between studies. That is, the GBD and WHO results for Australia cannot be compared with results produced in this study. While the ABDS 2011 has sought to maintain the same broad methodological approach as used for recent global studies, a number of changes have been made to align with Australian context (detailed in Table 11.1) that prevent direct comparison.

Table 11.1: Comparison of key method choices in the ABDS 2011, GBD 2013 and the WHO 2012 burden of disease studies

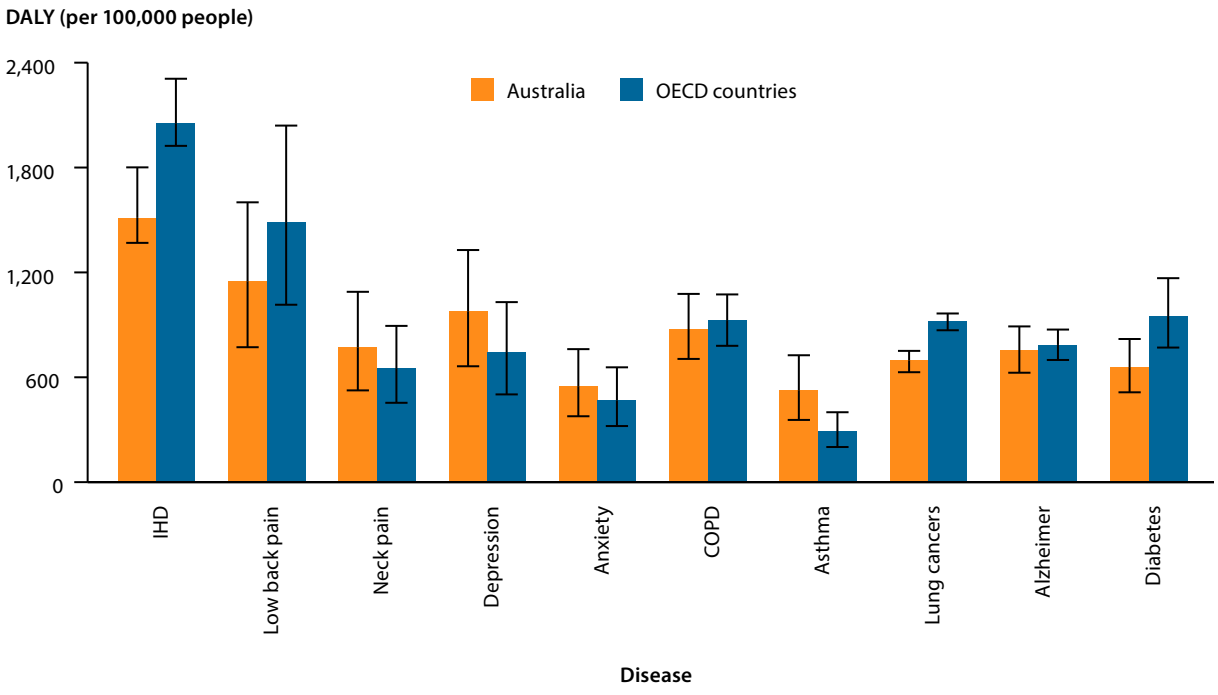
	ABDS 2011	GBD 2013	WHO 2012
Impacts on disease-specific results			
Disease (condition) list and ICD code allocation	Australian specific (grouped for policy relevance)	GBD specific	WHO specific
Reference year	2011	2013	2012
Impacts on total deaths and YLL results			
Data sources	AIHW National Mortality Database	Modelled from various sources	WHO mortality database
Redistribution	Australian specific	GBD specific	WHO specific
Standard life table	GBD 2010	GBD 2010	GBD 2010
YLL calculation	No age weighting or discounting	No age weighting or discounting	No age weighting or discounting
Impacts on YLD results			
Data sources	Australian-specific prevalence estimates derived directly where possible	Modelled from various sources	Modelled from various sources
Conceptual models	Australian specific	GBD specific	GBD/WHO specific
Disability/health state weights	GBD 2013	GBD 2013	GBD 2010 with some modifications
Impacts on risk factor-specific results			
Risk factor list	Australian specific	GBD 2013	—
Linked disease list	GBD 2010	GBD 2013	—
Data sources	Australian-specific exposure prevalence estimates	Modelled from various sources	—

11.5 Comparison using GBD 2013

Australia has lower rates of heart disease and lung cancer than other comparable countries, but higher rates of asthma.

The GBD 2013 estimates for Australia can be compared with the GBD estimates for other countries and regions because common methods are used to produce estimates for all countries. This makes them internally consistent. When comparing the top 20 diseases contributing to DALY in Australia using the GBD 2013 results, most rates of burden for Australia were similar to the average rates for Organisation for Economic Co-operation and Development (OECD) countries (GBD 2013 Collaborators 2015). The rate of

burden for ischemic heart disease and lung cancer were significantly lower in Australia than the average rates of burden for these diseases in OECD countries (Figure 11.1). By comparison, rates of burden for asthma were higher in Australia, although this difference was not statistically significant.



Source: AIHW analysis of the GBD 2013 (IHME 2015).

Note: 'Anxiety' refers to 'Anxiety disorders'; 'Alzheimer' refers to ' Alzheimer disease and other dementias; 'COPD' refers to 'Chronic obstructive pulmonary disease'; 'Diabetes' refers to 'Diabetes mellitus'; 'Depression' refers to 'Major depressive disorders; 'IHD' refers to 'Ischaemic heart disease'; 'Lung cancers' refers to 'Tracheal, bronchus and lung cancer'.

Figure 11.1: Burden of selected high burden diseases in Australia compared with OECD countries, 2013

11.6 Conclusion

This study has provided updated burden of disease estimates most relevant to the Australian context. This includes national and sub-national (state/territory, remoteness, socioeconomic group) estimates. Estimates for Aboriginal and Torres Strait Islander people are due to be released in coming months. In addition, 2003 estimates have been recalculated using the new methods for comparability.

It is difficult to assess the implications of these results for the health system based on only two time points. Further time points would enable analysis to better detect and interpret any trends and to provide greater insight into it, and how, the burden from these diseases and risk factors can be prevented. Continuing Australian burden of disease estimation and analysis into the future would continue to provide estimates that are valuable for policy, planning and investment decisions.

Appendix A: Methods summary

This appendix summarises the methodological approach of the ABDS 2011. A more detailed methodological description will be provided in a separate technical report available in mid-2016.

Burden of disease analysis aims to quantify health loss for all health outcomes, both fatal and non-fatal, and attribute it to a disease or injury category. This is achieved by separately estimating the fatal (YLL) and non-fatal (YLD) burden according to a defined list of diseases, and summing them. The methods for estimating each are described. This burden can then be attributed to risk factors selected for inclusion in that part of the analysis.

1 Disease and injury (condition) list

The disease and injury list details the specific diseases and causes of injury for which estimates were made. It is a classification which, in principle, is a set of mutually exclusive and collectively exhaustive categories of disease and causes of injury. Accordingly, it covers all fatal and non-fatal health outcomes (for which health loss is measured), with each outcome aligned to an item on the list.

An Australian disease and injury list was developed specifically for this study to reflect the Australian context; that is, the disease and cause groups are tailored to meet the needs of health reporting and monitoring for Australia. The list used in this study was developed with the following considerations:

- Australian and Indigenous policy interests are covered.
- The mortality and prevalence for each cause can be feasibly measured.

The resulting disease and injury list is hierarchical and comprises two levels. The highest level contains 17 disease groups under which 200 diseases and injuries are classified. This includes dual reporting of injury by either nature or external cause.

Residual causes are included for each disease group. These account for the health loss from diseases not specifically identified in the cause list, and ensure that health loss is captured for all conditions. For example, 'other musculoskeletal conditions' are musculoskeletal conditions not included in arthritis, gout, rheumatoid arthritis and back pain and problems. These will include conditions like systemic lupus erythematosus, fibromyalgia and tendonitis.

The condition list is included in Appendix Table A1. Definitions of each disease by ICD-10 for mortality or ICD-10-AM (where relevant) for morbidity are available in the additional online tables.

2 Fatal burden

A complete set of mortality data (by age, sex and geography) and a reference life table are the key requirements for producing estimates of YLL for each disease and injury included in the condition list.

2.1 Reference life table

The reference life table is a key component of the fatal burden analysis. Estimates of life expectancy at each age are used to indicate the number of years of life that are lost from dying at a specific age.

The ABDS 2011 uses the standard life table developed in the GBD 2010 study (Murray et al. 2012a). This life table was derived rigorously, using the lowest age-specific mortality rates experienced around the world. The result is a hypothetical life table, rather than one experienced in any single country. The reference life table estimates life expectancy at birth to be 86.0 years for both males and females, 28 years for a person aged 60 and 3 years for a person aged 95. The reference life table used in this study is in Appendix Table A2.

2.2 Mortality data source

Analysis of burden of disease takes into account all deaths that occur in a population during a specified time period. The total number of deaths from all causes comes from the AIHW's National Mortality Database.

Australian deaths data are collected through the vital registration system; this is a system for collecting and maintaining records of life events such as births, deaths and marriages, by a government authority. Cause of Death Unit Record File data are provided to the AIHW by the Registries of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice) and include cause of death coded by the ABS. The data are maintained by the AIHW in the National Mortality Database.

The AIHW website <http://www.aihw.gov.au/deaths/aihw-deaths-data/> provides detailed information on the registration of deaths and coding of causes of death to the ICD in Australia (AIHW 2013). The completeness, accuracy and coding of these data are also described elsewhere (ABS 2012a, 2014). The deaths data are collated into an administrative data set for analysis. Given the high quality of these data, no modelling had to be undertaken to adjust for coverage or completeness for national estimates. Some transformation of the data has been undertaken to reassign some deaths to better fit the purposes of burden of disease analysis (see Section 2.3 Redistribution methods).

Although derived from the same source, estimates of deaths by disease or disease group in this study should not be compared with estimates from other sources. This is because grouping of diseases may be different to that used in other studies, and deaths that do not fit within specific disease definitions for the ABDS 2011 have been 'redistributed' to other disease (see Section 2.3).

Versions of mortality data

The analyses for this report include all deaths that *occurred* during the reference periods (calendar years 2003 and 2011). These data were sourced from all cause of death unit record files for the deaths *registered* in the respective year and for all subsequent years to capture late registrations. This methodology ensures that all known deaths for these years are counted, including from preliminary and revised versions of the latest data.

Deaths registered in 2011 and earlier are based on the final version of cause of death data; deaths registered in 2012 and 2013 are based on revised and preliminary versions, respectively, and are subject to further revision by the ABS.

2.3 Redistribution methods

There are a number of ICD codes that are not considered appropriate or valid causes of death for a burden of disease study. Some examples are:

- causes that should not be considered as the underlying cause or are implausible as a cause of death, such as hypertension and paraplegia
- intermediate causes: causes such as septicaemia and pneumonitis that likely had some other precipitating cause
- immediate causes: causes that are generally observed as modes of dying, such as cardiac arrest, heart failure and respiratory failure
- causes that are ill-defined or unspecified within a larger cause group; for example, ill-defined digestive cancer and ill-defined digestive diseases.

Despite its overall high quality, the Australian deaths data set includes some records with these codes. A list of the ICD-10 codes used to identify deaths for redistribution in the ABDS is shown in Appendix Table A3. A total of 14,761 deaths (10.0%) were identified for redistribution.

The AIHW undertook a series of analyses in investigating methods for redistributing records with codes identified for redistribution. The methods ultimately adopted were, in order of priority:

- **Direct evidence**—this approach uses direct evidence about the particular deaths identified for redistribution. Information about the more likely cause of death is modelled on results of data linkage studies or sources other than the National Mortality Database. Direct evidence was used where available.
- **Indirect multiple causes of death (MCOD) method**—this method uses the pattern of the underlying causes of death (UCOD) where the cause identified for redistribution was mentioned as an associated cause of death. The corresponding UCODs and their proportional distribution provide the redistribution algorithm. For example, to inform the redistribution algorithm for deaths with an underlying cause of pneumonitis, all deaths that mentioned pneumonitis as an associated cause of death were identified. The UCODs of these records reflect a pattern of underlying causes of death for deaths that involved pneumonitis. This pattern was used to inform the algorithm for redistributing deaths where the underlying cause was coded as pneumonitis. The indirect MCOD method was applied where the redistribution was one of the most commonly occurring causes of death, and no direct evidence was available.
- **Proportional redistribution to specified target causes(s)**—this method reassigns deaths across a range of target causes selected according to the existing distribution of underlying cause of death within that disease group, or expert advice or the GBD redistribution algorithms. This method has the advantage of being a conceptually simple approach, but may not be well customised to a particular redistribution code. Because of this, it was considered appropriate only for low-volume redistribution causes, and for those that were proportionately allocated by the GBD 2010 study where direct evidence was not available or where the indirect MCOD method was not suitable.

The expert panels for the disease groups assisted in identifying the direct evidence for redistribution causes and reviewed the application of the indirect MCOD and other redistribution approaches.

Applying the redistribution algorithms developed for the ABDS (using the methods described above) resulted in 85% of deaths identified for redistribution to be reassigned to other causes using empirical evidence (direct evidence, indirect MCOD or a mix of both) (see Appendix Table A4).

2.4 Calculating YLL

YLL is calculated by summing the number of deaths at each single year of age, multiplied by the remaining life expectancy at this age according to the reference life table.

The number of deaths with missing age was very low (less than 5 in 2011 and less than 10 in 2003). In these instances, the age at death was set to the median age for the underlying cause of death for that sex.

2.5 Converting injury YLL from external cause to nature of injury

Two reporting perspectives are used for injury burden: external cause and nature of injury. Information pertaining to both perspectives is available in the National Mortality Database: external cause is reported as the UCOD, while information about the nature of injuries contributing to the death may be recorded as associated causes of death (ACOD). As each death record comprises a single UCOD and potentially multiple ACODs, a hierarchical list of injuries was developed to map the burden by external cause (the UCOD) to a single nature of injury category (the ACOD). The injury hierarchy was modified from the New Zealand study, where injuries were ordered according to the likelihood of causing death based on the nature of the injury, prognosis and clinical knowledge of injury conditions.

In this study, the relationships between the external cause and the nature of injury were produced as age- and sex-specific matrixes and used to convert YLL by external cause to YLL by nature of injury. The mapping process maintains internal consistency.

3 Non-fatal burden

The key inputs for estimating YLD are a complete set of prevalence estimates for each disease and injury included in the disease and injury list and a set of disability weights indicating the health loss.

3.1 Morbidity data sources

Unlike mortality data, there is no single comprehensive and reliable source of data on the incidence, prevalence, severity and duration of all non-fatal health conditions. Instead, morbidity estimates were drawn from a wide variety of sources, and generally based on the best single source.

Potential sources for disease-specific morbidity data were required to have case definitions appropriate to the disease being analysed; to be relevant to the Australian population; and to be timely, accurate, reliable and credible. Where possible, national data sources, rather than sources relating to particular regions or subpopulations, were used.

Administrative data sources (for example, disease registers, hospitalisations) were evaluated for their level of ascertainment and coverage. Surveys were evaluated for their representativeness, potential selection bias and measurement bias (validity and reliability of measurement). Epidemiological studies were evaluated for the quality of their study design, their timeliness, credibility, representativeness and sources of bias or error.

All potential data sources (whether published or unpublished) were assessed for comparability, relevance and representativeness, currency, accuracy, validity, credibility and accessibility/timeliness. These criteria were incorporated into a quality indicator for each estimate. Appendix B provides a summary of the quality for non-fatal estimates.

3.2 Disease conceptual models, disability weights and severity distributions

For each disease, a conceptual model of health loss was developed, based on models of the natural history of the disease. The conceptual models were developed in conjunction with disease experts. In many cases, a conceptual model was based on similar ones used in previous burden of disease studies. Each model depicts the major sources of health loss (sequelae) caused by different severity levels and stages of a disease, then maps these to one or more disability weights via corresponding '*health states*'.

A health state reflects a combination of signs and symptoms that result in a certain amount of health loss, and is not necessarily specific to one particular disease. Each health state is associated with a disability weight reflecting the health loss experienced by a person while in that health state. The health states and disability weights used in the ABDS 2011 were drawn from the GBD 2013 (GBD 2013 Supplement, see Vos et al. 2015).

Each sequela may be mapped to one or more health states—multiple states often constitute a severity distribution for the sequela (for example, mild, moderate, severe) or disease progression (such as progression through the various cancer phases). Within each sequela, a person can only be in one health state at any given point in time.

The disability weight for the sequela is the weighted average of the constituent disability weights.

Where prevalence measures were not available (such as long-term sequelae for injuries and congenital abnormalities), DISMOD-II was used to produce estimates from incidence, mortality, case fatality and duration.

DISMOD II is a freely available statistical software tool that is commonly used in burden of disease studies to calculate missing epidemiological estimates or to refine them. It requires epidemiological estimates (such as measures of incidence, prevalence, remission and mortality) as inputs to calculate related epidemiological measures. For example, to estimate the prevalence of the long-term sequelae of injury, estimates were available for the incidence, remission of the injury sequelae and mortality (in this case, the mortality rate ratio). Using these measures as inputs, DISMOD II produces an estimate of prevalence that is consistent with the input parameters.

3.3 Comorbidity bias adjustment

Comorbidity (the existence of more than one disease or injury in an individual at the same time) introduces a potential challenge for burden of disease analysis. As the available prevalence data and disability weights represent the situation without regard to comorbidity, summing YLD estimates on them without adjustment would lead to an overestimation of the overall non-fatal burden. The unadjusted health loss from some combinations of comorbid causes might even be greater than 1 (that is, worse than death). A method is therefore required to correct for the comorbidity bias.

The ABDS 2011 has not attempted to compile data on the pattern of actual comorbidity within the population. Instead, it addressed the comorbidity bias in the calculated YLD by adopting the two key assumptions used in burden of disease studies: the multiplicative independence model for prevalences of comorbidity, and the multiplicative model for health losses /disability weights associated with comorbidity. It then applied a modified deterministic approach where all possible combinations of four or fewer conditions are taken from the cause sequelae list.

Under this approach, the prevalence rate for a particular condition is a proxy for the probability of an individual's having that particular condition. The probability of having just one condition is calculated by multiplying the probability of having the condition by the probabilities of not having any other

condition(s). Similarly, the probability of having a particular combination is calculated by multiplying the probabilities of having each condition by the probabilities of not having any others.

Because of the multiplicative approach, the probabilities associated with each combination shrink rapidly toward zero (0) as the number of co-present sequelae rises. Capping the number of sequelae at four accounts for nearly all change in the associated disability weights. The impact of any change on the calculated YLD of the fifth co-present sequelae is minimal because the comorbidity bias adjusted disability weight is stable to the fifth decimal point. Any change in the fifth decimal place will only impact the YLD calculated for prevalence estimates greater than 100,000 in a particular age–sex cohort.

The model calculates an adjusted disability weight using all possible combinations of one to four simultaneous conditions drawn from the 700 conditions. Box A1 shows the calculation of the adjusted disability weight for a condition using all combinations of two of four conditions as an example.

Box A1: Calculation of an adjusted disability weight

Consider the calculation of the adjusted disability weight for a condition using all combinations of 2 of 4 conditions. Each of the 4 conditions (A–D) has a prevalence rate and an associated disability weight, specified by the following parameters:

4 conditions:	*A*	*B*	*C*	*D*
4 disability weights:	$DW_{(A)}$	$DW_{(B)}$	$DW_{(C)}$	$DW_{(D)}$
4 prevalence rates:	Pr(*A*)	Pr(*B*)	Pr(*C*)	Pr(*D*)

Calculate the probability that a person will have a combination of 2 or fewer conditions, including condition *A*.

The probability of a person in the population having condition *A* is approximated by the prevalence rate of condition *A* denoted as Pr(*A*).

The probability of a person in the population having only condition *A* is the probability of having condition *A* multiplied by the probability of not having condition *B*, *C* or *D* and is shown by:

$$Prob(A) = Pr(A)*(1-Pr(B))*(1-Pr(C))*(1-(Pr(D)).$$

It follows that the probability of having *A* and *B* only is given by:

$$Prob(AB) = Pr(A)*Pr(B)*(1-Pr(C))*(1-(Pr(D))$$

and, similarly, the probability of *A* and *C* only is given by

$$Prob(AC) = Pr(A)*Pr(C)*(1-Pr(B))*(1-(Pr(D))$$

and the probability of *A* and *D* only is given by

$$Prob(AD) = Pr(A)*Pr(D)*(1-Pr(B))*(1-(Pr(C)).$$

Combine disability weights:

The disability weight associated with having condition *A* only is shown as $DW_{(A)}$. Using the multiplicative method of combining disability weights, the DW for *A* and *B* combined is:

$$DW_{(AB)} = 1-[(1-DW_{(A)})(1-DW_{(B)})].$$

The proportion of this combined disability weight that can be attributed to condition *A* is:

$$Prob(A)/(Prob(A)+Prob(B)).$$

continued

Box A1 (continued): Calculation of an adjusted disability weight

Therefore, the disability weight associated with condition *A* from the population with both conditions (*A* and *B*) is given by:

$$DW_{(AB\_A)} = Prob(A)/(Prob(A)+Prob(B))* DW_{(AB)}$$

and the disability weight associated with condition *B* from the population with both conditions (*A* and *B*) is given by:

$$DW_{(AB\_B)} = Prob(B)/(Prob(A)+Prob(B))* DW_{(AB)}.$$

Adjust disability weight for condition A:

The comorbidity adjusted disability weight for condition *A* is a combination of the 4 adjusted disability weights derived from all the possible combinations (that is, $DW_{(A)}$, $DW_{(AB\_A)}$, $DW_{(AC\_A)}$, $DW_{(AD\_A)}$. The contribution of each disability weight is proportional, derived from the probability of each combination. The comorbidity adjusted disability weight for condition *A* ($adjDW_{(A)}$) is calculated using the following formula:

$$adjDW_{(A)}=[(Prob(A)* DW_{(A)}) + (Prob(AB)* DW_{(AB\_A)}) + (Prob(AC)* DW_{(AC\_A)}) + (Prob(AD)* DW_{(AD\_A)})] / [Prob(A) + Prob(AB) + Prob(AC) + Prob(AD)]$$

3.4 Calculating YLD

YLD is calculated at the disease-sequela level (by age and sex) by multiplying the prevalence of the disease-sequela by its comorbidity adjusted disability weight.

Residual causes

Where the prevalence of the residual cause within a disease group cannot be ascertained from data or modelled directly, the YLD for the residual cause is calculated using the ratio of YLDs to YLLs estimated for other conditions in that disease group. This method was used to generate estimates for other cardiovascular, endocrine, gastrointestinal, infectious, congenital, kidney and neurological diseases.

4 Total burden of disease

4.1 Calculating burden of disease measures

The DALY for each condition is calculated by summing the YLL and YLD for that condition. The total burden of diseased is calculated by summing DALY across all conditions.

5 Risk factors

Quantification of the impact of risk factors assists in making evidence-based decisions about where to direct efforts to improve population health and prevent disease and injury. The comparative risk assessment methodology has become standard practice in burden of disease risk factor analysis globally.

This section describes the method used to quantify the impact of risk factors in the ABDS 2011.

5.1 Risk outcome pairs

A risk–outcome pair associates a condition in the cause list with a known risk factor for that condition. For example, high fasting plasma glucose is a risk factor for diabetes, ischaemic heart disease, cerebrovascular disease and chronic kidney disease. In this report, this is described as diseases or injuries 'linked to' that risk factor. Thus, high fasting plasma glucose and diabetes constitute a risk–outcome pair; high glucose and ischaemic heart disease constitute another pair.

The risk factors selected for inclusion in the study are shown in Table 6.1.

For those risk factors selected for inclusion in this study, the ABDS 2011 has adopted the available relevant risk–outcome pairs used in the GBD 2010 (US Burden of Disease Collaborators 2013). Sun exposure was added to the ABDS risk factors after consulting Australian experts.

The risk–outcome pairs were spread across 13 disease groups. Some risk factors had only a single disease risk–outcome pair, while other had many outcomes within these disease groups.

5.2 Population distribution of exposure

A clear and consistent definition of risk factor exposure is a key requirement for estimating the proportion of the population 'at risk.' For the ABDS 2011, the definitions of risk factor exposures have been adopted where possible from the GBD 2010 (Lim et al. 2012).

Estimates of Australian and Indigenous population distributions of risk factor exposure by age and sex have been based on a variety of data sources:

- Australian Health Survey 2011–12
- National Drug Strategy Household Survey 2010
- ABS apparent consumption of alcohol data
- Kirby Institute annual surveillance reports
- National HIV Register
- AIHW Cancer Registry
- State-based air monitoring stations
- National Homicide Monitoring Program
- ABS Personal Safety Survey 2012.

For the ABDS 2011 study, empirical survey data were used where possible to determine the exposure to risk factors. The proportion of the population exposed to each risk factor was estimated in accordance with the finest exposure increments supported by the data source.

Where data were extracted directly from a survey (for example, Australian Health Survey 2011–12), they were extracted so that the relative standard error for the majority of cells was 25% or less. In some cases, sex, age groups or exposure categories were aggregated into larger cells to conform to this principle; however, for a small number of age–sex categories, it was necessary to accept estimates with relative standard errors between 25% and 50%.

5.3 Estimates of effect size (relative risks)

Burden of disease studies use relative risks to measure the strength of causal association between risk factors and the linked disease outcomes. The ABDS 2011 has adopted relative risks released by the GBD

2010 except when they are inappropriate or not available (US Burden of Disease Collaborators 2013). The relative risks used were appropriate for the United States of America.

Some relative risks for dietary risk factors were sourced from the GBD 2013 but only for diseases linked in the GBD 2010 (GBD 2013 Risk Factors Collaborators 2015). No additional linked diseases were included from the GDB 2013 because the timing of the release of this report was too late for inclusion in this study. The relative risks for injuries linked to alcohol use were from Taylor et al. (2010).

The relative risks from the GBD 2010 for infectious diseases such as hepatitis C, hepatitis B, HIV/AIDS and tuberculosis were not considered appropriate for Australia because control mechanisms exist for these conditions. There is also direct evidence data available from the Kirby Institute that details the number of cases of these conditions caused by the risk factor (unsafe sex or drug use) (The Kirby Institute 2012). These data were used directly to inform estimates of effect size instead of the comparative risk assessment method.

Direct evidence from the National Homicide Monitoring Program (Bryant & Cussen 2015) was used for homicides linked to intimate partner violence. Further work is being undertaken by the AIHW to review and refine the risk outcome pairs and estimates of effect sizes used to measure attributable burden due to exposure to intimate partner violence in Australian women.

Effect sizes used in the GBD 2010 were adjusted for confounders ('parallel' risk factors) but not for factors that occur 'serially' along the causal pathway. For example, relative risk of ischaemic heart disease due to physical inactivity was not adjusted for high blood pressure as these occur along the same causal pathway; this means that their effects cannot be added together, as discussed in chapter 6.

The relevant relative risk applied to each exposure category was determined as the relative risk for the mean of each category. For example, for the proportion of the population that had a diet in the category of 80 to 120 g of fruit, the relative risk for 100 g was applied. When the exposure category included a range, the limit of exposure was used. For example, for the proportion of the population that had a diet in the category of 400+ g of fruit, the relative risk for 400 g was applied.

5.4 Theoretical minimum risk exposure distribution

The estimated contribution of a risk factor to disease burden is calculated by comparing the observed risk factor distribution with an alternative, hypothetical distribution (the counterfactual scenario). This scenario could be an increase or decrease in levels of exposure or changes in behaviour compared with what is currently observed in the population. In the ABDS 2011, as in previous burden of disease studies, a TMRED scenario was adopted. This involved determining the hypothetical exposure distribution that would lead to the lowest conceivable disease burden.

The TMREDs developed as part of the GBD 2010 study have been adopted for the ABDS 2011 (Lim et al. 2012); except for a diet high in sodium, where a higher TMRED was used (1.6 g instead of 1 g), based on new evidence in the literature and advice from nutrition experts.

A panel of nutrition experts provided advice on an appropriate TMRED for this risk factor. Additionally, the TMRED for low bone mineral density was adopted from the more recent GBD 2013 (US Burden of Disease Collaborators 2013).

For some risk factors, the TMRED is a range, such as fasting blood plasma glucose 4.9 to 5.3 mmol/L. In this situation, the range of the level of exposure is compared with its relative position in the range of the TMRED. The level of exposure is then adjusted to incorporate the range of TMRED. For example, the units of

fasting blood plasma glucose exposure are adjusted by 0.4 at the highest level of exposure (10 to 9.62) and by only 0.035 at the lowest level of exposure (3.1 to 3.065) in the population extracted from the survey.

5.5 Calculation of population attributable fractions

PAFs determine the proportion of a particular disease that could have potentially been avoided if the population had never been exposed to a risk factor (or, rather, had been exposed to TMRED levels). The calculation of PAFs requires the input of the relative risk (*RR*) and prevalence of exposure in the population (*P*):

$$PAF = \frac{P(RR-1)}{P(RR-1)+1} \times 100$$

When the risk factor has multiple categories of relative risks and exposure levels, the following formula is used:

$$PAF = \frac{\Sigma_c P_c(RR_c-1)}{\Sigma_c P_c(RR_c-1)+1} \times 100$$

where

c= an index for category, *P*= prevalence and *RR* = relative risk.

The percentage change in *median age-adjusted PAF* is calculated by weighting the age and sex-specific PAF for each risk factor and linked disease by the 2001 population. The median PAF from all the linked disease PAFs is determined for each risk factor. The percentage change from 2003 to 2011 for this median PAF is then calculated.

The PAFs for sun exposure were calculated by collaborating experts Robyn Lucas and Fan Xiang from the National Centre for Epidemiology and the Australian National University. The PAF from melanoma that was appropriate for Australia was advised to be the upper estimate of 0.9 from the global study on the burden of disease from solar ultraviolet radiation (Lucas et al. 2006). The squamous cell carcinoma and basal cell carcinoma population attributable fractions were calculated using the comparative risk assessment approach based on levels of UV exposure in Australia.

5.6 Combined risk factor analysis

To combine risk factors the following formula was used:

$PAF = 1 - \Pi(1 - PAF_r)$

where

PAF is the population attributable fraction of burden attributable to a disease from all risk factors

PAF_r is the population attributable fraction for risk factor '*r*' and linked disease

the product Π runs over all risk factors within the cluster.

This formula, which has been used in several other studies, has the desirable property of placing a cap on the estimated combined attributable burden and therefore avoids the possibility of its ever exceeding 100% of the total burden of disease.

However, the formula assumes that risk factors are 'independent'; it does not take into account risk factors that are in the same causal pathway. To adjust for this, adjustment factor of 50% was used (as specified by the WHO) for risk factors that are secondary to other factors in the same causal pathway (Ezzati et al. 2004). For example, to reflect the causal pathway of high intake of sweetened beverages increasing the

risk of high body mass (which, in turn, increases the risk of diabetes), the PAF for high body mass causing diabetes is attenuated by 50%.

6 Overarching methodologies/choices

6.1 Reference year

The reference year for the estimates is 2011.

This is the latest year of data available at the time of analysis for the majority of data sources used to produce burden of disease estimates.

Where data were not available for the reference year from a particular data source, techniques were used to adjust the counts or rates to the reference year. The first step was to examine historical data over a number of years (if available) to determine whether prevalence rates have changed over time. If so, regression techniques were used to model the data point to the reference year. Where this was not possible, or where an examination of historical data suggested that prevalence rates had been stable over the intervening period, the historical data were used without an adjustment for reference period.

6.2 Age groups

Analysis of age groups

Preparation of input data was undertaken using as fine a disaggregation as the data supported. Analysis of YLL estimates was undertaken using single-year age groups, while YLD analysis was undertaken using 5-year age groups to 100+. DALY estimates were prepared using 5-year age groups to 100+.

Where data could not be obtained directly by single year or by the 5-year age groups as required for analysis, modelling was used to derive the required age groups.

Due to small populations in some jurisdictions and remoteness areas, sub-national estimates were prepared using 5-year age groups to age 85+.

Reporting of age groups

Age groups suitable for reporting are different for different aspects of the study. Generally, national estimates for 2003 and 2011 have been reported using the analysis age groups, or grouped for issues of practicality (such as describing burden by life stage). While numbers and rates are reported for older age groups (that is, age groups over 85), it should be noted that these are based on much smaller populations and hence are subject to greater variability.

6.3 Sub-national analyses

Analysis for state and territory, remoteness and socioeconomic group was carried out by geographical areas. Where the data source included the geographical information based on the Australian Statistical Geography Standard 2011, estimates were derived using ABS correspondence based on geographic location. Where geographical information was not available, ratios based on associated data sources were used to disaggregate national data.

6.4 Reference populations

All Australian population-based rates are calculated using populations rebased to the 2011 Census (released 20 June 2013). The Australian 2001 Standard Population (published 20 June 2013) is used for all age-standardisation as per AIHW and ABS standards.

Table A1: Disease and injury list

Infectious diseases

Barmah Forest virus
Campylobacteriosis
Chlamydia
Dengue
Diphtheria
Gonorrhoea
HIV/AIDS
Haemophilus influenzae type-b
Hepatitis A
Hepatitis B (acute)
Hepatitis C (acute)
Influenza
Lower respiratory infections
Malaria
Measles
Meningococcal disease
Other gastrointestinal infections
Other infections
Other meningitis and encephalitis
Other sexually transmitted infections
Otitis media
Pertussis
Pneumococcal disease
Ross River virus
Rotavirus
Rubella
Salmonellosis
Syphilis
Tetanus
Trachoma
Tuberculosis
Upper respiratory infections
Varicella-zoster

Infant and congenital conditions

Birth trauma and asphyxia
Brain malformations
Cardiovascular defects
Cerebral palsy
Cleft lip and/or palate
Down syndrome
Gastrointestinal malformations
Neonatal infections

Infant and congenital conditions (continued)

Neural tube defects
Other chromosomal abnormalities
Other congenital conditions
Other disorders of infancy
Pre-term birth and low birthweight complications
Sudden infant death syndrome
Urogenital malformations

Cancer and other neoplasms

Benign and uncertain brain tumours
Bladder cancer
Bowel cancer
Brain and central nervous system cancer
Breast cancer
Cervical cancer
Ductal carcinoma in situ (breast)
Gallbladder cancer
Hodgkin lymphoma
Kidney cancer
Laryngeal cancer
Leukaemia
Liver cancer
Lung cancer
Melanoma of the skin
Mesothelioma
Mouth and pharyngeal cancer
Myeloma
Non-Hodgkin lymphoma
Non-melanoma skin cancer
Oesophageal cancer
Other benign, in situ and uncertain neoplasms
Other lymphohaematopoietic (blood) cancers
Other malignant neoplasms (cancers)
Ovarian cancer
Pancreatic cancer
Prostate cancer
Stomach cancer
Testicular cancer
Thyroid cancer
Unknown primary
Uterine cancer

Cardiovascular diseases

Aortic aneurysm
Atrial fibrillation and flutter
Cardiomyopathy
Coronary heart disease
Hypertensive heart disease
Inflammatory heart disease
Non-rheumatic valvular disease
Other cardiovascular diseases
Peripheral vascular disease
Rheumatic heart disease
Stroke

Respiratory diseases

Asthma
COPD
Interstitial lung disease
Other respiratory diseases
Pneumoconiosis
Sarcoidosis
Upper respiratory conditions

Gastrointestinal disorders

Abdominal wall hernia
Appendicitis
Chronic liver disease
Diverticulitis
Functional gastrointestinal disorders
Gallbladder and bile duct disease
Gastro oesophageal reflux disease
Gastroduodenal disorders
Inflammatory bowel disease
Intestinal obstruction (without hernia)
Other gastrointestinal diseases
Pancreatitis
Vascular disorders of intestine

Neurological conditions

Dementia
Epilepsy
Guillain-Barré syndrome
Migraine
Motor neurone disease
Multiple sclerosis
Other neurological conditions
Parkinson disease

Table A1 (continued): Disease and injury list

Mental and substance use disorders

Alcohol use disorders
Anxiety disorders
Attention deficit hyperactivity disorder
Autism spectrum disorders
Bipolar affective disorder
Conduct disorder
Depressive disorders
Drug use disorders (excluding alcohol)
Eating disorders
Intellectual disability
Other mental and substance use disorders
Schizophrenia

Endocrine disorders

Diabetes
Other endocrine disorders

Kidney and urinary diseases

Chronic kidney disease
Enlarged prostate
Kidney stones
Other kidney and urinary diseases

Reproductive and maternal conditions

Early pregnancy loss
Endometriosis
Genital prolapse
Gestational diabetes
Hypertensive disorders of pregnancy
Infertility
Maternal haemorrhage
Maternal infections
Obstructed labour
Other maternal conditions
Other reproductive conditions
Polycystic ovarian syndrome
Uterine fibroids

Musculoskeletal conditions

Back pain and problems
Gout
Osteoarthritis
Other musculoskeletal
Rheumatoid arthritis

Hearing and vision disorders

Hearing loss
Other hearing and vestibular disorders
Other vision disorders
Vision loss

Skin disorders

Acne
Dermatitis and eczema
Other skin disorders
Psoriasis
Skin infections (including cellulitis)
Ulcers

Oral disorders

Dental caries
Other oral disorders
Periodontal disease
Severe tooth loss

Blood and metabolic disorders

Cystic fibrosis
Haemolytic anaemias
Haemophilia
Iron-deficiency anaemia
Other blood and metabolic disorders
Protein-energy deficiency

External causes of Injury

All other external causes of injury
Drowning
Falls
Fire, burns and scalds
Homicide and violence
Other land transport injuries
Other road traffic injuries
Other unintentional injuries
Poisoning
Road traffic injuries – motor vehicle occupants
Road traffic injuries – motorcyclists
Suicide and self-inflicted injuries

Nature of Injury

Burn injuries
Dislocations
Drowning and submersion injuries
Hip fracture
Humerus fracture
Internal and crush injury
Other fractures
Other injuries
Poisoning
Soft tissue injuries
Spinal cord injury
Tibia and ankle fracture
Traumatic brain injury

Table A2: Standard life table: remaining ideal life expectancy (years) by age for all people

Age	Life expectancy	Age	Life expectancy	Age	Life expectancy	Age	Life expectancy
0	86.02	27	59.43	54	33.32	81	10.32
1	85.21	28	58.44	55	32.38	82	9.65
2	84.22	29	57.45	56	31.47	83	8.98
3	83.23	30	56.46	57	30.55	84	8.31
4	82.24	31	55.48	58	29.64	85	7.64
5	81.25	32	54.49	59	28.73	86	7.12
6	80.25	33	53.50	60	27.81	87	6.61
7	79.26	34	52.52	61	26.91	88	6.09
8	78.26	35	51.53	62	26.00	89	5.57
9	77.27	36	50.56	63	25.10	90	5.05
10	76.27	37	49.58	64	24.20	91	4.70
11	75.28	38	48.60	65	23.29	92	4.35
12	74.28	39	47.62	66	22.42	93	4.00
13	73.29	40	46.64	67	21.55	94	3.66
14	72.29	41	45.67	68	20.68	95	3.31
15	71.29	42	44.71	69	19.80	96	3.09
16	70.30	43	43.74	70	18.93	97	2.88
17	69.32	44	42.77	71	18.10	98	2.66
18	68.33	45	41.80	72	17.28	99	2.44
19	67.34	46	40.85	73	16.45	100	2.23
20	66.35	47	39.90	74	15.62	101	2.11
21	65.36	48	38.95	75	14.80	102	1.99
22	64.37	49	38.00	76	14.04	103	1.87
23	63.38	50	37.05	77	13.27	104	1.75
24	62.39	51	36.12	78	12.51	105	1.63
25	61.40	52	35.19	79	11.75		
26	60.41	53	34.25	80	10.99		

Source: Murray et al. 2012b.

Table A3: ICD-10 codes used to identify deaths for redistribution

	ICD-10 codes
Redistribution	A40–A41 (excluding A40.3), A48.0, A48.3, B19, B94.2, C26, C76–C80, E85.3–E85.9, E86–E87, F99, G81–G83, H00.1, H01–H59, H60.2–H60.9, H61–H62, H67, H69, H71–H75, H80–H83, H90–H95, I10, I13, I15, I46, I49.0, I50, I70.9, J69, J96, K65–K66, K71.2, K92, L04, L21–L25, L27–L30, L41–L45, L52–L53, L55–L60, L63–L68, L70–L75, L80–L85, L87, L90–L92, L94, L98.0–L98.1, L98.8, L98.9, N17, N19, N51, N60–N61, N70–N73, N74.8, N84–N90, O94, Q10–Q18, Q38.1, Q54, Q65–Q74, Q82–Q84, Q89.9, Q99.9, R00–R94, R96–R99, X59, Y10–Y34, Y87.2, Y89.9, Y90–Y98

Table A4: Redistribution method for 2011 redistribution causes

Redistribution method	Per cent
Direct evidence	31.0
Mix of direct evidence and indirect MCOD	30.7
Indirect MCOD	22.9
Proportional	15.4
Total	**100.0**

Appendix B: How reliable are the estimates?

All estimates within the ABDS 2011 were produced using the best possible data that were available within the scope and time frame of the study.

A number of actions were undertaken to ensure the accuracy and relevance of the estimates in the ABDS:

- All standard inputs (such as the standard life table, disability weights and relative risks) were reviewed and assessed as appropriate by the study's Expert Advisory Group for relevance and applicability in the Australian context.
- All data used in the ABDS were required to meet strict inclusion criteria via protocols endorsed by the study's Expert Advisory Group.
- All models and inputs used in YLL and YLD estimates were reviewed by disease-specific experts and other experts to ensure their appropriateness for Australia. Methods for particular risk factors were also reviewed by experts.
- A quality index was produced to assist the user to interpret the reliability of estimates within this framework.

ABDS 2011 Quality Index

Uncertainty (or confidence) intervals —used to describe the reliability of estimates in some burden of disease studies—have not been produced for this study, largely due to the variety of sources of error: in data sources, in conceptual models and in assumptions underpinning the estimates. These are not straightforward to quantify and this was not within the scope of this project.

Instead of uncertainty intervals, guidance is provided to help users understand the quality and limitations of the estimates, especially which patterns and differences are most plausible and those which may reflect errors or uncertainties in the data or methods. This guidance is provided using a two-dimensional *quality index* based on:

- the relevance and quality of the source data, and
- the methods used to transform that data into a form required for this analysis.

The quality index operates at the disease or risk factor level, and is applied to the YLD, YLL, DALY and attributable burden for the 2011 national estimates. The index is built from the lowest level of estimate using these two dimensions, weighted for the contribution to the overall disease level estimate or risk-factor level estimate.

Generally, the higher the index, the more relevant and accurate the estimate. The ratings are interpreted as follows:

- A–B: highly relevant/accurate: estimate is derived from comprehensive and highly relevant data/little data transformation was required. The estimates can be considered to be highly indicative of the health loss incurred from these diseases or risk factors.
- C–D: moderately relevant/accurate: estimate is derived from reasonably comprehensive and relevant data/moderate transformations required, taking into account known trends in the underlying data

(such as over time or age-distributions). These estimates can be considered to be moderately indicative of the health loss experienced in Australia in 2011 due to these conditions or risk factors.

- E: questionable relevance/accuracy: estimate is derived from less comprehensive or relevant data/moderate transformations required with trends unknown or unaccounted for. These estimates are to be considered as possibly indicative of the health loss in Australia in 2011, and should be used with some caution.

More detailed information on the ABDS Quality Index, and the criteria and methods used, will be provided in a separate technical report expected to be available in mid 2016.

Fatal burden estimates

Using the ABDS Quality Index, all mortality data, and hence all YLL estimates, are considered relevant and accurate and highly indicative of the years of life lost due to these diseases. One exception to this is fatal injury burden by nature of injury, as inury-related deaths are classified by the external cause; subsequent mapping is required to estimate fatal burden by nature.

Fatal estimates account for around 50% of total DALY.

Non-fatal burden estimates

YLD estimates, which also account for around 50% of total DALY, vary in quality because there is no single comprehensive and reliable source of data on the incidence, prevalence, severity and duration of all non-fatal health conditions. The currency, generalisability and specificity of the data also varied, depending on the source.

YLD estimates for most of the major specific causes are considered relevant and accurate.

Relevance and quality of data sources

Nearly two-thirds (64%) of diseases (accounting for 74% of YLD) predominantly derived YLD from diagnostically confirmed data disease registers, administrative data or national surveys, that were either fully enumerated (or with known gaps in coverage), current and specific to both the disease (or sequela) in question and the population. This includes most cancer, cardiovascular, musculoskeletal, injuries, gastrointestinal, kidney & urinary and blood & metabolic estimates, and a large number of infections, mental & substance use and reproductive & maternal conditions.

A further 20% of diseases (accounting for 10% of YLD) predominantly derived YLD either from:

- diagnostically confirmed data disease registers, administrative data or national surveys of medium currency/coverage and/or specificity to both the disease (or sequela) in question and the population, or
- systematic and generalisable meta-analyses of Australian data, or
- small area Australian (or generalisable international) studies with good sampling.

The diseases that predominantly derived YLD by these means includes diabetes and dementia, and most of the remaining infectious and infant & congenital diseases.

Only 1.7% of causes (<1% total YLD) were predominantly derived from data that were of questionable quality. This included small Australian studies more than 5 years old, or international studies of questionable generalisability to the Australian context; or indirectly from secondary data sources. This included Parkinson disease, benign & uncertain brain tumours, and other respiratory diseases.

Methods of transformation to overcome data shortcomings

More than half (56%) of diseases estimated (accounting for 50% of YLD) could be derived with no transformation required or using known trends (for example, over time). A further 29% (accounting for 43% of YLD) needed to be derived from data where trends were unknown. A small proportion (11% of diseases, accounting for 5.5% of YLD) relied on deriving prevalence based on other epidemiological measures, or indirect methods from other (related) data sources. Only 4% of diseases (2.4% of YLD) relied on indirect modelling methods or inferences of distributions from other (unrelated) data sources or expert advice.

Table B1: Rating of data relevance, quality and transformation methods for YLD estimates

	Data relevance and quality		Method of transformation	
Rating	**% of diseases**	**% of YLD**	**% of diseases**	**% of YLD**
A	39.4	7.8	20.0	27.0
B	25.0	66.0	35.6	22.6
C	20.0	9.9	29.4	42.5
D	13.9	15.6	11.1	5.5
E	1.7	0.7	3.9	2.4

Risk factor estimates

It is only possible to assess the quality of data used to estimate exposure to the risk factors in Australia. The other inputs for this work, such as the relative risk data and TMREDs were adopted from the GBD 2010, which independently systematically reviewed and calculated appropriate relative risks and TMREDs.

Risk factor exposure is estimated using robust national measured survey data for 86% of risk factors—this accounts for 96% of the attributable DALY.

For 90% of risk factors (accounting for 92% of attributable DALY), exposure was able to be derived with no transformation required or using known trends.

It is important to note that the quality of the attributable DALY for each risk factor depends on the quality of the estimate of the linked diseases, and the proportion attributable to YLL or YLD.

Table B2: Rating of data relevance, quality and transformation methods for risk factor estimates

	Data relevance and quality		Method of transformation	
Rating	**% of risk factors**	**% of DALY**	**% of risk factors**	**% of DALY**
A	79.3	82.7	10.3	27.8
B	6.9	13.2	79.3	63.8
C	6.9	2.3	10.3	8.4
D	6.9	1.7	0.0	0.0
E	0.0	0.0	0.0	0.0

Older age groups

Care should also be taken when comparing disease level information in age groups over 85 years. Data for this population is often limited, leading to greater variability.

Key data gaps

A key data source for the non-fatal burden was national hospitalisation data, particularly for admitted patient care. While this is a highly accurate and reliable source, the inability to link the separate admissions for individuals has been a barrier when calculating the best estimates for chronic conditions (for example, cardiovascular diseases, chronic liver disease, injuries). This data gap has been overcome by using disease-specific data provided by the Western Australian Department of Health, using linked hospital data applied to the national hospital data; however, estimates could be greatly improved if similarly linked national hospital data were available.

Similarly, for conditions with long-term effects post-hospitalisation, such as epilepsy and liver transplants, prevalence estimates were often obtained from Western Australian hospitals data linked with deaths data, and rates applied to national populations. Linked national hospitals and deaths data would greatly improve the accuracy of such estimates.

The data for injuries prevalence are fragmented. For non-fatal burden, admitted cases were sourced from the national hospital admissions. A national data source was used for assessing non-admitted (emergency care) cases of injury; however, only a portion of the data were usable due to the use of different classifications to describe the injury diagnoses.

There are also a small number of conditions for which little or no Australian data were available (for example, peripheral vascular disease, inflammatory bowel disease, dementia and Parkinson disease). In these situations, estimates rely on small area Australian studies, or studies from similar countries. Further research into these areas to provide broader, Australian-specific results would increase the reliability of these estimates.

Appendix C: Understanding and using burden of disease estimates

This appendix provides guidance on using and interpreting estimates published in this report.

Different types of estimates presented in this report

There are a number of different estimates produced by a burden of disease study, which are useful for different purposes.

- DALY, YLD and YLL estimates provide a measure of health loss and describe the overall disease burden in the population being analysed. They are useful for summarising the health of that population at a point in time, and for assessing health-care needs and planning health services.
- Crude rates of DALY, YLL and YLD provide a measure of health loss against the size of the population, but without taking any other features of the population into account. These are useful for measuring the *relative* impact in one age group compared with another by describing the amount of health loss relative to the size of the age group. They are also useful for assessing health-care needs and planning health services.
- The ASR of DALY, YLL and YLD also provide a measure of the health loss against the size of the population, but take into account the age structure of the population. ASR have little use in service provision planning, but are useful for comparing the impact of various diseases between two populations with different age structures (for example, males and females) or between two different time points (for example, 2003 and 2011).

As with many other statistics, it is comparisons (between diseases, across population groups, across time), rather than single estimates, that are the most useful. Comparisons are often done using rate ratios and rate differences. A rate ratio shows how many times the rate of burden is relative to another, while a rate difference shows the difference between one rate and another. For example, when analysing age-standardised DALY rates of males compared with females, a rate ratio of 1.0 indicates that the burden in males and females is the same; a rate higher than 1.0, that the burden is higher among males; and a rate lower than 1.0, that the burden is lower among males. For example, a rate ratio of 1.6 means that the age-standardised DALY rate for males is 1.6 times or 60% higher than that for females.

Both rate ratios and rate differences are useful and have complementary value.

Levels of reporting and alternative reporting categories

Estimates in this study are calculated for individual conditions (for example, lung cancer, anxiety, chronic kidney disease, epilepsy, hip fracture). For some aspects of reporting, conditions that have a similar aetiology, outcomes or treatment are grouped together—generally according to ICD-10 classifications—into 17 *disease groups*. For ease of recognition in this publication, each disease group has been allocated a colour—these are used consistently throughout each overview chapter to identify a disease grouping.

Diseases are grouped in this study to reflect the Australian health context (that is, to meet health reporting and monitoring needs) while also informing policy setting, health planning and research. These

groupings may not suit all users. Alternative groupings of individual diseases are possible—these are not included in this report but can be the subject of future analyses.

It is important to be aware that some disease groups—such as injuries, infections and cancer & other neoplasms—are made up of a large number of separate diseases or injuries, while others—such as endocrine and oral disorders—include only a few specific conditions. Ranking by disease group and ranking by individual conditions may present different stories. For example, cancer is the disease group causing the most burden, but coronary heart disease (within the cardiovascular disease group) is the specific disease causing the most burden. This is not an anomaly—it reflects the level of reporting and the choice in how the disease group level is constructed. It is important to use the level of reporting that is most suited to a specific purpose.

In this report, YLL, YLD and DALY estimates are presented at three levels, each having a different purpose and audience:

- **Overall burden:** for presenting a picture of the overall health of the population at a given point in time, including age and sex differences, regardless of the disease.
- **Disease group** level: for understanding the broad patterns in the types of diseases causing health loss in the population. The collective impact of diseases of broadly similar cause assists in identifying large interrelated areas of health loss that might otherwise go unquantified (especially for the rarer and less prevalent diseases—such as blood & metabolic disorders). This is important for broad policy and research setting as well as for advocacy. There are 17 disease groups in the ABDS 2011.
- **Disease** level: for a more detailed picture of the diseases and injuries that give rise to burden. These represent individual diseases (such as appendicitis, Parkinson disease), or finer aggregations of related diseases (such as gastrointestinal infections [which include salmonella and campylobacter] or dementia [which includes Alzheimer disease as well as other dementias]). Diseases at this level have been chosen to be as policy-relevant as possible, subject to the constraints of data availability. Disease-level estimates are useful for detailed policy setting and research. Burden was estimated for nearly 200 diseases.

Comparing life lost in burden of disease studies with other measures of premature mortality

Different measures are used to highlight the impact of dying prematurely; however, the notion of 'premature' in relation to mortality can be arbitrary. Two of the most commonly used summary measures to describe premature mortality are YLL (as used in burden of disease studies) and potential YLL.

YLL in burden of disease studies assume a potential number of remaining years according to a *life table* (see Appendix Table A2). A life table specifies, for each age, a number of years that, on average, a person could potentially live—the life expectancy. For example, the standard life table from the Global Burden of Disease 2010 and 2013 studies (as used in this study) specifies that a person aged under 1 could potentially live 86.0 more years; a person aged 65, 23.3 more years; and a person aged 100, 2.2 more years. YLL is calculated by summing the number of deaths at each age multiplied by the remaining life expectancy for that age. In this measure, all deaths in a population are counted and accrue some lost years of life.

Potential years of life lost (PYLL), a simpler measure, specifies an *arbitrary age cut-off* to identify early deaths; that is, deaths occurring before the specified age are considered premature. For example, a recent AIHW report describes PYLL for deaths occurring before age 75 (AIHW 2015c). Using this parameter, death

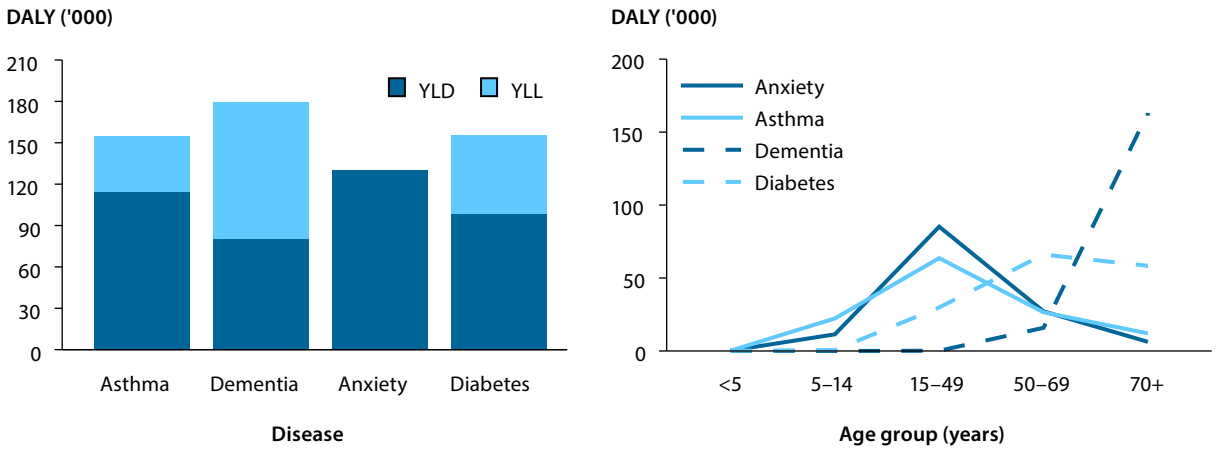
of an infant (aged under 1) loses 75 years of life; death of a person aged 65, 10 years. The death of a person aged over 75 would not be counted in this measure.

Both summary measures provide a means of assessing premature death. YLL, based on all deaths in a population, describes early death according to the life expectancy at each age of death. It uses the same metric as the YLD—a count of the number of years lost. In burden of disease studies, this enables combining measures of fatal and non-fatal effects into a summary measure of health, the DALY. PYLL, on the other hand, considers deaths only within a population younger than the specified age cut-off. In contrast to YLL, it tends to more strongly reflect the magnitude and causes of death that typically affect the younger population.

Interpreting estimates

Interpreting and comparing DALY estimates

When interpreting DALY estimates, it is often useful to look at the relative contribution of each condition to the overall health loss, or the relative contributions of fatal and non-fatal health loss for a given condition to gain a picture of a population's health. As a DALY is made up of YLL and YLD, diseases can have very similar DALY estimates, but tell very different stories regarding the relative contribution of YLL and YLD. For example, asthma, dementia, anxiety disorders and diabetes all have a similar number of DALY—but the contribution of fatal and non-fatal burden is quite different, as are the ages at which these diseases affect people (see Figure C1).



Source: AIHW analysis of Australian estimates in the GBD 2013 (IHME 2015), 2013.

Figure C1: Example of different DALY stories

Interpreting and comparing risk factor estimates

Risk factor analysis allows us to estimate how much the disease burden could be reduced if exposure to the risk factor were at or below the theoretical minimum level. Exposure to harmful levels of a risk factor can contribute to deaths and/or ill health resulting from one or more diseases. The estimates are presented in the following forms:

- the number of DALY that can be attributed to exposure to each risk factor. This 'attributable burden' is useful for gauging the contribution of each risk factor
- the proportion of disease DALY, disease group DALY or total DALY that can be attributed to the risk factor. This is a useful way of relating the contribution of each risk factor to the burden of the linked diseases, disease groups or to the total burden
- the age-specific rate of DALY attributable to a risk factor. Such a rate is used to compare the relative contribution of the risk in one age group with that of another, by depicting the amount of health loss relative to the size of each age group
- the ASR attributable to a risk factor. Such a rate also provides a relative measure of the health loss against the size of the population, but takes into account the age structure of the population. This allows comparison of estimates between 2003 and 2011.

Exposure to some risk factors is known to cause both ill health *and* death while exposure to other risk factors may be associated only with ill health *or* death. This affects the patterns of attributable YLL and YLD across the risk factors and linked diseases.

DALY attributable to a risk factor may also vary by age and sex. These variations may be caused by age and sex differences in:

- amounts of exposure to the risk factor
- the degree of increased risk of the linked disease due to exposure to the risk factor (relative risk)
- patterns of DALY, YLL, YLD for the linked diseases.

Estimates of attributable burden for the different risk factors cannot be simply added together without further analysis due to complex pathways and interactions between them. This analysis has been undertaken for all risk factors included in this report combined, and it underpins, for example, estimates of combined burden attributable to disease groups.

Interpreting rankings

Rankings are often used to tell the story of which disease or injury causes the biggest burden. However, rankings do not provide the reader with context of the size of each estimate, nor of the difference between adjacent estimates.

Further, the rankings in this report are specific to the level of reporting, as reporting rankings at different levels can be misperceived. For example, as a group, cancer ranks ahead of cardiovascular conditions for both men and women. This is because the cancer group is made up many different cancer types, some of which have a very high burden. At the individual disease level, however, both coronary heart disease and stroke (part of the cardiovascular disease group) rank ahead of breast cancer and lung cancer in women, and coronary heart disease ranks ahead of lung cancer in men. Misperception can arise easily so rankings should be interpreted with care.

Comparing with estimates from other studies

As a general rule, due to the large variety of data sources, possible disease models, assumptions and concepts of 'ideal health', the DALY, YLL and YLD estimates from different studies should not be compared.

For comparing the Australian burden with the burden of other countries, the AIHW recommends using the Australian estimates reported in either the most recent Global Burden of Disease Study (GBD 2013) or the Global Health Estimates produced by the WHO.

Which estimate is 'right'?—interpreting multiple results

There are a number of current burden of disease estimates for Australia. As DALY are the final output of a complex set of models and assumptions, there is no 'right' answer. Global studies are designed to enable comparability across countries and need to account for a large variation in the data availability and quality across countries. Country-based studies (such as the ABDS) are more likely to be designed to meet local needs and use detailed local data. When faced with more than one set of estimates, it is important to understand the data sources and assumptions behind the estimates, and use the set that most closely matches its purpose and user needs.

Box C1: Dos and don'ts of using burden of disease estimates in this study

Do

- Use estimates to compare health loss between different diseases, groups of diseases, risk factors or population groups in this study.
- Look beyond the ranking to understand the level of impact of a disease.
- Look beyond the DALY estimate to YLL and YLD to understand the estimate better.
- Be careful comparing groups of diseases with individual diseases.
- Make sure you understand what is being measured and assumptions that have been used.

Don't

- Compare YLL, YLD, DALY estimates from different burden of disease studies.
- Add together the unadjusted attributable YLL, YLD and DALY estimates across risk factors.
- Compare measures of mortality in this study with measures reported elsewhere, as burden of disease methods and grouping of causes are different from those used in other studies.

What can estimates from 2011 tell us about 2016?

The estimates in this report are for 2011, the common year that best reflects data availability from our main data sources—mortality, hospitals, disease registers and the latest Australian Health Survey—that were available to be analysed for this study.

Many factors influence health so it is difficult to project what might happen between 2011 and 2016. Some diseases, particularly chronic diseases such as cancer and musculoskeletal conditions, are relatively stable over short periods of time, and are influenced primarily by changes in the population, while episodic diseases such as infections can vary considerably from year to year. As the majority of the burden in Australia is from chronic diseases, it is likely that most of the patterns described here for the 2011 year are fairly generalisable to 2016.

Appendix D: Additional tables and figures

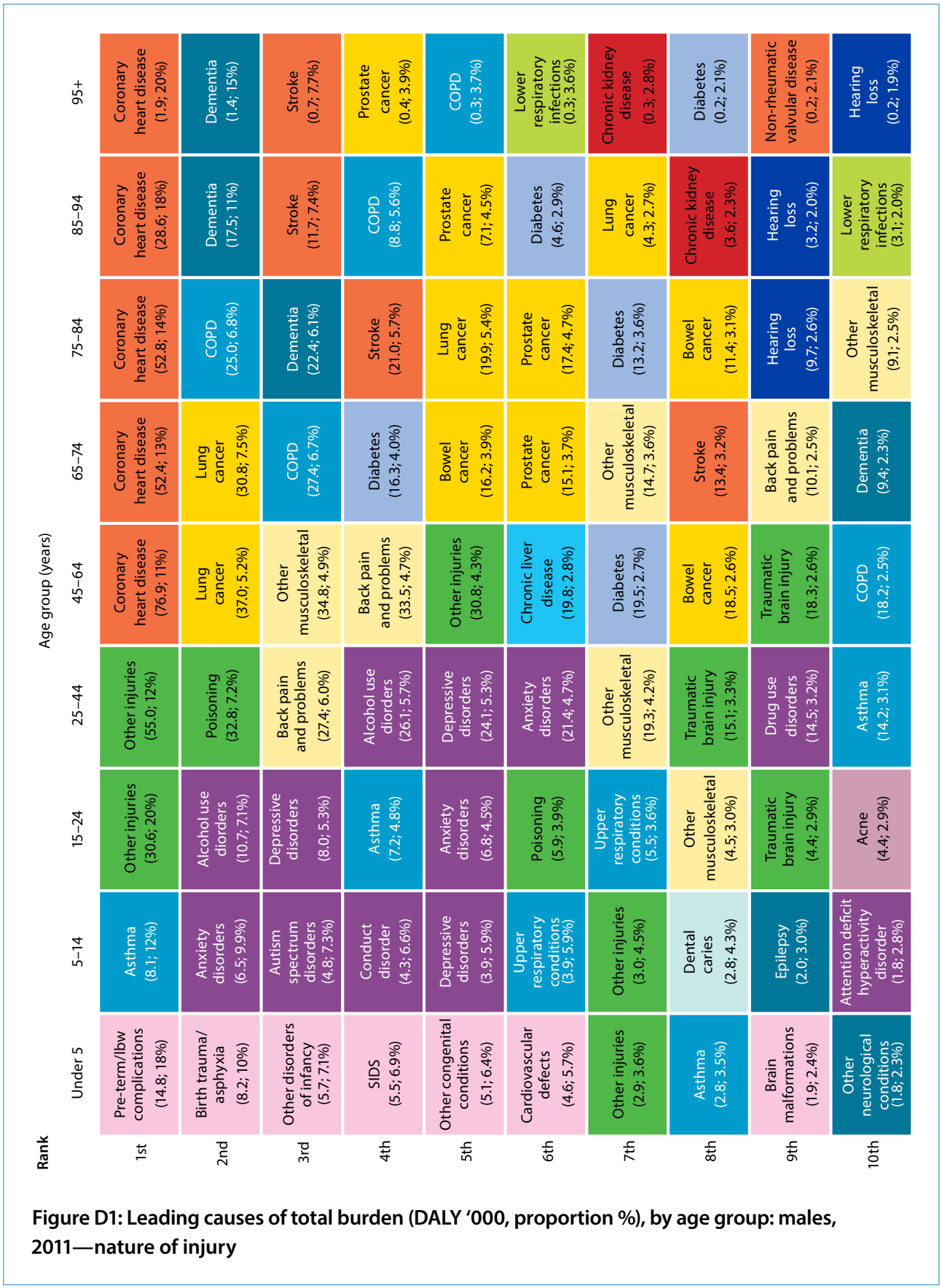


Figure D1: Leading causes of total burden (DALY '000, proportion %), by age group: males, 2011—nature of injury

Figure D2: Leading causes of total burden (DALY '000, proportion %), by age group: females, 2011—nature of injury

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Birth trauma/ asphyxia (8.6; 13%)	Anxiety disorders (5.7; 11%)	Anxiety disorders (14.0; 11%)	Anxiety disorders (33.8; 9.2%)	Other musculoskeletal (38.8; 6.8%)	Coronary heart disease (20.3; 6.8%)	Coronary heart disease (35.2; 11%)	Dementia (43.1; 18%)	Dementia (6.5; 23%)
2nd	Pre-term/lbw complications (8.6; 13%)	Asthma (5.2; 9.9%)	Other injuries (11.6; 9.1%)	Depressive disorders (27.9; 7.6%)	Breast cancer (36.2; 6.3%)	Lung cancer (18.3; 6.1%)	Dementia (30.9; 9.4%)	Coronary heart disease (37.2; 15%)	Coronary heart disease (5.3; 19%)
3rd	Other disorders of infancy (4.8; 7.4%)	Depressive disorders (4.5; 8.4%)	Depressive disorders (11.1; 8.7%)	Back pain and problems (25.8; 7.1%)	Back pain and problems (31.0; 5.4%)	COPD (18.1; 6.0%)	COPD (22.6; 6.9%)	Stroke (22.6; 9.4%)	Stroke (2.8; 9.7%)
4th	SIDS (3.6; 5.5%)	Dental caries (2.7; 5.1%)	Asthma (7.9; 6.2%)	Other musculoskeletal (19.0; 5.2%)	Anxiety disorders (26.6; 4.7%)	Other musculoskeletal (17.2; 5.7%)	Stroke (21.6; 6.6%)	COPD (10.7; 4.4%)	Lower respiratory infections (0.8; 2.9%)
5th	Cardiovascular of infancy (3.1; 4.7%)	Upper respiratory conditions (2.7; 5.0%)	Bipolar affective disorder (5.7; 4.5%)	Asthma (16.8; 4.6%)	Lung cancer (25.3; 4.4%)	Breast cancer (13.9; 4.6%)	Lung cancer (11.5; 3.5%)	Diabetes (6.4; 2.6%)	COPD (0.7; 2.5%)
6th	Other injuries (2.9; 4.5%)	Conduct disorder (2.6; 4.9%)	Back pain and problems (5.7; 4.4%)	Other injuries (14.9; 4.1%)	Osteoarthritis (24.1; 4.2%)	Osteoarthritis (13.0; 4.3%)	Other musculoskeletal (11.4; 3.5%)	Hearing loss (5.8; 2.4%)	Chronic kidney disease (0.7; 2.4%)
7th	Other congenital conditions (2.9; 4.4%)	Acne (2.5; 4.7%)	Upper respiratory conditions (5.1; 4.0%)	Upper respiratory conditions (13.9; 3.8%)	Depressive disorders (22.5; 3.9%)	Dementia (10.8; 3.6%)	Diabetes (10.2; 3.1%)	Atrial fibrillation (5.5; 2.3%)	Diabetes (0.6; 2.1%)
8th	Other neurological conditions (2.7; 4.2%)	Other injuries (2.1; 4.0%)	Polycystic ovarian syndrome (5.1; 4.0%)	Poisoning (11.4; 3.1%)	Rheumatoid arthritis (22.5; 3.9%)	Back pain and problems (10.3; 3.4%)	Osteoarthritis (9.7; 2.9%)	Chronic kidney disease (4.9; 2.0%)	Hearing loss (0.6; 2.1%)
9th	Other mental disorders (2.7; 4.1%)	Epilepsy (1.9; 3.6%)	Alcohol use disorders (4.8; 3.8%)	Bipolar affective disorder (10.2; 2.8%)	COPD (22.0; 3.8%)	Rheumatoid arthritis (9.9; 3.3%)	Hearing loss (9.5; 2.9%)	Other musculoskeletal (4.7; 2.0%)	Vision loss (0.6; 2.0%)
10th	Other chromosomal abnormalities (2.0; 3.1%)	Dermatitis and eczema (1.7; 3.1%)	Acne (3.9; 3.1%)	Rheumatoid arthritis (9.0; 2.5%)	Coronary heart disease (19.5; 3.4%)	Stroke (9.4; 3.1%)	Bowel cancer (9.3; 2.8%)	Osteoarthritis (4.5; 1.9%)	Atrial fibrillation (0.5; 1.9%)

Figure D3: Leading causes of non-fatal burden (YLD '000, proportion %), by age group: males, 2011—nature of injury

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Asthma (2.6; 16%)	Asthma (8.0; 15%)	Alcohol use disorders (10.7; 11%)	Back pain and problems (27.3; 9.6%)	Other musculoskeletal (33.6; 10%)	COPD (14.7; 9.7%)	Coronary heart disease (11.3; 9.8%)	Dementia (7.4; 16%)	Dementia (0.8; 26%)
2nd	Other gastrointestinal infections (1.6; 9.8%)	Anxiety disorders (6.5; 12%)	Depressive disorders (8.0; 8.3%)	Alcohol use disorders (24.9; 8.8%)	Back pain and problems (33.4; 10%)	Other musculoskeletal (13.7; 9.0%)	COPD (10.5; 9.1%)	Coronary heart disease (4.4; 9.7%)	Coronary heart disease (0.2; 8.2%)
3rd	Other congenital conditions (1.3; 8.2%)	Autism spectrum disorders (4.8; 8.7%)	Asthma (7.0; 7.3%)	Depressive disorders (24.1; 8.5%)	Anxiety disorders (17.5; 5.5%)	Coronary heart disease (13.2; 8.7%)	Hearing loss (9.7; 8.5%)	Hearing loss (3.2; 7.0%)	Hearing loss (0.2; 6.2%)
4th	Other mental disorders (1.3; 8.0%)	Conduct disorder (4.3; 7.9%)	Anxiety disorders (6.8; 7.1%)	Anxiety disorders (21.4; 7.5%)	Traumatic brain injury (15.8; 4.9%)	Back pain and problems (10.0; 6.6%)	Dementia (8.5; 7.4%)	COPD (2.9; 6.4%)	Epilepsy (0.2; 6.2%)
5th	Dermatitis and eczema (0.9; 5.7%)	Depressive disorders (3.9; 7.1%)	Upper respiratory conditions (5.5; 5.7%)	Other musculoskeletal (19.0; 6.7%)	Depressive disorders (14.2; 4.4%)	Hearing loss (8.3; 5.5%)	Other musculoskeletal (8.1; 7.0%)	Other musculoskeletal (2.4; 5.4%)	Vision loss (0.2; 6.0%)
6th	Anxiety disorders (0.7; 4.4%)	Upper respiratory conditions (3.9; 7.1%)	Other musculoskeletal (4.4; 4.6%)	Asthma (13.6; 4.8%)	Coronary heart disease (14.1; 4.4%)	Diabetes (7.5; 4.9%)	Osteoarthritis (4.8; 4.2%)	Vision loss (2.2; 4.8%)	Other musculoskeletal (0.1; 4.0%)
7th	Intellectual disability (0.7; 4.3%)	Dental caries (2.8; 5.2%)	Acne (4.4; 4.6%)	Upper respiratory conditions (12.9; 4.5%)	Rheumatoid arthritis (12.8; 4.0%)	Osteoarthritis (6.7; 4.4%)	Diabetes (4.5; 3.9%)	Osteoarthritis (1.8; 4.0%)	Osteoarthritis (0.1; 3.6%)
8th	Autism spectrum disorders (0.6; 3.5%)	Attention deficit hyperactivity disorder (1.8; 3.4%)	Back pain and problems (4.3; 4.4%)	Drug use disorders (12.5; 4.4%)	Osteoarthritis (12.3; 3.8%)	Rheumatoid arthritis (6.6; 4.3%)	Back pain and problems (4.5; 3.9%)	Atrial fibrillation (1.5; 3.4%)	COPD (0.1; 3.2%)
9th	Other neurological conditions (0.5; 3.2%)	Acne (1.8; 3.3%)	Bipolar affective disorder (4.2; 4.3%)	Traumatic brain injury (12.4; 4.4%)	Diabetes (11.2; 3.5%)	Traumatic brain injury (5.2; 3.4%)	Atrial fibrillation (4.0; 3.5%)	Diabetes (1.3; 2.8%)	Other kidney and urinary diseases (0.1; 2.6%)
10th	Upper respiratory conditions (0.5; 3.1%)	Epilepsy (1.8; 3.3%)	Drug use disorders (4.1; 4.3%)	Schizophrenia (11.8; 4.1%)	Asthma (10.1; 3.1%)	Dementia (5.0; 3.3%)	Severe tooth loss (3.7; 3.2%)	Stroke (1.2; 2.7%)	Atrial fibrillation (0.1; 2.4%)

Figure D4: Leading causes of non-fatal burden (YLD '000, proportion %), by age group: females, 2011—nature of injury

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Other mental disorders (2.6; 17%)	Anxiety disorders (5.7; 13%)	Anxiety disorders (14.0; 14%)	Anxiety disorders (33.8; 12%)	Other musculoskeletal (37.3; 11%)	Other musculoskeletal (16.0; 11%)	Dementia (13.7; 10%)	Dementia (21.5; 25%)	Dementia (3.2; 34%)
2nd	Other gastrointestinal infections (1.5; 9.9%)	Asthma (5.1; 12%)	Depressive disorders (11.1; 11%)	Depressive disorders (27.9; 10%)	Back pain and problems (30.9; 9.3%)	Osteoarthritis (13.0; 9.3%)	COPD (12.4; 9.3%)	Hearing loss (5.8; 6.8%)	Coronary heart disease (0.7; 6.9%)
3rd	Asthma (1.4; 9.3%)	Depressive disorders (4.5; 10%)	Asthma (7.5; 7.3%)	Back pain and problems (25.8; 9.3%)	Anxiety disorders (26.6; 8.0%)	Back pain and problems (10.2; 7.3%)	Other musculoskeletal (9.8; 7.4%)	COPD (5.8; 6.7%)	Hearing loss (0.6; 6.2%)
4th	Other neurological conditions (1.4; 8.9%)	Dental caries (2.7; 6.2%)	Bipolar affective disorder (5.7; 5.6%)	Other musculoskeletal (18.2; 6.6%)	Osteoarthritis (24.1; 7.2%)	Rheumatoid arthritis (9.3; 6.7%)	Osteoarthritis (9.5; 7.2%)	Coronary heart disease (5.7; 6.7%)	Vision loss (0.6; 5.9%)
5th	Dermatitis and eczema (0.9; 5.8%)	Upper respiratory conditions (2.7; 6.1%)	Back pain and problems (5.7; 5.6%)	Asthma (16.1; 5.8%)	Depressive disorders (22.5; 6.8%)	COPD (8.5; 6.1%)	Hearing loss (9.5; 7.2%)	Osteoarthritis (4.3; 5.0%)	Osteoarthritis (0.4; 4.0%)
6th	Other congenital conditions (0.6; 3.7%)	Conduct disorder (2.6; 6.0%)	Upper respiratory conditions (5.1; 5.0%)	Upper respiratory conditions (13.9; 5.0%)	Rheumatoid arthritis (22.2; 6.7%)	Coronary heart disease (6.1; 4.4%)	Coronary heart disease (8.5; 6.4%)	Vision loss (4.1; 4.8%)	COPD (0.4; 3.9%)
7th	Anxiety disorders (0.6; 3.6%)	Acne (2.5; 5.7%)	Polycystic ovarian syndrome (5.1; 5.0%)	Bipolar affective disorder (10.2; 3.7%)	COPD (14.8; 4.5%)	Severe tooth loss (6.1; 4.4%)	Rheumatoid arthritis (6.3; 4.8%)	Other musculoskeletal (3.5; 4.1%)	Protein-energy deficiency (0.3; 3.1%)
8th	Protein-energy deficiency (0.4; 2.9%)	Epilepsy (1.7; 3.9%)	Alcohol use disorders (4.8; 4.7%)	Rheumatoid arthritis (9.0; 3.2%)	Asthma (14.4; 4.3%)	Hearing loss (5.9; 4.2%)	Back pain and problems (5.7; 4.3%)	Rheumatoid arthritis (2.8; 3.2%)	Epilepsy (0.3; 2.9%)
9th	Epilepsy (0.4; 2.7%)	Dermatitis and eczema (1.7; 3.8%)	Acne (3.9; 3.9%)	Polycystic ovarian syndrome (8.6; 3.1%)	Upper respiratory conditions (11.5; 3.5%)	Dementia (5.7; 4.1%)	Severe tooth loss (5.4; 4.1%)	Severe tooth loss (2.5; 2.9%)	Other musculoskeletal (0.3; 2.7%)
10th	Upper respiratory conditions (0.4; 2.7%)	Other musculoskeletal (1.3; 3.0%)	Eating disorders (3.7; 3.6%)	Eating disorders (8.3; 3.0%)	Genital prolapse (7.4; 2.2%)	Asthma (4.8; 3.4%)	Atrial fibrillation (3.8; 2.9%)	Atrial fibrillation (2.4; 2.9%)	Rheumatoid arthritis (0.2; 2.5%)

Figure D5: Leading causes of fatal burden (YLL '000, proportion %), by age group: males, 2011—nature of injury

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Pre-term/lbw complications (14.6; 23%)	Other injuries (2.9; 26%)	Other injuries (30.3; 55%)	Other injuries (53.7; 31%)	Coronary heart disease (62.8; 16%)	Coronary heart disease (39.2; 15%)	Coronary heart disease (41.5; 16%)	Coronary heart disease (24.2; 21%)	Coronary heart disease (1.6; 25%)
2nd	Birth trauma/ asphyxia (8.2; 13%)	Drowning/ submersion (1.0; 8.6%)	Poisoning (5.9; 11%)	Poisoning (32.7; 19%)	Lung cancer (36.4; 9.3%)	Lung cancer (30.1; 12%)	Lung cancer (19.2; 7.6%)	Stroke (10.5; 9.3%)	Dementia (0.7; 11%)
3rd	SIDS (5.5; 8.7%)	Other cancers (0.9; 7.7%)	Drowning/ submersion (2.1; 3.8%)	Coronary heart disease (12.1; 7.0%)	Other injuries (29.2; 7.5%)	Bowel cancer (15.0; 5.8%)	Stroke (18.1; 7.2%)	Dementia (10.1; 9.0%)	Stroke (0.7; 10%)
4th	Other disorders of infancy (5.4; 8.5%)	Brain/CNS cancer (0.7; 6.3%)	Traumatic brain injury (2.0; 3.6%)	Chronic liver disease (4.0; 2.3%)	Chronic liver disease (19.2; 4.9%)	COPD (12.7; 4.9%)	Prostate cancer (15.2; 6.0%)	Prostate cancer (6.3; 5.6%)	Lower respiratory infections (0.3; 5.0%)
5th	Cardiovascular defects (4.3; 6.7%)	Leukaemia (0.6; 5.6%)	Internal/ crush injury (1.4; 2.5%)	Brain/CNS cancer (3.9; 2.2%)	Bowel cancer (17.4; 4.4%)	Prostate cancer (11.9; 4.6%)	COPD (14.5; 5.7%)	COPD (6.0; 5.3%)	Prostate cancer (0.3; 4.8%)
6th	Other congenital conditions (3.8; 5.9%)	Other blood/ metabolic disorders (0.5; 4.8%)	Other cancers (1.1; 2.0%)	Drowning/ submersion (3.6; 2.1%)	Poisoning (15.2; 3.9%)	Stroke (11.2; 4.3%)	Dementia (13.9; 5.5%)	Lung cancer (4.1; 3.6%)	COPD (0.3; 3.9%)
7th	Other injuries (2.8; 4.4%)	Cerebal palsy (0.5; 4.2%)	Cerebal palsy (1.0; 1.8%)	Bowel cancer (3.5; 2.0%)	Stroke (12.4; 3.2%)	Diabetes (8.7; 3.4%)	Bowel cancer (10.4; 4.1%)	Diabetes (3.3; 2.9%)	Chronic kidney disease (0.2; 3.6%)
8th	Brain malformations (1.8; 2.9%)	Traumatic brain injury (0.4; 3.5%)	Other neurological conditions (1.0; 1.8%)	Epilepsy (3.3; 1.9%)	Liver cancer (11.6; 3.0%)	Pancreatic cancer (7.1; 2.7%)	Diabetes (8.7; 3.5%)	Lower respiratory infections (3.0; 2.7%)	Non-rheumatic valvular disease (0.2; 2.6%)
9th	Drowning/ submersion (1.6; 2.5%)	Poisoning (0.3; 2.8%)	Leukaemia (0.9; 1.6%)	Melanoma (3.2; 1.8%)	Pancreatic cancer (10.7; 2.7%)	Other injuries (5.6; 2.1%)	Chronic kidney disease (5.1; 2.0%)	Chronic kidney disease (3.0; 2.6%)	Diabetes (0.2; 2.4%)
10th	Neonatal infections (1.6; 2.5%)	Other neurological conditions (0.2; 2.0%)	Epilepsy (0.9; 1.6%)	Stroke (3.0; 1.7%)	Brain/CNS cancer (9.0; 2.3%)	Oesophageal cancer (5.2; 2.0%)	Parkinson disease (4.7; 1.9%)	Bowel cancer (2.8; 2.5%)	Atrial fibrillation (0.1; 1.7%)

Figure D6: Leading causes of fatal burden (YLL '000, proportion %), by age group: females, 2011—nature of injury

Rank	Age group (years)								
	Under 5	5–14	15–24	25–44	45–64	65–74	75–84	85–94	95+
1st	Birth trauma/ asphyxia (8.6; 17%)	Other injuries (2.1; 22%)	Other injuries (11.5; 45%)	Other injuries (14.6; 16%)	Breast cancer (32.8; 14%)	Lung cancer (17.8; 11%)	Coronary heart disease (26.7; 14%)	Coronary heart disease (31.5; 20%)	Coronary heart disease (4.7; 24%)
2nd	Pre-term/lbw complications (8.5; 17%)	Brain/CNS cancer (0.9; 9.2%)	Poisoning (2.0; 8.0%)	Poisoning (11.2; 13%)	Lung cancer (24.9; 10%)	Coronary heart disease (14.2; 8.8%)	Stroke (19.2; 9.8%)	Dementia (21.6; 14%)	Dementia (3.3; 17%)
3rd	Other disorders of infancy (4.6; 9.2%)	Cerebal palsy (0.6; 6.2%)	Other cancers (0.9; 3.5%)	Breast cancer (7.9; 8.9%)	Coronary heart disease (14.3; 6.0%)	Breast cancer (12.3; 7.6%)	Dementia (17.2; 8.8%)	Stroke (20.8; 13%)	Stroke (2.6; 14%)
4th	SIDS (3.6; 7.2%)	Other cancers (0.5; 5.0%)	Epilepsy (0.8; 3.3%)	Chronic liver disease (3.1; 3.4%)	Bowel cancer (13.3; 5.6%)	COPD (9.6; 6.0%)	Lung cancer (11.1; 5.6%)	COPD (4.9; 3.2%)	Lower respiratory infections (0.8; 4.3%)
5th	Other injuries (2.9; 5.8%)	Cardiovascular defects (0.4; 4.3%)	Cerebal palsy (0.7; 2.7%)	Bowel cancer (2.6; 2.9%)	Stroke (9.6; 4.0%)	Stroke (8.1; 5.0%)	COPD (10.3; 5.2%)	Diabetes (4.8; 3.1%)	Chronic kidney disease (0.5; 2.9%)
6th	Cardiovascular defects (2.8; 5.6%)	Other blood/ metabolic disorders (0.4; 4.2%)	Traumatic brain injury (0.6; 2.4%)	Melanoma (2.4; 2.7%)	Poisoning (8.8; 3.7%)	Bowel cancer (7.9; 4.9%)	Bowel cancer (8.5; 4.3%)	Lower respiratory infections (4.0; 2.6%)	Diabetes (0.4; 2.3%)
7th	Other congenital conditions (2.3; 4.6%)	Burn injuries (0.4; 4.0%)	Cystic fibrosis (0.5; 2.2%)	Coronary heart disease (2.4; 2.7%)	Ovarian cancer (8.3; 3.5%)	Pancreatic cancer (5.8; 3.6%)	Breast cancer (7.0; 3.6%)	Bowel cancer (3.9; 2.5%)	Atrial fibrillation (0.4; 1.9%)
8th	Other chromosomal abnormalities (2.0; 4.0%)	Drowning/ submersion (0.3; 3.4%)	Brain/CNS cancer (0.5; 1.9%)	Stroke (2.4; 2.7%)	Other injuries (8.1; 3.4%)	Dementia (5.1; 3.1%)	Diabetes (6.6; 3.4%)	Chronic kidney disease (3.7; 2.4%)	Non-rheumatic valvular disease (0.4; 1.9%)
9th	Other neurological conditions (1.4; 2.7%)	Traumatic brain injury (0.2; 2.6%)	Other neurological conditions (0.5; 1.8%)	Other cardiovascular diseases (2.3; 2.6%)	COPD (7.1; 3.0%)	Diabetes (4.9; 3.1%)	Pancreatic cancer (4.7; 2.4%)	Non-rheumatic valvular disease (3.4; 2.2%)	COPD (0.3; 1.8%)
10th	Neural tube defects (1.3; 2.6%)	Lower respiratory infections (0.2; 2.6%)	Asthma (0.4; 1.6%)	Lung cancer (2.1; 2.4%)	Chronic liver disease (7.1; 3.0%)	Ovarian cancer (4.6; 2.8%)	Chronic kidney disease (4.2; 2.1%)	Atrial fibrillation (3.0; 2.0%)	Hypertensive heart disease (0.3; 1.7%)

Table D1: Number and percentage of YLL and deaths, by age group and sex, 2011

	Males				Females				People			
Age group (years)	**Deaths**	**Per cent**	**YLL**	**Per cent**	**Deaths**	**Per cent**	**YLL**	**Per cent**	**Deaths**	**Per cent**	**YLL**	**Per cent**
< 1	636	0.8	54,709	4.1	488	0.7	41,978	4.4	1,124	0.8	96,686	4.3
1–4	109	0.1	9,186	0.7	98	0.1	8,237	0.9	207	0.1	17,423	0.8
5–14	146	0.2	11,217	0.8	124	0.2	9,521	1.0	270	0.2	20,739	0.9
15–24	834	1.1	55,115	4.2	383	0.5	25,428	2.7	1,217	0.8	80,544	3.5
25–44	3,415	4.5	172,977	13.1	1,802	2.5	89,278	9.5	5,217	3.6	262,255	11.6
45–64	12,716	16.9	392,035	29.6	7,690	10.8	238,908	25.3	20,406	13.9	630,944	27.8
65–74	13,568	18.0	258,989	19.5	8,485	11.9	160,946	17.0	22,053	15.0	419,935	18.5
75–84	22,649	30.1	252,484	19.0	18,002	25.2	195,901	20.7	40,651	27.7	448,384	19.8
85–94	19,028	25.3	112,281	8.5	27,576	38.6	155,337	16.4	46,604	31.8	267,618	11.8
95+	2,223	3.0	6,492	0.5	6,740	9.4	19,081	2.0	8,963	6.1	25,572	1.1
Total	**75,324**	**100.0**	**1,325,486**	**100.0**	**71,388**	**100.0**	**944,615**	**100.0**	**146,712**	**100.0**	**2,270,101**	**100.0**

Table D2: Decomposition of changes in DALY between 2003 and 2011

Disease group	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing	Actual 2011 DALY	% change from 2003 to 2011 due to disease[c]	Total % change from 2003 to 2011
Blood/metabolic	45,247	51,256	13.3	53,725	5.5	50,493	–7.1	11.6
Cancer	767,210	869,110	13.3	926,652	7.5	833,250	–12.2	8.6
Cardiovascular	725,878	822,288	13.3	893,640	9.8	657,203	–32.6	–9.5
Endocrine	86,395	97,870	13.3	104,994	8.2	106,097	1.3	22.8
Gastrointestinal	128,614	145,696	13.3	152,677	5.4	143,136	–7.4	11.3
Hearing/vision	79,153	89,666	13.3	96,009	8.0	97,055	1.3	22.6
Infant/congenital	121,076	137,158	13.3	140,007	2.4	119,951	–16.6	–0.9
Infections	84,790	96,052	13.3	100,819	5.6	73,235	–32.5	–13.6
Injury	370,260	419,437	13.3	420,998	0.4	394,454	–7.2	6.5
Kidney/urinary	46,926	53,159	13.3	57,887	10.1	59,344	3.1	26.5
Mental	480,736	544,587	13.3	539,052	–1.2	542,554	0.7	12.9
Musculoskeletal	524,403	594,054	13.3	617,110	4.4	521,286	–18.3	–0.6
Neurological	216,237	244,958	13.3	261,599	7.7	306,409	20.7	41.7
Oral	84,525	95,751	13.3	98,996	3.8	98,936	–0.1	17.1
Reproductive/maternal	34,136	38,670	13.3	39,197	1.5	39,088	–0.3	14.5
Respiratory	343,114	388,686	13.3	403,862	4.4	374,985	–8.4	9.3
Skin	66,524	75,360	13.3	75,696	0.5	76,951	1.9	15.7
Total	**4,205,223**	**4,763,756**	**13.3**	**4,982,920**	**5.2**	**4,494,427**	**–11.6**	**6.9**

(a) Estimated by increasing DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to 2011 population.

(c) Estimated by subtracting the actual 2011 DALY estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Table D3: Decomposition of changes in YLD between 2003 and 2011

Disease group	Actual 2003 YLD	Expected 2011 YLD with population growth[a]	% change due to increasing population	Expected 2011 YLD with increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing	Actual 2011 YLD	% change from 2003 to 2011 due to disease[c]	Total % change from 2003 to 2011
Blood/metabolic	18,074	20,475	13.3	21,449	5.4	19,789	–9.2	9.5
Cancer	39,512	44,760	13.3	47,974	8.1	50,901	7.4	28.8
Cardiovascular	129,043	146,183	13.3	158,730	9.7	134,179	–19.0	4.0
Endocrine	33,215	37,627	13.3	39,955	7.0	49,598	29.0	49.3
Gastrointestinal	48,201	54,603	13.3	55,801	2.5	56,026	0.5	16.2
Hearing/vision	79,153	89,666	13.3	96,009	8.0	97,055	1.3	22.6
Infant/congenital	16,528	18,723	13.3	18,635	–0.5	18,891	1.6	14.3
Infections	24,993	28,313	13.3	28,435	0.5	26,817	–6.5	7.3
Injury	66,806	75,679	13.3	77,030	2.0	84,260	10.8	26.1
Kidney/urinary	12,819	14,522	13.3	15,760	9.7	19,772	31.3	54.2
Mental	464,058	525,694	13.3	519,573	–1.3	524,701	1.1	13.1
Musculoskeletal	509,938	577,668	13.3	599,378	4.3	505,673	–18.4	–0.8
Neurological	125,219	141,850	13.3	150,137	6.6	164,886	11.8	31.7
Oral	84,369	95,574	13.3	98,809	3.8	98,592	–0.3	16.9
Reproductive/maternal	33,215	37,626	13.3	38,158	1.6	37,909	–0.7	14.1
Respiratory	237,998	269,608	13.3	275,623	2.5	263,603	–5.1	10.8
Skin	62,725	71,057	13.3	70,924	–0.2	71,675	1.2	14.3
Total	**1,985,866**	**2,249,627**	**13.3**	**2,312,379**	**3.2**	**2,224,326**	**–4.4**	**12.0**

(a) Estimated by increasing YLD from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to 2011 population.

(c) Estimated by subtracting the actual 2011 YLD estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Table D4: Decomposition of changes in YLL between 2003 and 2011

Disease group	Actual 2003 YLL	Expected 2011 YLL with population growth[a]	% change due to increasing population	Expected 2011 YLL with increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing	Actual 2011 YLL	% change from 2003 to 2011 due to disease[c]	Total % change from 2003 to 2011
Blood/metabolic	27,172	30,781	13.3	32,275	5.5	30,704	–5.8	13.0
Cancer	727,697	824,349	13.3	878,678	7.5	782,349	–13.2	7.5
Cardiovascular	596,834	676,105	13.3	734,910	9.9	523,024	–35.5	–12.4
Endocrine	53,179	60,243	13.3	65,039	9.0	56,499	–16.1	6.2
Gastrointestinal	80,413	91,093	13.3	96,875	7.2	87,110	–12.1	8.3
Hearing/vision	0	0	—	0	—	0	—	—
Infant/congenital	104,549	118,435	13.3	121,373	2.8	101,060	–19.4	–3.3
Infections	59,797	67,739	13.3	72,385	7.8	46,418	–43.4	–22.4
Injury	303,453	343,758	13.3	343,968	0.1	310,194	–11.1	2.2
Kidney/urinary	34,107	38,637	13.3	42,128	10.2	39,572	–7.5	16.0
Mental	16,678	18,894	13.3	19,480	3.5	17,853	–9.7	7.0
Musculoskeletal	14,465	16,386	13.3	17,732	9.3	15,613	–14.7	7.9
Neurological	91,019	103,108	13.3	111,462	9.2	141,523	33.0	55.5
Oral	156	177	13.3	187	6.7	345	100.8	120.7
Reproductive/maternal	922	1,044	13.3	1,039	–0.6	1,179	15.2	27.9
Respiratory	105,116	119,078	13.3	128,239	8.7	111,382	–16.0	6.0
Skin	3,799	4,304	13.3	4,772	12.3	5,276	13.3	38.9
Total	**2,219,357**	**2,514,129**	**13.3**	**2,670,541**	**7.0**	**2,270,101**	**–18.0**	**2.3**

(a) Estimated by increasing YLL from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to 2011 population.

(c) Estimated by subtracting the actual 2011 YLL estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Table D5: Decomposition of changes in attributable DALY between 2003 and 2011

Risk factor	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing	Expected 2011 DALY with increasing and ageing population and risk factor exposure	% change due to risk factor exposure[c]	Actual 2011 DALY	% change from 2003 due to linked diseases[d]
Tobacco use	403,054	456,587	13.3	491,054	7.5	477,078	–2.8	402,377	–15.7
High body mass	199,654	226,171	13.3	241,462	6.8	297,627	23.5	245,816	–17.6
Alcohol use	218,408	247,417	13.3	254,733	2.9	281,535	9.9	228,641	–17.7
Physical inactivity	221,513	250,934	13.3	269,020	7.2	323,403	20.2	224,198	–30.7
High blood pressure	277,533	314,395	13.3	341,778	8.7	306,912	–10.2	221,315	–27.9
High cholesterol	149,116	168,921	13.3	181,082	7.2	167,515	–7.5	106,151	–36.6
Diet low in fruit	96,382	109,183	13.3	117,291	7.4	118,521	1.0	87,714	–26.0
Occupational exposures & hazards	81,339	92,143	13.3	94,555	2.6	106,777	–15.4	88,393	10.6
Drug use	64,522	73,092	13.3	74,365	1.7	76,344	2.7	78,942	3.4
Diet low in vegetables	66,298	75,103	13.3	80,681	7.4	87,730	8.7	62,756	–28.5
Intimate partner violence	19,007	21,532	13.3	21,433	-0.5	22,372	<0.1	21,608	0.8
Unsafe sex	17,950	20,334	13.3	20,672	1.7	21,418	3.6	18,672	–12.8
Low bone mineral density	8,265	9,363	13.3	10,475	11.9	12,988	<0.1	6,050	–42.2

(a) Estimated by increasing attributable DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to 2011 population.

(c) Percentage change due to risk factor exposure is equal to the percentage change in age-adjusted median PAF.

(d) Estimated by subtracting the actual 2011 attributable DALY estimate from the expected 2011 estimate, given risk factor exposure; expressed as a percentage increase from 2003.

Table D6: Age-standardised YLD rates, by disease group and state or territory, 2011

Disease group	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	Australia
Blood/metabolic	0.8	0.8	0.9	0.9	1.0	0.8	1.5	2.2	0.8
Cancer	2.0	2.0	2.2	2.1	2.1	2.1	2.0	1.8	2.1
Cardiovascular	5.6	4.9	5.9	4.8	6.0	4.7	5.3	10.5	5.4
Endocrine	2.0	1.7	2.4	2.1	2.6	2.2	2.4	2.8	2.1
Gastrointestinal	2.4	2.5	2.4	2.4	2.4	2.4	2.4	2.5	2.4
Hearing/vision	4.0	3.9	4.0	4.2	3.7	4.5	3.4	4.5	4.0
Infant/congenital	0.9	0.7	0.9	0.9	0.9	0.8	0.9	1.1	0.9
Infections	1.2	1.2	1.3	1.1	1.3	0.8	0.7	3.0	1.2
Injuries	3.4	3.9	3.9	3.3	3.4	2.9	3.2	9.3	3.6
Kidney/urinary	0.8	0.8	0.9	0.7	0.7	0.6	0.6	2.3	0.8
Mental	23.3	25.9	22.4	24.3	25.8	18.9	24.5	21.3	23.8
Musculoskeletal	20.7	20.9	22.5	21.6	22.2	25.6	22.7	19.6	21.5
Neurological	7.2	6.4	6.4	6.4	7.2	7.5	7.4	9.1	6.8
Oral	4.3	4.5	4.4	3.2	4.2	5.0	2.8	4.1	4.2
Reproductive/maternal	1.5	1.7	1.9	1.6	1.6	1.9	1.8	1.4	1.7
Respiratory	10.9	11.9	11.6	11.2	12.1	12.3	11.3	17.4	11.5
Skin	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.3	3.2
Total	**94.2**	**96.9**	**97.1**	**93.9**	**100.4**	**96.4**	**96.2**	**116.2**	**96.0**

Note: Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

Table D7: Age-standardised YLL rates, by disease group and state or territory, 2011

Disease group	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	Australia
Blood/metabolic	1.3	1.2	1.4	1.2	1.4	1.8	1.0	1.8	1.3
Cancer	32.8	31.7	32.4	29.8	35.8	35.3	26.7	40.2	32.1
Cardiovascular	21.4	19.2	22.4	19.2	22.1	22.4	16.8	37.0	20.9
Endocrine	2.0	2.3	2.3	2.3	2.5	2.7	1.5	8.5	2.3
Gastrointestinal	3.6	3.3	3.6	3.4	4.1	3.4	3.6	9.7	3.6
Hearing/vision	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Infant/congenital	4.6	3.8	5.7	3.4	3.8	5.5	3.5	10.6	4.5
Infections	1.9	1.7	2.1	1.7	2.3	1.3	1.5	5.3	1.9
Injuries	11.9	11.8	17.1	15.8	15.2	15.5	10.2	30.4	13.8
Kidney/urinary	1.6	1.5	1.6	1.4	1.7	1.7	1.5	5.5	1.6
Mental	0.7	0.9	0.8	0.7	0.6	1.1	0.8	1.0	0.8
Musculoskeletal	0.7	0.6	0.6	0.5	0.6	0.7	0.8	1.0	0.6
Neurological	5.5	5.5	5.4	5.7	6.2	7.9	6.8	8.7	5.6
Oral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reproductive/maternal	0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.1
Respiratory	4.5	4.2	4.9	4.1	4.4	6.3	4.0	9.0	4.5
Skin	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.9	0.2
Total	**92.8**	**87.9**	**100.7**	**89.4**	**100.8**	**106.0**	**78.9**	**170.1**	**93.9**

Note: Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.

Table D8: Age-standardised YLD rates, by disease group and remoteness, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very Remote	Australia	Rate ratio[(a)]	Rate difference[(b)]
Blood/metabolic	0.9	0.8	0.7	0.9	0.6	0.8	0.7	–0.2
Cancer	2.0	2.1	2.1	2.1	1.9	2.1	0.9	–0.1
Cardiovascular	5.3	5.3	6.3	8.2	9.9	5.4	1.9	4.6
Endocrine	2.1	2.0	2.0	2.5	3.7	2.1	1.8	1.6
Gastrointestinal	2.4	2.4	2.4	2.4	2.5	2.4	1.0	<0.1
Hearing/vision	3.9	4.4	3.9	2.7	5.1	4.0	1.3	1.2
Infant/congenital	0.8	1.0	0.9	1.0	1.0	0.9	1.3	0.2
Infections	1.1	1.3	1.4	2.1	3.1	1.2	2.8	2.0
Injuries	3.3	4.3	4.4	7.1	8.6	3.6	2.6	5.3
Kidney/urinary	0.7	0.7	0.9	2.7	6.1	0.8	8.2	5.4
Mental	24.9	22.6	19.6	20.0	20.9	23.8	0.8	–4.0
Musculoskeletal	20.4	24.9	20.3	23.2	29.0	21.5	1.4	8.7
Neurological	6.4	8.0	7.5	6.6	7.4	6.8	1.2	1.0
Oral	3.7	4.9	5.2	6.4	6.4	4.2	1.7	2.7
Reproductive/ maternal	1.6	2.1	1.7	1.6	1.1	1.7	0.7	–0.5
Respiratory	11.3	12.2	11.7	14.3	12.2	11.5	1.1	0.9
Skin	3.2	3.2	3.2	3.2	3.3	3.2	1.0	<0.1
Total	**94.2**	**102.2**	**94.3**	**107.0**	**122.8**	**96.0**	**1.3**	**28.7**

(a) Rate ratios are expressed as Very remote ASR divided by *Major cities* ASR.

(b) Rate differences are expressed as Very remote ASR minus *Major cities* ASR.

Note: Rates were age-standardised to the Australian population as at 30 June 2001 and are expressed per 1,000 people.

Table D9: Age-standardised YLL rates, by disease group and remoteness, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote	Australia	Rate ratio[a]	Rate difference[b]
Blood/metabolic	1.2	1.5	1.7	1.8	1.8	1.3	1.5	0.6
Cancer	30.8	34.4	35.7	36.7	35.3	32.1	1.1	4.5
Cardiovascular	19.5	22.8	24.3	30.4	43.2	20.9	2.2	23.8
Endocrine	2.0	2.3	3.1	5.6	9.3	2.3	4.6	7.3
Gastrointestinal	3.3	4.0	4.4	6.2	8.5	3.6	2.6	5.3
Hearing/vision	0.0	0.0	0.0	0.0	0.0	0.0	—	0.0
Infant/congenital	4.2	4.9	6.2	4.7	10.7	4.5	2.6	6.5
Infections	1.8	1.8	2.2	3.3	5.5	1.9	3.0	3.7
Injuries	11.7	17.1	20.0	29.7	35.8	13.8	3.1	24.1
Kidney/urinary	1.5	1.5	1.7	2.1	7.9	1.6	5.2	6.4
Mental	0.7	0.9	1.0	0.8	1.3	0.8	2.0	0.7
Musculoskeletal	0.6	0.7	0.7	1.0	0.8	0.6	1.4	0.3
Neurological	5.6	5.9	5.9	5.9	5.6	5.6	1.0	0.0
Oral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reproductive/ maternal	0.1	0.0	0.1	0.0	0.3	0.1	5.0	0.2
Respiratory	4.1	5.1	5.4	6.7	10.8	4.5	2.6	6.7
Skin	0.2	0.2	0.2	0.3	1.1	0.2	5.4	0.9
Total	**87.2**	**103.1**	**112.5**	**135.0**	**178.0**	**93.9**	**2.0**	**90.8**

(a) Rate ratios are expressed as Very remote ASR divided by *Major cities* ASR.

(b) Rate differences are expressed as Very remote ASR minus *Major cities* ASR.

Note: Rates were age-standardised to the Australian population as at 30 June 2001 and are expressed per 1,000 people.

Table D10: Age-standardised YLD rates, by disease group and socioeconomic group, 2011

Disease group	Q1 (Lowest)	Q2	Q3	Q4	Q5 (highest)	Australia	Rate ratio[a]	Rate difference[b]
Blood/metabolic	1.0	0.8	0.9	0.7	0.8	0.8	1.3	0.3
Cancer	2.1	2.0	1.9	2.1	2.1	2.1	1.0	0.0
Cardiovascular	6.0	5.9	4.9	5.2	5.1	5.4	1.2	0.9
Endocrine	3.1	2.2	1.7	1.9	1.5	2.1	2.2	1.7
Gastrointestinal	2.5	2.5	2.4	2.4	2.4	2.4	1.0	0.1
Hearing/vision	4.1	3.7	4.1	4.0	3.8	4.0	1.1	0.3
Infant/congenital	1.0	1.0	0.9	0.8	0.7	0.9	1.5	0.4
Infections	1.5	1.3	1.1	1.1	0.9	1.2	1.6	0.6
Injury	4.4	4.0	3.4	3.4	3.1	3.6	1.4	1.3
Kidney/urinary	1.0	0.8	0.8	0.7	0.6	0.8	1.7	0.4
Mental	30.6	29.8	27.1	21.3	15.5	23.8	2.0	15.1
Musculoskeletal	23.1	22.7	22.1	21.3	18.4	21.5	1.3	4.7
Neurological	7.6	7.3	6.6	6.4	6.0	6.8	1.3	1.6
Oral	4.9	5.3	4.2	3.9	3.2	4.2	1.5	1.7
Reproductive/maternal	1.8	1.8	1.6	1.6	1.6	1.7	1.2	0.2
Respiratory	12.0	12.5	11.1	11.7	10.3	11.5	1.2	1.7
Skin	3.2	3.2	3.2	3.2	3.2	3.2	1.0	0.0
Total	**110.3**	**106.7**	**98.1**	**91.7**	**79.2**	**96.0**	**1.4**	**31.1**

(a) Rate ratios are expressed as Q1 ASR divided by Q5 ASR.

(b) Rate differences are expressed as Q1 ASR minus Q5 ASR.

Note: Rates were age-standardised to the Australian population as at 30 June 2001 and are expressed per 1,000 people.

Table D11: Age-standardised YLL rates, by disease group and socioeconomic group, 2011

Disease group	Q1 (Lowest)	Q2	Q3	Q4	Q5 (highest)	Australia	Rate ratio[a]	Rate difference[b]
Blood/metabolic	1.7	1.6	1.4	1.0	0.8	1.3	2.3	1.0
Cancer	38.1	34.6	32.4	29.5	25.9	32.1	1.5	12.3
Cardiovascular	27.2	23.6	21.2	17.6	15.0	20.9	1.8	12.2
Endocrine	3.4	2.7	2.1	1.8	1.3	2.3	2.6	2.1
Gastrointestinal	5.2	4.3	3.5	2.8	2.3	3.6	2.2	2.9
Hearing/vision	0.0	0.0	0.0	0.0	0.0	0.0	—	0.0
Infant/congenital	5.7	5.3	4.5	3.9	3.5	4.5	1.7	2.3
Infections	2.5	2.1	1.8	1.6	1.4	1.9	1.8	1.1
Injury	19.1	16.7	14.3	11.1	9.0	13.8	2.1	10.1
Kidney/urinary	2.2	1.6	1.5	1.4	1.2	1.6	1.9	1.0
Mental	1.0	1.0	0.7	0.6	0.5	0.8	2.0	0.5
Musculoskeletal	0.8	0.7	0.6	0.5	0.4	0.6	2.0	0.4
Neurological	6.1	6.1	5.7	5.3	5.2	5.6	1.2	0.9
Oral	0.0	0.0	0.0	0.0	0.0	0.0	2.7	<0.1
Reproductive/maternal	0.1	0.0	0.0	0.0	0.1	0.1	1.0	<0.1
Respiratory	6.4	5.2	4.2	3.9	2.8	4.5	2.3	3.6
Skin	0.4	0.2	0.2	0.1	0.1	0.2	2.7	0.2
Total	**120.0**	**105.8**	**94.1**	**81.3**	**69.4**	**93.9**	**1.7**	**50.6**

(a) Rate ratios are expressed as Q1 ASR divided by Q5 ASR.

(b) Rate differences are expressed as Q1 ASR minus Q5 ASR.

Note: Rates were age-standardised to the Australian population as at 30 June 2001 and are expressed per 1,000 people.

Table D12: Comparison of age-standardised DALY rates—males: females, by selected cancers, 2011

Disease	ASR[a]		Rate difference[b]	Rate ratio[c]
	Males	Females		
Benign and uncertain brain tumours	0.2	0.2	1.0	<0.1
Bladder cancer	1.0	0.3	3.3	0.7
Bowel cancer	4.6	3.0	1.5	1.5
Brain and central nervous system cancer	1.9	1.2	1.6	0.7
Ductal carcinoma in situ (breast)	0.0	0.0	0.0	–0.0
Gallbladder cancer	0.1	0.2	0.7	–0.1
Hodgkin lymphoma	0.1	0.1	1.3	<0.1
Kidney cancer	1.0	0.4	2.4	0.6
Laryngeal cancer	0.3	0.0	6.2	0.2
Leukaemia	1.6	1.0	1.7	0.7
Liver cancer	1.8	0.6	3.1	1.2
Lung cancer	8.0	4.7	1.7	3.3
Melanoma of the skin	2.0	0.9	2.2	1.1
Mesothelioma	0.7	0.1	5.4	0.6
Mouth and pharyngeal cancer	1.1	0.3	3.6	0.8
Myeloma	0.7	0.5	1.5	0.2
Non-Hodgkin lymphoma	1.3	0.8	1.6	0.5
Non-melanoma skin cancer	0.6	0.2	3.5	0.4
Oesophageal cancer	1.5	0.4	3.7	1.1
Other benign, in situ and uncertain neoplasms	0.3	0.3	1.0	<0.1
Other lymphohaematopoietic (blood) cancers	0.4	0.2	1.9	0.2
Other malignant neoplasms (cancers)	1.3	1.2	1.0	0.1
Pancreatic cancer	2.1	1.5	1.4	0.5
Stomach cancer	1.3	0.6	2.0	0.6
Thyroid cancer	0.1	0.1	0.7	–<0.1

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as male ASR minus the female ASR.

(c) Rate ratio is the relative difference of females compared with males, calculated as male ASR divided by the female ASR.

Table D13: Comparison of age-standardised DALY/ YLL and YLD rates—males: females, by external cause of injury, 2011

Disease	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Total burden (DALY)				
Drowning	0.8	0.2	3.9	0.6
Falls	3.3	1.6	2.0	1.6
Fire, burns and scalds	0.4	0.3	1.7	0.2
Homicide and violence	1.7	0.7	2.4	1.0
Other land transport injuries	0.9	0.3	2.9	0.6
Other road traffic injuries	0.9	0.3	3.1	0.6
Other unintentional injuries	2.0	0.7	3.1	1.4
Poisoning	3.5	1.2	2.8	2.2
Road traffic injuries – motor vehicle occupants	3.1	1.4	2.2	1.7
Road traffic injuries – motorcyclists	1.1	0.1	13.4	1.0
Suicide and self-inflicted injuries	7.6	2.6	3.0	5.1
All other external causes of injury	0.3	0.3	1.2	0.1
All injuries	**25.4**	**9.6**	**2.7**	**15.9**
Fatal burden (YLL)				
Drowning	0.7	0.2	4.0	0.6
Falls	1.3	0.7	1.9	0.6
Fire, burns and scalds	0.2	0.1	1.4	0.1
Homicide and violence	0.9	0.5	1.6	0.3
Other land transport injuries	0.5	0.2	2.8	0.3
Other road traffic injuries	0.6	0.2	3.1	0.4
Other unintentional injuries	1.3	0.5	2.7	0.8
Poisoning	3.4	1.2	2.8	2.2
Road traffic injuries – motor vehicle occupants	2.6	1.2	2.2	1.4
Road traffic injuries – motorcyclists	0.8	0.1	12.6	0.7
Suicide and self-inflicted injuries	7.6	2.5	3.0	5.1
All other external causes of injury	0.2	0.2	1.1	<0.1
All injuries	**20.1**	**7.6**	**2.6**	**12.5**
Non-fatal burden (YLL)				
Drowning	<0.1	<0.1	2.1	<0.1
Falls	2.0	1.0	2.1	1.0
Fire, burns and scalds	0.2	0.1	2.0	0.1

continued

Table D13 (continued): Comparison of age-standardised DALY, YLL and YLD rates—males: females, by external cause of injury, 2011

Disease	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Homicide and violence	0.8	0.2	5.3	0.6
Other land transport injuries	0.4	0.1	2.9	0.2
Other road traffic injuries	0.3	0.1	3.2	0.2
Other unintentional injuries	0.7	0.2	4.1	0.6
Poisoning	0.0	0.0	1.9	0.0
Road traffic injuries – motor vehicle occupants	0.5	0.2	2.5	0.3
Road traffic injuries – motorcyclists	0.3	<0.1	16.6	0.2
Suicide and self-inflicted injuries	0.1	0.1	0.9	–0.0
All other external causes of injuries	0.1	<0.1	1.8	0.0
All injuries	**5.3**	**2.0**	**2.7**	**3.4**

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate ratio is the relative difference of females compared with males, calculated as male ASR divided by the female ASR.

(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as male ASR minus the female ASR.

Table D14: Comparison of age-standardised DALY/ YLL and YLD rates—males: females, by nature of injury, 2011

Disease	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Total burden (DALY)				
Burn injuries	0.6	0.3	2.1	0.3
Dislocations	<0.1	<0.1	1.6	<0.1
Drowning and submersion injuries	1.1	0.4	3.0	0.7
Hip fracture	0.3	0.3	1.1	<0.1
Humerus fracture	<0.1	<0.1	0.8	–<0.1
Internal and crush injuries	0.5	0.1	3.8	0.4
Other fractures	0.6	0.3	2.2	0.3
Poisoning	5.2	2.2	2.3	3.0
Soft tissue injuries	<0.1	<0.1	2.1	<0.1
Spinal cord injuries	0.5	0.1	3.9	0.4
Tibia and ankle fracture	<0.1	<0.1	1.5	<0.1
Traumatic brain injuries	4.6	1.7	2.7	2.9
Other injuries	12.0	4.2	2.9	7.8
All injuries	**25.4**	**9.6**	**2.7**	**15.9**
Fatal burden (YLL)				
Burn injuries	0.3	0.1	2.2	0.1
Dislocations	0.0	0.0	. .	0.0
Drowning and submersion injuries	1.0	0.3	3.0	0.7
Hip fracture	0.2	0.2	1.2	<0.1
Humerus fracture	0.0	0.0	. .	0.0
Internal and crush injuries	0.5	0.1	4.0	0.4
Other fractures	0.2	0.1	1.5	0.1
Poisoning	5.2	2.2	2.4	3.0
Soft tissue injuries	0.0	0.0	. .	0.0
Spinal cord injuries	<0.1	<0.1	3.2	<0.1
Tibia and ankle fracture	0.0	0.0	. .	0.0
Traumatic brain injuries	<0.1	0.4	2.3	0.6
Other injuries	11.7	4.1	2.9	7.6
All injuries	**20.1**	**7.6**	**2.6**	**12.5**

continued

Table D14 (continued): Comparison of age-standardised DALY, YLL and YLD rates—males: females, by nature of injury, 2011

Disease	ASR[a]		Rate ratio[b]	Rate difference[c]
	Males	Females		
Non-fatal burden (YLL)				
Burn injuries	0.3	0.2	2.0	0.2
Dislocations	<0.1	<0.1	1.6	<0.1
Drowning and submersion injuries	<0.1	<0.1	1.4	<0.1
Hip fracture	0.1	0.1	0.8	–<0.1
Humerus fracture	<0.1	<0.1	0.8	–<0.1
Internal and crush injury	<0.1	<0.1	2.3	<0.1
Other fractures	0.4	0.2	2.8	0.3
Poisoning	0.1	0.1	0.7	–<0.1
Soft tissue injuries	<0.1	<0.1	2.1	<0.1
Spinal cord injury	0.5	0.1	3.9	0.4
Tibia and ankle fracture	<0.1	<0.1	1.5	<0.1
Traumatic brain injury	3.5	1.2	2.9	2.3
Other injuries	0.4	0.1	3.2	0.3
All injuries	**5.3**	**2.0**	**2.7**	**3.4**

(a) Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.

(b) Rate ratio is the relative difference of females compared with males, calculated as male ASR divided by the female ASR.

(c) Rate difference is the absolute difference. Rate difference is the extra health loss in males compared with females, calculated as male ASR minus the female ASR.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011

Risk factor	Linked disease	DALY	
		Number	Per cent
Behavioural			
Tobacco use	Lung cancer	123,305	79.6
	COPD	119,542	74.6
	Coronary heart disease	49,726	14.3
	Stroke	15,721	11.5
	Oesophageal cancer	12,816	53.9
	Asthma	10,349	9.6
	Pancreatic cancer	10,336	23.3
	Mouth and pharyngeal cancer	8,124	46.1
	Bowel cancer	7,213	7.8
	Other cardiovascular diseases	6,263	16.6
	Liver cancer	6,191	21.1
	Bladder cancer	5,476	34.4
	Diabetes	3,747	3.7
	Atrial fibrillation and flutter	3,434	9.2
	Leukaemia	3,281	10.7
	Stomach cancer	3,234	14.3
	Kidney cancer	3,135	17.6
Tobacco use (continued)	Interstitial lung disease	2,979	21.5
	Other respiratory disease	2,845	18.5
	Aortic aneurysm	2,045	13.2
	Peripheral vascular disease	847	10.1
	Hypertensive heart disease	820	11.5
	Cervical cancer	619	9.4
	Lower respiratory infections	218	0.7
	Tuberculosis	86	6.4
	Influenza	23	0.9
	Otitis media	4	0.8
	Total	402,377	9.0
Alcohol use	Alcohol use disorders	66,042	100.0
	Suicide and self-inflicted injuries	25,489	22.5
	Coronary heart disease	15,431	4.5
	RTI—motor vehicle occupants	13,714	27.7
	Stroke	13,393	9.8
	Chronic liver disease	11,375	23.9
	Poisoning	10,052	19.6

continued

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011 (continued)

Risk factor	Linked disease	DALY	
		Number	Per cent
Alcohol use (continued)	Falls	6,840	11.6
	Liver cancer	6,757	23.0
	Breast cancer	5,834	8.3
	Epilepsy	5,675	12.7
	Homicide and violence	5,472	21.0
	Other unintentional injuries	5,183	16.9
	Mouth and pharyngeal cancer	5,112	29.0
	Bowel cancer	4,830	5.2
	Road traffic injuries—motorcyclists	4,172	32.9
	Other land transport injuries	4,077	30.7
	Oesophageal cancer	3,971	16.7
	Other road traffic injuries	3,396	26.3
	Atrial fibrillation and flutter	2,843	7.6
	Diabetes	2,123	2.1
	Lower respiratory infections	1,848	6.3
	Drowning	1,640	15.3
	Fire, burns and scalds	1,112	14.3
	Laryngeal cancer	742	18.2
	Pancreatitis	405	10.2
	Influenza	141	5.7
Alcohol use (continued)	Total	227,666	5.1
Physical inactivity	Coronary heart disease	113,873	32.8
	Diabetes	31,473	31.0
	Bowel cancer	28,570	30.9
	Stroke	25,726	18.8
	Breast cancer	24,555	34.7
	Total	224,198	5.0
Drug use	Drug use disorders (excluding alcohol)	31,951	100.0
	Chronic liver disease	24,525	51.5
	Liver cancer	15,468	52.7
	Suicide and self-inflicted injuries	6,594	5.8
	HIV/AIDS	254	5.0
	Hepatitis B (acute)	103	42.8
	Hepatitis C (acute)	49	82.5
	Total	78,943	1.8
Intimate partner violence	Suicide and self-inflicted injuries	10,215	9.0
	Depressive disorders	8,718	6.8
	Homicide and violence	2,638	10.1
	Early pregnancy loss	37	14.3
	Total	21,608	0.5

continued

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011 (continued)

Risk factor	Linked disease	DALY	
		Number	Per cent
Unsafe sex	Cervical cancer	6,555	100.0
	Chronic liver disease	4,724	9.9
	HIV/AIDS	4,567	90.0
	Liver cancer	2,552	8.7
	Other sexually transmitted infections	95	100.0
	Hepatitis B (acute)	63	26.1
	Chlamydia	63	100.0
	Syphilis	38	100.0
	Gonorrhoea	15	100.0
	Hepatitis C (acute)	2	3.8
	Total	18,673	0.4
Childhood sex abuse	Depressive disorders	6,794	5.3
	Suicide and self-inflicted injuries	5,762	5.1
	Alcohol use disorders	4,466	6.8
	Total	17,022	0.4
Metabolic			
High body mass	Coronary heart disease	81,179	23.4
	Diabetes	52,465	51.6
High body mass (continued)	Stroke	22,844	16.7
	Chronic kidney disease	16,320	38.3
	Other cardiovascular diseases	12,456	33.1
	Bowel cancer	11,035	11.9
	Atrial fibrillation and flutter	10,378	27.7
	Oesophageal cancer	8,047	33.8
	Breast cancer	7,336	10.4
	Cardiomyopathy	6,080	26.3
	Pancreatic cancer	3,698	8.3
	Kidney cancer	3,626	20.4
	Hypertensive heart disease	2,988	41.8
	Uterine cancer	2,820	37.0
	Peripheral vascular disease	2,323	27.6
	Gallbladder cancer	1,131	26.4
	Back pain and problems	682	0.4
	Inflammatory heart disease	274	5.1
	Osteoarthritis	136	0.2
	Total	245,816	5.5

continued

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011 (continued)

Risk factor	Linked disease	DALY Number	DALY Per cent
Blood pressure	Coronary heart disease	115,646	33.4
	Stroke	55,494	40.6
	Chronic kidney disease	12,744	29.9
	Atrial fibrillation and flutter	10,123	27.0
	Other cardiovascular diseases	9,434	25.1
	Cardiomyopathy	5,298	22.9
	Aortic aneurysm	4,877	31.5
	Hypertensive heart disease	3,925	54.9
	Peripheral vascular disease	2,192	26.0
	Rheumatic heart disease	1,358	11.8
	Inflammatory heart disease	224	4.1
	Total	221,315	4.9
High blood plasma glucose	Diabetes	101,653	100.0
	Coronary heart disease	13,659	3.9
	Stroke	4,835	3.5
	Chronic kidney disease	1,733	4.1
	Total	121,880	2.7
High cholesterol	Coronary heart disease	96,281	27.8
	Stroke	9,870	7.2
	Total	106,151	2.4
Iron deficiency	Iron-deficiency anaemia	11,477	100.0
	Total	11,477	0.3
Low bone mineral density	Falls	6,050	10.2
	Total	6,050	0.1
Environmental			
Occupational exposures and hazards	Back pain and problems	28,107	17.2
	Asthma	10,146	9.5
	Lung cancer	9,412	6.1
	Mesothelioma	8,452	80.7
	Hearing loss	4,954	7.4
	Other unintentional injuries	4,813	15.7
	COPD	4,664	2.9
	Falls	3,408	5.8
	Fire, burns and scalds	3,319	42.7

continued

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011 (continued)

Risk factor	Linked disease	DALY	
		Number	Per cent
Occupational exposures and hazards (continued)	Road traffic injuries–motor vehicle occupants	2,484	5.0
	Pneumoconiosis	1,691	100.0
	Other land transport injuries	1,684	12.7
	Leukaemia	1,621	5.3
	Homicide and violence	1,062	4.1
	Other road traffic injuries	1,008	7.8
	Poisoning	361	0.7
	Road traffic injuries—motorcyclists	325	2.6
	All other external causes of injury	257	3.7
	Laryngeal cancer	215	5.3
	Suicide and self-inflicted injuries	198	0.2
	Drowning	125	1.2
	Ovarian cancer	64	0.3
	Mouth and pharyngeal cancer	22	0.1
	Total	88,393	2.0
High sun exposure	Melanoma of the skin	31,189	90.0
	Non-melanoma skin cancer	6,558	70.0
	Total	37,747	0.8
Air pollution	Coronary heart disease	20,578	5.9
	Stroke	6,527	4.8
	Lung cancer	1,117	0.7
	COPD	434	0.3
	Lower respiratory infections	12	0.0
	Total	28,667	0.6
Dietary			
Diet low in fruit	Coronary heart disease	41,343	11.9
	Stroke	25,098	18.4
	Lung cancer	12,005	7.8
	Oesophageal cancer	4,838	20.4
	Mouth and pharyngeal cancer	3,609	20.5
	Laryngeal cancer	821	20.2
	Total	87,714	2.0
Diet low in vegetables	Coronary heart disease	34,685	10.0
	Stroke	23,535	17.2
	Mouth and pharyngeal cancer	3,681	20.9
	Laryngeal cancer	850	20.9

continued

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Table D15: Attributable burden (number and per cent by linked disease and total burden) for all risk factors, 2011 (continued)

		DALY	
Risk factor	**Linked disease**	**Number**	**Per cent**
Diet low in vegetables (continued)	Total	62,751	1.4
Diet high in processed meat	Coronary heart disease	49,197	14.2
	Diabetes	8,800	8.7
	Bowel cancer	7,124	7.7
	Total	65,121	1.4
Diet low in nuts and seeds	Coronary heart disease	55,294	16.0
	Diabetes	7,485	7.4
	Total	62,779	1.4
Diet low in whole grains	Coronary heart disease	29,188	8.4
	Diabetes	12,144	11.9
	Stroke	10,312	7.5
	Total	51,644	1.1
Diet low in fibre	Coronary heart disease	34,206	9.9
	Bowel cancer	8,982	9.7
	Total	43,188	1.0
Diet high in saturated fat	Total	32,831	0.7
Diet low in omega-3 fatty acids	Total	14,848	0.3
Diet high in sweetened beverages	Total	12,411	0.3
Diet high in sodium	Total	12,124	0.3
Diet low in milk	Total	10,214	0.2
Diet high in red meat	Total	7,501	0.2
Diet low in calcium	Total	5,982	0.1

Note: The 'per cent' columns refer to the proportion of burden attributable to the risk factor within the linked disease of that row or the proportion of the entire burden of disease and injury for the total row.

Appendix E: List of contributors

Table E1: List of disease-specific contributors

Expert (group or person)	Organisation
Blood and metabolic disorders	
Assoc. Prof. Scott Bell	The Prince Charles Hospital, University of Queensland
Prof. Amanda Lee	Queensland University of Technology
Dr Simon Mcrae	Royal Adelaide Hospital, The Queen Elizabeth Hospital
Dr John Rowell	Royal Brisbane and Women's Hospital
Cancer and other neoplasms	
Cancer and Screening Unit	AIHW
Cancer Monitoring Advisory Group	AIHW advisory group
Prof. James Bishop AO	Victorian Comprehensive Cancer Centre
Dr Pamela Brown	Consultant dermatologist
Dr Keng Chen	Skin and Cancer Foundation
Assoc. Prof. Rosemary Knight	Department of Health (former)
Prof. David Roder	University of South Australia
Dr Timothy Threlfall	WA Cancer Registry
Prof. Christobel Saunders	Harry Perkins Institute of Medical Research
Dr Catherine Shannon	Mater Cancer Care Centre
Assoc. Prof. James St John AM	Cancer Council Victoria (retired)
Assoc. Prof. Chris Stephenson	Deakin University
Cardiovascular diseases	
Cardiovascular, Diabetes & Kidney Unit	AIHW
Cardiovascular Disease Expert Advisory Group: Andrew Tonkin (Chair), Tom Briffa, Derek Chew, Annette Dobson, John Lynch and Mandy Thrift	AIHW advisory group
Endocrine disorders	
Cardiovascular, Diabetes and Kidney Unit	AIHW
Diabetes Expert Advisory Group: Jonathan Shaw (Chair), Stephen Colagiuri, Maria Craig, Wendy Davis, Mark Harris, Greg Johnson, Glynis Ross and Sophia Zoungas	AIHW advisory group

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
Gastrointestinal disorders	
Prof. Jane Andrews	Royal Adelaide Hospital
Dr Paul Clark	University of Queensland
Clinical Assoc. Prof. Peter Katelaris	University of Sydney
Dr Suzanne Mahady	University of Sydney
Dr Stephen Williams	Westmead Hospital
Hearing and vision disorders	
Office of Hearing Services	Department of Health
Prof. Robert Cowan	University of Melbourne, Macquarie University, HEARing CRC and HearWorks
Prof. Harvey Dillon	National Acoustic Laboratories, Australian Hearing, The HEARing CRC
Prof. Louise Hickson	University of Queensland, Communication Disability Centre
Ms Alison King	Australian Hearing
Prof. Hugh Taylor	The University of Melbourne
Infant and congenital conditions	
Maternal Health, Children, Youth and Families Unit	AIHW
Prof. Nadia Badawi	University of Sydney, Children's Hospital at Westmead, Cerebral Palsy Alliance
Clinical Assoc. Prof. Gareth Baynam	Western Australian Department of Health, University of Western Australia
Prof. Carol Bower	Telethon Kids Institute, Western Australian Department of Health
Dr Adrienne Gordon	University of Sydney
Dr Lisa Hilder	National Perinatal Epidemiology and Statistics Unit, University of New South Wales
Assoc. Prof. Alison Kent	Australian National University, The Canberra Hospital
Dr Karen Walker	University of Sydney
Infectious diseases	
Office of Health Protection	Department of Health
Dr Frank Beard	National Centre for Immunisation Research and Surveillance
Dr Paul Kelly	Australian Capital Territory Health
Assoc. Prof. Martyn Kirk	Australian National University
Assoc. Prof. David Wilson	The Kirby Institute, University of New South Wales
Dr Jeannette Young	Queensland Health

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
Injuries	
Prof. James Harrison	Research Centre for Injury Studies, Flinders University
Dr Sophie Pointer	Research Centre for Injury Studies, Flinders University
Kidney and urinary diseases	
Cardiovascular, Diabetes and Kidney Unit	AIHW
Chronic Kidney Disease Expert Advisory Group: Tim Mathew (Chair), Alan Cass, Steven Chadban, Jeremy Chapman, Joan Cunningham, Bettina Douglas, Wendy Hoy, Stephen McDonald and David Parker	AIHW advisory group
Mental and substance use disorders	
AIHW Mental Health and Palliative Care Unit	AIHW
Ms Jenny Bourke	Telethon Kids Institute
Prof. Louisa Degenhardt	National Drug and Alcohol Research Centre, University of New South Wales
Dr Alize Ferrari	University of Queensland
Prof. Wayne Hall	University of Queensland
Assoc. Prof. Helen Leonard	Telethon Kids Institute
Prof. John McGrath	University of Queensland
Prof. George Patton	Royal Children's Hospital Melbourne
Prof. Harvey Whiteford	University of Queensland
Musculoskeletal conditions	
Population Health and Primary Care Unit	AIHW
National Centre for Monitoring Arthritis and Other Musculoskeletal Conditions Advisory Group	AIHW advisory group
Prof. Chris Maher	University of Sydney
Prof. Lyn March	University of Sydney
Mr Matthew Montgomery	ABS
Prof. Tania Winzenberg	University of Tasmania

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
Neurological conditions	
Disability and Ageing Unit	AIHW
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Prof. George Mellick	Griffith University
Prof. Matthew Kiernan	University of Sydney
Prof. Andrew Palmer	University of Tasmania
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Prof. Marco Peres	Australian Research Centre for Population Oral Health, University of Adelaide
Dr John Rogers	Victorian Department of Health
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Prof. Caroline Homer	University of Technology, Sydney
Assoc. Prof. Michael Nicholl	University of Sydney, Northern Sydney Local Health District
Prof. Jeremy Oats	University of Melbourne
Respiratory diseases	
Australian Centre for Asthma Monitoring	AIHW collaborating centre
Prof. Tim Driscoll	University of Sydney
Prof. Guy Marks	Woolcock Institute of Medical Research, University of Sydney
Assoc. Prof. Helen Reddel	Woolcock Institute of Medical Research, University of Sydney
Skin disorders	
Dr Pamela Brown	Consultant dermatologist
Dr Keng Chen	Skin and Cancer Foundation
Dr Suzanne Kapp	La Trobe University
Dr Monique Kilkenny	Monash University
Dr Rosana Norman	Queensland University of Technology

Table E2: List of risk-specific contributors

Expert (group or person)	Organisation
Cardiovascular, Diabetes and Kidney Unit	AIHW
Tobacco, Alcohol and Other Drugs Unit	AIHW
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Prof. Tim Driscoll	University of Sydney
Ms Louise Gates	ABS
Dr Ivan Hanigan	Australian National University
Prof. Amanda Lee	Queensland University of Technology
Prof. Robyn Lucas	National Centre for Epidemiology and Population Health Australian National University
Ms Leanne Luong	ABS
Assoc. Prof. Peter Somerford	Western Australian Department of Health
Dr Rosemary Stanton	Nutritionist consultant
Assoc. Prof. David Wilson	The Kirby Institute, University of New South Wales
Dr Fan Xiang	National Centre for Epidemiology and Population Health Australian National University

Glossary

additional diagnosis: A condition or complaint either coexisting with the principal diagnosis or arising during the episode of admitted patient care, episode of residential care or attendance at a health care establishment. METeOR identifier: 514271.

admitted patient: A patient who undergoes a hospital's admission process to receive treatment and/or care. This treatment and/or care is provided over a period of time and can occur in hospital and/or in the person's home (for hospital-in-the-home patients). METeOR identifier: 268957.

age-standardisation: A set of techniques used to remove, as far as possible, the effects of differences in age when comparing two or more populations.

age-standardised rate: Rate that takes into account the age structure of the population.

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).

avoidable burden: The reduction in future burden that would occur if current and/or future exposure to a particular risk factor were avoided. Compare with attributable burden.

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.

chronic: Persistent and long-lasting.

comorbidity: A situation where a person has two or more health problems at the same time.

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.

disability weight: A factor that reflects the severity of health loss from a particular health state on a scale from 0 (perfect health) to 1 (equivalent to death).

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.

excess burden: The reduction that would occur in overall disease burden if all groups had the same rate of burden as the least burdened group.

external cause: The environmental event, circumstance or condition as the cause of injury, poisoning and other adverse effect. METeOR identifier: 514295.

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'.

health state: Consequences of diseases and conditions reflecting key differences in symptoms and functioning.

hospitalisation: Synonymous with admission and separation; that is, an episode of hospital care that starts with the formal admission process and ends with the formal separation process.

incidence: The number of new cases (of an illness or injury) occurring during a given period.

International Classification of Diseases (ICD): The World Health Organization's internationally accepted classification of diseases and related health conditions. The tenth revision, Australian modification (ICD-10-AM) is currently in use in Australian hospitals for admitted patients.

morbidity: Ill health in an individual, and levels of ill health in a population or group.

mortality: Death.

non-admitted patient: A patient who does not undergo a hospital's formal admission process. There are three categories of non-admitted patient: emergency department patient, outpatient, and other non-admitted patient (treated by hospital employees off the hospital site—includes community/outreach services). METeOR identifier: 268973.

non-fatal burden: The burden from living with ill health as measured by years lived with disability. Often used synonymously with YLD, and also referred to as 'health loss' in this report.

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.

premature mortality: Deaths that occur at a younger age than a selected cut-off.

prevalence: The number of cases of a disease or injury in a population at a given time.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health care establishment. METeOR identifier: 514273.

rate: A rate is one number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers.

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

sequelae: Consequences of diseases.

TMRED (theoretical minimum risk exposure distribution): The distribution of exposure to a risk factor that would have the lowest associated population risk.

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.

References

ABS (Australian Bureau of Statistics) 2010. Measures of Australia's progress, 2010. Cat. no. 1370.0. Canberra: ABS. Viewed: 13 November 2015. <http://www.abs.gov.au/ausstats/abs@.nsf/cat/1370.0>.

ABS 2012a. Causes of Death, Australia, 2012. ABS cat. no. 3303.0. Canberra: ABS. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3303.0Explanatory%20Notes12012?OpenDocument>.

ABS 2012b. Census of population and housing – Counts of Aboriginal and Torres Strait Islander Australians, 2011. ABS cat. no. 2075.0. Canberra: ABS. <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2075.0main+features32011>.

ABS 2012c. Population by Age and Sex, Regions of Australia, 2011. ABS cat. no. 3235.0. Canberra: ABS. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3235.0Main+Features12011?OpenDocument>.

ABS 2013. Australian Statistical Geography Standard (ASGS): Volume 5—Remoteness Structure, July 2011. ABS cat. no. 1270.0.55.005. Canberra: ABS.

ABS 2014. Deaths, Australia, 2013. ABS cat. no. 3302.0. Canberra: ABS.

AIHW (Australian Institute of Health and Welfare) 2012a. A working guide to international comparisons of health. Cat. no. PHE 159. Canberra: AIHW.

AIHW 2012b. Cancer survival and prevalence in Australia: period estimates from 1982 to 2010. Cancer Series no. 69. Cat. no. CAN 65. Canberra: AIHW

AIHW 2013. Deaths data at AIHW. Canberra: AIHW. <http://www.aihw.gov.au/deaths/aihw-deaths-data/>.

AIHW 2014a. Assessment of Global Burden of Disease 2010 methods for the Australian context: Australian Burden of Disease Study. Working paper no. 1. Canberra: AIHW.

AIHW 2014b. Australia's health 2014. Australia's health series no. 14. Cat. no. AUS 178. Canberra: AIHW.

AIHW 2014c. Cancer in Australia: an overview 2014. Cancer series no. 90. Cat. no. CAN 88. Canberra: AIHW.

AIHW 2014d. National Drug Strategy Household Survey detailed report: 2013. Drug statistics series no. 28. Cat. no. PHE 183. Canberra: AIHW.

AIHW 2015a. Australian Burden of Disease Study: fatal burden of disease 2010. Australian Burden of Disease Study series no. 1. Cat. no. BOD 1. Canberra: AIHW.

AIHW 2015b. Australian Burden of Disease Study: fatal burden of disease in Aboriginal and Torres Strait Islander people 2010. Australian Burden of Disease Study series 2. Cat. no. BOD 2. Canberra: AIHW.

AIHW 2015c. Premature mortality in Australia 1997–2012. Canberra: AIHW. <http://www.aihw.gov.au/deaths/premature-mortality/>.

Begg S, Vos T, Barker B, Stevenson C, Stanley L & Lopez A 2007. The burden of disease and injury in Australia 2003. Cat. no. PHE 82. Canberra: AIHW.

Boerma T & Mathers CD 2015. The World Health Organization and global health estimates: improving collaboration and capacity. BMC Medicine 13:50.

Brennan DS & Spencer AJ 2004. Disability weights for the burden of oral disease in South Australia. Population Health Metrics 2(1):1.

Bryant W & Cussen T 2015. Homicide in Australia: 2010–11 to 2011–12: National Homicide Monitoring Program report. Canberra: Australian Institute of Criminology.

CDC (Centers for Disease Control and Prevention) 2015. Health effects of cigarette smoking. Viewed 10 February 2016, <http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/#quit>.

Chen A, Jacobsen KH, Deshmukh AA & Cantor SB 2015. The evolution of the disabilityadjusted life year (DALY). Socio-Economic Planning Sciences 49:10–5.

Ezzati M, Lopez AD, Rodgers AA & Murray CJL 2004. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva: World Health Organization.

GBD 2013 Risk Factors Collaborators 2015. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013; 2013: a systematic analysis for the Global Burden of Disease Study 2013: Supplementary appendix The Lancet The Lancet 386(10010):2287–2323. doi: 10.1016/S0140-6736(15)60692-4.

Haagsma JA, Maertens de Noordhout C, Polinder S, Vos T, Havelaar AH, Cassini A et al. 2015. Assessing disability weights based on the responses of 30,660 people from four European countries. Population Health Metrics 13:10. doi: 10.1186/s12963-015-0042-4.

Hall G, Kirk M, Becker N, Gregory J, Unicomb L, Millard G et al. 2005. Estimating foodborne gastroenteritis, Australia. Emerging Infectious Diseases 11(8):1257–64.

Harrison JE & Henley G 2015. Injury deaths data, Australia: technical report on issues associated with reporting for reference years 1999–2010. Injury research and statistics series no. 94. Cat. no. INJCAT. 170. Canberra: AIHW.

Institute for Health Metrics and Evaluation (IHME) 2015. GBD Compare. Seattle, WA: IHME, University of Washington. Viewed 11 April 2016, <http://vizhub.healthdata.org/gbd-compare>.

Jansson J & Wilson D 2012. Mapping HIV outcomes: geographical and clinical forecasts of numbers of people living with HIV in Australia. Sydney: National Centre in HIV Epidemiology and Clinical Research.

Kemmeren JM, Mangen MJJ, van Duynhoven YTHP & Havelaar AH 2005. Priority setting of foodborne pathogens. RIVM Report 330080001. RVIM: Bilthoven.

Kilkenny M, Merlin K, Plunkett A & Marks R 1998. The prevalence of common skin conditions in Australian school students: 3. Acne vulgaris. British Journal of Dermatology 139(5): 840–5.

Kirk M, Glass K, Ford L, Brown K & Hall G. Foodborne illness in Australia: annual incidence circa 2010. Canberra: Department of Health.

Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. 2012. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380(9859): 2224-2260.

Lopez A, Mathers C, Ezzati M et al. (eds) 2006. Global burden of disease and risk factors. Washington DC: World Bank.

Lucas R, McMichael T, Smith W & Armstrong B. 2006. Solar Ultraviolet Radiation: Global burden of disease from solar ultraviolet radiation. Environmental Burden of Disease Series. Geneva: World Health Organization.

Mathers C, Vos T & Stevenson C 1999. The burden of disease and injury in Australia. Cat. no. PHE 17. Canberra: AIHW.

McCarty CA, Nanjan MB & Taylor HR 2001. Vision impairment predicts 5 year mortality. British Journal of Ophthalmology 85:322-6.

MOH (New Zealand Ministry of Health) 2012. Ways and means: a report on methodology from the New Zealand Burden of Diseases, Injuries and Risk Factors Study, 2006–2016. Wellington: New Zealand Ministry of Health.

Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C et al. 2012a. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380:2197–223.

Murray CJ, Ezzati M, Flaxman AD et al. 2012b. GBD 2010: design, definitions, and metrics. The Lancet 380: 2063–6.

Murray CJ & Lopez A 1996. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Harvard: Harvard School of Public Health.

Murray CJ, Barber RM, Foreman KJ, Abbasoglu Ozgoren A, Abd-Allah F, Abera SF et al. 2015. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition. Lancet 386:2145–91.

Nord E 2013. Disability weights in the Global Burden of Disease 2010: Unclear meaning and overstatement of international agreement. Health Policy 111:99–104.

Plunkett A, Merlin K, Gill D, Zuo Y, Jolley D & Marks R 1999. The frequency of common non-malignant skin conditions in adults in central Victoria, Australia. International Journal of Dermatology 38(12):901–8.

Richardson J 2002. Evaluating summary measures of population health. In: Murray C, Salomon J, Mathers C & Lopez A (eds). Summary measure of population health: concepts, ethics, measurement and applications. Geneva: World Health Organization 147–60.

Salomon JA, Haagsma JA, Davis A, de Noordhout CM, Polinder S, Havelaar AH et al. 2015. Disability weights for the Global Burden of Disease 2013 study. The Lancet Global Health 3:e712–e23.

Taylor B, Irving HM, Kanteres F et al. 2010. The more you drink, the harder you fall: a systematic review and meta-analysis of how acute alcohol consumption and injury or collision risk increase together. Drug and Alcohol Dependence 110:108–16.

The Kirby Institute 2012. HIV, viral hepatitis and sexually transmissible infections in Australia annual surveillance report 2012. Sydney: The Kirby Institute.

The Kirby Institute 2013. National blood-borne virus and sexually transmissible infections surveillance and monitoring report. Sydney: The Kirby Institute.

The Kirby Institute 2015. Annual surveillance report of HIV, viral hepatitis and sexually transmitted infections. Sydney: The Kirby Institute.

US Burden of Disease Collaborators 2013. The state of US health, 1990-2010: burden of diseases, injuries, and risk factors. The Journal of the American Medical Association 210(6):591–606.

Voigt K & King NB 2014. Disability weights in the global burden of disease 2010 study: two steps forward, one step back? Bulletin of the World Health Organization 92:226–8.

Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I et al. 2015. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet 386(9995):743–800. doi: 10.1016/S0140-6736(15)60692-4.

Vos T, Barker B, Stanley L and Lopez A 2007. The burden of disease and injury in Aboriginal and Torres Strait Islander peoples 2003. Brisbane: School of Population Health, The University of Queensland.

WHO (World Health Organization) 2009. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: WHO.

WHO 2014a. Disease and injury regional estimates, 2000–2011. Geneva: WHO. Viewed 23 June 2014, <http://www.who.int/healthinfo/global_burden_disease/estimates_regional_2000_2011/en/>.

WHO 2014b. WHO methods and data sources for global causes of death 2000–2011 (Global Health Estimates). Geneva: WHO. Viewed 30 October 2014, <http://www.who.int/healthinfo/global_burden_disease/en/>.

WHO 2015. Respiratory tract diseases. Geneva: WHO. Viewed 10 February 2016, <http://www.who.int/topics/respiratory_tract_diseases/en/>.

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This report analyses the impact of nearly 200 diseases and injuries in terms of living with illness (non-fatal burden) and premature death (fatal burden). The study found that chronic diseases such as cancer, cardiovascular diseases, mental and substance use disorders, and musculoskeletal conditions, along with injury contributed the most burden in Australia in 2011. Almost one third of the overall disease burden could be prevented by removing exposure to risk factors such as tobacco use, high body mass, alcohol use, physical inactivity and high blood pressure.