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Australian Burden of Disease Study

Impact and causes of illness and death in Aboriginal and Torres Strait Islander people

2011

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Foreword

I am pleased to present *Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2011*, a landmark report that presents detailed burden of disease estimates for the Aboriginal and Torres Strait Islander population. The report presents the results of the Indigenous component of the Australian Burden of Disease Study (ABDS) 2011; results from the national component of the study are presented in *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011*, also published by AIHW in 2016.

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 guide expenditure on health that is cost effective, equitable and optimises health gains. In funding the ABDS, the Department of Health and the former Australian National Preventive Health Agency have made a substantial investment in information that will help to improve the health of Aboriginal and Torres Strait Islander people and close the gap between Indigenous and other Australians.

This report—the first Indigenous burden of disease study undertaken by the AIHW—provides a set of estimates of the fatal and non-fatal burden of disease for the 2011 and 2003 reference years. It also provides estimates of attributable burden for various risk factors, as well as disaggregation of estimates by selected states and territories, socioeconomic group and remoteness. Estimates of the gap in disease burden between Indigenous and non-Indigenous Australians are also reported.

The last burden of disease study that provided estimates for the Aboriginal and Torres Strait Islander population was published in 2007 using data from 2003. The ABDS 2011 provides updated Indigenous burden of disease estimates which aim to provide an evidence base to inform Indigenous health policy and planning in Australia. The study uses Australian data sources and incorporates methodological developments from recent global studies where relevant tailored for their relevance to the Australian and Indigenous Australian population and health system context. The ABDS 2011 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 experienced by the Aboriginal and Torres Strait Islander population in 2011 (the year with the best data available when this study commenced), how it has changed since 2003 and how it compares to the non-Indigenous population. A companion summary report is also available.

My thanks go to the many individuals and organisations—including the authors, expert advisors and data suppliers—that contributed to this study.

Barry Sandison
Director
September 2016

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Acknowledgments

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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 is appreciated.

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Abbreviations

AATSIHS	Australian Aboriginal and Torres Strait Islander Health Survey
ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AHS	Australian Health Survey
AIHW	Australian Institute of Health and Welfare
ANZDATA	Australian and New Zealand Dialysis and Transplant Registry
ASR	age-standardised rate
BMI	body mass index
BoD	burden of disease
CDE	Census Data Enhancement Study
CHD	coronary heart disease
CKD	chronic kidney disease
CLD	chronic liver disease
COAG	Council of Australian Governments
COPD	chronic obstructive pulmonary disease
CVD	cardiovascular disease
DALY	disability-adjusted life years
EAG	Expert Advisory Group
ED	emergency department
EMD	Enhanced Mortality Database
ERP	Estimated Resident Population
FGID	functional gastrointestinal disorders
GBD	Global Burden of Disease Study
GBS	Guillain-Barré Syndrome
GI	gastrointestinal
GORD	gastro-oesophageal reflux disease
IBD	inflammatory bowel disease
ICD	International Classification of Diseases
IDEA	Intellectual Disability Exploring Answers
IHME	Institute for Health Metrics and Evaluation
ILD	interstitial lung disease
IRG	Indigenous Reference Group
IRSEO	Indigenous Relative Socioeconomic Outcomes
LBW	Low birthweight
NNDSS	National Notifiable Diseases Surveillance System
NSW	New South Wales
NT	Northern Territory
PAF	population attributable fraction
Qld	Queensland
RTI	road traffic injuries
SA	South Australia
SEIFA	Socio-economic Indexes for Areas
SIDS	sudden infant death syndrome
Tas	Tasmania
TMRED	Theoretical-minimum-risk exposure distribution
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
n.a.	not available
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

Summary

This report presents the results of the Indigenous component of the Australian Burden of Disease Study 2011. It provides estimates of the total, non-fatal and fatal burden of disease and injuries for the Aboriginal and Torres Strait Islander population for 2011 and 2003 using the DALY (disability-adjusted life years) measure. It also provides estimates of the burden attributable to 29 risk factors, and estimates of the gap in disease burden between Indigenous and non-Indigenous Australians.

The results presented here are for the year 2011 unless otherwise stated. For any comparisons between populations or years, adjustments have been made where necessary to account for differences in population size and age structure.

Indigenous Australians experience a burden of disease that is 2.3 times the rate of non-Indigenous Australians

There were 284 years lost due to premature death or living with illness for every 1,000 Indigenous people in Australia in 2011, equivalent to 190,227 DALY. Indigenous Australians experienced a burden of disease that was 2.3 times the rate of non-Indigenous Australians. Rates of fatal and non-fatal burden for Indigenous Australians were 2.7 and 2.0 times those for non-Indigenous Australians, respectively.

Most of the burden is from chronic diseases and injuries

Chronic diseases as a group accounted for almost two-thirds (64%) of the total disease burden. The disease group causing the most burden among Indigenous Australians was mental & substance use disorders (19% of the total). This group includes conditions such as anxiety and depressive disorders, alcohol use disorders, drug use disorders and autism spectrum disorders. Other major contributors to the total burden were injuries (which includes suicide) (15%), cardiovascular diseases (12%), cancer (9%), respiratory diseases (8%) and musculoskeletal conditions (7%). Disease groups varied in their contribution to the fatal and non-fatal burden.

Coronary heart disease (CHD), suicide & self-inflicted injuries, anxiety disorders, alcohol use disorders and diabetes were the leading specific diseases, together contributing 24% of the total burden.

These are also the main causes of the gap in disease burden

Chronic diseases were responsible for more than two-thirds (70%) of the gap in disease burden between Indigenous and non-Indigenous Australians. This group includes conditions such as cardiovascular diseases (19% of the gap), mental & substance use disorders (14%), cancer (9%), chronic kidney disease (CKD), diabetes, vision loss, hearing loss and certain respiratory, musculoskeletal, neurological and congenital disorders.

Injuries were responsible for 14% of the overall gap (15% of the gap in fatal burden and 11% of the gap in non-fatal burden). Indigenous Australians experienced rates of disease burden due to injuries 3 times those for non-Indigenous Australians.

Disease burden differs across state/territory, remoteness and socioeconomic groups

The Northern Territory and Western Australia had higher rates of Indigenous burden of disease than New South Wales and Queensland (the 4 jurisdictions for which estimates are reported). In Western Australia, Indigenous Australians experienced rates of disease burden 2.8 times those for non-Indigenous Australians.

Large inequalities were also evident across remoteness areas, with *Remote* and *Very remote* areas having higher rates of disease burden than non-remote areas. Burden of disease rates were highest in areas where the Indigenous population was most socioeconomically disadvantaged and fell with decreasing level of disadvantage.

There has been a decrease in the fatal burden since 2003

There was a 5% reduction in the rate of total burden in the Indigenous population between 2003 and 2011 (equivalent to 25 DALY per 1,000 people). Most of this improvement came from decreases in the rate of fatal burden (11%), by preventing or delaying deaths from particular diseases or injuries. Large reductions were evident in rates of fatal burden due to cardiovascular diseases.

There was, however, a 4% increase in the rate of non-fatal burden for Indigenous Australians between 2003 and 2011 (equivalent to 7 YLD per 1,000 people). This was mainly due to increases in people living with chronic diseases such as diabetes, anxiety and depressive disorders, and asthma; and from the non-fatal effects of injuries such as falls.

A large proportion of the burden is preventable

Around 37% of the burden of disease in Indigenous Australians was preventable by reducing exposure to the modifiable risk factors included in this study (which does not include the social determinants of health). The risk factors causing the most burden were tobacco use (12% of the total burden), alcohol use (8%), high body mass (8%), physical inactivity (6%), high blood pressure (5%) and high blood plasma glucose (5%). Dietary factors were also important, together accounting for almost 10% of the total burden.

Together, the 29 risk factors included in the study accounted for half (51%) of the gap in disease burden between Indigenous and non-Indigenous Australians. Tobacco use was the biggest contributor to this, accounting for almost one-quarter (23%) of the overall gap.

1 Introduction

Burden of disease analysis is a way of measuring the combined effect of the fatal and non-fatal impacts of diseases and injuries on a population. It takes into account people's age at death and the severity of disease in addition to counting deaths and disease prevalence. 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 guide expenditure on health that is cost effective, equitable and optimises health gains. This is especially important for the Indigenous population because it is known to have unacceptably high levels of mortality, illness and injury (AIHW 2015d). The Australian Burden of Disease Study (ABDS) 2011 directly addresses this information requirement with detailed analysis of national and Indigenous burden of disease estimates designed to meet Australia's needs.

This report is 1 of 2 major works arising from the ABDS. This report presents a detailed picture of the burden of disease for the Aboriginal and Torres Strait Islander population in 2011, as well as how this burden has changed since 2003 (the focus of the last Indigenous burden of disease study). It also provides estimates of the gap in disease burden between Indigenous and non-Indigenous Australians as well as estimates of the burden attributable to selected risk factors. Detailed results for the Australian population as a whole are presented in *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016a).

Readers will note that this report contains a lot of technical detail and is written mainly for health professionals, policy makers and planners, and health researchers. For the general reader, 'What it means' boxes have been included throughout the report to provide an overview of the key concepts and messages. A simpler and much smaller summary report has also been written and is available on the AIHW website at <aihw.gov.au>.

Note that the terms 'Indigenous Australians' and 'Indigenous population' have been used interchangeably throughout this report to refer to the Aboriginal and Torres Strait Islander population in Australia.

1.1 What is burden of disease?

Burden of disease analysis is a way of measuring, comparing and combining 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 the DALY—a disability-adjusted life year. A DALY combines estimates of years of life lost due to premature death (YLL) and years lived with ill health or 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 in 'Appendix B: Methods overview'.

The health loss that the DALY measures 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. A key strength of a burden of disease study is its ability to use data from a range of sources to construct an internally consistent measure for all diseases. Similar comparisons and rankings across different diseases or injuries cannot be produced using separate studies conducted on a disease-by-disease basis or using disparate data sources.

What it means: counting the impact of health problems

How do we know what causes early death and poor health of Indigenous Australians?

How do we know if health is getting better?

How do we know if the health of Indigenous Australians is better or worse than the health of non-Indigenous Australians? And what causes that?

This study uses a method called burden of disease analysis, to answer these questions. It adds up all the effects of different health problems—the causes of why people die early and at what age they die, and the causes of poor health while people are alive. It includes diseases like cancer and injuries like falls.

This study also counts the effect of poor health and early death that risks to health, like smoking and alcohol, cause.

Burden of disease analysis is a way of measuring and comparing the effect of different diseases or injuries and risk factors on a group of people. It adds all the impacts of health problems together into a measure of health called the DALY—disability-adjusted life years. This is done by counting up:

- the years that people die earlier than the 'ideal' age (for example, dying early due to cancer), called YLL—years of life lost, and
- the years people spend living with a disease or the results of an injury (for example, living with cancer), called YLD—years of life lived with disability.

Total impact of health problems = early death + living with poor health

Box 1.1: Key terms used in this report

Attributable burden: The disease burden attributed to a particular risk factor. This then provides an estimate of 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 years (DALY) measure. Referred to as the 'burden' of the disease or injury in this report.

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.

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

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).

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, with which health losses can be associated.

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. Often used synonymously with YLD.

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

Risk factor: Any factor which represents a greater risk of a health condition or health event. For example, smoking, excess alcohol use, high body mass, low consumption of vegetables, and so forth.

Sequelae: Health consequences of diseases. For example, heart failure due to coronary heart disease.

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 the non fatal burden.

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

(Refer to the 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 monitoring the health of the population, making health policies and planning health services, and assessing the relative impact of different diseases. It can't by itself provide information about direct impacts on the health system, how resources should be allocated or what kinds of interventions will be most effective, though it can help with identifying potential starting points for these kinds of investigations.

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. It allows comparability of these measures between disease groups, individual causes and population groups. The contribution of various risk factors can also be described using the same measures.

What it means: How can this information be used?

Information from burden of disease analysis can be used to help:

- make sure that the right actions are taken to improve health
- plan programs to avoid or prevent as much poor health as possible
- check to see if health is improving.

Health policy and health-service planning

Burden of disease studies can provide valuable information to inform health policy formulation and health-service planning. These studies can highlight which diseases and risk factors cause the most burden, which are increasing or decreasing, and which show the most 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.

In addition, estimates of the burden attributable to specific risk factors can be used to develop prevention policies. Burden of disease estimates are designed to inform health policy in relation to prevention, early intervention and treatment (aiming for a cure or lesser severity) of diseases and risk factors.

Assessing 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. It can also be used to highlight which diseases or risk factors to focus on for cost-effectiveness analyses—the areas where there is the most potential for health gains. It can be also be useful to compare burden of disease information with disease expenditure estimates.

What can't burden of disease studies tell us?

Burden of disease analysis quantifies the size of health problems in terms of mortality and ill health or disability. It does not take into account broader factors, such as social or 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 in conjunction with other information about workforce to determine where the gaps are.

Although burden of disease analysis quantifies 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 ones are most cost-effective. However, as outlined earlier, burden of disease analysis helps to identify those conditions for which cost-effectiveness of interventions should be investigated, to gain the maximum benefit.

1.3 Previous burden of disease studies

The first global study—for the year 1990—developed the DALY measure and quantified the global disease burden (and attribution to risk factors) reported for 8 regions of the world (Murray & Lopez 1996). Since then, additional global and country studies have been undertaken and methods have been further developed. Before this 2011 study, there have been 2 major national burden of disease studies in Australia—the first of which the Australian Institute of Health and Welfare (AIHW) published in 1999 using 1996 data, and the second the AIHW and the University of Queensland published in 2007 using 2003 data. There has also been 1 national study for Aboriginal and Torres Strait Islander people published in 2007 using 2003 data (Vos et al. 2007). Some states and territories have also carried out burden of disease studies. 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
Global study: WHO	2004 with projections to 2030	WHO 2009
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: 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 Institute of Health Metrics and Evaluation (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 methods changes included a new standard life table, removal of age weighting and discounting, use of a prevalence-based YLD and new disability weights. 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 burden of disease studies have also estimated disease burden in Australia but not the burden that Indigenous Australians and subnational population groups experience. The primary use of these global studies is for international comparisons. They use methods and assumptions designed to match the 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.

1.4 Australian Burden of Disease Study 2011

In 2013, the Department of Health and the former Australian National Preventive Health Agency funded the AIHW to update burden of disease estimates for Australia and for the Aboriginal and Torres Strait Islander population. The Australian Burden of Disease Study (ABDS) 2011 has 2 separate but interlinked components:

- the national component, which provides estimates for the total Australian population
- the Indigenous component, which provides estimates for the Indigenous population.

The ABDS builds on the AIHW's previous burden of disease studies, disease monitoring work and significant experience in Indigenous data and statistics.

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 data availability from key data sources at the time analysis began (Estimated Resident Population estimates for the Aboriginal and Torres Strait Islander population from the 2011 Census, the Australian Health Survey (AHS)/Australian Aboriginal and Torres Strait Islander Health Survey (AATSIHS), deaths data, hospital admissions data and various disease registers).

The ABDS 2011 provides Australian-specific burden of disease estimates designed to suit the Australian context for the total population and Aboriginal and Torres Strait Islander population (including subnational estimates). 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.

Why study the Aboriginal and Torres Strait Islander disease burden?

Aboriginal and Torres Strait Islander people as a population group experience a very different disease burden to non-Indigenous Australians— both a higher burden as well as some differences in the pattern and age distribution of diseases. Indigenous Australians also have higher mortality rates than non-Indigenous Australians across all age groups and for all leading causes of death. Responding to this, 2 of 6 Council of Australian Governments (COAG) Closing the Gap targets are mortality-related—to close the gap in life expectancy within a generation, and to halve the gap in mortality rates for Indigenous children aged under 5 by 2018.

Burden of disease estimates for the Aboriginal and Torres Strait Islander population will provide evidence on the diseases and injuries currently contributing most to Indigenous mortality and ill health, and on the largest gaps in disease burden between Indigenous and non-Indigenous Australians. This information will be important in assisting governments and service providers to develop interventions that can reduce the incidence of risk factors and other main contributors to the burden of disease and injury in the Indigenous population.

Box 1.2: Key developments since the 2003 Indigenous Australian burden of disease study

Burden of disease estimates for Indigenous Australians in the ABDS 2011 will differ to those produced in the 2003 Indigenous burden of disease study due to differences in the following:

- 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, and the maximum number of years remaining for a person of given age. The table is the same for males and females, and for the Indigenous and non-Indigenous population.
- Updated disability weights.
- YLD now based more directly on data, so less reliance on modelling; this is closer to how YLL are calculated.
- A more comprehensive list of diseases for explicit estimation which has been tailored to suit the Australian context.
- New conceptual models for some diseases.
- New data sources for many diseases, notably the AATSIHS and greater use of linked data.
- Use of direct methods to adjust for Indigenous under-identification in mortality data based on national data linkages studies, and in hospitalisation data based on national hospital audits involving patient interviews.
- More comprehensive assessment of indirect methods to derive Indigenous prevalence estimates when no suitable data source was available, using a set of criteria that the AIHW developed.
- More accurate and useful measures of the gap between Indigenous and non-Indigenous Australians, by reporting of both rate ratios and rate differences, and using the direct age-standardisation method to enable comparisons over time.
- Reporting of Indigenous burden of disease estimates for selected states and territories, 5 categories of remoteness (2003 study reported estimates for remote and non-remote areas only), and by level of socioeconomic disadvantage using an Indigenous-specific index of socioeconomic outcomes (Biddle 2013).

Further information on these key developments can be found in 'Chapter 3 Context, assumptions and methodological choices'.

How does the ABDS 2011 compare to previous burden of disease studies?

Due to a number of substantial methodological changes, the estimates from the previous Indigenous burden of disease study in Australia (Vos et al. 2007) are not comparable with those for the Indigenous component of the ABDS 2011 (refer to Box 1.2 for the main differences). Estimates for 2003 have been recalculated using the updated methods to enable comparison over time (see 'Chapter 9 Change between 2003 and 2011'). This current study includes a number of improvements to methods relating specifically to the calculation of Indigenous burden of disease estimates. Such improvements include:

- adjusting for Indigenous under-identification in mortality data using direct methods based on national data linkage studies
- reporting of 2 key measures of the gap between Indigenous and non-Indigenous Australians (rate ratios and rate differences) using the direct age-standardisation method to enable comparisons over time
- using an Indigenous-specific index of socioeconomic outcomes (Biddle 2013) to examine burden estimates by level of socioeconomic disadvantage.

Project governance and stages of work

The ABDS 2011 was undertaken between 2013 and 2016. To guide the work at the outset, a set of principles and requirements was developed in consultation with the study's funders and advisory groups. It was agreed that 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 (EAG) was established to provide advice on key technical issues including the overall methodology and policy implications for the national study. An Indigenous Reference Group (IRG) provided advice on estimates for the Aboriginal and Torres Strait Islander population. Disease-specific advice was sought through engagement with expert panels. Additionally, a Jurisdictional Working Group, comprising representatives from the states and territories and the Australian Government, was also set up to ensure input and communication on subnational 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 EAG and IRG, 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*—that 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 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 2013) and, more recently, GBD 2013—have also been incorporated into ABDS 2011 where appropriate. Estimates of fatal burden for 2010 for the total Australian population and Aboriginal and Torres Strait Islander population were the first publications from this study (AIHW 2015b; AIHW 2015c). Estimates of Indigenous fatal burden have been updated in this report for the reference year 2011.

This report presents the full set of estimates for the Aboriginal and Torres Strait Islander population. It includes estimates of both fatal and non-fatal burden for the reference periods 2011 and 2003, along with risk factor and subnational estimates. Estimates of the gap in disease burden between Indigenous and non-Indigenous Australians (often referred to in this report as the 'gap in health outcomes') are also reported.

1.5 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. One DALY is 1 year of 'healthy life' lost due to illness and death. The more DALY associated with a disease or injury, the greater the burden.

YLD measures the proportion of healthy life lost due to disease in 1 year compared to full health in that same year. 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 for each disease. The disability weights used in this study are drawn from the GBD 2013 and represent the health loss that the consequences of each disease caused.

YLL measure the years lost between the age at which a person dies against an *ideal lifespan*. In this study, the ideal remaining lifespan varies at each age but starts as a life expectancy at birth of age 86 for both males and females (see Appendix Table B2 for the full standard life expectancy table). This ideal life expectancy 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). Both the total number of deaths and the ages at which those deaths occur influence total YLL.

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

Box 1.3 provides a summary of the range of statistics and estimates included in the report.

Box 1.3: Different types of estimates presented in this report

A range of different statistics and estimates are presented in this report, which are useful for different purposes. These include:

DALY, YLD and YLL estimates describe the overall, non-fatal and fatal disease burden in the population being analysed. They are useful for summarising the health of that population at a point in time, for assessing health-care needs and planning health services.

Crude numbers, proportions and 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. They 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.

Age-standardised rates 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 and changes in population size and ageing over time. Age-standardised rates have little use in service provision planning, but are useful for comparing the impact of various diseases between 2 populations with different age structures (for example, Indigenous and non-Indigenous Australians) or between 2 different time points (for example, 2003 and 2011).

Rate ratios and rate differences (based on age-standardised rates) are used for comparisons between population groups (that is Indigenous and non-Indigenous Australians and subnational populations), in measures of the gap as well as in comparisons over time (between 2003 and 2011 estimates). A rate ratio shows how many times one rate of burden is relative to another, while a rate difference shows the difference between one rate and another (see 'Appendix B: Methods overview' for more detail).

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 in size between adjacent estimates.

In this report, YLL, YLD and DALY estimates are presented at 3 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 helps to identify large interrelated areas of health loss that might otherwise go unquantified (especially for the rarer and less prevalent diseases—such as blood and metabolic disorders). This is important for broad policy and research setting as well as for advocacy. There are 17 disease groups covered 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 or 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. In the ABDS 2011 the burden was estimated for nearly 200 diseases.

How is the contribution of risk factors measured?

Information on the impact of various risk factors (such as smoking, physical inactivity or 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 theoretical-minimum-risk exposure distribution—TMRED—for example, if smoking was 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 various levels of exposure to the risk factor (relative risks), and the number of people in the population exposed to various levels of the risk factor.

Where do the data come from?

Data to develop the ABDS estimates for the Aboriginal and Torres Strait Islander population were obtained from many different sources. Deaths data for the fatal burden were sourced from the National Mortality Database, while data for the non-fatal burden came from a variety of sources including national data sets (such as the National Hospital Morbidity Database, Australian Cancer Database), national surveys (such as the AATSIHS 2012–13) and a number of epidemiological studies.

Where possible, and appropriate to Australian circumstances, other inputs for the ABDS were obtained from the 2010 or 2013 GBD. These included the standard reference 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 Bureau of Statistics (ABS).

Details on the various data sources, including standard inputs, are at 'Appendix B: Methods overview'.

1.6 Who is this report for and what is in it?

The primary audiences of this report are analysts, researchers, policy makers, and health service planners and providers who are interested in the detailed results from the Indigenous component of the ABDS 2011, and require a broad understanding of the methods used to produce them.

To that end, the report includes:

- estimates of fatal, non-fatal and total burden of disease for the Aboriginal and Torres Strait Islander population, using the DALY, YLD and YLL measures, for the 2011 and 2003 reference years
- estimates of attributable burden for various risk factors for the 2011 and 2003 reference years
- estimates of the gap between Indigenous and non-Indigenous Australians in fatal, non-fatal and total burden as well as risk factor attribution for the 2011 and 2003 reference years
- subnational estimates (by state/territory, remoteness and socioeconomic group) for the 2011 reference year
- descriptions of the high-level methodology used to derive the estimates
- guidance on understanding and using burden of disease estimates.

Results of the national component of the ABDS 2011 are provided in the report *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016a).

Social determinants of health, such as income, poverty, education and employment, play an important role in population health, often having a strong association with health outcomes and health behaviours. The importance of social determinants of health to both the health of the Aboriginal and Torres Strait Islander population, as well as to the health 'gap' and health inequalities between the Indigenous and non-Indigenous populations, is well recognised (for example, see AIHW 2014b).

In this study, burden of disease estimates are disaggregated by a measure of socioeconomic disadvantage of where people live as a rough representation of the disparities in burden. While it was not feasible to include social determinants of health as risk factors in the current study due to the resources needed to undertake the large and complex body of work that would be required (such as developing appropriate definitions directly related to health and sourcing disease-specific relative risks), the AIHW recognises this is an important area of work to progress for future burden of disease studies. The importance of social determinants of health for the health and wellbeing of Indigenous Australians, as well as studies which have attempted to quantify the impact of social determinants on the health gap and on disease burden, are discussed further in 'Appendix A: Social determinants of health'.

1.7 Structure of this report

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

Chapter 2 provides a synthesis of the key findings from across the chapters that follow.

Chapter 3 provides an overview of the key contextual issues, inputs and methodological choices made in the ABDS 2011 with a focus on those that affect Indigenous burden of disease estimates.

Chapters 4, 5 and 6 summarise the burden of disease results for overall burden, non-fatal burden and fatal burden for the Indigenous population.

Chapter 7 summarises the impact of selected risk factors on the burden of disease among Indigenous Australians.

Chapter 8 presents estimates of the gap in disease burden and risk factor attribution between Indigenous and non-Indigenous Australians.

Chapter 9 presents a comparison of burden between 2 reference years, 2011 and 2003.

Chapter 10 provides detailed results on fatal, non-fatal and total burden for each of the 17 disease groups used in this study.

Chapter 11 provides detailed results for the leading risk factors included in this study which contributed to disease burden in the Indigenous population.

Chapter 12 presents results for burden of disease at the subnational level, including by state and territory (for New South Wales, Queensland, Western Australia and the Northern Territory), remoteness area and by socioeconomic group.

Chapter 13 provides commentary on the main data gaps and limitations of the study in relation to Indigenous estimates, key methodological developments, and opportunities to improve and further use the estimates.

Appendix A provides information on the importance of social determinants of health in Indigenous health outcomes as well as burden of disease analyses.

Appendix B provides an overview of the methods used in the ABDS including those specific to Indigenous burden of disease estimates.

Appendix C provides a summary of the quality of the estimates and associated data quality framework used in the study.

Appendix D provides additional tables for each of the results chapters.

Appendix E provides 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

This chapter aims to cover in more detail the key findings from the chapters that follow. It takes 8 major points, including those already highlighted in this report's summary, and provides some additional depth to the findings.

2.1 Overall disease burden for Indigenous Australians is higher than for non-Indigenous Australians

DALY rates for Indigenous Australians were 2.3 times as high as those for non-Indigenous Australians in 2011.

After adjusting for population size and age structure, there were 429 years lost due to premature death or living with disease or injury for every 1,000 Indigenous people in Australia, compared with 185 years for every 1,000 non-Indigenous people.

Indigenous DALY rates were higher than non-Indigenous DALY rates at all ages, but the difference was greatest in those aged 35–54.

The absolute burden (total DALY) was higher for Indigenous males than Indigenous females at all ages up to 70, mostly due to the fatal rather than non-fatal burden. In the non-Indigenous population, DALY was higher for males than for females at all ages except for 85 and over.

DALY rates for Indigenous Australians were relatively high in the first year of life, after which they declined in early childhood; there is then a gradual increase to around age 65, followed by rapid increases. Most of the absolute burden to age 45 in the Indigenous population was from non-fatal burden (with the exception of children aged 0–4), after which the fatal burden was higher. The pattern in the non-Indigenous population was similar, but with lower rates and a more rapid increase in the older age groups.

2.2 Most of the burden is from chronic diseases and injuries

The 5 disease groups causing the most burden among Indigenous Australians were mental & substance use disorders, injuries, cardiovascular diseases, cancer and respiratory diseases.

Chronic diseases caused 64% of the total disease burden among Indigenous Australians in 2011. This group includes cardiovascular diseases, mental & substance use disorders, cancer, chronic kidney disease (CKD), diabetes, vision loss, hearing loss and selected musculoskeletal, respiratory, neurological and congenital disorders.

The disease group causing the most burden was mental & substance use disorders (19% of the total). This group includes conditions such as anxiety and depressive disorders, alcohol use disorders, drug use disorders and autism spectrum disorders. Other leading contributors to the total burden were injuries (15%), cardiovascular diseases (12%), cancer (9%) and respiratory diseases (8%) (Table 2.1).

The cancer burden was mostly fatal while the burden from mental & substance use disorders was mostly non-fatal. The burden from cardiovascular diseases and injuries was also largely fatal but the non-fatal component was substantial.

The largest differences in DALY rates between Indigenous males and females were for injuries and cardiovascular diseases (rates for Indigenous males were 2.3 and 1.5 times those for Indigenous females respectively).

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 for Indigenous Australians aged 5–44. Cardiovascular diseases become more prominent in terms of DALY from age 45 onwards, although the burden started at a somewhat younger age for fatal burden. Cancer also became a major cause of the burden in older Indigenous Australians.

Table 2.1: Total disease burden and leading disease groups in 2011, and changes between 2003 and 2011, Indigenous Australians

	Disease group								
	Mental & substance user	**Injuries**	**Cardio-vascular**	**Cancer**	**Respiratory**	**Musculo-skeletal**	**Infant & congenital**	**Endocrine**	**All disease groups**
DALY (no.)	36,223	28,790	23,771	17,847	15,085	12,704	10,770	7,863	190,227
% of total burden (DALY)	19%	15%	12%	9%	8%	7%	6%	4%	100%
Leading causes of total burden (DALY)	Anxiety disorders Alcohol use disorders	Suicide Motor vehicle injuries	CHD Stroke	Lung cancer Bowel Cancer	Asthma COPD	Other MSK Back pain	Pre-term birth & LBW complications SIDS	Diabetes Other endocrine	CHD Suicide
100% YLD YLL 0%	97 3	16 84	12 88	3 97	69 31	95 5	10 90	32 68	47 53
100% Female Male 0%	45 55	32 68	42 58	48 52	55 45	56 44	43 57	51 49	46 54
Change in DALY ASR 2003 to 2011[(a)]	↑ 1.4	↑ 2.3	↓ -18.7	↑ 3.1	↓ -0.9	↓ -1.0	↓ -1.8	↓ -2.8	↓ -24.5
Change in YLD ASR 2003 to 2011[(a)]	↑ 2.4	↑ 4.9	– -0.4	– 0.1	↑ 1.2	– -0.3	– -0.1	↑ 0.7	↑ 7.2
Change in YLL ASR 2003 to 2011[(a)]	↓ -1.0	↓ -2.6	↓ -18.2	↑ 3.0	↓ -2.0	↓ -0.7	↓ -1.6	↓ -3.4	↓ -31.8

YLL = fatal burden; YLD = non-fatal burden.

(a) Difference in the Indigenous age-standardised rate per 1,000 between 2003 and 2011.

2.3 Role of specific diseases

Coronary heart disease, suicide & self-inflicted injuries, anxiety disorders, alcohol use disorders and diabetes ranked highest for the burden in Indigenous Australians.

The 20 specific diseases with the highest burden in the Indigenous population accounted for more than half (59% for males, 57% for females) of the burden in 2011. The 5 highest ranked were coronary heart disease (CHD) (contributing 7% of total burden), suicide & self-inflicted injuries (5%), anxiety disorders (4%), alcohol use disorders (4%) and diabetes (4%). Addressing these conditions would make a significant contribution to reducing the disease burden in the Aboriginal and Torres Strait Islander population.

The top-ranked specific diseases differ for Indigenous males and females. For Indigenous males, CHD, alcohol use disorders, suicide & self-inflicted injuries, diabetes and anxiety disorders were the highest ranking diseases. For Indigenous females, it was anxiety disorders, CHD, depressive disorders, other musculoskeletal conditions and diabetes.

The diseases causing the most burden among Indigenous Australians also differed across the life course. The non-fatal burden largely drove the patterns for the younger age groups and the fatal burden is the driver for the remaining age groups.

2.4 Large Indigenous/non-Indigenous disparities exist for some disease groups

Chronic diseases were responsible for more than two-thirds (70%) of the total health gap in 2011.

In 2011, the disease groups contributing most to the gap in total burden between Indigenous and non-Indigenous Australians (based on age-standardised DALY rate differences) were: cardiovascular diseases (responsible for 19% of the gap), mental & substance use disorders (14%), injuries (14%), respiratory diseases (10%), cancer (9%) and endocrine disorders (including diabetes) (7%). This reflects the disease groups with the largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians (Table 2.2).

Together all chronic diseases (cardiovascular diseases, mental & substance use disorders, cancer, CKD, diabetes, vision and hearing loss, and selected musculoskeletal, respiratory, neurological and congenital disorders) were responsible for 70% of the health gap in 2011.

The disease groups with the highest relative disparities in rates of burden between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were kidney & urinary diseases and endocrine disorders (including diabetes). Indigenous Australians experienced a burden from these 2 disease groups at 7 and 5 times the rate of non-Indigenous Australians respectively.

Infant & congenital conditions were responsible for one-third (33%) of the gap that Indigenous children aged 0–14 experienced. Mental & substance use disorders and injuries were the largest contributors to the gap among those aged 15–44. Cardiovascular diseases, cancer and respiratory diseases were the main contributors to the gap among those aged 45 and over.

The specific diseases contributing most to the gap in total burden (DALY) between Indigenous and non-Indigenous Australians were CHD (11%) and diabetes (7%). These were the leading causes of the gap for both Indigenous males and females. Addressing these conditions would make a significant contribution to reducing the gap in disease burden between Indigenous and non-Indigenous Australians.

Table 2.2: Summary of findings on the leading causes of the gap in disease burden between Indigenous and non-Indigenous Australians, 2011

	Disease group								
	Cardio-vascular	Mental & substance use	Injuries	Respiratory	Cancer	Endocrine	Kidney & urinary	Musculo-skeletal	All disease groups
Indigenous DALY ASR per 1,000	71.8	57.8	49.9	39.2	57.0	21.9	14.9	30.6	429.4
Non-Indigenous ASR per 1,000	25.6	23.6	16.6	15.7	33.9	4.1	2.2	21.9	185.0
Rate ratio	2.8	2.4	3.0	2.5	1.7	5.4	6.8	1.4	2.3
Rate difference per 1,000	46.2	34.1	33.3	23.5	23.1	17.9	12.7	8.7	244.4
% of gap in total burden (DALY)[(a)]	19%	14%	14%	10%	9%	7%	5%	4%	100%
% of gap in non-fatal burden (YLD)[(a)]	4%	35%	11%	13%	0%	3%	5%	9%	100%
% of gap in fatal burden (YLL)[(a)]	28%	2%	16%	8%	15%	10%	5%	1%	100%

(a) Based on the percentage contribution to the total age-standardised DALY rate difference between Indigenous and non-Indigenous Australians.

2.5 Small reduction in overall burden due to substantial improvement in fatal burden since 2003

There was a small decrease (5%) in the age-standardised rate of total burden in the Indigenous population between 2003 and 2011, mostly from reductions in fatal burden.

After accounting for population increase and ageing (using age-standardised rates), there was a small decrease (5%) in the rate of burden of disease in the Indigenous Australian population, from 454 to 429 DALY per 1,000 people between 2003 and 2011.

Most of this improvement came from decreases in the age-standardised rate of fatal burden (11%), by preventing or delaying deaths from particular diseases or injuries. There was however a small increase (4%) in the age-standardised rate of non-fatal burden coupled with a shift towards more non-fatal burden in 2011 than in 2003. This suggests that, overall, the substantial successes in preventing or delaying Indigenous deaths between 2003 and 2011 led to the Aboriginal and Torres Strait Islander population living longer with disease.

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

1. **Cardiovascular diseases and infectious diseases: large decreases in overall burden** due to a large decrease in the fatal burden and a smaller decrease in the non-fatal burden.
2. **Endocrine disorders (including diabetes): small decrease in overall burden**, due to a decrease in the fatal burden but with a smaller increase in the non fatal burden.
3. **Cancer: large increase in overall burden** which was mostly due to an increase in fatal burden.
4. **Injuries and mental & substance use disorders: small increases in overall burden** with decreases in the fatal burden outweighed by larger increases in the non-fatal burden.

Large reductions were evident in Indigenous age-standardised rates of fatal burden due to CHD and stroke. In contrast, notable increases were evident in rates of non-fatal burden for falls, asthma, diabetes, anxiety disorders and depressive disorders. CKD, although not ranked in the top 20 causes of burden in 2011, also showed notable increases in non-fatal burden between 2003 and 2011, both in terms of ranking and in age-standardised rates.

Despite the modest improvement in the total burden for Indigenous Australians between 2003 and 2011, there was little change in the overall gap between Indigenous and non-Indigenous Australians. There was a 15% increase in the gap in non-fatal burden, and a 9% decrease in the gap in fatal burden (measured by age-standardised YLD and YLL rate differences). As a result, the DALY rate difference changed from 248 per 1,000 in 2003 to 244 per 1,000 in 2011. However, there were some contrasting differences by disease group. Decreases in the overall health gap were observed for cardiovascular diseases and infectious diseases, but there was a widening of the health gap for cancer and injuries.

2.6 A large proportion of the burden is preventable

Just over one-third (37%) of the burden of disease that Indigenous Australians experienced is due to the modifiable risk factors included in this study. The risk factors causing the most burden were tobacco use, alcohol use, high body mass, physical inactivity, high blood pressure, high blood plasma glucose and dietary factors.

Just over one-third (37%) of the total burden of disease that Indigenous Australians experienced in 2011 was attributed to the 29 modifiable risk factors that were able to be measured in this study (which do not include the social determinants of health which are also important to the health and wellbeing of the Indigenous population but were not able to be included in the current study). This indicates that, with further decreases in the exposure to these risk factors, a large proportion of the burden that the Indigenous population experienced could be prevented.

The 6 risk factors causing the most burden in Indigenous Australians in 2011 were tobacco use (12%), alcohol use (8%), high body mass (8%), physical inactivity (6%), high blood pressure (5%) and high blood plasma glucose (5%). Dietary risk factors were analysed individually in the study; however, an analysis of the joint effects of all dietary risk factors combined showed that they accounted for about 10% of the disease burden that Indigenous Australians experienced in 2011 (Table 2.3).

Alcohol use was the leading contributor to the burden in Indigenous males aged 15–44, and tobacco use was the leading contributor in ages 45 and over. For Indigenous females, alcohol use was the leading contributor to the burden in those aged 15–24, intimate partner violence was the leading contributor to the burden in those aged 25–34 (closely followed by alcohol use), and tobacco use was the leading contributor in those aged 35 and over.

For 3 of the top 5 disease groups—namely, cardiovascular diseases, cancer and respiratory diseases—a large proportion of the burden was due to the risk factors included in this study (the joint effects were 80%, 54% and 45% respectively). The largest risk factor for all 3 was tobacco use, which caused around 40% of the burden in each group.

Risk factors for which there were notable improvements in attributable burden in the Indigenous population between 2003 and 2011 (based on age-standardised DALY rates) included high cholesterol (37% reduction), high blood pressure (23% reduction) and physical inactivity (22% reduction). There was little change in age-standardised attributable DALY rates for tobacco use despite recent reductions in Indigenous smoking rates. This reflects the accumulated risk due to past exposure contributing to the current disease burden for a number of diseases, namely cancer and chronic respiratory diseases. Conversely, there has been a decrease in the burden of cardiovascular diseases linked to tobacco use.

Table 2.3: Burden attributable to leading risk factors in the Indigenous population and their contribution to the gap in disease burden between Indigenous and non-Indigenous Australians, 2011

	Indigenous disease burden		Health gap				
	DALY (count)	DALY (%)	Indigenous DALY ASR per 1,000	Non-Indigenous DALY ASR per 1,000	Rate ratio	DALY rate difference per 1,000	% of health gap[a]
Tobacco use	23,300	12.3	72.5	15.6	4.6	56.9	23.3
Alcohol use	15,850	8.3	29.1	9.4	3.1	19.7	8.1
High body mass	15,647	8.2	44.1	9.5	4.6	34.5	14.1
Physical inactivity	10,504	5.5	28.8	8.8	3.3	20.0	8.2
High blood pressure	9,310	4.9	28.5	8.6	3.3	19.9	8.1
High blood plasma glucose	8,710	4.6	26.2	4.7	5.6	21.5	8.8
Drug use	7,032	3.7	13.3	3.2	4.2	10.1	4.1
All dietary risks combined[b]	*18,400*	*9.7*	*52.4*	*15.3*	*3.4*	*37.1*	*15.2*
All 29 risk factors combined[b]	**70,167**	**36.9**	**188.8**	**63.3**	**3.0**	**125.5**	**51.4**
Total burden	**190,227**	**100.0**	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap between Indigenous and non-Indigenous Australians as measured by the DALY rate difference (244.4). The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non–Indigenous Australians.

(b) Due to the complex pathways and interactions between risk factors, it is not possible to simply sum the impact of each risk factor. A combined risk factor analysis has been conducted to estimate the joint effect of all risk factors included in the study, and all dietary risk factors included in the study, following methods used in previous global burden of disease studies. However, these methods rest on the assumption that each risk factor is independent and does not take into account known features of 'real–world' epidemiology such as mediation between risk factors, correlations between exposures, or effect modification. The estimates shaded in this table should therefore be used with caution.

2.7 Risk factors contributing to the health gap

The 29 risk factors included in the study accounted for about one-half (51%) of the overall health gap between Indigenous and non-Indigenous Australians.

Tobacco use contributed the most to the gap (accounting for 23%), followed by high body mass (14%), high blood plasma glucose (9%), physical inactivity, high blood pressure and alcohol use (each 8%). Dietary factors combined accounted for 15% of the gap (Table 2.3).

It is important to note that estimates for individual risk factors cannot be added together due to the complex pathways and interactions between them. In addition, the risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden and to the health gap. For example, social determinants of health and access to health services are not included. Past research has suggested that social determinants of health such as income, education and employment (see 'Appendix A: Social determinants of health') may explain between one-third and one-half of the Indigenous health gap, and lack of access to health services is likely to also be a large contributor.

2.8 Burden varies across state/territory, remoteness and socioeconomic groups

The Northern Territory and Western Australia had substantially higher rates of burden in the Indigenous population than New South Wales and Queensland. The lower socioeconomic groups and the more remote areas also have a higher burden.

The patterns in disease burden in Aboriginal and Torres Strait Islander people across states and territories, remoteness categories and socioeconomic groups were analysed separately.

Overall, of the 4 states and territories for which Indigenous burden of disease estimates are specifically reported in this study (New South Wales, Queensland, Western Australia and the Northern Territory), the Northern Territory and Western Australia had substantially higher rates of burden in the Indigenous population than Queensland and New South Wales (499, 498, 419 and 409 DALY per 1,000 people, respectively). This was driven mostly by fatal rather than non-fatal burden.

In Western Australia, Indigenous Australians experienced burden of disease at 2.8 times the rate of non-Indigenous Australians. Rates of burden for Indigenous Australians in New South Wales, Queensland and the Northern Territory were 2.3, 2.2 and 2.0 times those for non-Indigenous Australians in those jurisdictions, respectively.

Similarly, the higher rates of burden for Indigenous Australians living in *Remote* and *Very remote* areas of Australia and in the lower socioeconomic groups was largely due to fatal rather than non-fatal burden. *Remote* areas had the greatest disparity in disease burden between Indigenous and non-Indigenous Australians, with a rate 2.4 times that for non-Indigenous Australians.

For Indigenous Australians, mental & substance use disorders were the leading contributor to the burden across all non-remote areas. In remote areas, injuries were the leading contributor to the total burden.

Cardiovascular diseases, mental & substance use disorders, injuries, kidney & urinary diseases, infectious diseases and endocrine disorders (which includes diabetes) were key disease groups behind the higher Indigenous burden in the Northern Territory and Western Australia.

The disease groups with the largest differentials for both remoteness and socioeconomic groups were endocrine disorders, kidney & urinary diseases, infectious diseases and injuries. Gradients across all 5 socioeconomic groups, with the most disadvantaged groups having the most burden, were noticeable for mental & substance use disorders, cardiovascular diseases, cancer, and infant & congenital conditions.

Importantly, analysis at the level of state/territory, remoteness and socioeconomic group highlights how leading diseases for a particular population may be masked in the national data. For example, kidney & urinary diseases, which ranked in the top 6 leading causes of Indigenous fatal burden in the Northern Territory and in *Very remote* areas, did not rank in the leading causes of burden for the Indigenous population nationally.

3 Context, assumptions and methodological choices

Underlying the Indigenous burden of disease estimates presented in this report are a number of methodological choices and assumptions. This includes overarching inputs which draw on methodological advances made in recent global studies, as well as specific choices made for Indigenous burden of disease estimates. These choices are each associated with underlying assumptions and can have an effect on the burden of disease estimates produced, including the relative burden assigned to different diseases and risk factors.

Burden of disease estimates quantify 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 disability-adjusted life years (DALY). When DALY are used to measure the burden of disease in a population in a time interval, they can be calculated in several different ways: from an incidence, prevalence, or hybrid perspective. Each method produces a different measurement of quantity. In this study, a hybrid perspective for calculating DALY has been used which is consistent with recent global studies. This calculates YLL from an incidence perspective and YLD from a prevalence perspective—the mixed perspectives explaining the term 'hybrid'.

DALY calculated under this approach can be thought of as an index of population health in a given year which has a number of advantages over the other approaches. The main advantage is that all data needed to calculate DALY can be measured in the time period in question (whereas a purely incidence-based DALY would require a projection of the future duration of health loss from non-fatal conditions, and a purely prevalence-based DALY would require knowledge of deaths that occurred prior to the time period in question).

Methods used in current burden of disease studies will systematically give more or less prominence to certain diseases by nature of the methodology. For example, short-term conditions such as infections will be downplayed to some extent as they do not result in health loss over the full year, the burden due to individual chronic diseases will be reduced as a result of adjustments for coexisting diseases (known as 'comorbidity'), and the impact of diseases that are often not clinically diagnosed (for example, chronic obstructive pulmonary disease, or COPD) may be underestimated. Fatal burden estimates for diseases which are commonly reported on death certificates as 'associated' causes of death rather than 'underlying' causes of death (such as kidney diseases) will also be underestimated in burden of disease studies because current methods use the underlying cause of death only.

Burden of disease studies also traditionally focus on risk factors that are modifiable including behavioural, metabolic and dietary risk factors. They do not aim to cover all potential risk factors that may contribute to the disease burden in a population. Social determinants of health (such as income, education and employment) and access to services are acknowledged as playing important roles in population health. However, these are not generally included in burden of disease studies due to the difficulty in obtaining good estimates of the risk associated with specific conditions.

This chapter begins by looking at the distinctive features of the Indigenous population. It then introduces the main overarching inputs and methodological choices made in the ABDS 2011 for both national and Indigenous estimates. This is followed by considerations of methodological choices specific to Indigenous estimates.

A summary of the methods examined in this chapter, including differences between the previous and current Indigenous burden of disease studies, and the impact of changes made in the current study on the estimates, is provided at the end of the chapter in Table 3.2.

3.1 The Aboriginal and Torres Strait Islander population

In 2011, according to the ABS Census of Population and Housing, there were an estimated 669,881 Aboriginal and Torres Strait Islander people in Australia, accounting for 3% of the total population (ABS 2013b).

Most Indigenous Australians live in non-remote areas (79% in 2011) rather than remote areas (21%). By comparison, 98% of non-Indigenous Australians lived in non-remote areas and 2% in remote areas in 2011. However, of all people living in remote areas, the proportion who are Indigenous is relatively high. In 2011, 45% of people living in *Very remote* areas and 16% of people living in *Remote* areas were Indigenous. Almost one-third of people living in the Northern Territory were Indigenous compared with 5% or less in other jurisdictions.

The Indigenous population has a younger age structure compared with the non-Indigenous population, with this difference being due to higher birth rates as well as shorter life expectancy. In 2011, the median age of the Indigenous population was 21.8 compared with 37.6 for the non-Indigenous population. The Indigenous population living in remote areas tends to have a younger age structure than those living in urban areas. The Indigenous population is also ageing (although at a slower rate than the non-Indigenous population). For example, in 1996 2.8% of the Indigenous population were aged 65 and over, and this increased to 3.4% in 2011 (AIHW 2015d).

The number of Indigenous people formally counted in the Census has increased considerably over the last 2 decades, with a particularly large increase of 21% between 2006 and 2011 (compared with a 9% increase for non-Indigenous people) (ABS 2013a). Population growth (that is more births than deaths) can explain the majority (70%) of this increase. However, the remaining 30% cannot be explained by population growth; instead, the factors considered to contribute to this increase included improvements in Census coverage, a decrease in the number of records with unknown Indigenous status, and an increased likelihood that individuals identified themselves and their children as Indigenous. The majority of the increase in the 'unexplained' count of Indigenous people between 2006 and 2011 occurred among those living in non-remote areas (90% increase), in New South Wales and Queensland (67%) and in children and adolescents (aged less than 19).

To account for differences in the population age structure and size described here, age-standardisation has been used in this report when comparing burden of disease estimates for the Indigenous and non-Indigenous populations, as well as for comparisons between 2003 and 2011 estimates. However, changes in the propensity to identify as Indigenous may affect the comparability of data about Indigenous people over time, and it is not known if, and by how much, the changes in Indigenous identification evident in the Census have occurred in most other data collections. See Section 3.3 for further discussion of these issues.

3.2 Overarching inputs

Underpinning burden of disease analysis is a series of social value choices and other inputs that determine the methods used to calculate DALY. These choices include the standard life table to be used, whether future health loss (or gain) is to be valued differently to current health loss (or gain), the use of incidence or prevalence estimates for calculating YLD, the disability weights used to account for the severity of health loss associated with a particular state of health, the method of adjusting for comorbidity and the choice of risk factors and disease outcomes included in the study. These have all changed between burden of disease studies undertaken and are discussed in the following section, together with an assessment of their likely impact on the Indigenous burden of disease estimates and estimates of the gap that are presented in this report.

Choosing a standard life table

Years of life lost (YLL) in burden of disease studies are calculated with reference to a standard life expectancy at each age. For both national and Indigenous burden of disease estimates in the ABDS 2011, the standard life table developed in the GBD 2010 study is used. It is based on the lowest observed death rates for each age group across all countries in 2010. This results in an 'aspirational' life table for all populations, showing the potential life-years remaining at each age. In particular, the table shows a life expectancy at birth of age 86.0 for both males and females.

The choice of standard life table requires a somewhat arbitrary decision regarding target life expectancies, a decision which will impact on the burden of disease estimates produced. In general, a life table with higher life expectancies gives a greater proportional influence to deaths occurring at the older ages in the resulting YLL and will also result in a greater number of total YLL (and consequently greater total DALY).

The GBD 2010 standard life table has remarkably higher potential life expectancies than estimates of actual life expectancies derived from recent Indigenous life tables (that is, ages 69.1 and 73.7 at birth for Indigenous Australian males and females, respectively, in 2010–2012; ABS 2013d). Using the GBD 2010 reference life table will result in substantially greater YLL for Indigenous Australians compared with the 2003 Indigenous study. The increase in life expectancies also alters the YLL:YLD ratio by increasing the relative significance of fatal conditions. However, using the GBD 2010 life table still results in a shift towards more non-fatal burden over time in the Indigenous population which is consistent with the pattern found in other recent burden of disease studies.

The choice of standard life table will not only affect the size of Indigenous and non-Indigenous YLL estimates, but also estimates of the gap in YLL rates between Indigenous and non-Indigenous Australians. This is because the 2 populations have quite different distributions of ages at death, and so the choice of life span will affect each population's age-specific YLL estimates differently.

The AIHW undertook sensitivity analyses to look at the impact of using different standard life tables on resulting Indigenous and non-Indigenous YLL, and the gap. These types of analyses vary the different inputs and assumptions to see what effect different choices have on the key findings, and determine whether the conclusions drawn are robust. The life tables examined included: the GBD 2010 standard life table, the life table used in the previous Australian and Indigenous BoD studies, the most recent ABS Indigenous and non-Indigenous life tables for 2010–2012, and the standard life table used in the WHO's recent global burden of disease report (which has a higher life expectancy than the GBD 2010 standard life table). The analysis supported the assumptions that life tables with longer life expectancies will lead to higher YLL and also a higher rate difference in YLL between Indigenous and non-Indigenous Australians. However, rate ratios remained stable regardless of which life table was used (Table 3.1).

Table 3.1: Age-standardised gap measures of YLL in 2006–2010 (unadjusted for Indigenous under-identification), based on different standard life tables

	Age-standardised rate of YLL (per 1,000 people per year)			
Standard life table used (life expectancy)	**Indigenous**	**Non-Indigenous**	**Rate difference**	**Rate ratio**
WHO 2012 (LE 91.9)	250.0	120.0	130.0	2.1
GBD 2010 (LE 86)	211.3	98.0	113.2	2.2
Australian BoD 2003 (LE 80.0 males 82.5 females)	178.0	80.3	97.6	2.2
Non-Indigenous 2010–12 (LE 79.7 males and 83.1 females)	193.3	88.7	104.5	2.2
Indigenous 2010–12 (LE 69.1 males and 73.7 females)	156.5	72.8	83.8	2.2

Source: AIHW analysis of AIHW National Mortality Database.

The ranking of disease groups by number of YLL and by their contribution to the gap also did not change based on the different life tables examined. This suggests that the ranking of diseases is robust no matter which standard life table is used (for detailed results from this sensitivity analyses see AIHW 2015c).

Whether to use discounting and age-weighting

Discounting assumes that health years lived in the present are valued more than those lived in the future. Age-weighting is a method used to assign larger importance to certain age groups compared with others.

In the ABDS 2011, DALY were calculated without discounting or age-weighting, consistent with recent global studies (GBD 2010 and 2013, WHO 2000–2011 global health estimates). This is a different approach to that used in earlier global burden of disease studies and the previous Australian and Indigenous studies, which used a discount rate of 3% per year (meaning that a weighted year of life saved next year is worth 97% of a year of life saved this year), and gave a higher weighting to health loss in young adults than in young children and the elderly.

Analysis that the AIHW has undertaken shows that the effect of a 3% discount rate is that a year of healthy life gained in 25 years' time is worth less than half of a year gained now (Figure 3.1).

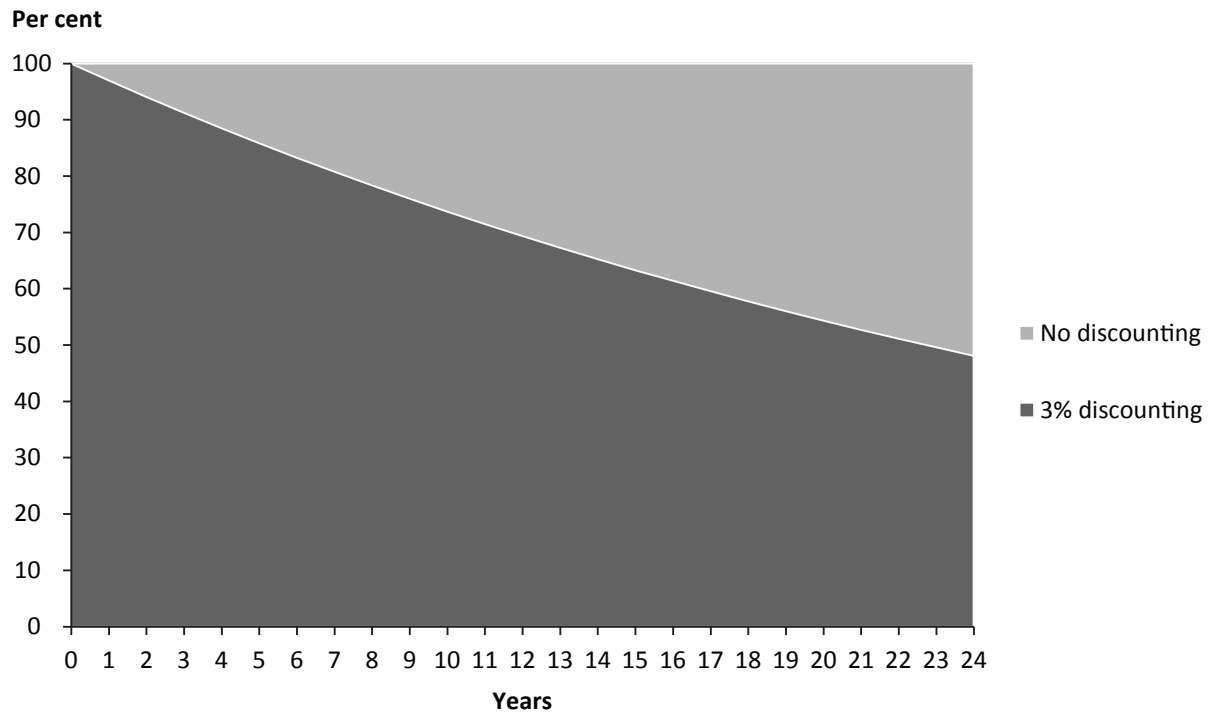


Figure 3.1: Per cent change in the value of a year due to discounting: no discounting and 3% discounting

WHO sensitivity analyses showed that the change in approach to a 0% time discounting rate and no age-weighting produces an increase in the absolute number of DALY and a relative increase in the share of DALY at older ages. Given that the Indigenous population has proportionately less people living to older ages than the non-Indigenous population, this change is likely to have less of an impact on Indigenous estimates.

Choosing between prevalence- or incidence-based YLD

The measure of years lived with disability (YLD) can be calculated using an incidence- or prevalence-based approach to measuring health loss. At a basic level, incidence-based YLD for a particular year reflect the burden of disease due to conditions and injuries newly occurring in that year, whereas prevalent YLD reflect the burden of disease due to all conditions and injuries existing in that year, regardless of when they originally occurred.

The 2003 Australian and Indigenous burden of disease studies used an incidence-based approach for YLD which was consistent with global studies at the time. However, the incidence-based approach has a number of disadvantages. First, it will not reflect the current burden for conditions for which incidence has been substantially reduced. For example, polio would not have YLD reported under the incidence approach (as there are no new cases in Australia), but would have YLD using the prevalence approach (as some people are still living with the consequences of polio contracted many years ago). Second, it assigns YLD for a particular condition to the age groups at which the condition first occurred rather than the ages at which the health loss is experienced (the latter is generally considered more useful for policy and planning purposes). Third, it requires estimates of both incidence and duration of the disease sequelae, whereas for many conditions prevalence data is the primary information collected. Finally, incorporating comorbidity data is computationally more straightforward using the prevalence method (AIHW 2014a).

Given these factors, and to be consistent with recent global studies (GBD 2010 and 2013, WHO), the ABDS 2011 used prevalence-based YLD as its main reporting measure. As a result, the estimates in this report cannot be compared with incidence-based estimates in previous Australian burden of disease studies.

The change from an incidence to prevalence-based approach for calculating YLD will have an effect on the relative burden assigned to different health conditions. The exact impact of this change cannot be quantified for the ABDS (as only prevalence-based YLD have been calculated). However, a comparison of incident and prevalent YLD in the 2003 Indigenous burden of disease study showed an overall shift in the age distribution of prevalent YLD to be more concentrated in the older age groups and less in the younger age groups compared with incident YLD. This difference was most apparent for childhood conditions (for example, congenital disorders and asthma), and for chronic mental disorders (for which incidence peaks in childhood and early adulthood). Prevalence-based YLD at these life stages were much smaller compared with incidence-based YLD because most incident cases of chronic conditions at young ages were expected to remain prevalent cases at older ages (Vos et al. 2007).

WHO sensitivity analyses showed a similar shift in the age distribution of YLD when using a prevalence-based approach. For example, YLD for congenital hearing loss will be spread relatively evenly across all age groups in the prevalence perspective, whereas they will be zero in all except the youngest age group in an incidence perspective (WHO 2014b).

(It should be noted, however, that as direct prevalence estimates were not available for all diseases included in this study, for some conditions prevalence estimates were derived from data on incidence, hospitalisations or other evidence.)

Deriving disability weights

The amount of time lived in less than full health for burden of disease analysis needs to be defined and measured for each disease and injury, and a value must be assigned to the associated loss of health. The valuation process involves first identifying the specific consequences of each particular disease or injury to be included in the study, known as 'sequelae' (for example, brain injury due to brain cancer), and then developing 'health states' that describe the functional consequences or symptoms that people with these sequelae experience. Through a process of comparing health states, a set of weights is produced 'based on individuals' perceptions of the impact on people's lives from a particular disability' (IHME 2013). Commonly known as disability weights, they reflect the severity of health loss associated with a disease or injury on a scale from 0 (perfect health) to 1 (equivalent to death).

In earlier GBD studies, disability weights were derived mainly based on the views of health-care professionals and included concepts of both health and welfare loss. The GBD 2010 study explicitly attempted to separate the health effect from other societal factors (in particular, welfare effects) and employed new methods to estimate these factors. It aimed to respond to suggestions for a more inclusive measurement exercise—one which represents the broader perspective of different cultures and societies using a transparent, standardised and replicable approach.

The health states and disability weights used in the ABDS 2011 were drawn from the Global Burden of Disease Study (GBD) 2013 which used the same methods as the GBD 2010 study. Disability weights were derived using a survey instrument that allowed respondents in the general public to make pairwise comparisons between 2 health states. Respondents were surveyed in 2 ways: household surveys (face-to-face interviews in Bangladesh, Indonesia, Peru and Tanzania, and telephone interviews in the United States of America), and an open-access, web-based survey. At least 500 of the web-based survey participants were based in Australia (Salomon et al. 2012). The result is a set of weights which is claimed

to reflect consistent results across different cultural environments (Salomon 2010; Salomon et al. 2012). Using the GBD disability weights therefore inherently assumes that they are applicable in the Indigenous Australian context.

Adjusting for comorbidity bias

Many people have more than 1 disease or injury at the same time, particularly at older ages and in the Aboriginal and Torres Strait Islander population. Owing to such comorbidities, simply adding YLD estimates across causes may result in overestimation of the total non-fatal burden. This problem is known as 'comorbidity bias'.

Comorbidity bias arises because comprehensive data on the actual pattern (prevalence) of comorbid combinations of causes are not available, nor are comprehensive data on the health losses (disability weights) associated with such combinations. Therefore, to derive prevalence rates and disability weights for comorbidities the ABDS has needed to rely on modelling, as have other recent burden of disease studies, assuming independence or multiplicatively.

The comorbidity modelling and bias adjustment have been undertaken separately for the Indigenous and non-Indigenous populations, and for each of the reference years: 2003 and 2011.Because disease prevalence rates are known to vary by age and sex (and in order to support a disaggregated presentation of the results), the estimates were built up from the level of the age-sex cohort.

Choice of risk factors and disease outcome pairs

A major component of previous global and Australian burden of disease analyses has been the estimation of the burden attributable to key risk factors. Quantifying the impact of risk factors in this way assists in making evidence-based decisions about where to direct efforts to improve population health and prevent disease and injury.

The first step in the process involves determining which risk factors should be included in the analysis. These choices were based on a set of criteria including policy relevance, the strength of causal associations between risk factors and diseases, and data availability. The ABDS included 29 risk factors for Indigenous estimates which focus on behavioural, metabolic, environmental and dietary risks. Risk factors that were social determinants (such as income, employment and education) could not be included in the current study as it was not possible to develop an appropriate methodology within the study's timeframe.

The selection of diseases linked to each risk factor (referred to as risk–outcome pairs—for example, tobacco smoking and lung cancer) was largely based on the methods used in the GBD 2010. One criterion used to decide on the inclusion of a risk–outcome pair in the GBD 2010 analysis was the availability of 'evidence to support generalisability of effect sizes to populations other than those included in the available epidemiological studies or satisfactory models for extrapolating them' (Lim et al. 2012, 2226)—in other words, that either there is evidence that the relationship between a risk factor and a certain disease is the same for all populations, or enough information about any differences is available to be able to make estimates of the relationship for different populations.

The GBD authors maintain that there is increasing evidence to support the view that relative risks reflect intrinsic biological relationships which are common across all humanity (Danaei et al. 2009). Reflecting this principle of generalisability, the previous and current Indigenous burden of disease studies have used relative risk estimates which were based on meta-analyses that pooled the findings of both national and international epidemiological studies. It is assumed that these risk estimates are applicable to the

Indigenous population as there is little evidence to support the view that Indigenous Australians may have a greater risk of some diseases due to genetic predisposition; and publications of relative risks specific to the Indigenous Australian population are extremely limited. However, for some infectious diseases, the relative risks used in the GBD 2010 were not considered appropriate because the risk of infection is directly related to the underlying disease prevalence in the population. In these circumstances, direct evidence was used to calculate the attributable burden. For example, the 'most likely method of infection' data recorded on HIV/AIDS notifications among Indigenous Australians was used to attribute the disease burden to 2 risk factors—unsafe sex and drug use.

When interpreting risk factor estimates presented in this report it is important to note that each risk factor was calculated independently and it is not valid to simply sum the impact of each individual risk factor. Further analysis would be needed to correct for the complex pathways and interactions between risk factors. In this report, 2 combined analyses have been conducted to produce an estimate for 'all dietary risk factors combined' and an estimate for 'all risk factors combined' (referred to as the 'joint effect' of all risk factors in this study). These 2 combined analyses have relied on expert advice and assumptions about certain risk interactions.

As more research evidence becomes available, the list of risk factors and the conditions to which they are linked may grow with each successive burden of disease study.

3.3 Methodological choices specific to Indigenous estimates

In addition to the impact of the methodology choices highlighted here, several additional factors were considered when calculating burden of disease estimates for Aboriginal and Torres Strait Islander people. As a general principle in the ABDS, the methods used to produce Indigenous burden of disease estimates are consistent with those used to produce national estimates. However, this was not always possible due to differences in data availability, data quality and population size and characteristics, particularly at the subnational level.

While in recent decades major improvements have been made to the quality and availability of information about Indigenous Australians, existing data about Indigenous people are subject to a number of limitations in data quality and availability. This includes under-identification of Indigenous people in administrative data sets (and changes in the propensity of people to identify as Indigenous over time); and lack of available data on the prevalence of certain diseases in the Indigenous population. Where possible, methods have been used to address these issues in this study. These are discussed in the following section.

Adjusting for Indigenous under-identification in mortality and hospitalisation data

For some administrative data sources, Indigenous Australians are under-identified to varying degrees across states and territories, remoteness areas and over time. Where the extent of this under-identification is known, and adjustment factors are available such as in the case of mortality and hospitalisations data, estimates can be adjusted to account for such under-identification.

Mortality data

There have been a number of national and state/territory data linkage studies recently undertaken to ascertain levels of Indigenous under-identification in death registration records which have each produced adjustment factors. This includes the ABS Census Data Enhancement Study (CDE) (ABS 2013d) and the AIHW Enhanced Mortality Database (EMD) study (AIHW 2012).

The AIHW undertook a series of sensitivity analyses of Indigenous mortality data to examine the impact of using the different adjustment factors produced from these studies on the resulting Indigenous YLL and gap measures. These analyses suggested that the absolute magnitude of the number and rate of Indigenous YLL was greater when using the ABS adjustment factors compared to the AIHW adjustment factors. However, the age patterns and ranking of disease groups remained the same when using either set of adjustment factors. Similarly, the estimates of the percentage contribution to total fatal burden in the Indigenous population were almost identical when using AIHW or ABS adjustment factors. When estimating the gap between the Indigenous and non-Indigenous fatal burden, using ABS adjustment factors produced slightly higher rate ratios compared with using AIHW adjustment factors (2.6 compared to 2.4); however, both sets of estimates show the same general ranking and pattern in terms of the leading causes of the gap (AIHW 2015c).

Based on these findings, the agreed approach for the ABDS was to use mortality adjustment factors from the ABS 2011–12 CDE Study to adjust Indigenous deaths for YLL estimates and gap measures. The ABS adjustment factors were chosen because they take into account under-identification in both mortality and population data and therefore, in theory, provide consistency in the numerator and denominator used in Indigenous YLL calculations. Also, the ABS adjustment factors are the official estimates of Indigenous mortality coverage in Australia.

The exception to this approach was for estimates by remoteness, for which AIHW adjustment factors were used due to limitations with the available ABS remoteness adjustment factors (only available for 2 remoteness categories of *Major cities/Inner regional* combined and *Outer regional/Remote/Very remote* combined*).*

Hospitalisation data

The AIHW has undertaken 2 national studies to assess the level of Indigenous under-identification in hospitalisations data (2007–08 and 2011–12 hospital audits; AIHW 2010 and 2013a). These studies compared results of face-to-face interviews with patients in public hospitals in each state and territory with the information recorded in the patients' hospital administrative records to produce correction factors for Indigenous under-identification in hospital data. Adjustment factors were produced from these studies at varying levels (national, state/territory, remoteness, and remoteness within state/territory for the 2011–12 audit only).

The AIHW undertook a series of sensitivity analyses of hospitalisation data to inform the following:

- which level of adjustment factors would be most suitable to apply to Indigenous hospitalisations for the purpose of burden of disease analysis
- whether the adjustment factors were suitable to apply at the health-condition level (given that these factors were produced using total hospitalisations and did not include diagnosis information)
- whether the additional adjustments were needed for private hospitals given that the AIHW's studies only included public hospitals
- whether applying the state/territory by remoteness adjustment factors adequately addresses the issue of great variation in the quality of Indigenous hospitalisation data within a jurisdiction.

As a result of this analysis, it was agreed to apply the AIHW's state/territory by remoteness adjustment factors from the 2011–12 hospital audit to both public and private hospitalisation data for calculating Indigenous hospitalisation rates for calculating 2011 burden of disease estimates. It was also agreed that there was no need to adjust Indigenous hospitalisations data for remote areas (as they have close to complete coverage), or to adjust data on Indigenous hospitalisations for dialysis (as patients are hospitalised numerous times a week and they are likely to have accurate Indigenous status information recorded).

It is important to note that despite the attempt to remove bias in the results through adjustments made to Indigenous deaths and hospitalisations, the adjustment factors themselves are inexact and so inherently introduce a degree of uncertainty around the estimates produced.

Indirect methods used for deriving Indigenous morbidity estimates

Prevalence estimates for the Indigenous population, by age and sex, are required for each disease and injury included in the ABDS 2011 in order to calculate Indigenous burden of disease estimates. Prevalence estimates can be taken directly from disease registers, health surveys or epidemiological studies, or indirectly from other sources, such as hospitalisations and incidence data. However, for some causes, there is no data source that can provide a reliable prevalence estimate for the Indigenous population. In such cases, indirect methods are required to derive prevalence estimates for the Indigenous population. Such methods include applying Indigenous: non-Indigenous rate ratios from proxy data sources (for example, hospitalisations) to the total population prevalence.

Potential indirect methods were assessed based on a set of guidelines and criteria that the AIHW developed. They covered 8 dimensions relating to the data source used in the indirect method (comparability, relevance and representativeness, currency, accuracy, coverage, statistical uncertainty, measurement error and credibility). This assessment was used in conjunction with expert advice to determine the most appropriate indirect method to derive an Indigenous prevalence estimate for each cause.

There were 41 diseases across 8 disease groups where indirect methods were used to derive Indigenous prevalence for either the whole or part of the disease. Of these, 13 (32%) used hospitalisation rate ratios, 29 (71%) used rate ratios from other data sources, and 2 (5%) used Maori prevalence rates. A list of these diseases and sequelae and the indirect methods used can be found in Appendix Table B7. Mental and substance use disorders represented the large majority (85%) of the Indigenous YLD produced based on indirect methods (and accounted for 9 of the diseases).

A further 11 diseases used national prevalence rates to derive Indigenous prevalence for the whole disease, representing 5% of total Indigenous YLD in 2011; and an additional 11 diseases used national ratios to derive Indigenous prevalence for particular sequelae (applied to Indigenous hospitalisations or cancer incidence rates) (Appendix Table B8).

Methods for Indigenous subnational estimates

In determining methods to produce Indigenous burden of disease estimates at subnational levels, consideration was given to a number of factors. This included the availability of Indigenous data at the geographical levels of interest (state/territory, remoteness and socioeconomic groups), availability of Indigenous identification adjustment factors at subnational levels for relevant administrative data collections; the size of numbers when Indigenous estimates are disaggregated at subnational levels; and the most appropriate measure of socioeconomic disadvantage for the Indigenous population.

Based on an assessment of these considerations, Indigenous subnational estimates were considered reliable to report at the disease group level but not at the specific disease level due to small numbers.

Indigenous subnational estimates were considered adequate to report for 4 states and territories (New South Wales, Queensland, Western Australia and the Northern Territory), and all 5 remoteness categories. Estimates were not calculated for Victoria, South Australia, Tasmania or the Australian Capital Territory due to small numbers of Indigenous deaths in these jurisdictions and the lack of suitable mortality adjustment factors. National estimates for the Indigenous population are also provided for comparison purposes alongside the state and territory estimates. For fatal burden, these were calculated using national mortality adjustment factors; and for non-fatal burden, these were largely calculated using national prevalence estimates sourced from national data collections rather than based on state-level data to build the national estimates.

For Indigenous burden estimates by level of socioeconomic disadvantage, an Indigenous-specific index (the IRSEO index) was used as this was considered to more accurately reflect levels of disadvantage in the Indigenous population than the more traditional measures used in Australia, such as the Socio-Economic Indexes for Areas (SEIFA). SEIFA was used to examine differences by socioeconomic status for the national component of the ABDS 2011. This means that the Indigenous estimates by socioeconomic disadvantage presented in this report should not be compared to the national estimates by socioeconomic disadvantage in the report *Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011* (AIHW 2016a).

A direct approach for producing Indigenous subnational estimates of fatal burden was able to be used in this study. This was based on mortality data adjusted for Indigenous under-identification using state/territory- and remoteness-specific adjustment factors.

For Indigenous non-fatal burden, however, a proxy approach was used for estimates at subnational levels. The need for this approach was due to a lack of available data on Indigenous prevalence at subnational levels for many causes, and a lack of available state and territory and remoteness adjustment factors for most administrative data collections. Under the proxy approach used, subnational proportions from either hospitalisation data (adjusted for under-identification) or health survey data (the 2012–13 AATSIHS) was used to disaggregate national Indigenous YLD estimates for each disease group. The choice of hospitalisation data or health survey data for the subnational disaggregations was based on an assessment of which data source most accurately reflected the prevalence of the causes included in each disease group. For example, for disease groups such as musculoskeletal conditions, the AATSIHS was used as the primary data source for prevalence for all causes and was therefore used in the subnational disaggregations. Similarly for disease groups such as gastrointestinal diseases, hospitalisation data were used as the primary data source for prevalence for most causes and were therefore used in the subnational disaggregations.

This approach assumes that the subnational proportions used for each disease group reflect subnational differences in the underlying disease prevalence. For skin disorders, the subnational Indigenous population structure was used to disaggregate the national Indigenous YLD estimates for this disease group. This was because health survey data and hospitalisation data were not considered to provide an accurate picture of the prevalence of skin disorders and expert advice suggested that there is unlikely to be much difference in the prevalence across subnational populations.

Due to some differences in the methods and/or data sources used to produce subnational estimates of YLD for the Indigenous and national components of the ABDS, these estimates cannot be compared. In addition, the sum of the Indigenous and non-Indigenous YLD and DALY estimates for each subnational category will not always equal the subnational estimate published for the total Australian population in this study.

It is important to note that variation in disease burden across subnational disaggregations reflects a complex interaction of factors such as demographic, socioeconomic and environmental variations; and also variation in access to services and in the prevalence of risky health behaviours.

More information on the methods used to calculate both national and subnational Indigenous burden of disease estimates in the ABDS is provided in Appendix B.

Choice of population denominator for 2003 estimates

Issues pertaining to changing Indigenous identification over time and potential inconsistencies in identification in numerator data and population denominators affect the comparability of Indigenous burden of disease rates over time. These issues also have implications for the choice of population denominator to use for 2003 Indigenous burden of disease estimates.

The AIHW undertook analysis to look at the impact of using 2 different Indigenous population denominators in rate calculations for 2003 Indigenous burden of disease estimates. The 2 denominators assessed were the ABS 2003 Indigenous backcast population based on the 2011 Census, and the 2003 interpolated Indigenous population based on the ABS 2001 and 2006 Indigenous Estimated Resident Populations (ERPs).

Based on this analysis, it was agreed to use the Indigenous population estimates from the 2011 Census for both 2003 and 2011 Indigenous burden of disease estimates in the ABDS. This population series inherently applies the Indigenous identification level in 2011 to earlier years in the series, including for 2003, in the backcast methods used. Using this backcast population for 2003 estimates provides consistency between the denominators used for 2003 and 2011 Indigenous burden of disease estimates, which is important for assessing rate changes over time.

3.4 Measuring the gap between Indigenous and non-Indigenous Australians

A final overarching methodological consideration for the study was deciding on the best way of measuring the gap in burden between Indigenous and non-Indigenous Australians. This included whether to use direct or indirect age-standardisation methods, and reporting rate ratios or rate differences.

The AIHW undertook a series of sensitivity analyses which looked at the impact and robustness of using the direct method of age-standardisation compared with the indirect method on resulting Indigenous YLL estimates. These analyses showed that both methods of age-standardisation produced similar results in terms of the disease groups with the highest rate ratios, rate differences and relative contributions to the gap. The indirect method, however, produced slightly higher rate ratios than the direct method in most cases. For example, the direct method of age-standardisation resulted in a total YLL rate ratio of 2.6 compared with 2.8 using the indirect method.

As a result of this work, it was agreed to use direct age-standardisation to compare rates between the Indigenous and non-Indigenous populations and for measures of the gap. The direct method was chosen as it enables multiple comparisons (for example, cause by sex) and can be used for comparisons over time. A limitation of the direct method is that less reliable estimates can be produced when the method is applied to a small number of events (particularly deaths). This should be kept in mind when interpreting gap results for less common causes.

For reporting of the health gap between the Indigenous and non-Indigenous populations, rate differences, as well as rate ratios are presented in this report. Rate differences provide a measure of the absolute gap (or difference) between 2 populations, while rate ratios are a measure of the relative gap (or difference) between 2 population groups. Both measures are considered useful when examining health inequalities because they provide different information. With mortality, for example, rate differences tell us which leading causes of the gap should be targeted in order to reduce the overall mortality gap, whereas rate ratios tell us which causes have the greatest relative disparities between the Indigenous and non-Indigenous populations.

For the most accurate estimation of the gap in disease burden between Indigenous and non-Indigenous Australians, comparisons have been made to estimates calculated for the non-Indigenous population. These estimates are not the same as estimates for the total Australian population. Refer to the AIHW report *Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011* (AIHW 2016a) for burden of disease estimates for the total Australian population.

Table 3.2: Comparison of key methods and inputs used for Indigenous estimates in the ABDS 2011 and the previous Indigenous Australian burden of disease study

Input/ method	2003 Indigenous BoD	ABDS 2011	Impact	Reference
Standard life table	GBD 1997 (80.0 males 82.5 females)	GBD 2010 (86 for males and females)	Higher life expectancy will result in greater YLL (and consequently greater DALY)	AIHW analyses
Discounting	Yes (3%)	No	No discounting for time results in an increase in total DALY and DALY at older ages	WHO analyses AIHW analyses
Age-weighting	Yes	No	No age-weighting results in an increase in the relative share of DALY in children and in the elderly compared to young adults.	WHO analyses
Disability weights	GBD 1997 and Dutch study—health and welfare loss studies	GBD 2013—health loss only	Changes to the disability weights are likely to cause changes in both the quantum of YLD for a condition and the relative ranking of conditions.	. .
YLD approach	Incidence	Prevalence	Prevalence-based YLD result in an overall shift in the age-distribution to the older age groups, particularly for childhood conditions and chronic mental conditions	AIHW analyses (2003)
Co-morbidity adjustment	Yes—independent comorbidity	Yes—independent multiplicative model	Higher prevalent conditions will have a greater reduction in YLD following comorbidity adjustment than low prevalent conditions	AIHW analyses (ABDS 2011)
Risk factors	11	29	The inclusion of more risk factors will result in a greater proportion of the total burden explained, but may reduce the estimated contribution of individual risk factors.	. .
Measure of the gap	Indirect age-standardisation	Direct age-standardisation	Direct age-standardisation results in slightly lower rates and rate ratios compared to indirect standardisation, however similar results in terms of the ranking of diseases.	AIHW analyses (ABDS 2011)

4 Total burden of disease

What it means: the impact of early death and living with poor health

This section is about the overall impact of health problems in Indigenous Australians, including the effects of both early death and living with poor health. Early death and living with poor health are looked at separately in the next 2 chapters of the report.

Burden of disease analysis estimates the number of years of healthy life lost due to the diseases and injuries causing early death and poor health in a particular population. In 2011, there were 284 years of healthy life lost for every 1,000 Indigenous Australians. Dying early caused more of these lost years (53% of the total) than living with poor health.

What causes the most burden?

The biggest cause was mental and substance use disorders, such as anxiety disorders and alcohol use disorders—these caused almost 1 in every 5 of the lost years (19%). The next biggest cause was injuries, including suicide & self-inflicted injuries (15%). Then cardiovascular diseases like heart disease and stroke (12%), cancer (9%), and asthma and other breathing problems (8%).

Chronic diseases caused the most burden for Indigenous Australians, causing almost two-thirds (64%) of the total impact of early death and living with poor health.

Coronary heart disease (including heart attacks), suicide & self-inflicted injuries, anxiety, alcohol use diseases and diabetes were the specific diseases causing the most burden.

Males and females—young people and old people

Males lost more healthy years than females (54% of the total), mainly from injuries and heart disease.

The causes of burden were different at different ages:

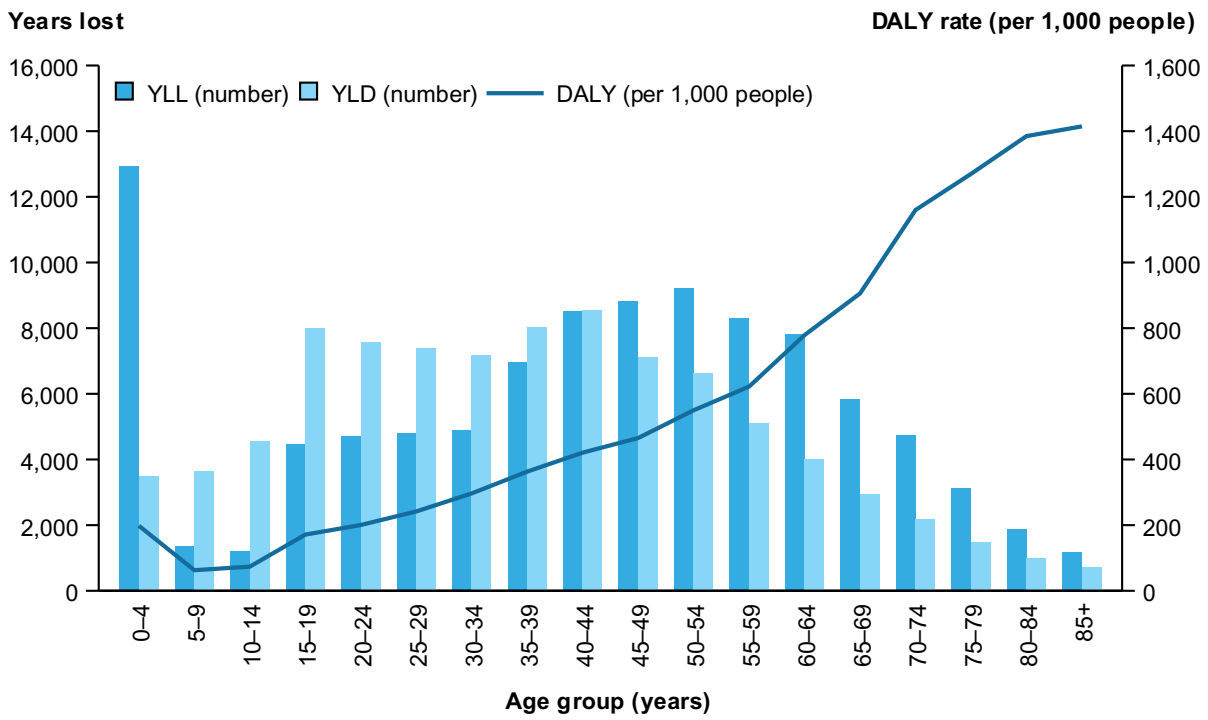
- Mental and substance use disorders and injuries were the largest causes of disease burden for those aged 5–44.
- Heart disease and cancer were the largest causes of the disease burden for those aged 45 and over.

Burden of disease—expressed as disability adjusted life years (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 the impact of different diseases on the health of the population.

This chapter presents estimates of total burden (DALY) for the Aboriginal and Torres Strait Islander population in 2011. Comparisons to estimates for the non-Indigenous population, including estimates of the gap in total burden between Indigenous and non-Indigenous Australians, are presented in 'Chapter 8 Gap in health outcomes'. Estimates of burden at the subnational level (by state and territory, remoteness and socioeconomic status) are presented in 'Chapter 12 Variation across geographic and population groups'.

4.1 Total burden experienced in 2011

In 2011, Indigenous Australians lost 190,227 years due to premature death or living with disease or injury, which equates to around 284 DALY for every 1,000 Indigenous Australians. This burden was split between 100,663 years of life lost due to premature death (YLL) and 89,564 years lived with disease or injury (YLD) (52.9% fatal, 47.1% non-fatal burden), which affected Aboriginal and Torres Strait Islander people differently across the life course (Figure 4.1).

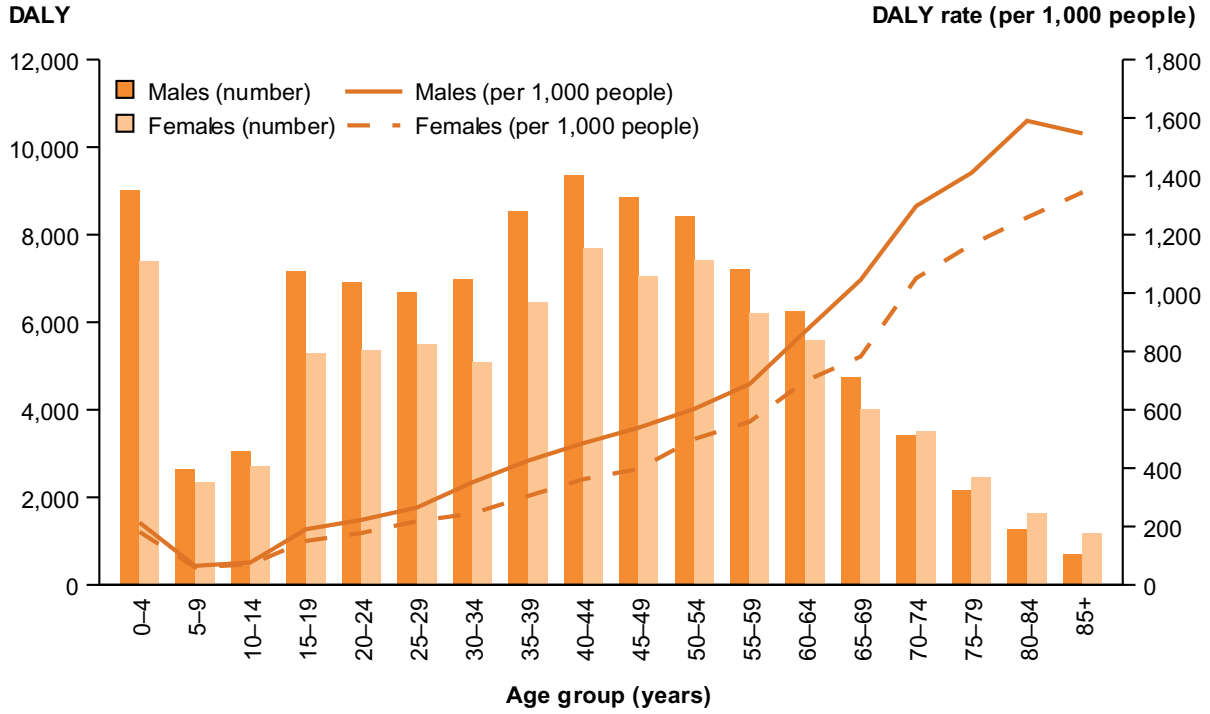


Note: The smaller estimates occurring in those aged 85 and over may make estimates for YLL and YLD in these age groups less reliable.

Source: This figure is based on data in a supplementary table available online—Table S4.1.

Figure 4.1: Fatal and non-fatal composition of the total burden for Indigenous Australians, by age, 2011

Indigenous males experienced 103,365 DALY compared to 86,862 DALY for Indigenous females, accounting for 54% of the total burden compared with 46% for females. More burden was experienced by Indigenous males than females across all age groups as reflected in the higher DALY rates (Figure 4.2). Higher DALY counts for Indigenous females aged 70 and over were driven by the greater number of Indigenous women still alive in these age groups compared to Indigenous men.



Source: This figure is based on data in a supplementary table available online—Table S4.2.

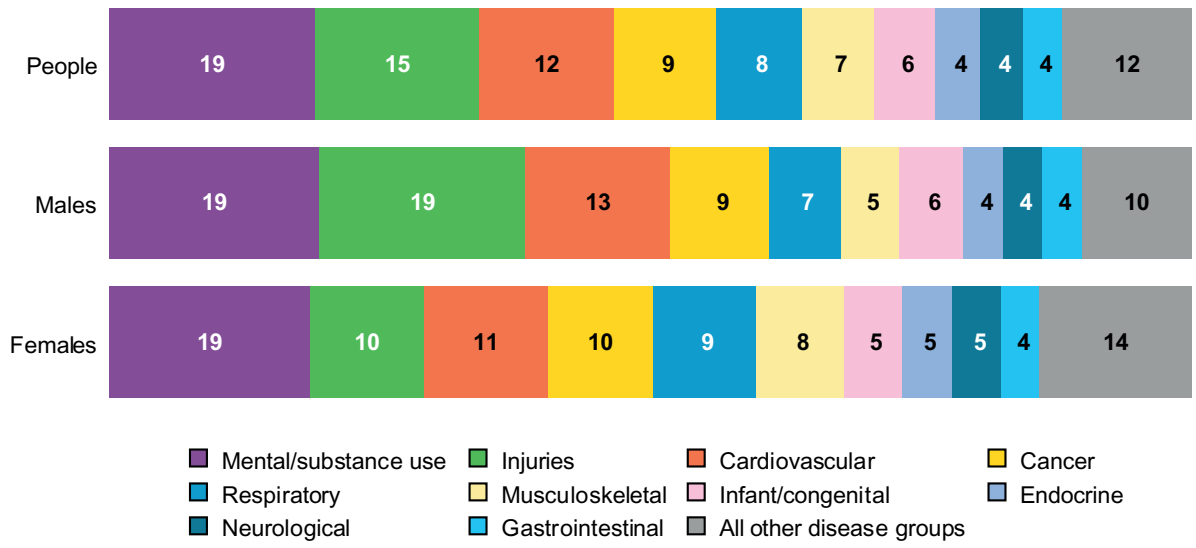
Figure 4.2: Number and rates of DALY, by age and sex, Indigenous Australians, 2011

4.2 Which disease groups caused the most burden?

Mental & substance use disorders (19% of total DALY), injuries, which includes suicide (15%), cardiovascular diseases (12%), cancer (9%) and respiratory diseases (8%) were the leading causes of total burden that Indigenous Australians experienced in 2011 (Figure 4.3, Table 4.1).

All chronic diseases (which include cardiovascular diseases, mental & substance use disorders, cancer, CKD, diabetes, vision loss, hearing loss and selected musculoskeletal, respiratory, neurological and congenital disorders—see Appendix Table B13 for a complete list) accounted for 64% of the total disease burden that Indigenous Australians experienced in 2011.

Injuries were responsible for a higher proportion of the burden in Indigenous males (19%) than in Indigenous females (10%), and were ranked second for males (behind mental & substance use disorders) and third for females (behind mental & substance use disorders and cardiovascular diseases) (Figure 4.3, Table 4.1).



Source: Table 4.1.

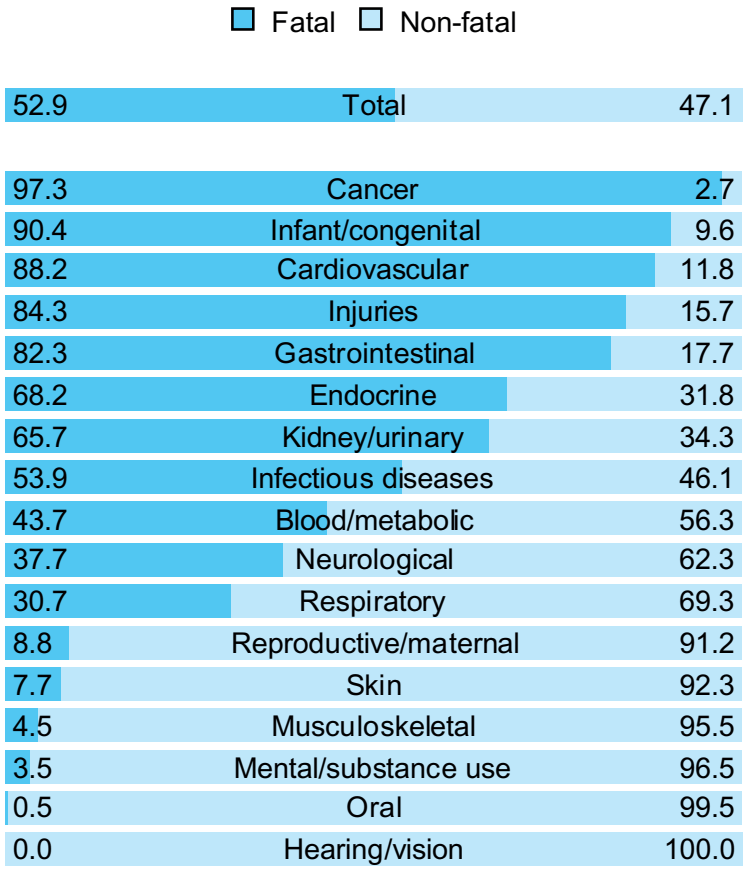
Figure 4.3: Proportion (%) of total burden (DALY), by disease group and sex, Indigenous Australians, 2011

Table 4.1: Total burden (DALY and proportion of total) for Indigenous Australians, by disease group and sex, 2011

	Males		Females		People	
Disease group	**DALY**	**Proportion (%)**	**DALY**	**Proportion (%)**	**DALY**	**Proportion (%)**
Mental/substance use	20,088	19.4	16,135	18.6	36,223	19.0
Injuries	19,673	19.0	9,116	10.5	28,790	15.1
Cardiovascular	13,852	13.4	9,920	11.4	23,771	12.5
Cancer	9,362	9.1	8,485	9.8	17,847	9.4
Respiratory	6,862	6.6	8,223	9.5	15,085	7.9
Musculoskeletal	5,618	5.4	7,086	8.2	12,704	6.7
Infant/congenital	6,138	5.9	4,632	5.3	10,770	5.7
Endocrine	3,825	3.7	4,038	4.6	7,863	4.1
Neurological	3,634	3.5	3,952	4.5	7,587	4.0
Gastrointestinal	3,821	3.7	3,075	3.5	6,896	3.6
Infectious diseases	3,194	3.1	2,875	3.3	6,069	3.2
Kidney/urinary	2,114	2.0	2,573	3.0	4,687	2.5
Oral	1,710	1.7	1,540	1.8	3,250	1.7
Blood/metabolic	1,178	1.1	1,824	2.1	3,002	1.6
Skin	1,170	1.1	1,213	1.4	2,383	1.3
Hearing/vision	1,046	1.0	1,142	1.3	2,188	1.2
Reproductive/maternal	79	0.1	1,033	1.2	1,112	0.6
Total	**103,365**	**100.0**	**86,862**	**100.0**	**190,227**	**100.0**

Note: The numbers may not add to total for all columns due to rounding.

The contributions of fatal and non-fatal burden for each disease group are shown in Figure 4.4. Among the 5 highest burden disease groups, the total burden from cancer, cardiovascular diseases and injuries was predominantly fatal (97%, 88% and 84% respectively), while the burden from mental & substance use disorders and respiratory diseases was predominantly non-fatal (97% and 69% respectively). The smaller contribution of fatal burden in these latter 2 groups highlights the importance of including non-fatal health outcomes in population health measurement.

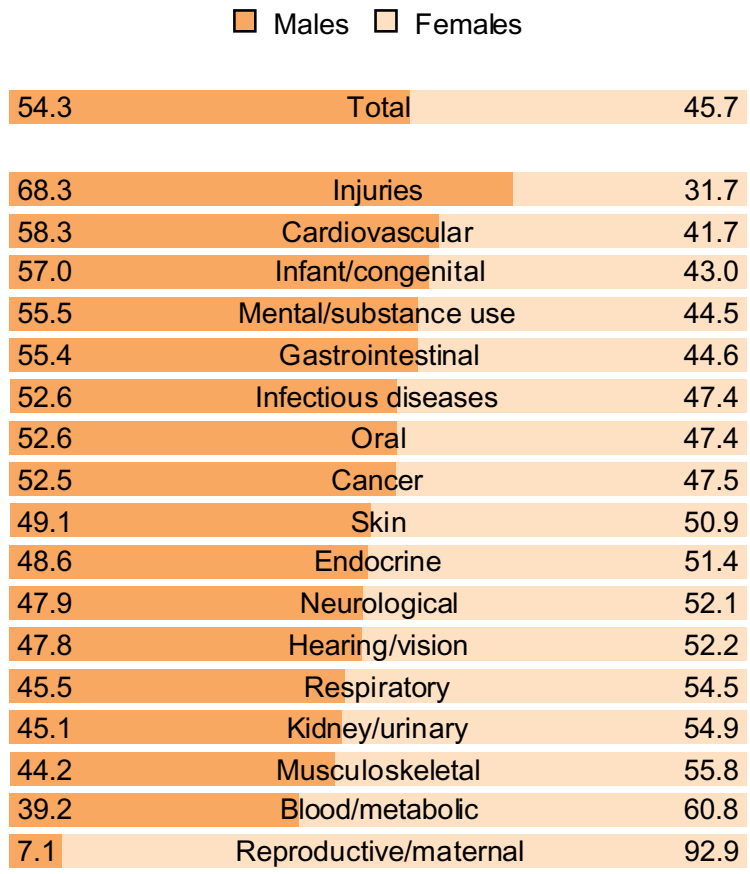


Source: This figure is based on data in a supplementary table available online—Table S4.3.

Figure 4.4: Fatal and non-fatal proportion of total burden, by disease group, Indigenous Australians, 2011

How does burden differ between males and females?

The distribution of overall burden between the sexes varied by disease group (Figure 4.5). Indigenous males experienced over two-thirds (68%) of the burden from injuries and a greater share of the burden from cardiovascular diseases (58%), infant & congenital conditions (57%) and mental & substance use disorders (56%). Indigenous females experienced a greater share of the burden from blood & metabolic disorders (61%), musculoskeletal conditions (56%), kidney & urinary diseases (55%) and respiratory diseases (55%). Predominantly female-related conditions characterised reproductive & maternal conditions, which accounted for the high proportion of burden in Indigenous females (93%).



Source: This figure is based on data in a supplementary table available online—Table S4.4.

Figure 4.5: Proportion of total burden by sex, by disease group for Indigenous Australians, 2011

Age-standardised rates were compared to evaluate the difference in total burden between Indigenous males and Indigenous females. After adjusting for differences in the population age structure, Indigenous males experienced 27% more burden than Indigenous females (rate ratio of 1.27); however, there were clear differences in burden by disease group (Table 4.2).

Indigenous males had 2.3 times the burden from injuries and 1.5 times the burden from cardiovascular diseases. Due to the high rate of burden for these conditions, this translated into large rate differences.

Indigenous females experienced higher rates of burden than Indigenous males for respiratory diseases (rate ratio of 0.9), blood & metabolic disorders (0.8) and musculoskeletal conditions (0.9).

Table 4.2: Comparison of DALY rate ratios and rate differences of age-standardised rates: Indigenous males: Indigenous females, Australia, 2011

	DALY ASR			
Disease group	**Males**	**Females**	**Rate difference**	**Rate ratio**
Cardiovascular	87.7	58.1	29.6	1.5
Injuries	70.5	30.9	39.6	2.3
Cancer	66.1	49.7	16.4	1.3
Mental/substance use	64.9	51.1	13.8	1.3
Respiratory	38.0	40.6	–2.6	0.9
Musculoskeletal	28.4	32.7	–4.3	0.9
Neurological	23.6	24.1	–0.5	1.0
Endocrine	22.8	21.2	1.6	1.1
Gastrointestinal	19.0	14.1	5.0	1.4
Kidney/urinary	14.8	15.0	–0.2	1.0
Infectious diseases	12.7	10.2	2.5	1.2
Infant/congenital	11.4	8.4	3.0	1.4
Oral	7.2	5.9	1.2	1.2
Hearing/vision	6.8	6.1	0.7	1.1
Blood/metabolic	5.7	6.8	–1.1	0.8
Skin	3.9	3.9	–0.1	1.0
Reproductive/maternal	0.3	3.0	–2.7	0.1
Total	**483.7**	**381.8**	**101.9**	**1.27**

Notes

1. Rates were age-standardised to the Australian population as at 30 June 2001, and are expressed per 1,000 people.
2. Rate ratio is the relative difference of males compared to females, calculated as the male age-standardised rate divided by the female age-standardised rate.
3. Rate difference is the absolute difference in health loss in males compared to females, calculated as male age-standardised rate minus the female age-standardised rate.
4. The numbers may not add to total for all columns due to rounding.

How does burden vary with age?

Figure 4.6 shows the distribution of DALY by disease over the life course for Indigenous males and females.

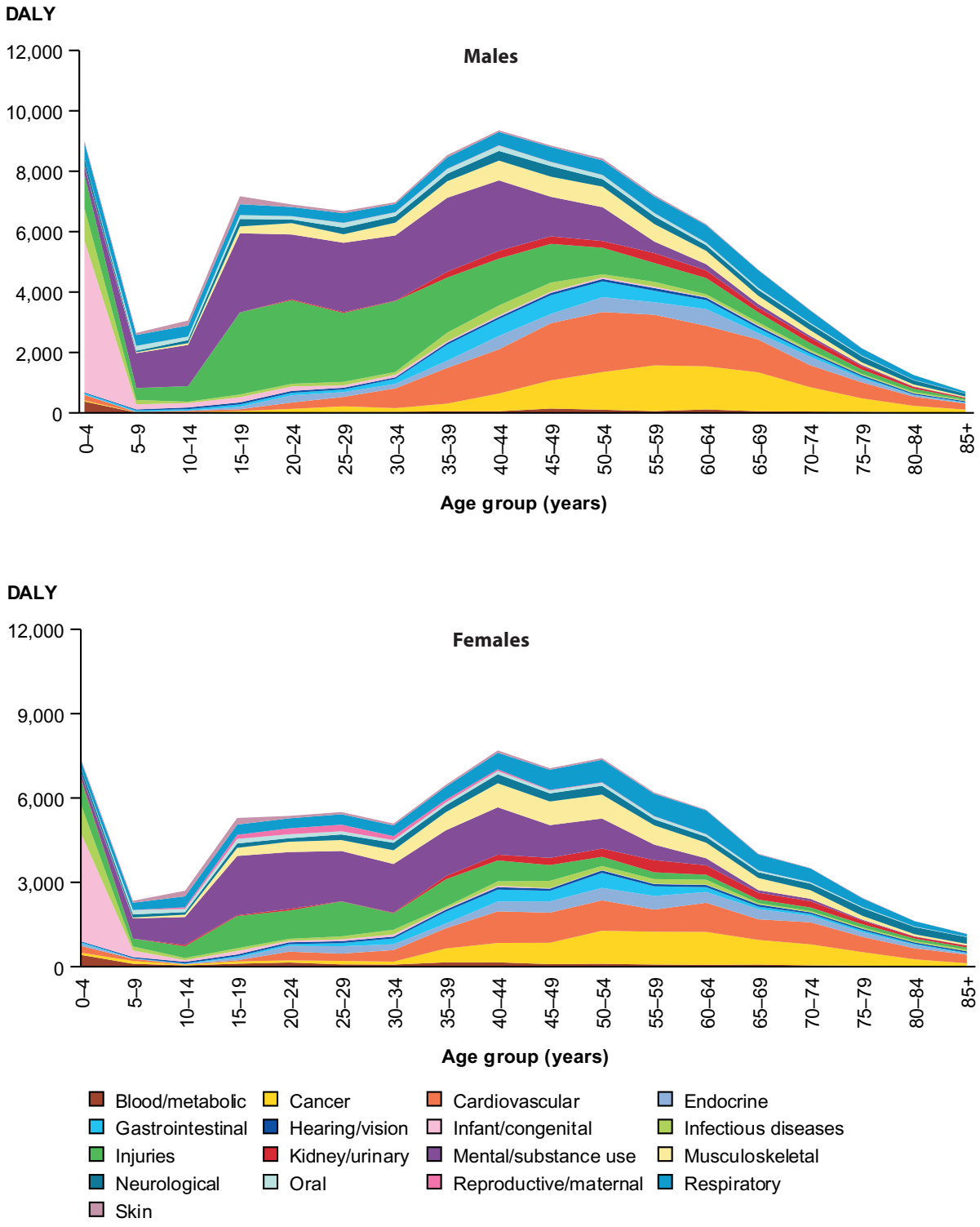


Figure 4.6: Total burden (number of DALY), by disease group and age, Indigenous males and females, 2011

Apart from infancy, where infant & congenital conditions were the predominant cause of burden, total burden was relatively low in young Indigenous children. Mental & substance use disorders and injuries (including suicide) were the main causes of burden for late childhood, adolescence and adulthood to age 44, although injuries caused more burden in Indigenous males than Indigenous females.

Cardiovascular diseases and cancer started to emerge as major causes of burden among Indigenous males and females from around age 45, and continued to be the main co ntributors to disease burden in older Indigenous Australians.

Respiratory diseases affected all age groups, accounting for between 4% and 14% of total burden in Indigenous males, and between 3% and 15% of total burden in Indigenous females across age groups.

4.3 Which specific diseases caused the most burden?

The top 20 specific diseases accounted for 58% of the burden that Indigenous Australians experienced (59% for males and 57% for females). CHD, anxiety disorders and diabetes were ranked in the top 5 diseases for both sexes; however, the proportion of burden that each contributed was different (Table 4.3).

For Indigenous males, alcohol use disorders and suicide & self-inflicted injuries were also ranked in the top 5 diseases causing burden, while for Indigenous females, depressive disorders and other musculoskeletal conditions ranked in the top 5.

Table 4.3: Leading 20 specific diseases contributing to total burden (DALY) for Indigenous Australians, by sex, 2011

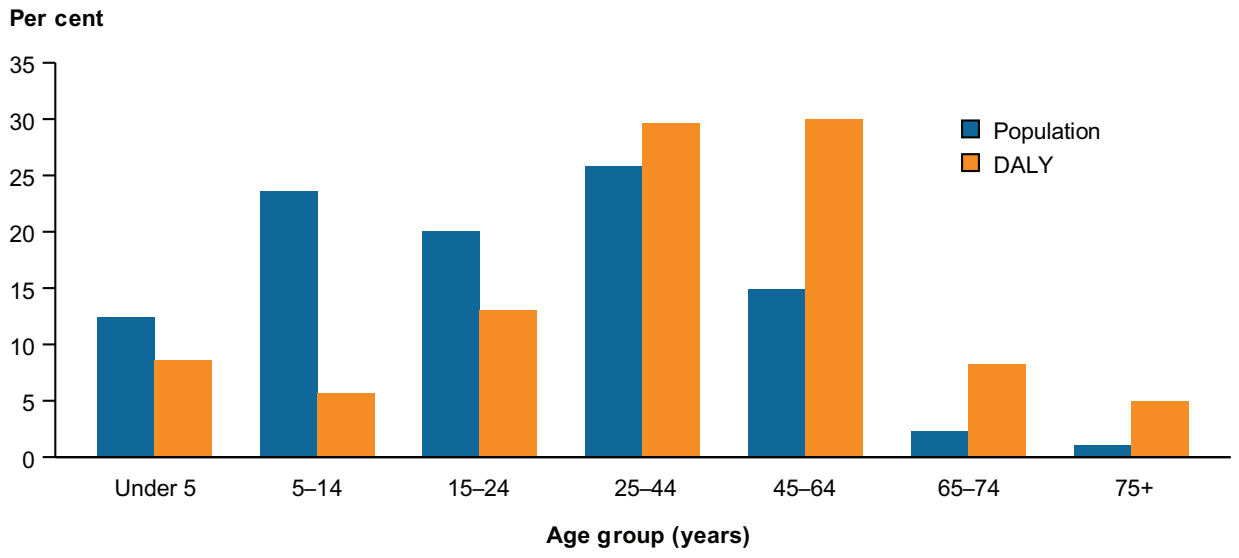
Rank	Males	DALY	% of total	Females	DALY	% of total	People	DALY	% of total
1	Coronary heart disease	9,206	8.9	Anxiety disorders	**5,158**	5.9	Coronary heart disease	13,716	7.2
2	Alcohol use disorders	6,027	5.8	Coronary heart disease	**4,511**	5.2	Suicide & self-inflicted injuries	8,513	4.5
3	Suicide & self-inflicted injuries	5,977	5.8	Depressive disorders	**4,031**	4.6	Anxiety disorders	8,455	4.4
4	Diabetes	3,807	3.7	Other musculoskeletal	**3,957**	4.6	Alcohol use disorders	8,037	4.2
5	Anxiety disorders	3,296	3.2	Diabetes	**3,917**	4.5	Diabetes	7,725	4.1
6	Other musculoskeletal	3,027	2.9	Asthma	**3,652**	4.2	Other musculoskeletal	6,985	3.7
7	RTI —motor vehicle occupants	3,025	2.9	COPD	**3,131**	3.6	Depressive disorders	6,970	3.7
8	Depressive disorders	2,939	2.8	Suicide & self-inflicted injuries	**2,536**	2.9	Asthma	6,130	3.2
9	COPD	2,624	2.5	Chronic kidney disease	**2,170**	2.5	COPD	5,755	3.0
10	Asthma	2,477	2.4	Alcohol use disorders	**2,010**	2.3	RTI —motor vehicle occupants	4,741	2.5
11	Lung cancer	2,342	2.3	Lung cancer	**1,916**	2.2	Lung cancer	4,258	2.2
12	Chronic liver disease	2,341	2.3	Stroke	**1,904**	2.2	Chronic liver disease	4,174	2.2
13	Homicide & violence	2,186	2.1	Chronic liver disease	**1,832**	2.1	Chronic kidney disease	3,696	1.9
14	Poisoning	1,996	1.9	RTI —motor vehicle occupants	**1,717**	2.0	Homicide & violence	3,378	1.8
15	Schizophrenia	1,897	1.8	Back pain & problems	**1,333**	1.5	Stroke	3,299	1.7
16	Pre-term birth & LBW complications	1,851	1.8	Dementia	**1,274**	1.5	Poisoning	3,102	1.6
17	Falls	1,656	1.6	Pre-term birth & LBW complications	**1,217**	1.4	Pre-term birth & LBW complications	3,068	1.6
18	Epilepsy	1,556	1.5	Homicide & violence	**1,192**	1.4	Schizophrenia	2,721	1.4
19	Other unintentional injuries	1,552	1.5	Breast cancer	**1,172**	1.3	Epilepsy	2,683	1.4
20	Chronic kidney disease	1,526	1.5	Bipolar affective disorder	**1,152**	1.3	Back pain & problems	2,521	1.3
	Leading 20 diseases	**61,308**	**59.3**	**Leading 20 diseases**	**49,783**	**57.3**	**Leading 20 diseases**	**109,925**	**57.8**
	All other diseases	*42,056*	*40.7*	*All other diseases*	*37,080*	*42.7*	*All other diseases*	*80,302*	*42.2*
	Total	**103,365**	**100.0**	**Total**	**86,862**	**100.0**	**Total**	**190,227**	**100.0**

Colour legend: >= 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

Notes: The numbers may not add to total for all columns due to rounding.

How do the causes of disease burden vary by age and sex?

The overall disease burden was not evenly distributed over the different stages of life. This was partly due to the different diseases that have an impact at different ages, and partly due to the different causes of death and patterns of age at death for Indigenous males and females. The burden in 7 broad age groups is described in this section, drawing on results shown in figures 4.7, 4.8 and 4.9.



Source: This figure is based on data in a supplementary table available online—Table S4.5.

Figure 4.7: Proportion of Indigenous population and total burden (DALY), by age, Indigenous Australians, 2011

Infants and children aged under 5 comprised 12% of the Indigenous population, and accounted for 9% of the total burden of Indigenous Australians in 2011. Infant & congenital conditions accounted for a large portion of the burden in this age group, mostly due to pre-term/low birthweight complications, SIDS, other disorders of infancy and birth trauma & asphyxia.

Children aged 5–14 comprised 24% of the total Indigenous population, but accounted for only 6% of the total burden of disease. Asthma, anxiety disorders, depressive disorders and conduct disorders were the main causes of health loss for Indigenous males and females aged 5–14. Estimates for conduct disorders should be interpreted with caution however, as they are based on indirect methods assessed to have a lower level of accuracy than other estimates reported for this age group.

Adolescents and adults aged 15–24 made up about 20% of the Indigenous population and accounted for 13% of the total burden. Injuries and mental & substance use disorders were the main contributors to the burden in this age group. Suicide & self-inflicted injuries, alcohol use disorders and motor vehicle traffic accidents were the leading causes of the burden in Indigenous males aged 15–24. Anxiety disorders, suicide & self-inflicted injuries, and depressive disorders were the leading causes of the burden in Indigenous females aged 15–24.

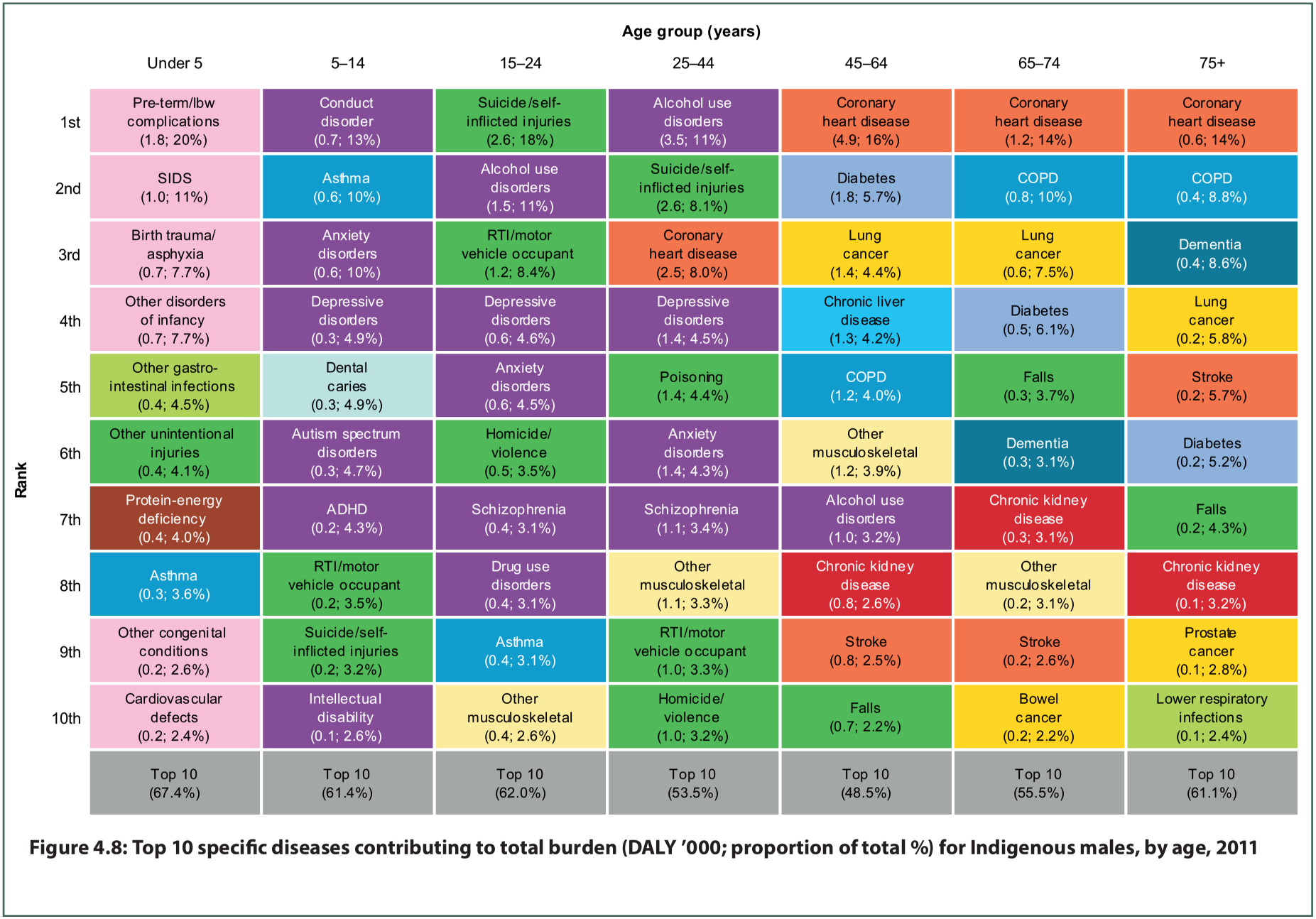
Adults aged 25–44 made up 26% of the total Indigenous population and contributed 30% to the total burden. For Indigenous males aged 25–44, alcohol use disorders were the leading contributor to the burden, followed by suicide & self-inflicted injuries and CHD. Anxiety disorders and depressive disorders were the 2 leading contributors to the burden among Indigenous females aged 25–44, followed by other musculoskeletal conditions.

Adults aged 45–64 made up 15% of the Indigenous population and contributed 30% of total burden. For Indigenous males aged 45–64, CHD, diabetes and lung cancer were the leading specific diseases contributing to the burden, accounting for over one-quarter (26%) of the burden for Indigenous males in this age group. Chronic liver disease (CLD) and COPD were also leading contributors to the burden in this age group.

For Indigenous females aged 45–64, CHD, COPD and diabetes were the leading diseases contributing to the total burden (accounting for 21% of the burden in this age group). CKD and other musculoskeletal conditions were also leading contributors of burden for Indigenous females in this age group.

Adults aged 65–74 made up only 2% of the Indigenous population in 2011, but accounted for 8% of the burden. CHD, COPD, lung cancer and diabetes were the major contributors to the burden for both Indigenous males and females in this age group. Falls was also a notable contributor to the burden in Indigenous males, and other musculoskeletal conditions and CKD were also major contributors to the burden in Indigenous females in this age group.

Adults aged 75 and over comprised only 1% of the Indigenous population, but accounted for 5% of the total burden. CHD, dementia, COPD, lung cancer, stroke, and diabetes were responsible for the majority of this burden in both Indigenous males and females aged 75 and over.



Rank	Under 5	5–14	15–24	25–44	45–64	65–74	75+
	Age group (years)						
1st	Pre-term/lbw complications (1.8; 20%)	Conduct disorder (0.7; 13%)	Suicide/self-inflicted injuries (2.6; 18%)	Alcohol use disorders (3.5; 11%)	Coronary heart disease (4.9; 16%)	Coronary heart disease (1.2; 14%)	Coronary heart disease (0.6; 14%)
2nd	SIDS (1.0; 11%)	Asthma (0.6; 10%)	Alcohol use disorders (1.5; 11%)	Suicide/self-inflicted injuries (2.6; 8.1%)	Diabetes (1.8; 5.7%)	COPD (0.8; 10%)	COPD (0.4; 8.8%)
3rd	Birth trauma/ asphyxia (0.7; 7.7%)	Anxiety disorders (0.6; 10%)	RTI/motor vehicle occupant (1.2; 8.4%)	Coronary heart disease (2.5; 8.0%)	Lung cancer (1.4; 4.4%)	Lung cancer (0.6; 7.5%)	Dementia (0.4; 8.6%)
4th	Other disorders of infancy (0.7; 7.7%)	Depressive disorders (0.3; 4.9%)	Depressive disorders (0.6; 4.6%)	Depressive disorders (1.4; 4.5%)	Chronic liver disease (1.3; 4.2%)	Diabetes (0.5; 6.1%)	Lung cancer (0.2; 5.8%)
5th	Other gastro-intestinal infections (0.4; 4.5%)	Dental caries (0.3; 4.9%)	Anxiety disorders (0.6; 4.5%)	Poisoning (1.4; 4.4%)	COPD (1.2; 4.0%)	Falls (0.3; 3.7%)	Stroke (0.2; 5.7%)
6th	Other unintentional injuries (0.4; 4.1%)	Autism spectrum disorders (0.3; 4.7%)	Homicide/ violence (0.5; 3.5%)	Anxiety disorders (1.4; 4.3%)	Other musculoskeletal (1.2; 3.9%)	Dementia (0.3; 3.1%)	Diabetes (0.2; 5.2%)
7th	Protein-energy deficiency (0.4; 4.0%)	ADHD (0.2; 4.3%)	Schizophrenia (0.4; 3.1%)	Schizophrenia (1.1; 3.4%)	Alcohol use disorders (1.0; 3.2%)	Chronic kidney disease (0.3; 3.1%)	Falls (0.2; 4.3%)
8th	Asthma (0.3; 3.6%)	RTI/motor vehicle occupant (0.2; 3.5%)	Drug use disorders (0.4; 3.1%)	Other musculoskeletal (1.1; 3.3%)	Chronic kidney disease (0.8; 2.6%)	Other musculoskeletal (0.2; 3.1%)	Chronic kidney disease (0.1; 3.2%)
9th	Other congenital conditions (0.2; 2.6%)	Suicide/self-inflicted injuries (0.2; 3.2%)	Asthma (0.4; 3.1%)	RTI/motor vehicle occupant (1.0; 3.3%)	Stroke (0.8; 2.5%)	Stroke (0.2; 2.6%)	Prostate cancer (0.1; 2.8%)
10th	Cardiovascular defects (0.2; 2.4%)	Intellectual disability (0.1; 2.6%)	Other musculoskeletal (0.4; 2.6%)	Homicide/ violence (1.0; 3.2%)	Falls (0.7; 2.2%)	Bowel cancer (0.2; 2.2%)	Lower respiratory infections (0.1; 2.4%)
	Top 10 (67.4%)	Top 10 (61.4%)	Top 10 (62.0%)	Top 10 (53.5%)	Top 10 (48.5%)	Top 10 (55.5%)	Top 10 (61.1%)

Figure 4.8: Top 10 specific diseases contributing to total burden (DALY '000; proportion of total %) for Indigenous males, by age, 2011

Figure 4.9: Top 10 specific diseases contributing to total burden (DALY '000; proportion of total %) for Indigenous females, by age, 2011

5 Non-fatal burden of disease

What it means: living with diseases and injuries

This section is about the number of years Indigenous people spend not being completely healthy, because they are living with diseases and injuries. When all these years are added up, there was a total of 89,564 years, or 134 years of healthy life lost for every 1,000 Indigenous Australians in 2011.

What causes Indigenous Australians to lose years of healthy life?

About two-thirds of the years lost due to poor health are caused by:

- mental health and substance use disorders, especially alcohol use disorders, anxiety and depression (39%)
- musculoskeletal conditions such as arthritis and back problems (14%)
- respiratory diseases such as asthma and other breathing problems (12%).

Is it different for males and females?

Overall, males and females lost a similar amount of healthy years. Mental health and substance use disorders, musculoskeletal conditions and respiratory diseases were the 3 largest causes of healthy life lost for both males and females. But there were some differences:

- Males lost about 2.5 times as many healthy years due to injuries as females.
- Females lost more healthy years than males due to blood and metabolic disorders like iron-deficiency anaemia.
- Males aged 35–44 and males 70 and over lost more years of healthy life than females at these ages.

Are the causes different at different ages?

- In children aged under 5, the 3 main causes were infectious diseases, blood and metabolic disorders, and respiratory conditions such as asthma. These diseases caused about two-thirds of the years of healthy life lost for children under 5.
- From ages 5 to 49, mental and substance use disorders were the main cause. These disorders caused a different amount of the years of healthy life lost at different ages, but it was always a large amount—from one-third to three-fifths.
- Chronic diseases, including heart disease, diabetes, arthritis and back problems, caused more of the lost healthy years as people got older.

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

Expressed as years lived with disability (YLD), non-fatal burden is a measure of healthy years lost due to ill health. In this study, YLD were calculated using a prevalence-based approach, which means it counts the effect in a reference year of all cases of disease and injury existing in that year (see Box 5.1 for more information).

Where possible, national data sources containing information on the prevalence and severity of disease in the Indigenous Australian population were used to estimate YLD. However for a number of diseases, such information was not available and indirect methods were used and/or estimates of severity used for the total Australian population were applied. Further details on the calculation of YLD and the specific diseases for which indirect methods were used can be found in 'Appendix B: Methods overview'. Information on the quality of these estimates can be found in 'Appendix C: Indigenous-specific data quality issues', with further detail provided in the ABDS technical methods report (AIHW 2016b).

This chapter presents YLD estimates for the Aboriginal and Torres Strait Islander population. Comparisons with the non-Indigenous population, including estimates of the gap in non-fatal burden between Indigenous and non-Indigenous Australians, are primarily included in 'Chapter 8 Gap in health outcomes'.

Box 5.1: 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 of health loss, which directly measures the YLD that the population experienced 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.

5.1 Years lived in less than full health in 2011

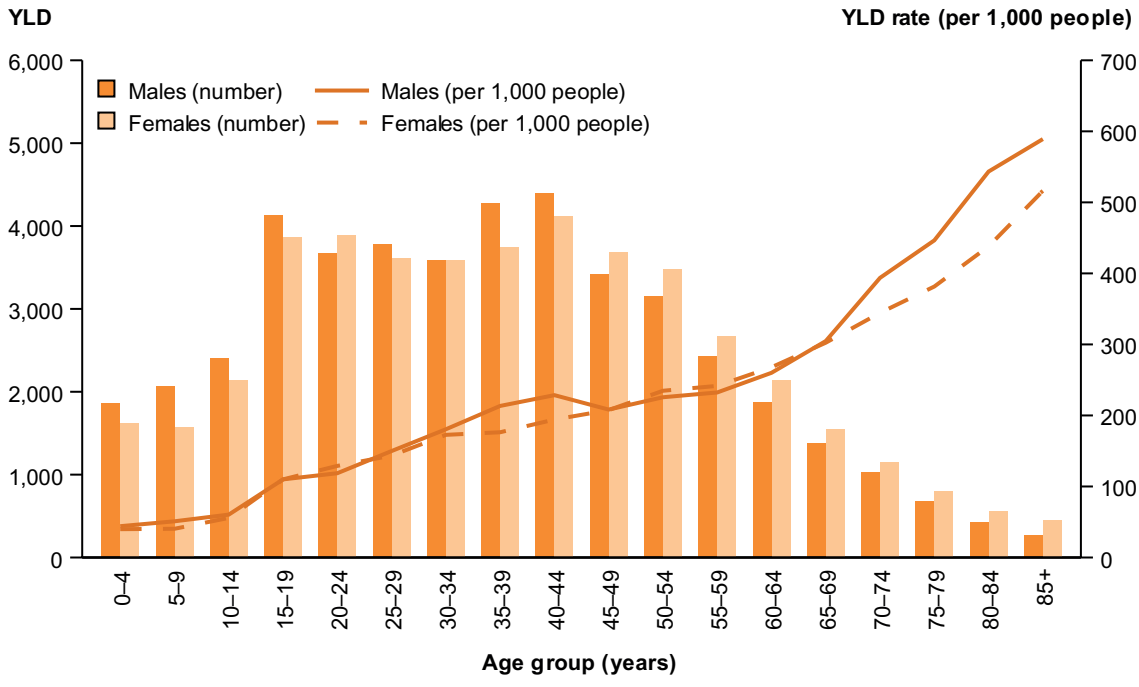
In 2011, Indigenous Australians lost 89,564 years of healthy life due to the impact of living with disease and injury. This accounted for just under half (47%) of the total burden that Indigenous Australians experienced and is equivalent to 134 YLD per 1,000 people.

There was little overall difference in non-fatal health loss between Indigenous males and females (Figure 5.1), with each accounting for 50% of the total YLD (44,883 YLD for males, 44,681 for females). There was also little difference in the age pattern of health loss between the sexes (both in terms of numbers and rates); however, Indigenous males experienced a higher rate of non-fatal burden at ages 35–44 and from age 70 onwards.

The non-fatal health loss Indigenous Australians experienced in 2011 differed by age, both in absolute number and rate of YLD. The total YLD that Indigenous infants and young children experienced was low, but increased rapidly in absolute terms until early adulthood.

In absolute terms (number of YLD), Indigenous males and females aged 15–44 experienced the majority of the non-fatal burden.

While the total YLD decreased in absolute terms from age 45 onwards, rates of non-fatal burden steadily increased for both sexes, with a sharper increase from age 65, indicating that the older Indigenous population experienced a significant amount of health loss.



Source: This figure is based on data in a supplementary table available online—Table S5.1.

Figure 5.1: Number and rates of years lived with disability, by age and sex, Indigenous Australians, 2011

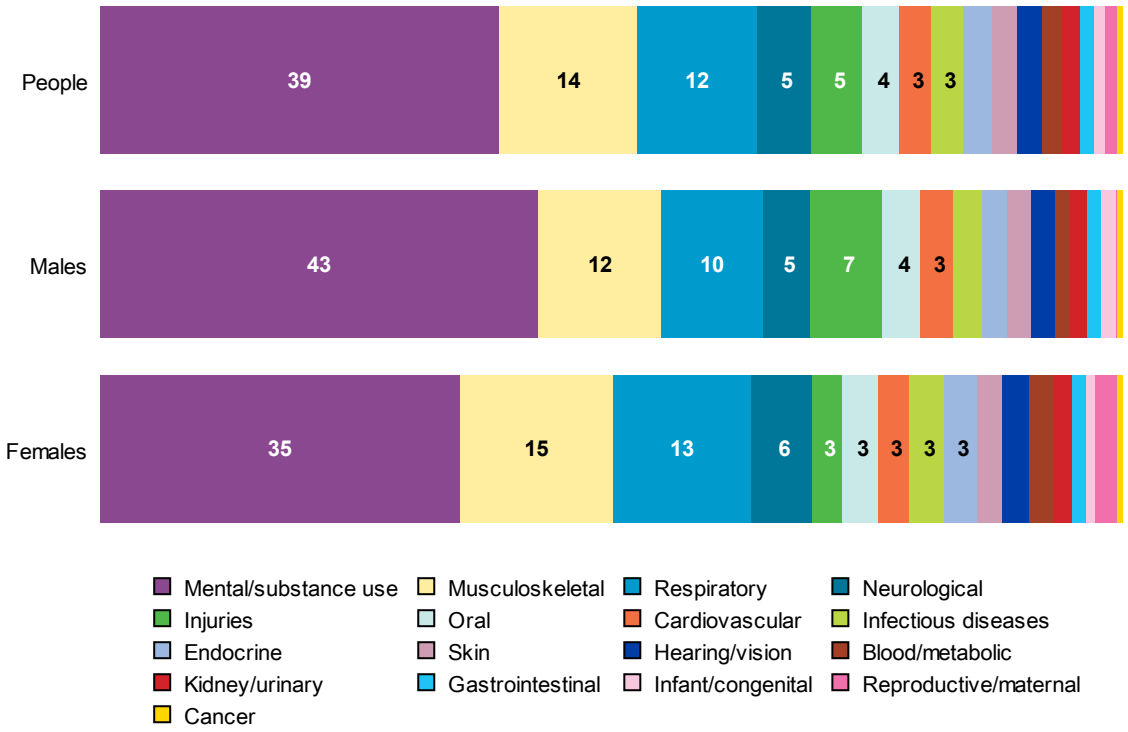
5.2 Which disease groups caused the greatest non-fatal burden?

Causes of health loss can be examined by disease groups, and by specific diseases. This section looks at health loss by broad disease group.

Major causes of non-fatal burden in males and females

Three disease groups accounted for around two-thirds (65%) of the non-fatal burden that Indigenous Australians experienced in 2011: mental & substance use disorders (43% of the total for males; 35% for females), musculoskeletal conditions (12% males; 15% females) and respiratory diseases (10% males; 13% females).

Injuries was ranked as the fourth leading disease group for Indigenous males, accounting for 7% of the non-fatal burden compared to 3% for Indigenous females. Neurological conditions accounted for 5% of non-fatal burden for Indigenous males and 6% for Indigenous females (Figure 5.2).



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S5.2.

Figure 5.2: Proportion (%) of non-fatal burden by disease groups and sex, Indigenous Australians, 2011

Age-standardised rates were compared to evaluate the difference in non-fatal burden between Indigenous males and females. After taking into account differences in population age structure, Indigenous males experienced 7% more non-fatal burden than Indigenous females. Using age-standardised rates, however, there were some larger differences in YLD rates by disease group between Indigenous males and females (Table 5.1):

- Indigenous males had around 2.5 times the non-fatal burden due to injuries and 1.8 times the non-fatal burden due to infant & congenital conditions compared with Indigenous females.
- Indigenous males experienced less non-fatal burden due to blood & metabolic disorders than Indigenous females (rate ratio of 0.6).
- In addition, reproductive & maternal conditions included a number of highly gender-specific diseases for which females experience the large majority of the burden.

Table 5.1: Comparison of YLD rate ratios and rate differences of age-standardised rates: Indigenous males and females, Australia, 2011

	YLD ASR			
Disease group	**Males**	**Females**	**Rate difference**	**Rate ratio**
Mental & substance use	60.4	49.1	11.3	1.2
Musculoskeletal	27.0	30.8	–3.8	0.9
Respiratory	20.5	25.7	–5.2	0.8
Injuries	19.2	7.7	11.5	2.5
Neurological	14.0	14.8	–0.9	0.9
Cardiovascular	9.9	8.5	1.3	1.2
Oral	7.1	5.9	1.1	1.2
Hearing/vision	6.8	6.1	0.7	1.1
Kidney/urinary	5.5	4.5	1.0	1.2
Endocrine	4.2	5.4	–1.2	0.8
Infectious diseases	3.9	4.7	–0.8	0.8
Skin	3.2	3.4	–0.2	0.9
Gastrointestinal	2.3	2.4	–0.2	0.9
Blood/metabolic	2.1	3.6	–1.6	0.6
Infant/congenital	2.1	1.1	0.9	1.8
Cancer	1.8	1.6	0.2	1.2
Reproductive/maternal	0.3	2.8	–2.4	0.1
Total	**190.3**	**178.3**	**12.0**	**1.1**

Notes

1. Rates were age-standardised to the Australian population as at 30 June 2001, and are expressed per 1,000 people.
2. Rate ratio is the relative difference of males compared to females, calculated as the male age-standardised rate divided by the female age-standardised rate.
3. Rate difference is the absolute difference in health loss in males compared to females, calculated as male age-standardised rate minus the female age-standardised rate.
4. The numbers may not add to total for all columns due to rounding.

Major causes of non-fatal burden across the life course

The disease groups making the greatest contribution to non-fatal burden varied across the life course (Figure 5.3). In Indigenous children aged under 5, infectious diseases, blood & metabolic conditions (including protein-energy malnutrition) and respiratory diseases were responsible for around two-thirds (67%) of the non-fatal burden.

From ages 5–49, mental & substance use disorders dominated the non-fatal burden, accounting for one-third to over one-half (32–59%) of the burden in these age groups.

The burden of musculoskeletal conditions also gradually increased from childhood onwards. From ages 45–74, musculoskeletal conditions accounted for over 20% of the non-fatal burden that Indigenous Australians experienced, and chronic diseases such as cardiovascular diseases also began to emerge. From age 60 onwards, cardiovascular diseases, neurological conditions, musculoskeletal conditions and injuries together became the greatest cause of the non-fatal burden that Indigenous Australians experienced.

The proportion of non-fatal burden from respiratory diseases remained at 8–20% across all ages.

5.3 Which specific diseases caused the most non-fatal burden?

The leading 20 specific diseases for Indigenous males and females in terms of non-fatal burden are presented in Table 5.2. Together these accounted for over two-thirds of the non-fatal disease burden. Chronic diseases and substance use disorders predominantly characterise the list.

Anxiety disorders, alcohol use disorders, depressive disorders, other musculoskeletal conditions and asthma were leading causes of non-fatal burden for both Indigenous males and females. Alcohol use disorders contributed a much higher proportion of YLD for Indigenous males (12%) compared to Indigenous females (4%), and anxiety disorders contributed a higher proportion of YLD for Indigenous females (12% compared to 7% for Indigenous males).

Other major differences between Indigenous males and females were:

- the high level of burden due to schizophrenia, drug use disorders and falls for males
- dementia and iron-deficiency anaemia ranking in the top 20 diseases for females but not males.

Specific diseases contributing to non-fatal burden by age and sex

The non-fatal burden was not evenly distributed over the different stages of life. For example, infants and children aged under 5 comprised 12% of the Indigenous population and accounted for 4% of non-fatal burden of Indigenous Australians in 2011. Indigenous Australians aged 75 and over also accounted for 4% of non-fatal burden, but only comprised 1% of the Indigenous population (Figure 5.4).

Non-fatal burden in 7 broad age groups is described in this section, drawing on results shown in figures 5.4, 5.5 and 5.6.

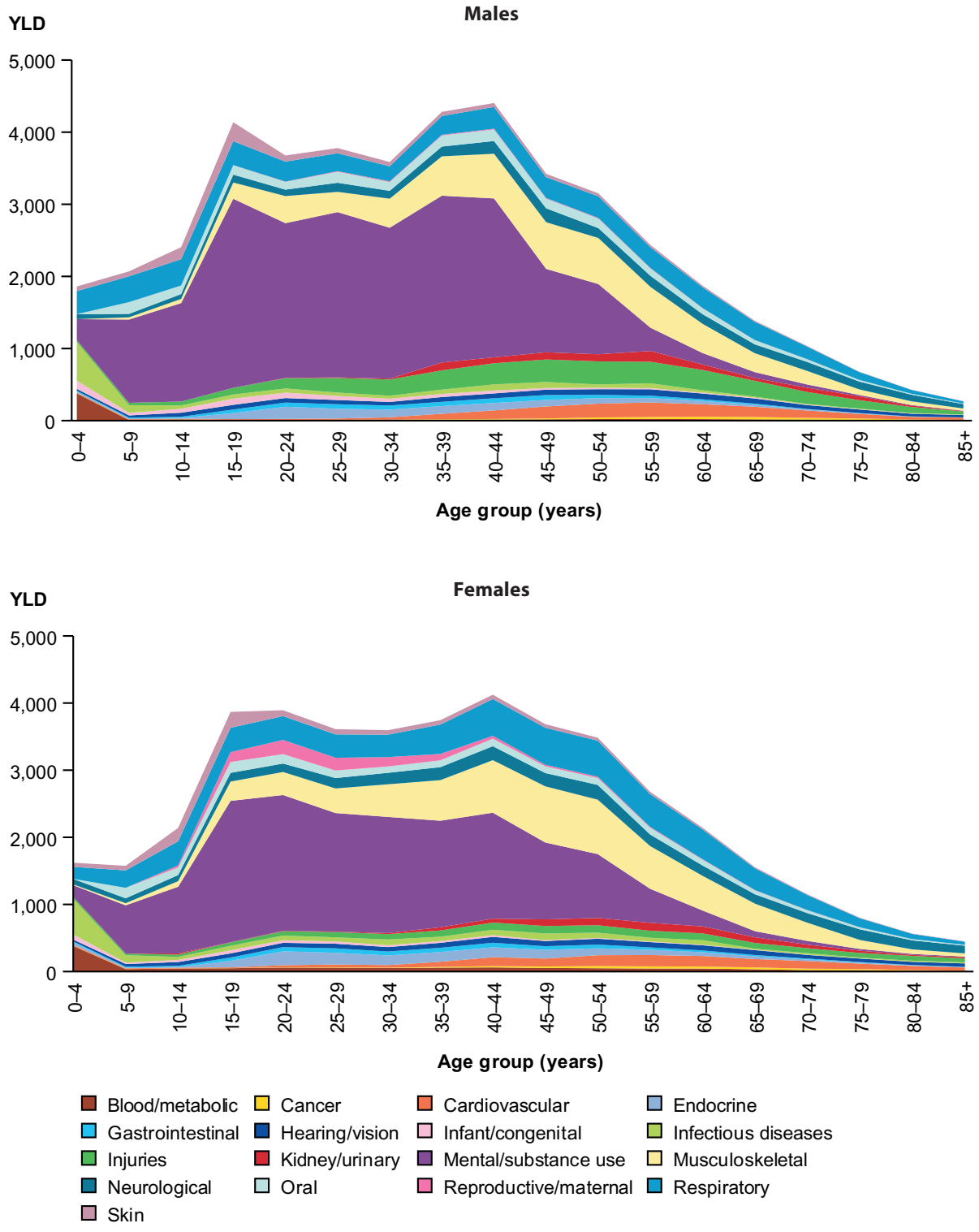


Figure 5.3: Number of non-fatal burden (YLD), by disease group and age, Indigenous males and females, 2011

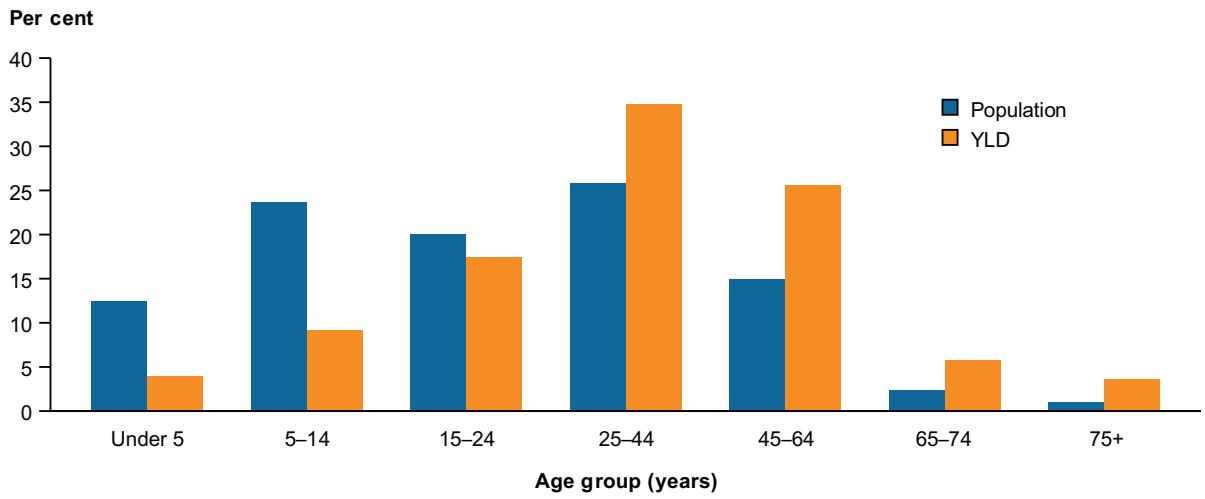
Table 5.2: Leading 20 specific diseases contributing to non-fatal burden (YLD) for Indigenous Australians, by sex, 2011

Rank	Males	YLD	% of total	Females	YLD	% of total	People	YLD	% of total
1	Alcohol use disorders	5,376	12.0	Anxiety disorders	5,158	11.5	Anxiety disorders	8,454	9.4
2	Anxiety disorders	3,296	7.3	Depressive disorders	4,031	9.0	Alcohol use disorders	7,120	8.0
3	Depressive disorders	2,939	6.5	Other musculoskeletal	3,641	8.1	Depressive disorders	6,969	7.8
4	Other musculoskeletal	2,817	6.3	Asthma	3,477	7.8	Other musculoskeletal	6,458	7.2
5	Asthma	2,325	5.2	Alcohol use disorders	1,745	3.9	Asthma	5,802	6.5
6	Schizophrenia	1,864	4.2	COPD	1,520	3.4	COPD	2,672	3.0
7	Drug use disorders (excluding alcohol)	1,392	3.1	Diabetes	1,394	3.1	Schizophrenia	2,649	3.0
8	Back pain and problems	1,185	2.6	Back pain and problems	1,332	3.0	Back pain and problems	2,517	2.8
9	Falls	1,182	2.6	Bipolar affective disorder	1,152	2.6	Diabetes	2,456	2.7
10	COPD	1,153	2.6	Dental caries	1,046	2.3	Dental caries	2,190	2.4
11	Dental caries	1,144	2.5	Upper respiratory conditions	990	2.2	Drug use disorders (excluding alcohol)	1,957	2.2
12	Diabetes	1,062	2.4	Rheumatoid arthritis	948	2.1	Upper respiratory conditions	1,948	2.2
13	Conduct disorder[(a)]	1,021	2.3	Dementia	802	1.8	Bipolar affective disorder	1,839	2.1
14	Epilepsy	976	2.2	Schizophrenia	785	1.8	Falls	1,769	2.0
15	Upper respiratory conditions	958	2.1	Epilepsy	769	1.7	Epilepsy	1,745	1.9
16	Intellectual disability	873	1.9	Osteoarthritis	744	1.7	Rheumatoid arthritis	1,653	1.8
17	Coronary heart disease	766	1.7	Hearing loss	689	1.5	Conduct disorder[(a)]	1,633	1.8
18	Rheumatoid arthritis	705	1.6	Other gastrointestinal infections	680	1.5	Coronary heart disease	1,438	1.6
19	Other gastrointestinal infections	689	1.5	Coronary heart disease	672	1.5	Dementia	1,425	1.6
20	Bipolar affective disorder	687	1.5	Iron-deficiency anaemia	672	1.5	Other gastrointestinal infections	1,369	1.5
	Leading 20 diseases	**32,412**	**72.2**	**Leading 20 diseases**	**32,244**	**72.2**	**Leading 20 diseases**	**64,064**	**71.5**
	All other diseases	*12,471*	*27.8*	*All other diseases*	*12,437*	*27.8*	*All other diseases*	*25,500*	*28.5*
	Total	**44,883**	**100.0**	**Total**	**44,681**	**100.0**	**Total**	**89,564**	**100.0**

Colour legend: >= 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

(a) Estimates in relation to conduct disorder should be interpreted with caution as they are also subject to data quality issues.

Note: The numbers may not add to total for all columns due to rounding.



Source: This figure is based on data in a supplementary table available online—Table S5.3.

Figure 5.4: Proportion of Indigenous population and non-fatal burden (YLD), by age, Indigenous Australians, 2011

The contribution of specific diseases to non-fatal burden varied across the life course. In early childhood (ages 0–4) there was 3,482 YLD (4% of the total non-fatal burden), with 'other gastrointestinal infections', protein-energy deficiency and asthma accounting for over half of these (56% for Indigenous males and 52% for Indigenous females).

For ages 5–14 there was 8,191 YLD (9% of the total). Conduct disorders are the main cause of non-fatal burden that Indigenous males experienced in this age group (although Indigenous estimates for conduct disorder should be interpreted with caution as they were based on indirect modelling methods assessed to have less reliability than some other causes). Anxiety disorders are the main cause of non-fatal burden for Indigenous females of this age. Asthma, depressive disorders and dental caries also cause substantial non-fatal burden in this age group for both boys and girls.

For ages 15–24 and 25–44, a variety of mental & substance use disorders accounted for a large proportion of the 46,703 YLD (52% of the total). In Indigenous males, specific diseases contributing greatly to the non-fatal burden were alcohol use disorders, depressive disorders, anxiety disorders and, to a lesser extent, drug use disorders and schizophrenia. For Indigenous females the key specific diseases were anxiety disorders, depressive disorders, 'other musculoskeletal conditions', alcohol use disorders and asthma.

Musculoskeletal problems, including rheumatoid arthritis and other musculoskeletal conditions, are among the top 10 specific diseases contributing to non-fatal burden for both Indigenous males and females aged 45–74, along with COPD, asthma and CHD. This age group accounts for 31% of the total YLD. For age groups 65 and over, mental & substance use disorders no longer rank among the top 10 specific diseases for either Indigenous males or females.

For older Indigenous Australians (aged 75 and over) dementia, falls, COPD and vision loss were predominant sources of non-fatal burden for both males and females. There was an estimated 3,194 YLD in this age group, accounting for 4% of the total.

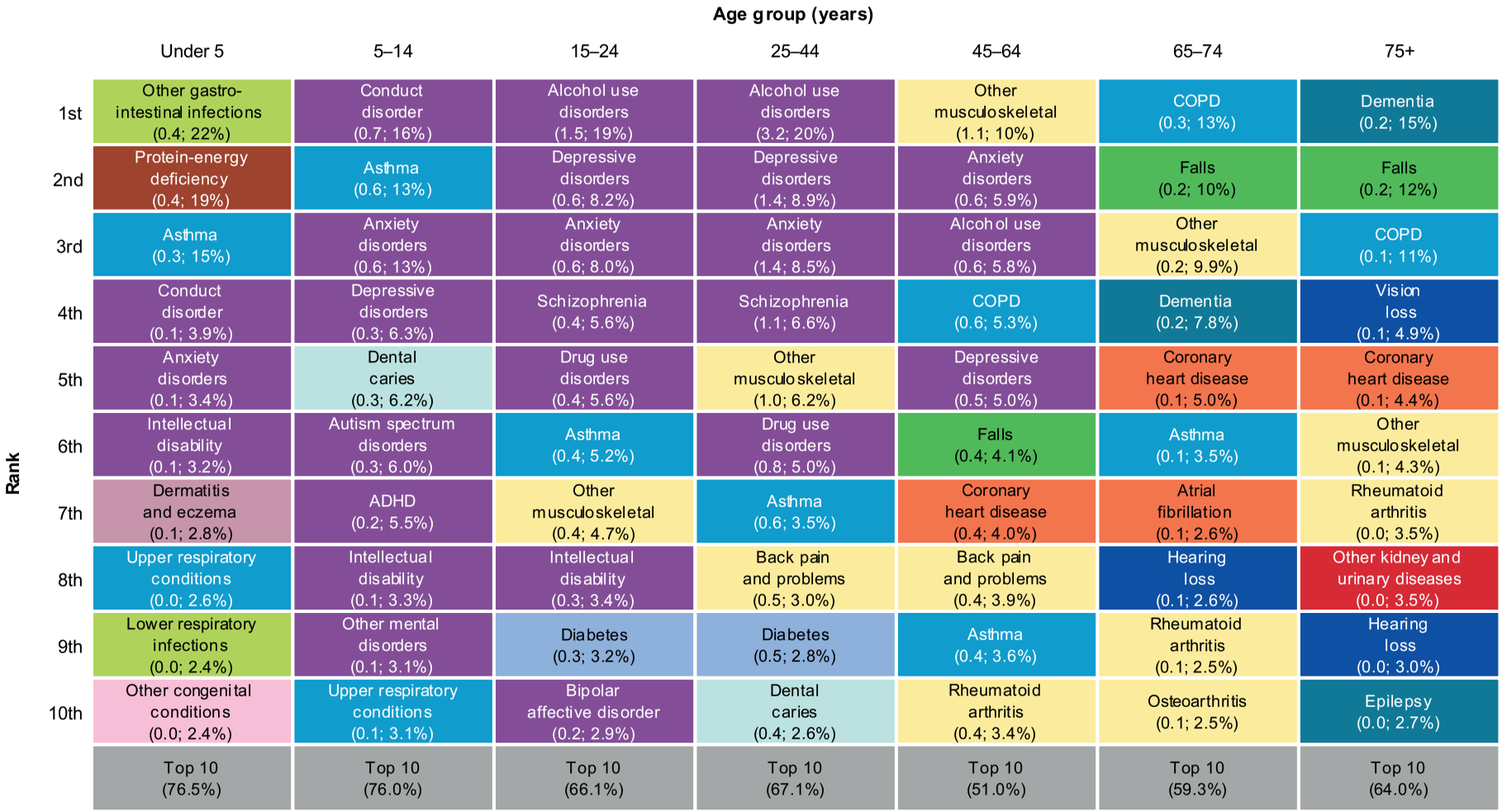


Figure 5.5: Top 10 specific diseases contributing to non-fatal burden (YLD '000; proportion of total %) for Indigenous males, by age, 2011

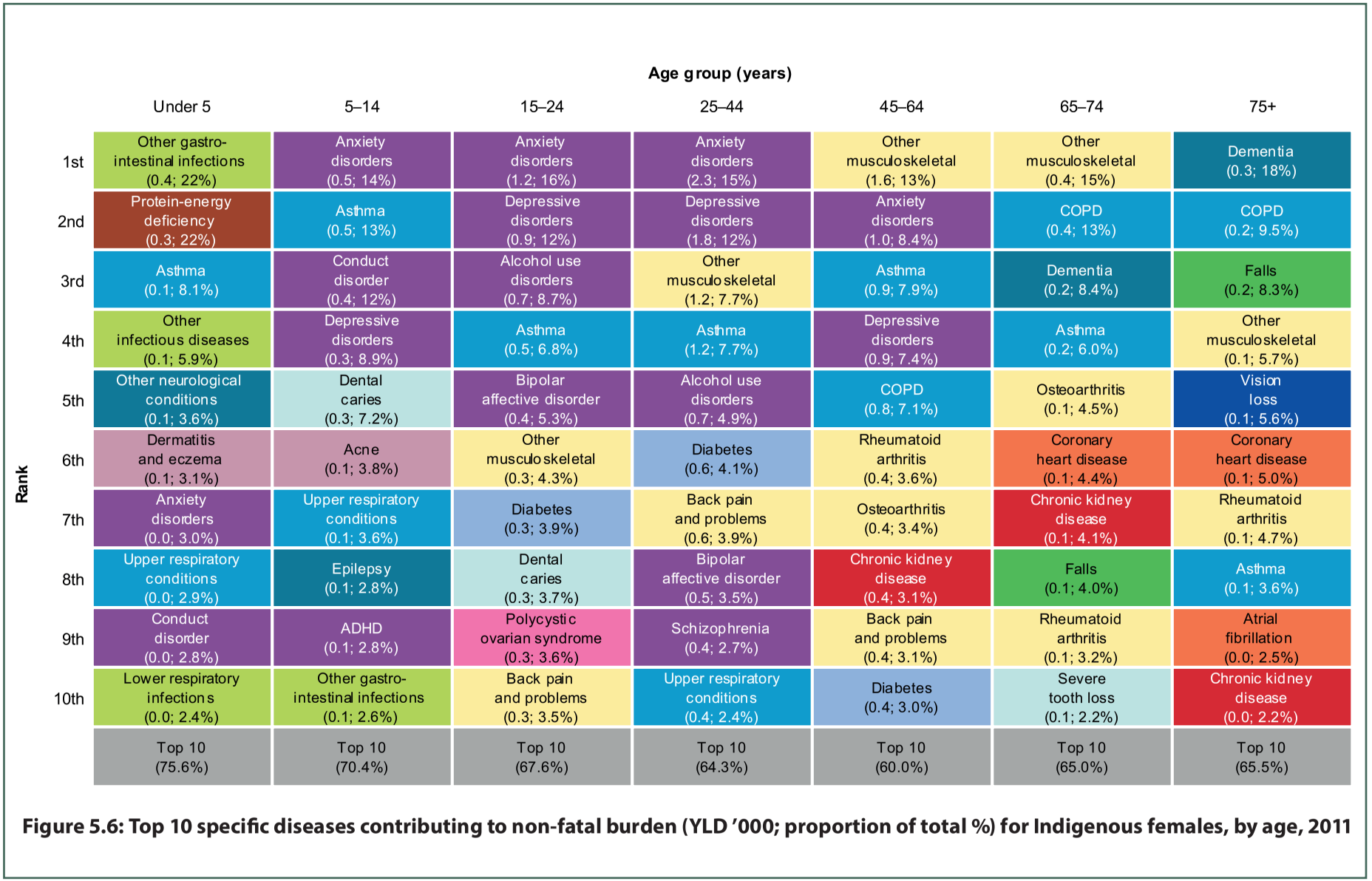


Figure 5.6: Top 10 specific diseases contributing to non-fatal burden (YLD '000; proportion of total %) for Indigenous females, by age, 2011

6 Fatal burden of disease

What it means: the impact of early death

This section is about the years of life that are lost when Indigenous Australians die before their time. This is worked out by looking at the difference between the age at which they die, and the 'ideal' old age they could have lived to. In this study, the 'ideal' old age for all people—Indigenous and non-Indigenous, male and female—was age 86.

Indigenous Australians lost a total of 100,663 years of life from dying early in 2011, around 150 years for every 1,000 people. This was more than the number of years lost due to living with poor health.

Dying early was a much bigger problem for males than females. Males lost a total of 58,481 years in 2011 compared with 42,182 years for females. This was because more males than females died in that year, and they died at younger ages.

Three disease groups caused the most years lost due to early death:

- injuries including suicide & self-inflicted injuries (causing 24% of the total), which caused more of the lost years for males than females (28% of the total for males and 18% for females)
- cardiovascular diseases, like heart disease and stroke (21%), in similar amounts for males and females
- cancer (17%), which caused more of the lost years for females than for males (16% of the total for males and 20% for females).

Just 5 specific diseases caused about one-third of the years lost due to early death:

- coronary heart disease (including heart attacks and angina)
- suicide & self-inflicted injuries
- diabetes
- injuries from car crashes
- lung cancer.

Are the causes of lost years due to early death different at different ages?

- Being born too early, low birthweight, and SIDS or cot death were the largest causes of lost years due to early death in Indigenous babies before their first birthday.
- For children and young adults under 25, injuries (mainly road traffic injuries and suicide & self-inflicted injuries) were the main causes of the lost years.
- At ages 25–44, injuries were still a large cause of lost years, however cardiovascular diseases and cancer also caused a lot of lost years due to early death.
- For Indigenous people aged 45 and over, cardiovascular disease (mainly coronary heart disease) and cancer (mainly lung cancer) were the 2 biggest causes of lost years due to early death.

Measures of mortality are of fundamental importance to policy debate and public health intervention and planning. Typically, Indigenous Australians die at much younger ages than non-Indigenous Australians and Indigenous mortality has consequently become a major focus of policy attention. Two of the 6 Council of Australian Governments (COAG) Closing the Gap targets on Indigenous disadvantage are mortality-related—to close the gap in life expectancy within a generation, and to halve the gap in mortality rates for Indigenous children under 5 by 2018. In this study, the burden of deaths at all ages is combined to quantify the impact of death due to diseases and injuries on the Aboriginal and Torres Strait Islander population.

Expressed as years of life lost (YLL), fatal burden is a measure of years lost due to dying prematurely (that is, before the expected life span). YLL are calculated by summing, across age groups, the number of deaths multiplied by the remaining life expectancy at each 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 to the actual life table for the Indigenous population (the GBD table was derived from global mortality data), and the same aspirational table has been used for Indigenous and non-Indigenous Australians. Further details on the calculation of Indigenous YLL estimates can be found in 'Appendix B: Methods overview'.

The results reported here for 2011 provide an update of the 2010 YLL results for the Aboriginal and Torres Strait Islander population published by the AIHW (AIHW 2015c). However, comparisons to the 2010 results should be made with caution as there have been some modifications to the disease list.

Indigenous YLL estimates presented in this chapter include deaths from all states and territories and have been adjusted to account for Indigenous under-identification in mortality data (see 'Appendix B: Methods overview' for further information). Comparisons with the non-Indigenous population, including estimates of the gap in fatal burden between Indigenous and non-Indigenous Australians are primarily included in 'Chapter 7 Contribution of risk factors to burden'.

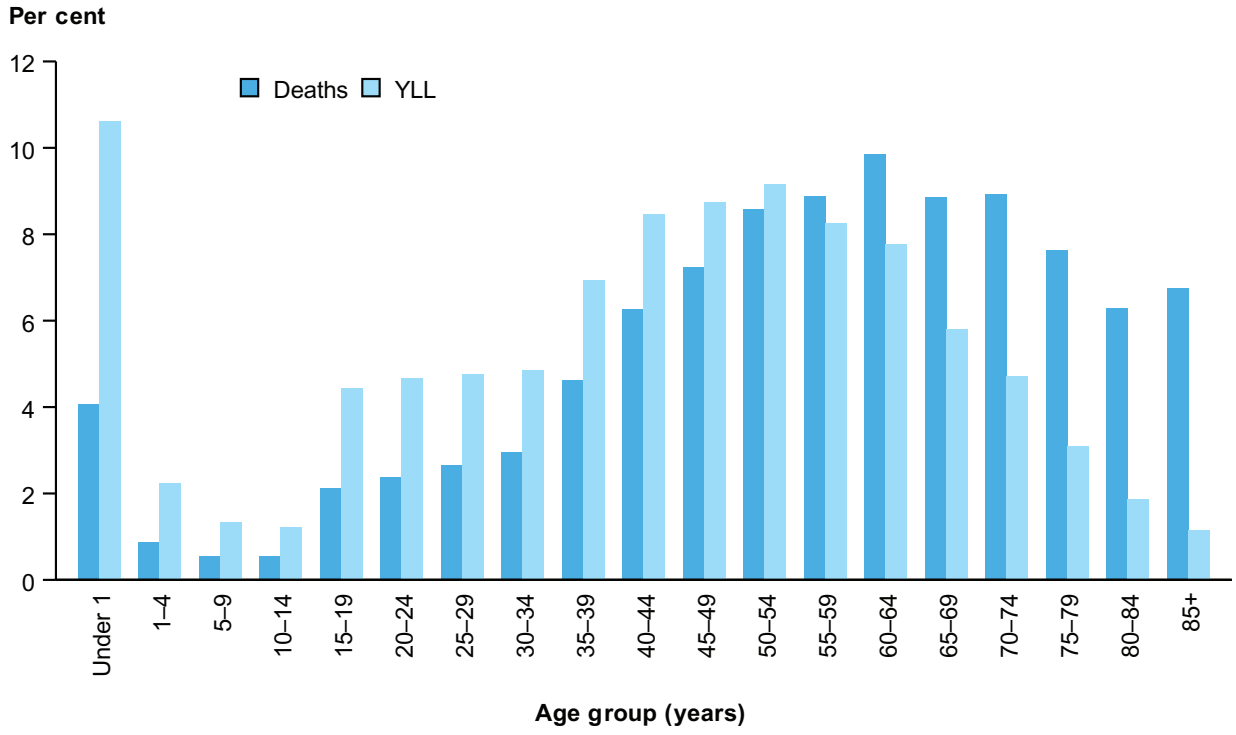
Differences from the previous Indigenous burden of disease study

The previous Indigenous burden of disease study (Vos et al. 2007) 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 a lower life expectancy and 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. In addition, this study has made a number of improvements in the calculation of Indigenous YLL estimates including the use of direct methods to adjust for Indigenous under-identification in mortality data based on national data linkages studies. This means the Indigenous estimates from this study cannot be compared with estimates from the previous Indigenous Australian burden of disease study.

6.1 Years of life lost in 2011

In 2011, Indigenous Australians lost 100,663 years of life due to early death. This was based on an estimated 3,054 deaths in that year. The fatal burden in 2011 comprised 53% of the total burden of disease and injury for Indigenous Australians.

Both the *number of deaths* and the *life expectancy* (remaining years a person of that age can, on average, expect to live) influence the fatal burden. Figure 6.1 shows the impact of these factors. A small number of deaths in younger ages can contribute substantially to the total YLL owing to the large average loss of remaining years; and, in older age groups, a large number of deaths can contribute large YLL, even though the average loss of remaining years is relatively small.



Source: This figure is based on data in a supplementary table available online—Table S6.1.

Figure 6.1: Proportion of years of life lost (YLL) and deaths for Indigenous Australians, by age, 2011

How does fatal burden vary by age and sex?

The majority (65%) of Indigenous deaths occurred before age 65. This is in stark contrast to the non-Indigenous population where only 19% of deaths occurred before this age.

Given the relative proportion of Indigenous deaths under 1 (4% of deaths), infants contribute substantially to total YLL (11%). This age group has a relatively high mortality rate compared to other ages, and each death at this age incurs the largest number of YLL (Figure 6.1).

After infancy, a considerable component of the fatal burden in the Indigenous population is experienced in the middle-aged (ages 35–59), also reflecting the high number of deaths occurring in these age groups.

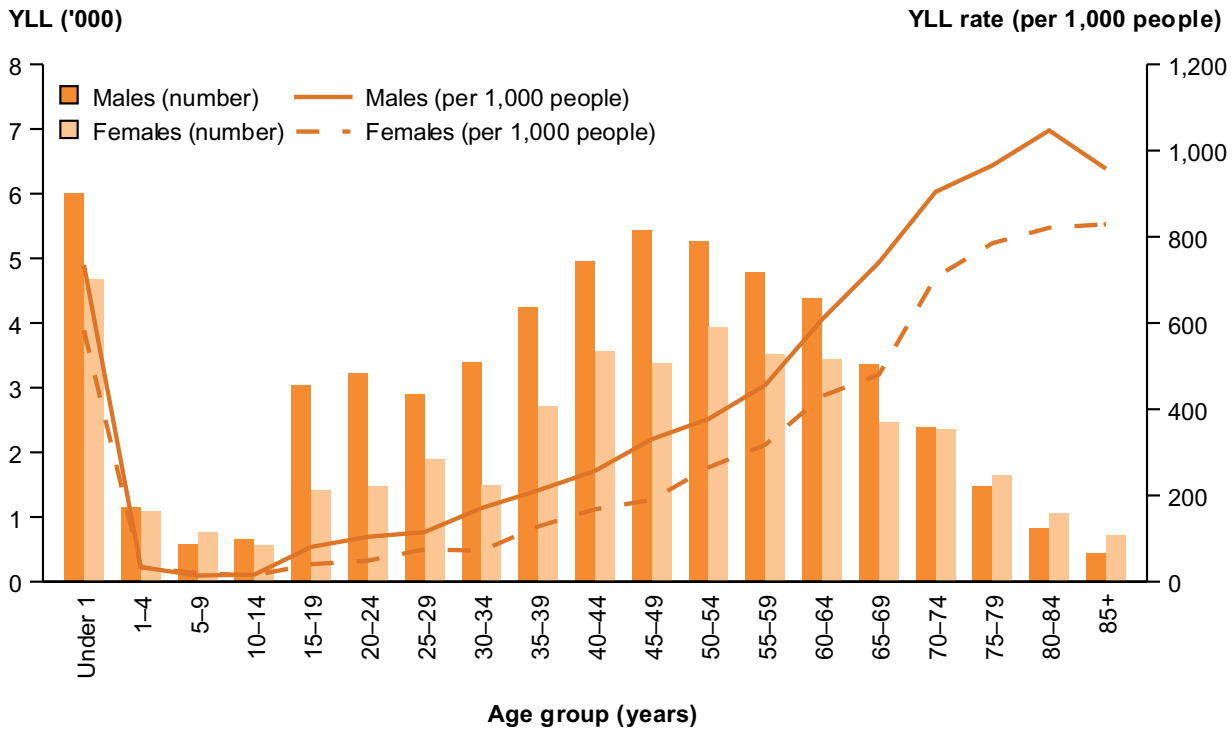
This pattern is quite different to that observed in the total Australian population, in which there is a general increase in the number of YLL with increasing age (up to around age 84) (AIHW 2016a). Despite the potential years of life remaining at an older age being smaller than at a younger age, the observed increase in YLL reflects the much higher proportion of deaths occurring in the older ages in the non-Indigenous population.

Overall, these different patterns in YLL by age group reflect observed differences in life expectancy between Indigenous and non-Indigenous Australians (that is, Aboriginal and Torres Strait Islander people tend to die at much younger ages than non-Indigenous Australians).

Indigenous males experienced more of the fatal burden than Indigenous females (58% compared with 42%) (Table 6.1). After taking into account differences in population age structure between the sexes, Indigenous males experienced 44% higher fatal burden than Indigenous females (293 compared with 204 YLL per 1,000, a rate ratio of 1.4) (Table 6.2).

Figure 6.2 shows that the number of YLL in each age group before age 75 was greater for Indigenous males than for Indigenous 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 at these ages. Conversely, in the older age groups (age 75 and over), the number of YLL was greater for Indigenous females than Indigenous males, again due to the higher number of deaths.

Age-specific YLL rates were higher for Indigenous males in all age groups except at ages 1–14, where the rates were similar. The slight drop-off in the YLL rate for Indigenous males in the 85+ age group is likely due to the relatively small number of deaths and small population in this age group.



Source: This figure is based on data in a supplementary table available online—Table S6.2.

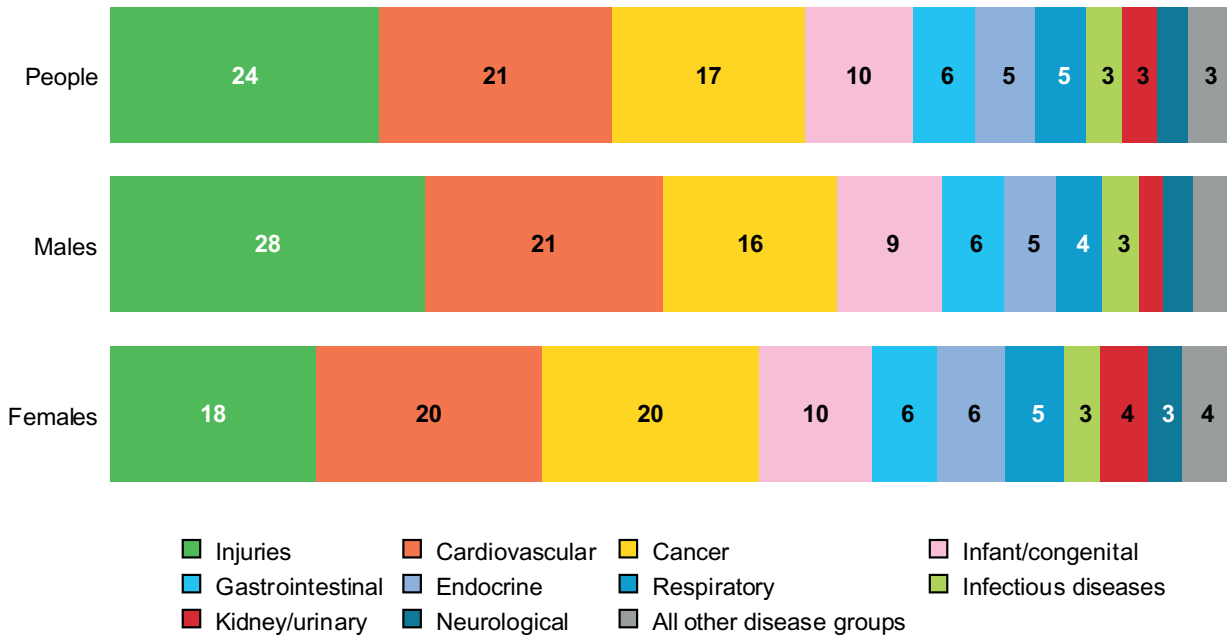
Figure 6.2: Numbers and rates of years of life lost (YLL) for Indigenous Australians, by age and sex, 2011

6.2 Which disease groups resulted in the most years of life lost?

Diseases underlying YLL can be examined individually or by disease group. In this section, results are presented for 17 broad disease groups.

Four disease groups accounted for almost three-quarters of YLL that Indigenous Australians experienced in 2011: injuries (28% for males and 18% for females), cardiovascular diseases (21% for males and 20% for females), cancer (16% for males and 20% for females) and infant & congenital conditions (9% for males and 10% for females) (Figure 6.3). Other disease groups that contributed substantially to the fatal burden included gastrointestinal disorders (6% for males and females), and endocrine disorders, which includes diabetes (5% for males and 6% for females).

Kidney & urinary diseases accounted for 2% of the fatal burden in Indigenous males and 4% in Indigenous females. It is important to note that the fatal burden results presented here are based on the underlying cause of death only (consistent with current burden of disease analysis). The indirect impacts of diseases such as kidney disease, which are often reported as associated causes of death, are not included here. The burden due to such diseases may therefore be under-estimated in the current burden of disease study.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S6.3.

Figure 6.3: Percentage contribution (%) of the top 10 leading causes of fatal burden in Indigenous Australians, by disease group and sex, 2011

Table 6.1 shows that while there may be fewer deaths from some disease groups, they can contribute proportionately higher YLL. Extreme differences, such as a low number of Indigenous deaths and high YLL, reflect that the disease typically caused death at younger ages.

For example, injuries were responsible for 19% of Indigenous male and 11% of Indigenous female deaths, but contributed 28% and 18% YLL, respectively.

Table 6.1: Number and percentage of YLL and deaths for Indigenous Australians, by sex, 2011

Disease group	Males				Females			
	Deaths (no.)	Deaths (%)	YLL (no.)	YLL (%)	Deaths (no.)	Deaths (%)	YLL (no.)	YLL (%)
Injuries	310	18.5	16,498	28.2	149	10.8	7,770	18.4
Cardiovascular	432	25.8	12,445	21.3	343	24.9	8,525	20.2
Cancer	357	21.4	9,142	15.6	320	23.2	8,229	19.5
Infant/congenital	68	4.1	5,486	9.4	51	3.7	4,248	10.1
Gastrointestinal	96	5.7	3,231	5.5	75	5.4	2,445	5.8
Endocrine	103	6.2	2,758	4.7	107	7.8	2,601	6.2
Respiratory	96	5.7	2,411	4.1	101	7.3	2,221	5.3
Infectious diseases	50	3.0	1,888	3.2	39	2.8	1,382	3.3
Neurological	53	3.2	1,576	2.7	71	5.1	1,288	3.1
Kidney/urinary	51	3.1	1,297	2.2	73	5.3	1,784	4.2
Mental/substance use	25	1.5	837	1.4	12	0.9	418	1.0
Blood/metabolic	20	1.2	578	1.0	22	1.6	735	1.7
Musculoskeletal	8	0.5	215	0.4	12	0.9	361	0.9
Skin	4	0.2	104	0.2	4	0.3	79	0.2
All other disease groups	–	–	16	–	2	–	98	–
All diseases	**1,673**	**100.0**	**58,481**	**100.0**	**1,381**	**100.0**	**42,182**	**100.0**

Note: The numbers may not add to total for all columns due to rounding.

Age-standardised rates were compared to evaluate the difference in fatal burden between Indigenous males and females. After taking into account differences in the population age structure, Indigenous males had more than twice the rate of fatal burden due to injuries and mental & substance use disorders as Indigenous females (rate ratio of 2.2), and almost 60% more fatal burden due to cardiovascular diseases and infectious diseases than Indigenous females (rate ratios of 1.6). Indigenous females had higher age-standardised rates of fatal burden due to kidney & urinary disease, and musculoskeletal conditions, than Indigenous males (rate ratios of 0.9 and 0.7) (Table 6.2).

Table 6.2: Comparison of YLL rate ratios and rate differences of age-standardised rates: Indigenous males: Indigenous females, Australia, 2011

	YLD ASR			
Disease group	**Males**	**Females**	**Rate difference**	**Rate ratio**
Cardiovascular	77.8	49.6	28.2	1.6
Cancer	64.3	48.2	16.1	1.3
Injuries	51.3	23.2	28.1	2.2
Endocrine	18.6	15.8	2.8	1.2
Respiratory	17.5	14.9	2.7	1.2
Gastrointestinal	16.7	11.6	5.1	1.4
Neurological	9.7	9.3	0.4	1.0
Kidney/urinary	9.3	10.5	–1.2	0.9
Infant/congenital	9.3	7.3	2.1	1.3
Infectious diseases	8.8	5.5	3.2	1.6
Mental & substance use	4.4	2.0	2.4	2.2
Blood/metabolic	3.6	3.1	0.5	1.2
Musculoskeletal	1.3	1.8	–0.5	0.7
Skin	0.7	0.5	0.1	1.2
Oral	0.1	–	0.1	. .
Hearing/vision	–	–	–	. .
Reproductive/maternal	–	0.3	–0.3	–
All diseases	**293.4**	**203.5**	**89.9**	**1.4**

Notes

1. Rates were age-standardised to the Australian population as at 30 June 2001, and are expressed per 1,000 people.
2. Rate ratio is the relative difference of males compared to females, calculated as the male age-standardised rate divided by the female age-standardised rate.
3. Rate difference is the absolute difference in health loss in males compared to females, calculated as male age-standardised rate minus the female age-standardised rate.
4. The numbers may not add to total for all columns due to rounding.

How do the causes of fatal burden vary by age?

The main disease groups causing fatal burden vary across the life course (Figure 6.4).

Infant & congenital conditions were responsible for 80% of YLL in 2011 in Indigenous babies aged under 1.

Injuries were the leading cause of fatal burden among Indigenous Australians aged 1–34. Over half (59%) of fatal burden among Indigenous children and adolescents aged 1–14 was due to injuries. Injuries also contributed 80% of YLL among Indigenous young adults (aged 15–24).

Among Indigenous persons aged 35–44, fatal burden from injuries was still high however the contribution from cardiovascular diseases became apparent. In the later working age (45–64), chronic diseases, mainly cardiovascular diseases and cancer became the main contributors to fatal burden, contributing 28% and

27% respectively. Respiratory diseases and endocrine disorders (mainly diabetes) were also notable causes of fatal burden in the Indigenous population in this age range.

Among older ages (65 and over), the impact on YLL from cancer and cardiovascular diseases continue to increase.

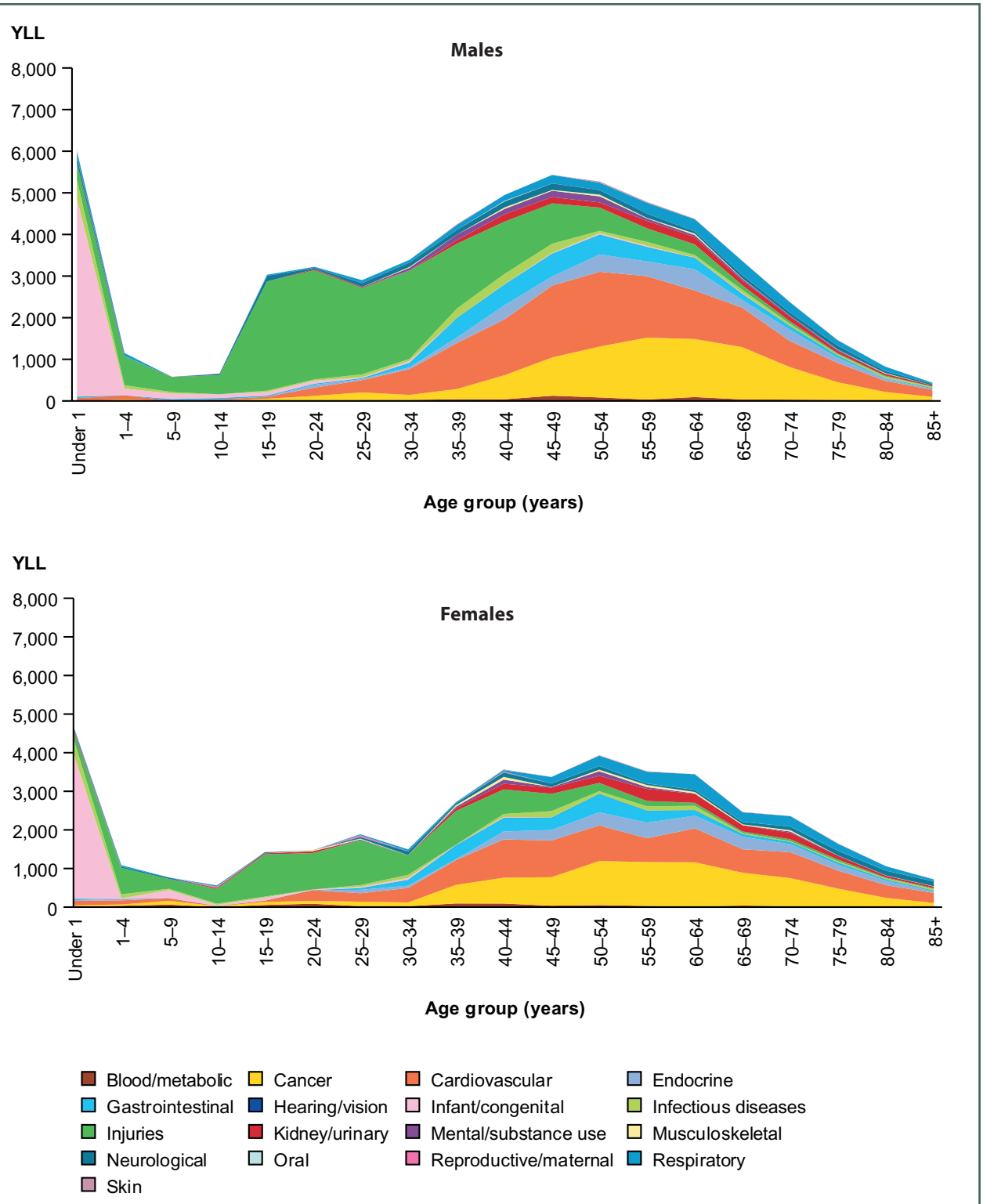


Figure 6.4: Number of fatal burden (YLL), by disease group and age, Indigenous males and females, 2011

6.3 Which specific diseases resulted in the most life lost?

Of the 188 specific diseases in the ABDS 2011, 5 diseases resulted in just over one-third of life lost in the Aboriginal and Torres Strait Islander population: CHD, suicide & self-inflicted injuries, diabetes, injuries from motor vehicle accidents, and lung cancer.

The leading 20 diseases were responsible for around two-thirds of the fatal burden for Indigenous males and females (Table 6.3). The leading diseases were largely chronic diseases, except for injuries.

CHD was the leading disease for life lost for both Indigenous males (14%) and females (9%). Among Indigenous males, this was followed by suicide & self-inflicted injuries (10%), injuries from motor vehicle accidents and diabetes (both contributing 5%). For Indigenous females, the subsequent causes were diabetes (6%), suicide & self-inflicted injuries (6%), and lung cancer (5%).

Table 6.3: Leading 20 causes of fatal burden (YLL) for Indigenous Australians, by sex, 2011

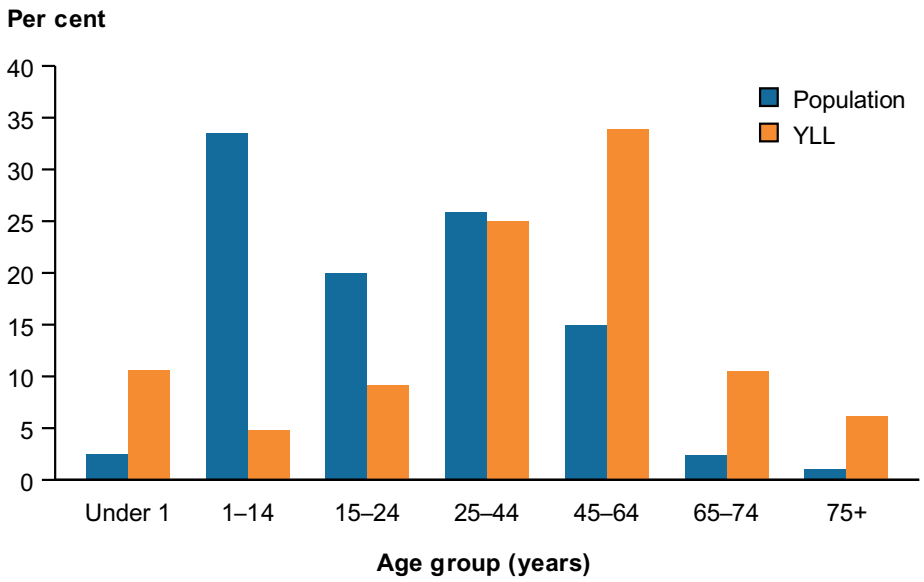
Rank	Males	YLL	% of total	Females	YLL	% of total	People	YLL	% of total
1	Coronary heart disease	8,440	14.4	Coronary heart disease	3,839	9.1	Coronary heart disease	12,279	12.2
2	Suicide & self-inflicted injuries	5,936	10.2	Diabetes	2,523	6.0	Suicide & self-inflicted injuries	8,420	8.4
3	RTI—motor vehicle occupants	2,761	4.7	Suicide & self-inflicted injuries	2,484	5.9	Diabetes	5,269	5.2
4	Diabetes	2,746	4.7	Lung cancer	1,888	4.5	RTI—motor vehicle occupants	4,358	4.3
5	Chronic liver disease	2,333	4.0	Chronic liver disease	1,825	4.3	Lung cancer	4,194	4.2
6	Lung cancer	2,307	3.9	Stroke	1,768	4.2	Chronic liver disease	4,158	4.1
7	Poisoning	1,969	3.4	COPD	1,611	3.8	COPD	3,083	3.1
8	Pre-term birth & LBW complications	1,762	3.0	RTI—motor vehicle occupants	1,597	3.8	Poisoning	3,056	3.0
9	Homicide & violence	1,699	2.9	Chronic kidney disease	1,530	3.6	Stroke	3,038	3.0
10	COPD	1,471	2.5	Pre-term birth & LBW complications	1,165	2.8	Pre-term birth & LBW complications	2,927	2.9
11	Stroke	1,270	2.2	Breast cancer	1,097	2.6	Homicide & violence	2,792	2.8
12	Other unintentional injuries	1,106	1.9	Homicide & violence	1,092	2.6	Chronic kidney disease	2,628	2.6
13	Chronic kidney disease	1,097	1.9	Poisoning	1,086	2.6	SIDS	1,723	1.7
14	SIDS	1,022	1.7	Other cardiovascular diseases	875	2.1	Other cardiovascular diseases	1,570	1.6
15	Mouth & pharyngeal cancer	899	1.5	SIDS	701	1.7	Other unintentional injuries	1,534	1.5
16	Other RTI	823	1.4	Other blood & metabolic disorders	650	1.5	Lower respiratory infections	1,443	1.4
17	Lower respiratory infections	805	1.4	Lower respiratory infections	638	1.5	Bowel cancer	1,305	1.3
18	Liver cancer	778	1.3	Rheumatic heart disease	607	1.4	Other disorders of infancy	1,245	1.2
19	Bowel cancer	773	1.3	Other disorders of infancy	566	1.3	Birth trauma & asphyxia	1,240	1.2
20	Other respiratory disease	731	1.2	Birth trauma & asphyxia	541	1.3	Liver cancer	1,239	1.2
	Leading 20 diseases	**40,728**	**69.6**	**Leading 20 diseases**	**28,084**	**66.6**	**Leading 20 diseases**	**67,499**	**67.1**
	All other diseases	*17,753*	*30.4*	*All other diseases*	*14,098*	*33.4*	*All other diseases*	*33,164*	*32.9*
	Total	**58,481**	**100.0**	**Total**	**42,182**	**100.0**	**Total**	**100,663**	**100.0**

Colour legend: >= 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

Note: The numbers may not add to total for all columns due to rounding.

Patterns of life lost by age

The fatal burden that Indigenous Australians experienced in 2011 differed by age. The burden in 7 broad age groups is described in this section, drawing on results shown in figures 6.5, 6.6 and 6.7.



Source: This figure is based on data in a supplementary table available online—Table S6.4.

Figure 6.5: Proportion of Indigenous population and fatal burden (YLL), by age, Indigenous Australians, 2011

The specific causes of YLL vary across the life course. Patterns of leading causes of fatal burden among Indigenous Australians are shown in figures 6.6 (males) and 6.7 (females). Note that for many diseases, the numbers of deaths for Indigenous Australians is small. An * indicates those YLL for which less than 10 deaths contributed to the calculation.

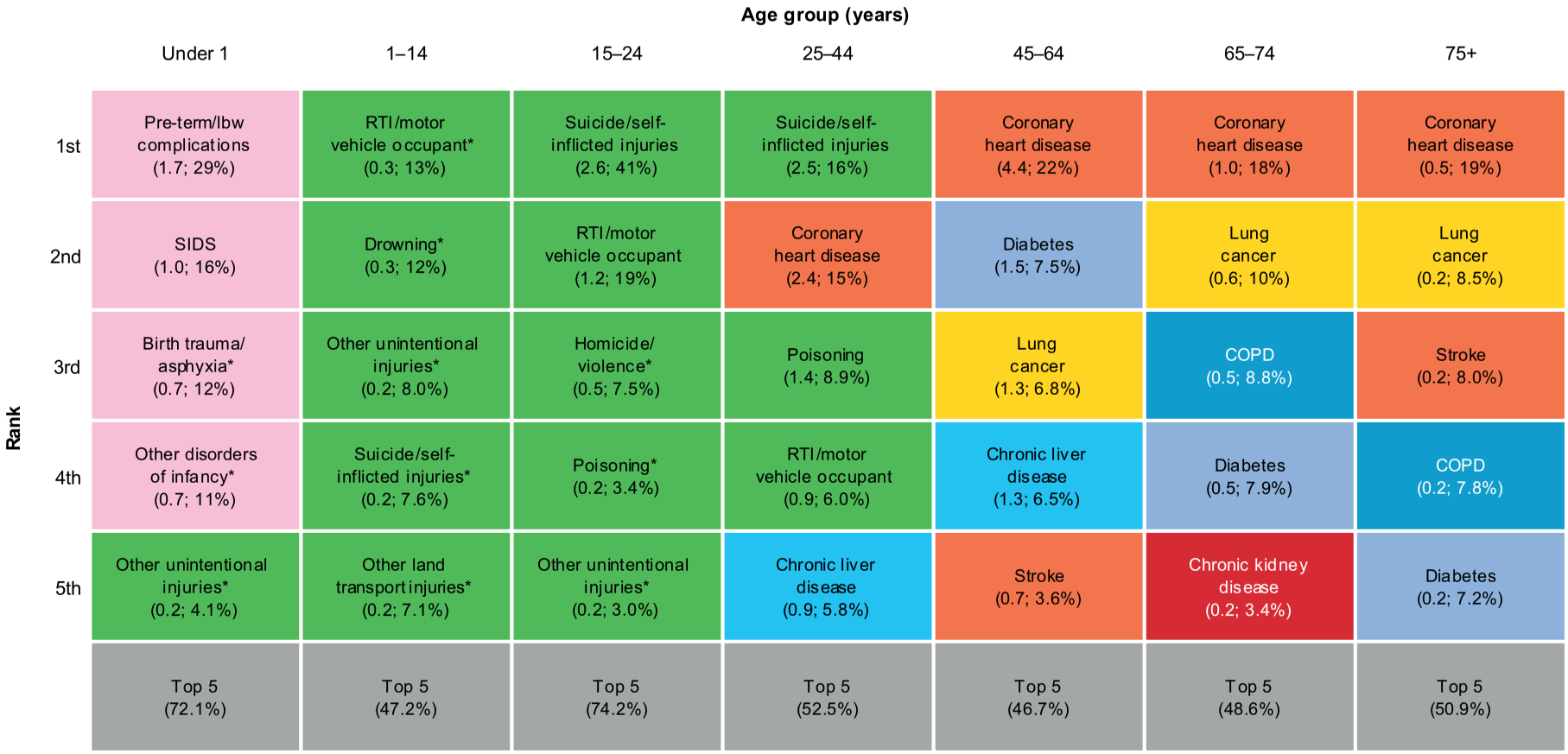
Infants represented 2% of the Indigenous Australian population in 2011, yet accounted for 11% of the fatal burden. Almost all life lost in infancy was due to infant-related diseases, such as pre-term birth & LBW complications, SIDS, birth trauma & asphyxia and other disorders of infancy.

Those aged 1–14 and 15–24 account for 34% and 20% of the Indigenous population, respectively, but 13% and 9% of the fatal burden. Injuries dominated as the leading cause of life lost for both Indigenous males and females in these age groups—specifically injuries due to motor vehicle accidents, suicide & self-inflicted injuries, drowning, poisoning, homicide & violence and other unintentional injuries.

Although injuries still feature in the group aged 25–44, CHD and CLD started to feature as leading causes of life lost for Indigenous males and females. This age group accounts for 26% of the Indigenous population and 25% of the fatal burden.

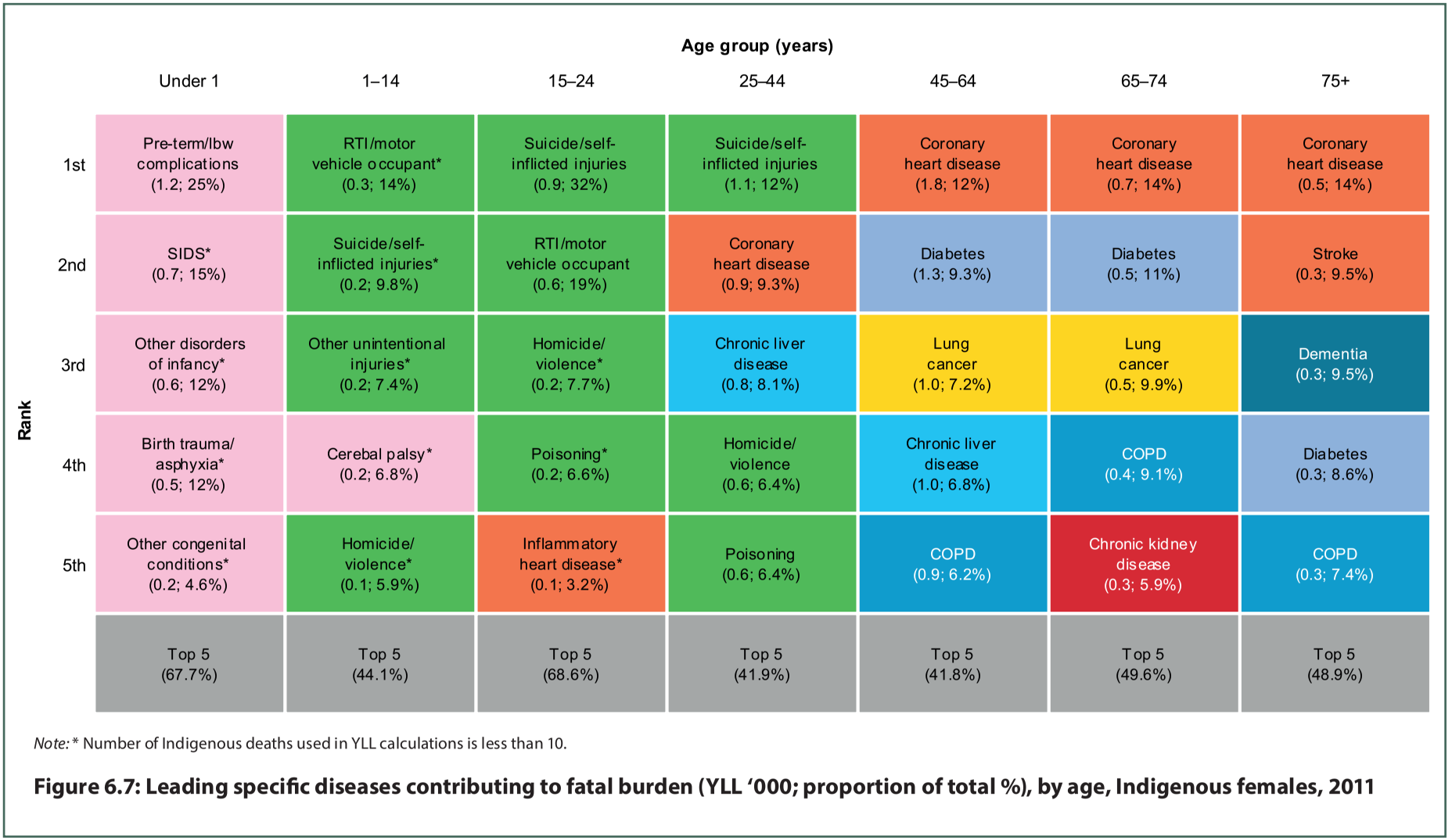
In the remaining age groups, chronic diseases were the major causes of fatal burden that Indigenous Australians experienced, dominated by CHD, diabetes, lung cancer, COPD and stroke.

CKD also featured in the top 5 diseases causing fatal burden in Indigenous males and females aged 65–74. As mentioned earlier in this chapter, these estimates are based on the underlying cause of death only and represent the direct impact of CKD in terms of fatal burden. As CKD is often reported as an associated cause of death and is a risk factor for other diseases such as CHD, the indirect impacts are likely to be much greater.



Note: * Number of Indigenous deaths used in YLL calculations is less than 10.

Figure 6.6: Leading specific diseases contributing to fatal burden (YLL '000; proportion of total %) by age, Indigenous males, 2011



Note: * Number of Indigenous deaths used in YLL calculations is less than 10.

Figure 6.7: Leading specific diseases contributing to fatal burden (YLL '000; proportion of total %), by age, Indigenous females, 2011

7 Contribution of risk factors to burden

What it means: risks to health

This section looks at some of the risks to health and what part of the years of healthy life lost (due to premature death or living with poor health) they cause for Indigenous Australians. This study can only report on some of the risks to health, and only included things that can be changed, like smoking, diet and not getting enough exercise. Some other very important things, like whether someone has a job, couldn't be included.

The study looked at 29 different risk factors and found that the most important were:

- tobacco (which caused 12% of the lost years for Indigenous Australians)
- dietary factors combined, for example, not eating enough fruit and vegetables, or eating too much processed meat (which together caused 10%)
- alcohol (8%)
- too much weight (8%)
- too little exercise (6%)
- high blood pressure (5%)
- high blood sugar (5%).

The study also looked at the combined effect of all 29 risk factors together, taking into account the effects of having more than 1 risk factor at the same time, and found that they caused more than one-third (37%) of all the lost years for Indigenous Australians.

Are the risks to heath different for males and females and at different ages?

- For Indigenous males, alcohol was the largest cause of lost years in those aged 15–44, and tobacco was the largest cause in those aged 45 and over.
- For Indigenous females, alcohol was the largest cause of lost years in those aged 15–24, intimate partner violence was the largest cause in those aged 25–34, and tobacco was the largest cause in those aged 35 and over.

What are the risks for different diseases and injuries?

The risk factors included in this study were a bigger problem for some diseases than for others. Combined, the risk factors caused:

- almost all (90%) of the lost years due to diabetes and other endocrine diseases
- most (80%) of the lost years due to cardiovascular diseases (heart problems and stroke)
- over half (54%) of the lost years due to cancer
- almost half (48%) of the lost years due to kidney and urinary conditions
- almost one-third (29%) of the lost years due to injuries.

For cancer, tobacco was the biggest risk and caused 39% of the lost years. For cardiovascular diseases, tobacco (which caused 39% of the lost years), high blood pressure (35%) and too much weight (34%) were the biggest risks. For injuries, alcohol was the biggest risk and caused 19% of the lost years.

The contribution of selected risk factors to the burden of disease (referred to as the **attributable burden**, see Box 7.1) 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 level of exposure or that would have the lowest associated population risk.

Table 7.1 shows the 29 risk factors included in this report. This does not cover all potential risk factors. The risk factors included:

- are behavioural, metabolic, dietary, environmental and occupational risks
- are modifiable
- have strong evidence of causal association
- can be measured in the Aboriginal and Torres Strait Islander population (that is have sufficient data to estimate both population exposure and disease–specific effect sizes)
- are linked to diseases that occur in the Indigenous population in Australia.

Box 7.1 Factors influencing attributable burden

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, the burden may continue to exist because of 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 smoking to diseases 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 have been becoming more common (for example, high body mass), current exposure may contribute to higher burden in the future.

The amount of the total burden attributed to a particular risk factor is affected by the total disease burden for the diseases that risk factor is linked with. 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 risk factors included are largely based on those in GBD 2010 that are relevant to the Aboriginal and Torres Strait Islander population. Childhood underweight, although considered important in the Aboriginal and Torres Strait Islander population, was not included. This is because the effect sizes for childhood underweight available from GBD 2010 were sourced from developing countries and related only to the link between underweight and infectious diseases, not the links between low birthweight and chronic disease later in life (Hoy & Nicol 2010). Sub-optimal breastfeeding was not included as this was linked in GBD 2010 to intestinal infections that are not common in Australia. Exposure to lead was also excluded because exposure data were not available for Australia.

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

The 29 risk factors included in this study are broadly grouped into 4 categories: behavioural, metabolic, environmental and dietary risks. Detailed estimates of attributable burden due to individual risk factors are presented in 'Chapter 11 Detailed results by risk factor'. Estimates for individual risk factors cannot be added together (see Box 7.2).

Social determinants of health

The social determinants of health play an important role in population health, displaying a strong association with health behaviours and outcomes. The importance of social determinants on the health and wellbeing of Indigenous Australians is well documented. Studies which have attempted to quantify the impact of social determinants on both the disease burden and the health gap between Indigenous and non–Indigenous Australians are discussed further in 'Appendix A: Social determinants of health'. The social determinants of health were not included as risk factors in the current study because of the amount of work that would be required to do it (such as developing appropriate definitions directly related to health and sourcing disease–specific relative risks). The estimation of the impact of social determinants is further complicated because their influence accumulates over the life of an individual and across generations (Atkinson et al. 2010; Zubrick et al. 2010). Nevertheless, the AIHW recognises this as an important area of work for future burden of disease studies.

Box 7.2 Why risk factor estimates cannot simply be added together

For the majority of the analysis in this chapter, risk factors are analysed independently. Due to the complex pathways and interactions between risk factors, it is not possible to simply add or combine the estimated impact of each risk factor.

For example, combining the burden of diabetes attributable to high body mass and sugar-sweetened beverages accounts for more diabetes than occurred in the Indigenous population in 2011. This is because these risk factors act along the same causal pathway. High intake of sugar-sweetened beverages can increase an individual's body mass which in turn increases their risk of diabetes. Therefore, further analysis is needed to combine risk factors.

In this report, a combined risk factor analysis has been conducted for all risk factors included in the study, following methods used in previous global burden of disease studies (Ezzati et al. 2004). However, these methods rest on the assumption that each risk factor is independent and does not take into account known features of 'real–world' epidemiology such as mediation between risk factors, correlations between exposures, or effect modification. Where possible, joint estimates have been corrected to account for mediation and correlation based on evidence from previous global studies (see 'Appendix B: Methods overview'). In the tables that follow, this is referred to as the 'joint effect' of all risk factors.

7.1 The effect of all risk factors combined

The proportion of the total burden due to the joint effect of all 29 risk factors included in this study was 37%. Reduction in exposure to these risk factors could provide substantial health gains.

7.2 Which risk factors contribute the most disease burden?

The individual contribution of each risk factor was calculated as the number of attributable DALY for each relevant disease. Table 7.1 shows the proportion of the total burden of disease that Indigenous Australians experienced in 2011 attributed to each risk factor.

The individual risk factors contributing the most to the burden in Indigenous Australians were tobacco use (12%), alcohol (8%), high body mass (8%), physical inactivity (6%), high blood pressure (5%) and high blood plasma glucose (5%). Dietary factors as a group contributed 10% to the total disease burden.

The amount and quality of evidence of a causal relationship between risk factors and diseases influence the findings presented here. The lists of risk factors and of the multiple diseases and injuries 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 7.1: 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**	
Tobacco use	12.3	Diet high in processed meat	2.8
Alcohol use	8.3	Diet low in fruit	2.5
Physical inactivity	5.5	Diet low in whole grains	2.3
Drug use	3.7	Diet low in nuts and seeds	2.3
Childhood sexual abuse	2.1	Diet low in vegetables	1.6
Intimate partner violence	1.4	Diet high in sweetened beverages	1.6
Unsafe sex	0.7	Diet low in omega-3 fatty acids	1.0
Metabolic		Diet low in fibre	1.0
High body mass	8.2	Diet high in saturated fat	0.9
High blood pressure	4.9	Diet high in sodium	0.4
High blood plasma glucose	4.6	Diet high in red meat	0.3
High cholesterol	2.6	Diet low in milk	0.1
Iron deficiency	0.5	Diet low in calcium	<0.1%
Low bone mineral density	<0.1%	***Joint effect of all dietary risks combined***	***9.7%***
Environmental			
Occupational exposures and hazards	1.1		
Air pollution	<0.1%		
Unimproved sanitation	<0.1%	**Joint effect of all risk factors**	**36.9%**

How much of the burden for disease groups is attributable to these risk factors?

The proportion of the burden attributable to individual risk factors within selected disease groups is presented in Table 7.2. Cells without an amount 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 total number of DALY for each disease group differs, so the percentages are not always comparable in terms of the numbers of DALY they represent. Also note that the numbers in the table cannot be added together as the risk factors are analysed independently (see Box 7.2).

Some risk factors are linked to a large number of disease groups. Tobacco use contributed to the burden for 5 disease groups including 42% of respiratory diseases, 39% of cancers, 39% of cardiovascular diseases, 8% of endocrine disorders (including diabetes) and 2% of infectious diseases. High body mass was also linked to a range of disease groups, contributing 62% of the burden for endocrine disorders, 37% for kidney & urinary diseases, 34% for cardiovascular diseases and 5% for cancer.

All the risk factors combined (the joint effect) contributed greatly to the burden for endocrine disorders (90%), cardiovascular diseases (80%), cancer (54%) and kidney & urinary diseases (48%) (Table 7.2).

Table 7.2: Proportion (%) of burden attributable to selected risk factors for selected disease groups, Indigenous Australians, 2011

Risk factor	Mental/ substance use	Injuries	Cardio-vascular	Cancer	Respiratory	Musculo-skeletal	Endocrine	Neuro-logical	Gastro-intestinal	Infectious diseases	Kidney/ urinary
DALY (number)	**36,223**	**28,790**	**23,771**	**17,847**	**15,085**	**12,704**	**7,863**	**7,587**	**6,896**	**6,069**	**4,687**
Attributable burden (%)											
Tobacco use	..	..	39.4	39.0	41.7	..	8.2	..	..	1.9	..
High body mass	..	..	33.8	5.3	..	0.3	62.3	..	..	..	36.6
Alcohol use	22.2	18.5	3.3	2.8	..	..	0.7	1.4	14.6	0.4	..
Physical inactivity	..	..	28.8	4.8	..	..	35.6	..	..	..	..
High blood pressure	..	..	35.4	..	..	..	..	..	..	..	19.2
High blood plasma glucose	..	..	6.0	..	..	..	89.5	..	..	..	5.4
Drug use	5.9	7.4	..	3.1	..	..	..	..	30.9	1.2	..
High cholesterol	..	..	20.9	..	..	..	..	..	..	..	..
Diet low in fruit	..	..	16.2	5.5	..	..	..	..	..	..	..
Childhood sexual abuse	7.7	4.3	..	..	..	..	..	..	..	..	..
Diet low in vegetables	..	..	13.1	1.8	..	..	..	..	..	..	..
Intimate partner violence	2.5	6.2	..	..	..	..	..	..	..	..	..
Occupational exposures	..	0.2	..	1.9	4.4	3.7	..	..	..	..	..
Air pollution	..	..	3.6	0.1	0.1	..	..	..	..	<0.1%	..
Unsafe sex	..	..	..	3.4	..	..	..	..	6.2	3.6	..
Joint effect of all 29 risk factors	**33.1**	**29.0**	**79.5**	**54.0**	**44.6**	**3.9**	**89.5**	**1.4**	**40.4**	**6.8**	**48.3**

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

7.3 How does the impact of risk factors vary by age and sex?

Risk factors ranked by their contribution to total burden in each age group are shown for Indigenous males and females in figures 7.1 and 7.2, respectively. The number of attributable DALY and the proportion of attributable burden to the overall DALY by risk factor, age and sex are also shown.

Alcohol use was the leading contributor to the burden in Indigenous males aged 15–44, and tobacco use was the leading contributor in those aged 45 and over. For Indigenous females, alcohol use was the leading contributor to the burden in those aged 15–24, intimate partner violence was the leading contributor to burden in those aged 25–34 (closely followed by alcohol use), and tobacco use was the leading contributor in those aged 35 and over.

Due to the time lag between exposure to a risk factor and disease burden, as well as the relatively small burden experienced in young age groups, few risk factor estimates could be produced for those aged 0–14. Only risk factors contributing to greater than 0.1% of the attributable burden are reported in figures 7.1 and 7.2. Nevertheless, iron deficiency was the leading contributor to burden for Indigenous children aged 0–14, followed by tobacco (due to exposure to second-hand smoke in the home).

For Indigenous males aged 15–24, alcohol use was the leading cause of disease burden accounting for around one-fifth (21%) of total. This was followed by drug use (8%). For Indigenous females of this age, alcohol use was also the leading cause of burden (9%), followed by childhood sexual abuse and intimate partner violence (both around 5%).

Alcohol remained the leading cause of disease burden in Indigenous males aged 25–34 (21%), followed by drug use (9%), high body mass (5%) and tobacco (4%). For Indigenous females aged 25–34, intimate partner violence accounted for 8% of the attributable burden of disease, followed by alcohol (7%) and high body mass (6%).

For Indigenous males aged 35–44, alcohol use was the leading cause of burden (18%), followed by tobacco use (12%), high body mass (10%) and physical inactivity (8%). For Indigenous females in this age group, tobacco use was the leading risk factor (11%), followed by high body mass (10%), and physical inactivity and intimate partner violence (both 6%).

Tobacco use became the leading cause of disease burden for Indigenous males aged 45–54 (21%) and remained the leading cause of burden for Indigenous females in this age group (18%). Alcohol use remained in the top 3 causes of burden for Indigenous males of this age and high body mass ranked second for both Indigenous males and females. This age group experienced increased contributing burden from other metabolic risk factors and dietary risk factors; however, this differed by sex.

Tobacco use and high body mass remained the top 2 risk factors in Indigenous adults aged 55–64, where males experienced a slightly increased proportion compared to females. High blood pressure increased in ranking with increasing age; for this age group it was ranked third for Indigenous males (10%) and fifth for Indigenous females (8%).

For both Indigenous males and females aged 65 and over, the same 5 risk factors contributed the most to the burden of disease: tobacco use, high body mass, high blood pressure, high blood plasma glucose and physical inactivity, although ordered differently for each sex. The contribution of dietary risk factors was notable in this age group, with a diet low in fruit contributing to 4% of the burden in Indigenous males and 3% of the burden in Indigenous females.

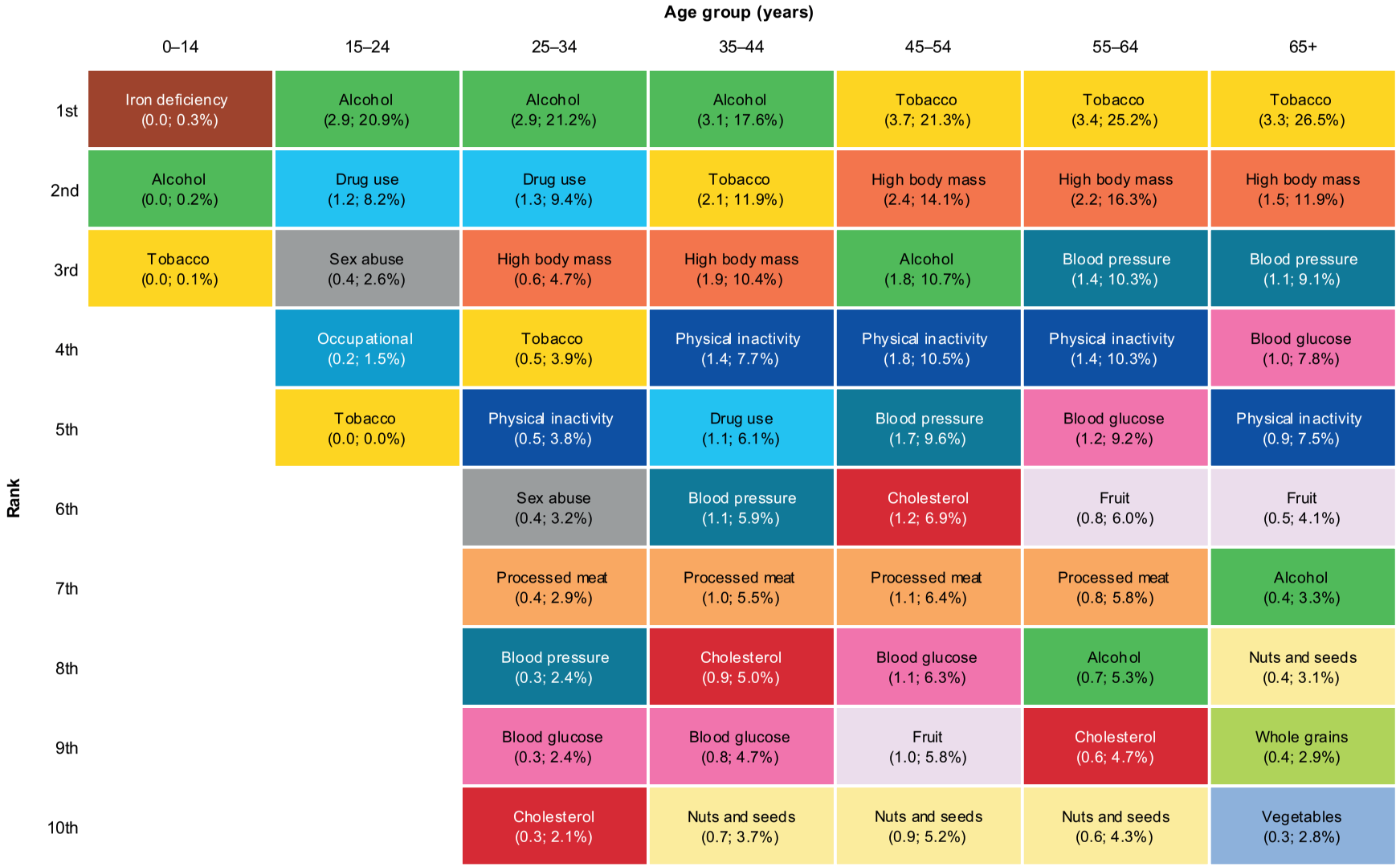


Figure 7.1: Leading risk factor contribution to total burden (DALY '000; proportion of DALY %), by age, Indigenous males, 2011

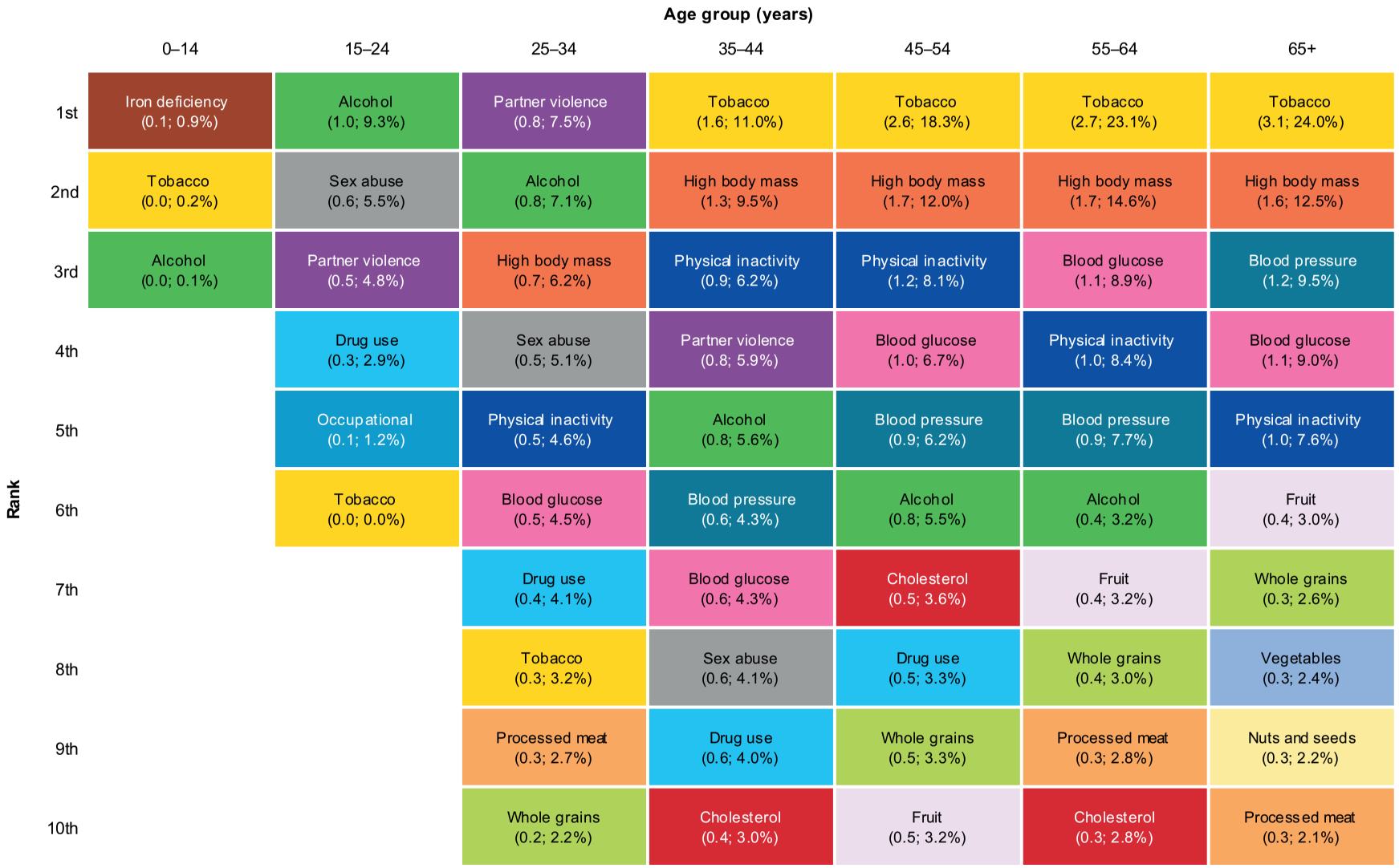


Figure 7.2: Leading risk factor contribution to total burden (DALY '000; proportion of DALY %), by age, Indigenous females, 2011

8 Gap in health outcomes

What it means: comparing the health of Indigenous and non-Indigenous Australians

How big is the health gap?

Indigenous Australians were more than twice as likely (2.3 times) to die early or live with poor health as non-Indigenous Australians in 2011. Age differences for these populations were not a cause of this gap as age was taken into account in the study.

Dying early causes more of the gap than living with poor health. Indigenous Australians were nearly 3 times (2.7 times) as likely as non-Indigenous Australians to die early, and twice (2.0 times) as likely to live with poor health.

What diseases and injuries cause the health gap?

The difference in disease burden between Indigenous and non-Indigenous Australians was greater for some diseases and injuries:

- Diabetes and other endocrine diseases caused 5 times as much early death and poor health for Indigenous Australians as for non-Indigenous Australians.
- Kidney and urinary diseases caused 7 times as much.
- Injuries caused 3 times as much.

Chronic diseases as a whole caused more than two-thirds (70%) of the gap in disease burden between Indigenous and non-Indigenous Australians. The largest causes of the gap were:

- cardiovascular diseases, causing about one-fifth (19%) of the gap
- mental and substance use disorders, such as anxiety and alcohol use disorders (14%)
- injuries including suicide & self-inflicted injuries (14%)
- respiratory diseases, such as asthma and other breathing problems (10%)
- cancer (9%)
- diabetes and other endocrine diseases (7%).

Are the causes of the health gap different at different ages?

For children aged 0–14, infant and congenital conditions such as being born too early, weighing too little at birth, and SIDS (cot death) caused one-third (33%) of the gap. Mental and substance use disorders and injuries were the largest causes of the gap for people aged 15–44. For those aged 45 and over, cardiovascular diseases, respiratory diseases and cancer were the main causes of the gap.

How do risks to health contribute to the gap?

About half (51%) of the health gap between Indigenous and non-Indigenous Australians was due to the 29 risk factors included in this study. Tobacco was the largest cause of the health gap, causing about one-quarter (23%) of the gap. The next largest contributors to the gap were too much weight (14%) and high blood sugar (9%).

Measuring the 'gap' in disease burden between Indigenous and non-Indigenous Australians is of key interest to current policy makers, as reflected in the COAG commitment to close the gap in Indigenous life expectancy within a generation (COAG 2009).

Indigenous and non-Indigenous rates presented in this report have been age-standardised in order to remove the effect of differences in age structure between the 2 populations. Rate ratios as well as rate differences are presented as measures of the gap in disease burden (see 'Chapter 2 Synthesis and discussion of key results' for more information). In addition, results are presented on the diseases contributing the most to the health gap which is measured using rate differences (that is the proportion that each disease group contributes to the total DALY rate difference).

8.1 How big is the health gap?

In 2011, after taking into account differences in age structure, Indigenous Australians experienced overall burden from disease and injury at 2.3 times the rate of non-Indigenous Australians. While this relative gap was the same for both sexes, the absolute gap in disease burden was greater for males than females (DALY rates differences of 275 per 1,000 compared with 219 per 1,000 respectively).

Indigenous Australians experienced non-fatal burden at twice the rate of non-Indigenous Australians after taking into account differences in population age structure.

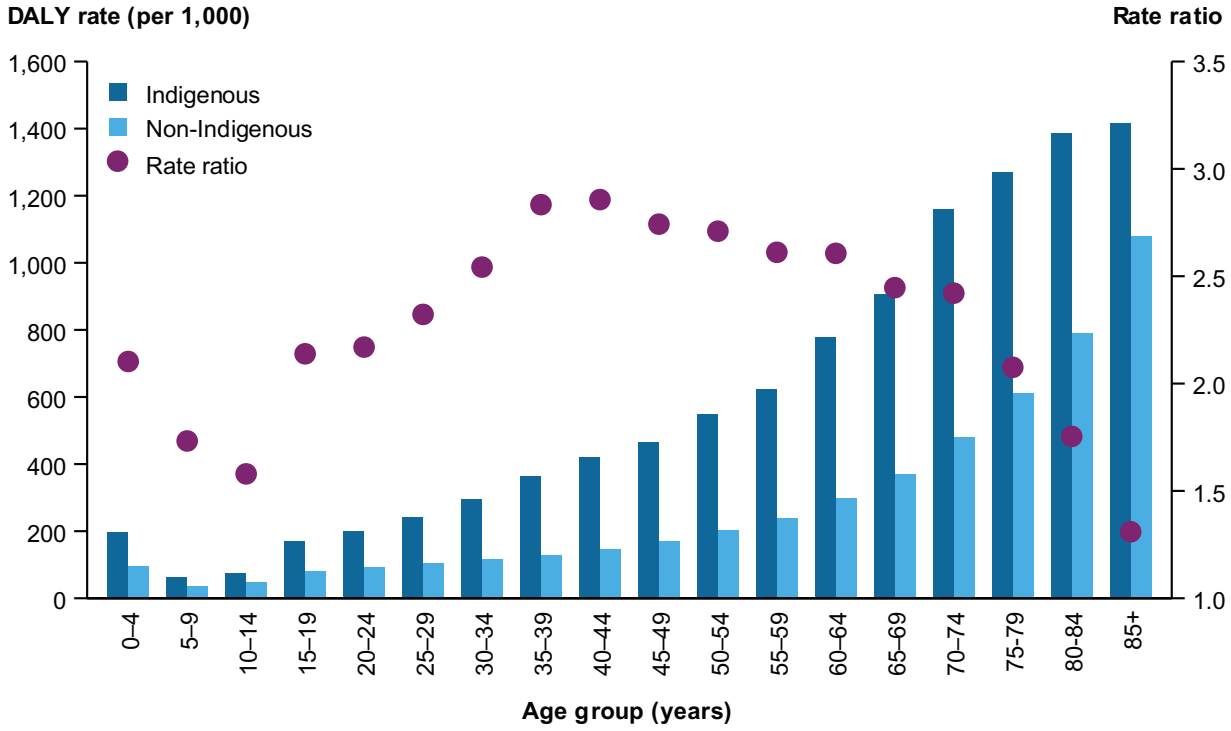
The largest disparity existed for the fatal burden, where Indigenous males and females experienced YLL rates that were 2.6 and 2.9 times those for non-Indigenous males and females respectively (Table 8.1).

Table 8.1: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and sex, 2011

	Indigenous rate per 1,000	Non-Indigenous rate per 1,000	Rate ratio	Rate difference per 1,000
Total burden (DALY)				
Males	483.7	208.6	2.3	275.0
Females	381.8	163.3	2.3	218.5
People	429.4	185.0	2.3	244.4
Non-fatal burden (YLD)				
Males	190.3	95.0	2.0	95.3
Females	178.3	93.0	1.9	85.2
People	183.6	94.0	2.0	89.6
Fatal burden (YLL)				
Males	293.4	113.7	2.6	179.7
Females	203.5	70.2	2.9	133.3
People	245.8	91.0	2.7	154.8

Notes: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

In all age groups, Indigenous Australians had higher rates of DALY than non-Indigenous Australians (Figure 8.1). The largest relative differences were for those aged 35–39 and 40–44, where DALY rates for Indigenous Australians were 2.8 and 2.9 times those for non-Indigenous Australians in these age groups, respectively.



Source: This figure is based on data in a supplementary table available online—Table S8.1.

Figure 8.1: Age-specific DALY rates (per 1,000 people) and rate ratios, by age, Indigenous and non-Indigenous Australians, 2011

8.2 How does the gap vary by disease group?

In 2011, across all disease groups, Indigenous Australians experienced a higher rate of burden than non-Indigenous Australians, with the exception of skin disorders and reproductive & maternal conditions, for which rates were similar (ratios of 1.1 and 1.0 respectively).

Cardiovascular diseases were the largest contributor to the gap in disease burden between Indigenous and non-Indigenous Australians (based on age-standardised DALY rate differences), contributing 19% of the gap. This was followed by mental & substance use disorders (14%) and injuries (14%) (Table 8.2).

Together all chronic diseases were responsible for 70% of the health gap in 2011. This included cardiovascular diseases, mental & substance use disorders, cancer, CKD, diabetes, vision loss, hearing loss and selected musculoskeletal, respiratory, neurological and congenital disorders.

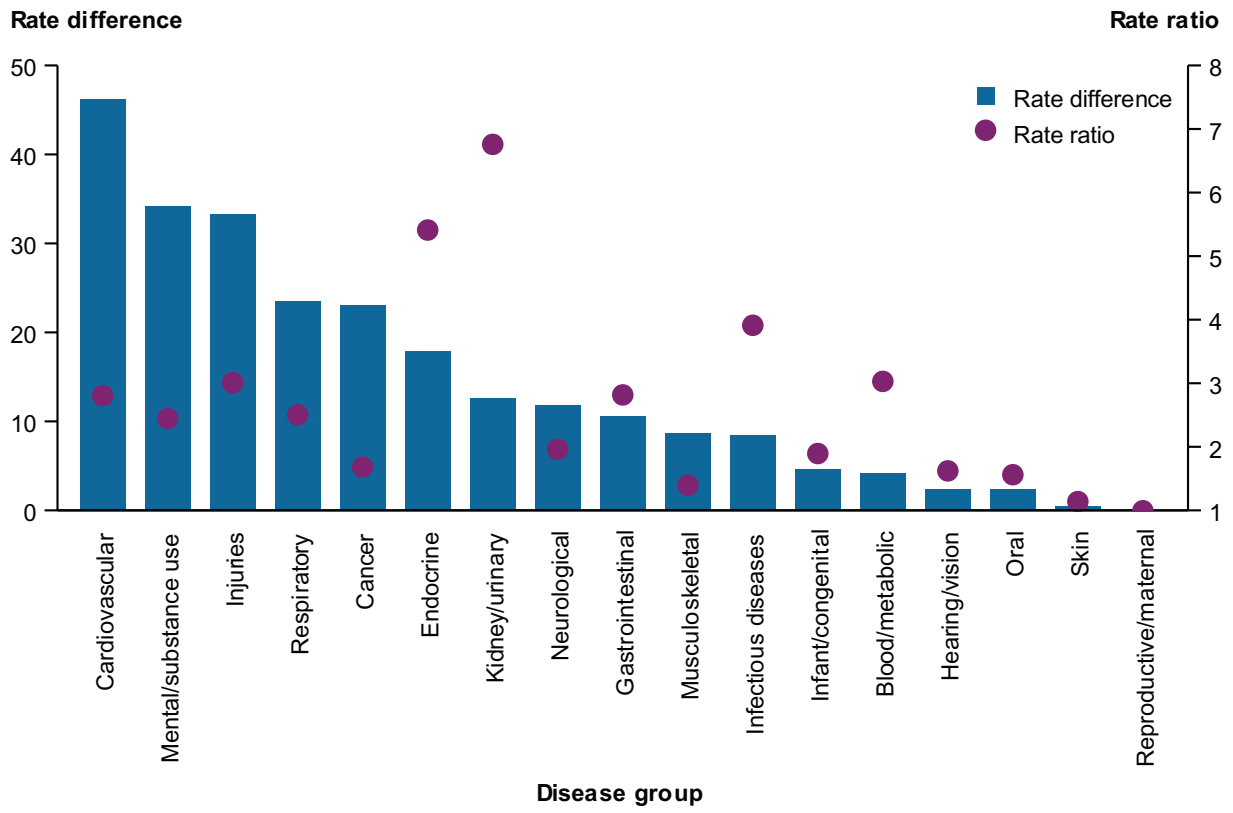
Table 8.2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, 2011

	DALY per 1,000[a]				
Disease group	**Indigenous**	**Non-Indigenous**	**Rate ratio**	**Rate difference**	**Contribution to health gap (% of total rate difference)**
Cardiovascular	71.8	25.6	2.8	46.2	18.9
Mental & substance use	57.8	23.6	2.4	34.1	14.0
Injuries	49.9	16.6	3.0	33.3	13.6
Respiratory	39.2	15.7	2.5	23.5	9.6
Cancer	57.0	33.9	1.7	23.1	9.5
Endocrine	21.9	4.1	5.4	17.9	7.3
Kidney/urinary	14.9	2.2	6.8	12.7	5.2
Neurological	24.0	12.3	2.0	11.8	4.8
Gastrointestinal	16.4	5.8	2.8	10.6	4.3
Musculoskeletal	30.6	21.9	1.4	8.7	3.5
Infectious diseases	11.3	2.9	3.9	8.4	3.4
Infant/congenital	9.9	5.2	1.9	4.7	1.9
Blood/metabolic	6.2	2.1	3.0	4.2	1.7
Hearing/vision	6.4	3.9	1.6	2.4	1.0
Oral	6.5	4.2	1.6	2.3	1.0
Skin	3.9	3.4	1.1	0.5	0.2
Reproductive/maternal	1.7	1.7	1.0	–	–
Total all diseases	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Disease groups which showed the greatest relative differences in disease burden between Indigenous and non-Indigenous Australians (based on age-standardised DALY rate ratios) were kidney & urinary diseases (ratio of 6.8) and endocrine disorders, including diabetes (ratio of 5.4) (Table 8.2; Figure 8.2). While these rate ratios are much higher than for cardiovascular diseases (ratio of 2.8), mental & substance use disorders (2.4) and injuries (ratio of 3.0), their contribution to the total health gap was lower (7% for endocrine disorders and 5% for kidney & urinary diseases).



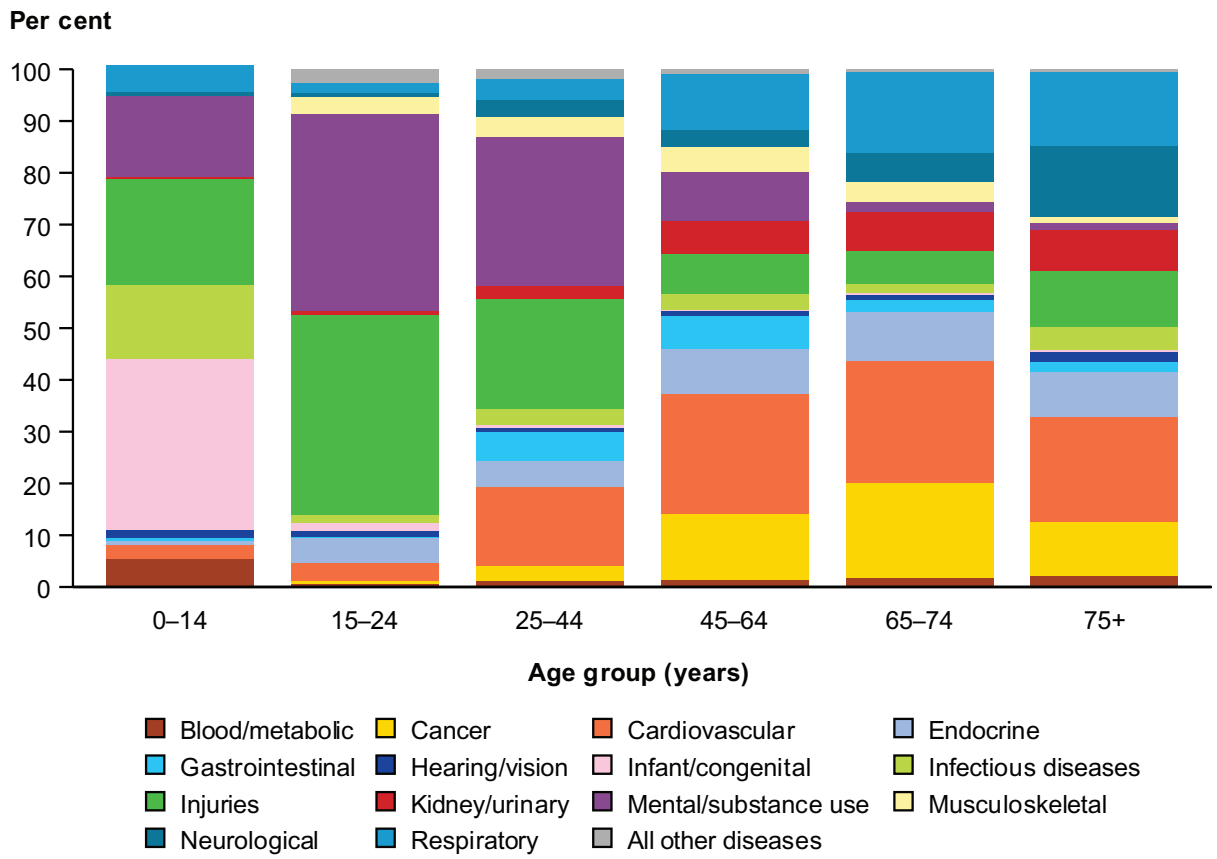
Source: Table 8.2.

Figure 8.2: DALY rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group, 2011

Differences by age

The contribution of different disease groups to the gap in total disease burden between Indigenous and non-Indigenous Australians varies by age (Figure 8.3). For example:

- Infant & congenital conditions, injuries and infectious diseases were the greatest contributors to the gap among children aged 0–14. Infant & congenital conditions contributed one-third of the gap in this age group.
- Mental & substance use disorders and injuries were the largest contributors to the gap among those aged 15–24, together representing 77% of the gap.
- Mental & substance use disorders and injuries were also important contributors to the gap among those aged 25–44 (representing 29% and 21% of the gap respectively). Cardiovascular diseases also emerged as an important contributor, representing 15% of the gap in this age group.
- Cardiovascular diseases, cancer and respiratory diseases were the main contributors to the gap among those aged 45 and over. Cardiovascular diseases were responsible for around one-quarter of the gap in those aged 45 and over.



Source: This figure is based on data in a supplementary table available online—Table S8.2.

Figure 8.3: Percentage contribution to the health gap (based on DALY rate difference) between Indigenous and non-Indigenous Australians, by age and disease group, 2011

Differences by sex

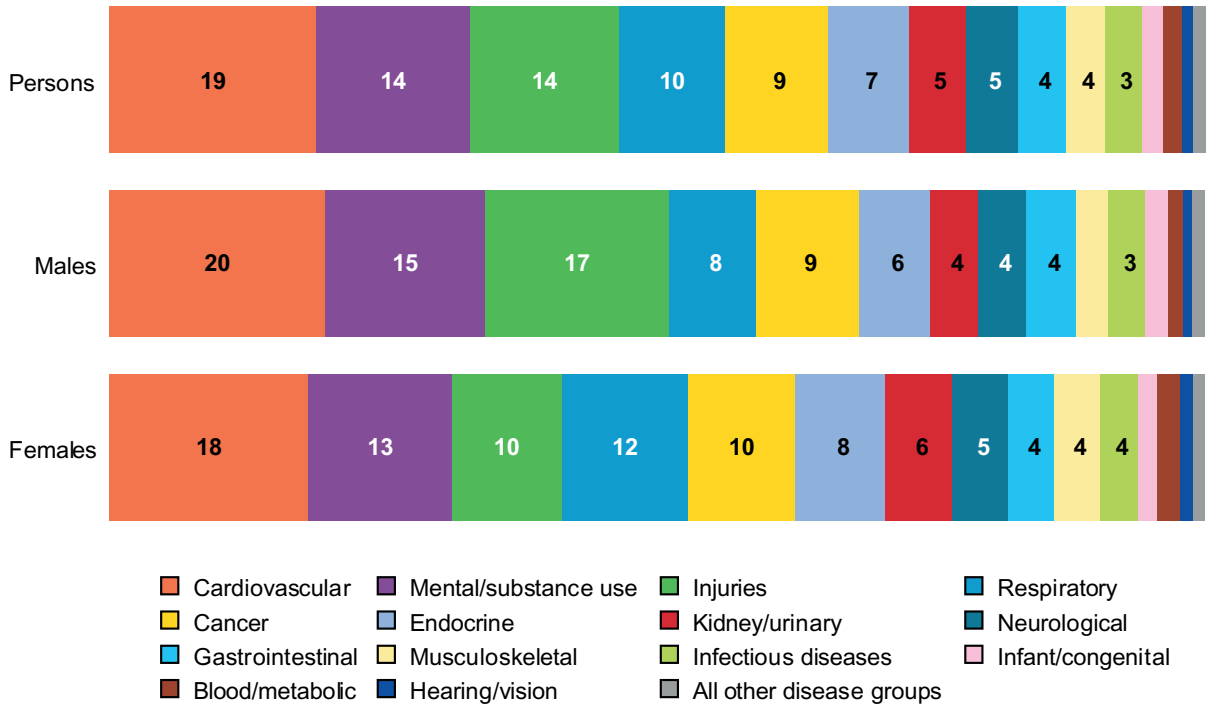
Cardiovascular diseases were the largest contributor to the gap in total disease burden between Indigenous and non-Indigenous Australians for both males and females in 2011, accounting for 20% and 18% of the gap respectively (Figure 8.4). Indigenous males and females experienced a rate of total burden from this disease group of 2.6 and 3.2 times the rate of non-Indigenous males and females respectively (Appendix tables D1 and D2).

Injuries were ranked as the second leading contributor to the gap for males (17%), and ranked fourth for females (10%). Rate ratios were 2.9 for males and 3.4 for females.

Mental & substance use disorders was the second leading contributor to the gap for females (representing 13%), and this was ranked third for males (representing 15%). Indigenous males and females experienced burden of disease from mental & substance use disorders at 2.6 and 2.3 times the rate on non-Indigenous males and females respectively.

Respiratory diseases were responsible for a larger proportion of the gap for females (12%, ranked third) than males (8%, ranked fifth).

The disease groups with the highest relative disparities in overall disease burden between Indigenous and non-Indigenous Australians for both males and females were kidney & urinary diseases (rate ratios of 5.4 for males and 8.5 for females) and endocrine disorders, which includes diabetes (rate ratios of 4.5 for males and 6.7 for females) (Appendix tables D1 and D2).



Note: Per cent labels are not shown for disease groups contributing less than 3% of gap.

Source: This figure is based on data in a supplementary table available online—Table S8.3.

Figure 8.4: Percentage contribution (%) of leading disease groups to the gap in total disease burden (DALY), by sex, 2011

8.3 Health gap by specific diseases

Table 8.3 presents the top 20 specific diseases contributing to the gap in total burden for males and females in 2011; together they accounted for almost three-quarters of the gap (71% for males and 72% for females).

CHD and diabetes were the 2 leading specific diseases that contributed to the gap in total burden between Indigenous and non-Indigenous Australians for both males and females in 2011. CHD accounted for 14% of the gap for males and 9% of the gap for Indigenous females. Diabetes accounted for 7% of the gap for males and 8% of the gap for Indigenous females.

For males, alcohol use disorders and COPD were the next ranked conditions contributing to the gap (each representing around 6% of the gap).

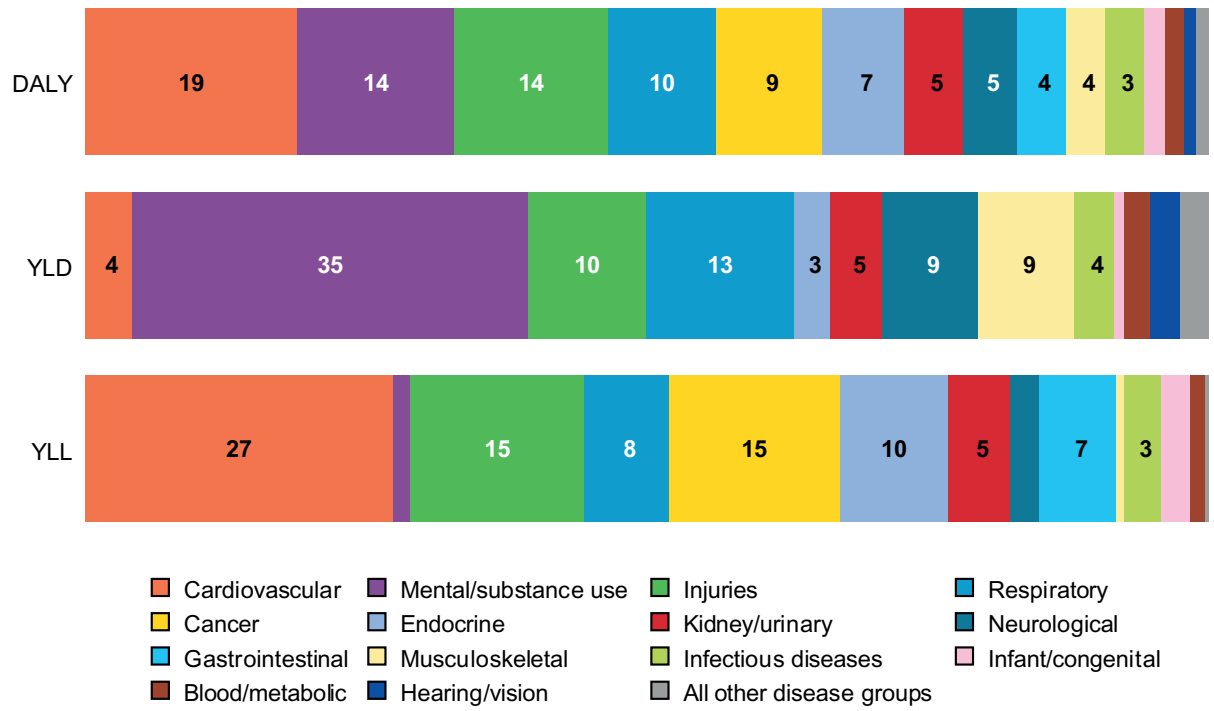
For females, COPD and CKD were the next ranked conditions contributing to the gap (7% and 5% respectively).

Table 8.3: Leading 20 specific diseases contributing to the gap in total burden (DALY) for Indigenous males and females, 2011

	Males						Females					
Rank	Disease	Indigenous DALY ASR per 1,000	Non-Indig. DALY ASR per 1,000	Rate ratio	Rate difference per 1,000	Contribution to health gap (%)	Rank	Disease	Indigenous DALY ASR per 1,000	Non-Indig. DALY ASR per 1,000	Rate ratio	Rate difference per 1,000	Contribution to health gap (%)
1	Coronary heart disease	56.8	19.3	3.0	37.6	13.7	1	Coronary heart disease	27.7	8.1	3.4	19.6	9.0
2	Diabetes	22.7	4.9	4.6	17.8	6.5	2	Diabetes	20.8	2.9	7.1	17.9	8.2
3	Alcohol use disorders	21.0	4.1	5.2	17.0	6.2	3	COPD	21.0	5.9	3.5	15.1	6.9
4	COPD	22.4	6.9	3.2	15.4	5.6	4	Chronic kidney disease	12.5	1.4	9.0	11.1	5.1
5	Suicide	18.0	7.3	2.5	10.7	3.9	5	Other musculoskeletal	18.0	7.7	2.3	10.3	4.7
6	Lung cancer	18.0	7.9	2.3	10.0	3.6	6	Anxiety disorders	16.3	7.4	2.2	9.0	4.1
7	Chronic kidney disease	10.6	1.8	5.8	8.8	3.2	7	Asthma	13.4	4.9	2.7	8.4	3.9
8	Chronic liver disease	11.1	2.6	4.2	8.4	3.1	8	Stroke	12.4	4.8	2.6	7.6	3.5
9	Falls	11.5	3.2	3.6	8.3	3.0	9	Lung cancer	12.1	4.6	2.6	7.5	3.4
10	Other musculoskeletal	14.7	7.5	2.0	7.2	2.6	10	Dementia	13.4	6.0	2.2	7.4	3.4
11	Dementia	11.7	5.1	2.3	6.6	2.4	11	Depressive disorders	13.3	6.4	2.1	7.0	3.2
12	RTI—motor vehicle occupants	9.3	2.9	3.3	6.5	2.3	12	Chronic liver disease	7.9	1.1	7.2	6.8	3.1
13	Homicide & violence	7.4	1.5	4.9	5.9	2.2	13	Alcohol use disorders	6.5	1.4	4.8	5.1	2.3
14	Stroke	11.7	5.9	2.0	5.9	2.1	14	Suicide	7.2	2.4	3.0	4.8	2.2
15	Anxiety disorders	10.6	4.9	2.2	5.7	2.1	15	RTI—motor vehicle occupants	4.9	1.3	3.9	3.7	1.7
16	Depressive disorders	10.0	4.8	2.1	5.1	1.9	16	Falls	5.2	1.6	3.3	3.6	1.7
17	Lower respiratory infections	6.3	1.3	4.8	5.0	1.8	17	Other cardiovascular diseases	4.7	1.3	3.6	3.4	1.5
18	Epilepsy	6.7	2.1	3.2	4.6	1.7	18	Homicide & violence	3.6	0.6	6.1	3.0	1.4
19	Schizophrenia	6.5	1.9	3.3	4.5	1.6	19	Rheumatic heart disease	3.2	0.5	6.9	2.8	1.3
20	Mouth & pharyngeal cancer	5.5	1.1	5.1	4.4	1.6	20	Poisoning	3.9	1.2	3.4	2.8	1.3
Total all causes		**483.7**	**208.6**	**2.3**	**275.0**	**100.0**	**Total all causes**		**381.8**	**163.3**	**2.3**	**218.5**	**100.0**

8.4 Health gap by fatal and non-fatal burden

The diseases contributing the most to the gap between Indigenous and non-Indigenous Australians were different for fatal and non-fatal burden (Figure 8.5). When looking at non-fatal burden, mental & substance use disorders, respiratory diseases and injuries were the largest contributors to the gap between Indigenous and non-Indigenous Australians, together contributing 59% of the total gap in YLD in 2011. In contrast, for fatal burden, cardiovascular diseases, injuries and cancer were the leading disease groups contributing to the gap between Indigenous and non-Indigenous Australians, together responsible for more than half (58%) of the total gap in YLL in 2011.



Note: Per cent labels are not shown for disease groups contributing less than 3% of gap.

Source: This figure is based on data in a supplementary table available online—Table S8.4.

Figure 8.5: Percentage contribution (%) of leading disease groups to the gap in total, fatal and non-fatal burden, 2011

8.5 Health gap by risk factors

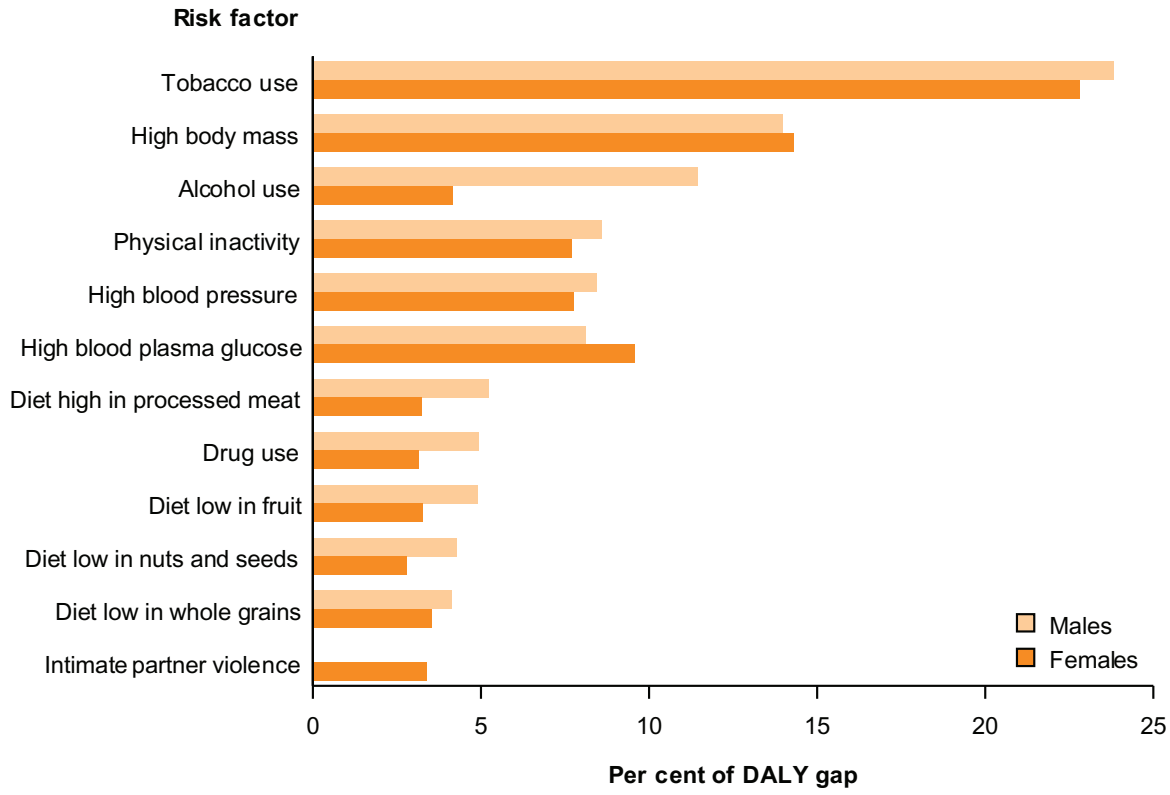
The contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians is presented in Figure 8.6. Due to the interactions between risk factors, it is not possible to simply sum the impact of each risk factor (see 'Chapter 7 Contribution of risk factors to burden'). Further, the 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden. As such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

After adjustment for the joint effect of multiple risk factors (see 'Chapter 7, Box 7.2'), Indigenous Australians experienced rates of burden attributable to the 29 risk factors included in the study at 3 times the rate of non-Indigenous Australians in 2011. Together these 29 risk factors accounted for approximately half (51%) of the health gap between Indigenous and non-Indigenous Australians.

Tobacco use contributed the most to the health gap, responsible for 23% of the gap between Indigenous and non-Indigenous in 2011. This was followed by high body mass (contributing to 14% of the burden) and high blood plasma glucose (9%) (Table 8.4). It is important to note that the gap estimates for individual risk factors cannot be added together due to the complex pathways and interactions between them.

The largest relative differences in attributable burden due to the risk factors included in the study were reported for a diet high in sweetened beverages (rate ratio of 20) and childhood sexual abuse (rate ratio of 12). However it should be noted that these 2 risk factors contributed to only 3.1% and 2.6% of the total health gap respectively (Table 8.4).

The risk factors contributing the most to the health gap was similar for both males and females, however alcohol use contributed a much larger proportion of the health gap for males than females (11% compared to 4%) and high blood plasma glucose contributed a higher proportion of the gap for females (10% compared to 8% for males) (Figure 8.6).



Source: This figure is based on data in a supplementary table available online—Table S8.5.

Figure 8.6: Leading risk factors contributing to gap in the attributable burden for males and females, 2011 (proportion % of the gap in total DALY due to each risk factor)

Table 8.4: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to selected risk factors, rate ratios and rate differences, 2011

	Age-standardised DALY rate per 1,000				
Disease group	**Indigenous**	**Non-Indigenous**	**Rate ratio**	**Rate difference**	**% of health gap[(a)]**
Tobacco use	72.5	15.6	4.6	56.9	23.3
High body mass	44.1	9.5	4.6	34.5	14.1
High blood plasma glucose	26.2	4.7	5.6	21.5	8.8
Physical inactivity	28.8	8.8	3.3	20.0	8.2
High blood pressure	28.5	8.6	3.3	19.9	8.1
Alcohol use	29.1	9.4	3.1	19.7	8.1
Diet high in processed meats	13.0	2.5	5.3	10.5	4.3
Diet low in fruit	13.5	3.4	4.0	10.1	4.1
Drug use	13.3	3.2	4.2	10.1	4.1
Diet low in whole grains	11.4	2.0	5.8	9.4	3.9
Diet low in nuts and seeds	11.1	2.4	4.6	8.7	3.6
High cholesterol	12.4	4.2	3.0	8.2	3.4
Diet high in sweetened beverages	8.1	0.4	20.2	7.7	3.1
Diet low in vegetables	9.6	2.4	3.9	7.2	2.9
Childhood sexual abuse	7.0	0.6	11.8	6.4	2.6
Diet low in omega-3 fatty acids	4.9	0.5	9.2	4.4	1.8
Intimate partner violence	4.7	0.9	5.4	3.8	1.6
Diet low in fibre	4.9	1.7	2.9	3.2	1.3
Diet high in saturated fat	4.2	1.3	3.3	3.0	1.2
Unsafe sex	2.9	0.8	3.9	2.2	0.9
Occupational exposures	4.6	2.5	1.8	2.1	0.9
Ambient particulate matter pollution	2.7	1.1	2.4	1.6	0.7
Diet high in sodium	2.0	0.5	4.2	1.5	0.6
Iron deficiency	1.8	0.5	3.7	1.3	0.5
Diet high in red meat	1.5	0.3	5.4	1.3	0.5
Low bone mineral density	0.7	0.2	2.9	0.4	0.2
Diet low in milk	0.6	0.4	1.3	0.1	0.1
Diet low in calcium	0.2	0.2	1.0	0.0	0.0
Unimproved sanitation	0.02	n.a.	n.a.	n.a.	n.a.
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

9 Change between 2003 and 2011

What it means: has health got better?

There has been some improvement in health for Indigenous Australians. Between 2003 and 2011 the number of years of healthy life lost per person decreased by 5%. The decrease was not due to changes in the age or size of the Indigenous population, as this was taken into account in the study.

This small decrease in overall disease burden was because there has been a decrease (of 11%) in the impact of dying early, but there has been a small increase (of 4%) in the impact of living with poor health.

The impact of dying early due to cardiovascular diseases, mostly coronary heart disease, was smaller in 2011 than in 2003. But the impact of living with injuries (mostly falls), mental and substance use disorders (mostly anxiety and depression), diabetes and asthma increased.

Has the gap between Indigenous and non-Indigenous Australians changed?

The overall health gap has not improved, but the separate impact of dying early and living with poor health have both changed. The gap in dying early has decreased (by 9%), and the gap in living with poor health has increased (by 15%).

Injuries, cancer and musculoskeletal conditions caused more of the gap in 2011 than they did in 2003, and cardiovascular diseases caused less of the gap.

Have the risks to heath changed?

The disease burden caused by some risk factors has decreased a lot. The burden caused by high cholesterol has decreased by one-third (37%). High blood pressure and too little exercise are also causing much fewer lost years (23% less) due to illness and death in 2011 than they did in 2003.

The risk factors which caused the health gap have changed. Intimate partner violence caused more of the health gap between Indigenous and non-Indigenous Australians in 2011 than it did in 2003. Too little exercise caused less of the health gap in 2011. The health gap due to tobacco and too much weight did not change.

This chapter compares the disease burden for Indigenous Australians at 2 points in time: 2003 and 2011. A comparison of the gap in disease burden between Indigenous and non-Indigenous Australians in 2003 and 2011 is also presented. 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 for 2003 have been analysed using the methods for the ABDS 2011 to produce comparable estimates.

The Indigenous estimates for 2003 contained here cannot be compared with those estimates for 2003 from the previous Indigenous Australian study (Vos et al. 2007) as they are developed using different methodologies and are based on different Indigenous population estimates for 2003. See 'Appendix B: Methods overview' for further information on the methods used to develop the estimates presented here.

Estimating changes in the Indigenous population between 2 time points

In this chapter, the population denominators used to calculate rates for 2003 and 2011 Indigenous burden of disease estimates are the ABS Aboriginal and Torres Strait Islander population estimates as at 30 June 2003 and 30 June 2011 based on the 2011 Census (ABS 2014b). This population series inherently applies the Indigenous identification level in 2011 to earlier years in the series, including 2003, in the backcast methods used. Using this backcast population for 2003 estimates provides consistency between the denominators used for 2003 and 2011 Indigenous burden of disease estimates.

It is important to note that the Indigenous population used for 2003 estimates in the current study is different to the 2003 population used in the previous Indigenous burden of disease study (which used the 2003 Indigenous population projected based on the 2001 Census). It does not reflect the population of people who would have identified as Indigenous in 2003.

The AIHW undertook a sensitivity analysis to look at the impact of using the Indigenous population as identified in 2003 (using an interpolated population between the 2001 and 2006 Census ERPs). This showed that using the interpolated population for 2003 would imply a larger overall decline in Indigenous DALY rates and a larger overall decline in the gap (rate difference) between 2003 and 2011, compared to using the backcast 2003 population adopted for this study. But those larger declines would be entangled with shifts in the rate and pattern of Indigenous identification between the 2 reference years, rather than reflecting shifts in underlying health patterns.

Presenting and interpreting changes between 2 time points

When comparing estimates for the same disease between 2 time points, it is important to note the following:

- To account for differences in the population age structure and size between 2003 and 2011, direct age-standardisation has been used. This method takes the 2003 and 2011 age-specific rates calculated using the populations as described and produces estimates of the rates of burden that would have occurred if the population size and structure was the same as a chosen 'standard' at both points in time. The Australian population as at 30 June 2001 has been used as the standard in this report.

- The 2 estimates can be compared to each other to give a general indication of whether disease burden has changed over time, however it cannot be assumed that there is a straight-line between the 2 data points.
- YLD and YLL may change by differing proportions and thus make differing contributions to the change in DALY. Analysis presented in this chapter includes changes in fatal and non-fatal burden and how this contributes to the changes observed in DALY rates.
- Differences in total DALY between 2 time points are partly due to population changes (for example, increasing size and ageing) and partly due to changes in disease epidemiology (that is, underlying disease prevalence and/or severity). The impact of population changes may mask changes in underlying disease epidemiology. In this chapter, age-standardised rates which remove the effects of population changes (both in size and age) are presented first. Consideration of the impacts of changes in population size, age and disease epidemiology on differences in the number of DALY, YLD and YLL is presented later in the chapter.
- Definitional changes such as the coding of diseases and injuries between the 2 time points may impact on the comparability between the 2003 and 2011 estimates produced. Where possible, these have been adjusted for in the analyses.
- Changes in Indigenous identification in both the numerator and denominator data over time (as well as numerator and denominator inconsistencies in identification levels) impact on the ability to assess changes over time in Indigenous estimates, and affects estimates of the gap between Indigenous and non-Indigenous Australians. As the 2003 backcast population from the 2011 Census is used as the denominator for 2003 rate calculations, the 2003 numerators should ideally be on the same basis of Indigenous identification to avoid biases in the 2003 rates. Where possible, adjustments have been made to address this issue. For example, Indigenous deaths for both 2003 and 2011 were adjusted using factors which take into account under-identification in both mortality and population data based on the 2011 Census, which provides numerator/denominator consistency in Indigenous YLL estimates. Where this has not been possible (for example for some Indigenous YLD estimates for which adjustment factors were not available to adjust the numerator data to be consistent with the identification in the population denominator), 2003 rates may be underestimated to some degree.

More detailed information about the methods used to estimate 2003 data for specific diseases, including adjustments made and notes about the impact of coding changes, is presented in the ABDS methods report *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016b).

Statistics presented in this chapter

This chapter starts by presenting changes in Indigenous age-standardised rates of total burden (DALY), non-fatal burden (YLD) and fatal burden (YLL) between 2003 and 2011 (sections 9.1 and 9.2). Changes in age-standardised rates of attributable burden due to selected risk factors are then discussed in Section 9.3. Changes in the gap between Indigenous and non-Indigenous Australians (as measured by age-standardised rate differences and rate ratios) in DALY, YLL, YLD and risk factor attribution is presented in Section 9.4.

This chapter ends with a discussion of changes in the absolute number of DALY, YLL and YLD between 2003 and 2011 for the Indigenous population (Section 9.5), and a decomposition of these changes to help distinguish between the impact of population increase, population ageing and epidemiological changes (Section 9.6).

Box 9.1 summarises the statistics included in this chapter used to measure changes in disease burden between 2003 and 2011.

Box 9.1 Statistics on changes in disease burden presented in this chapter

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

- **Age-standardised rates (ASRs):** these account for changes in population composition over time, such as increasing size and ageing.
- **ASR rate differences** show the difference between the age-standardised rate of burden from 2003 to 2011. The difference between ASRs is also expressed as a percentage in some cases.
- **ASR rate ratios** used in this chapter show how many times the rate of burden is in 2011 relative to 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.
- **Changes in ranking:** disease rankings are often used in burden of disease reporting. While they are used in some places in this chapter, 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.
- **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 to 2003 and the relative change expressed as a percentage. A negative absolute or relative change indicates a decline in 2011 compared to 2003 and a positive value indicates an increase.
- **Drivers of change:** these describe the influence of increasing population size, ageing and epidemiological changes on burden estimates. They also highlight where changes in Indigenous identification may have impacted on the rate changes observed.

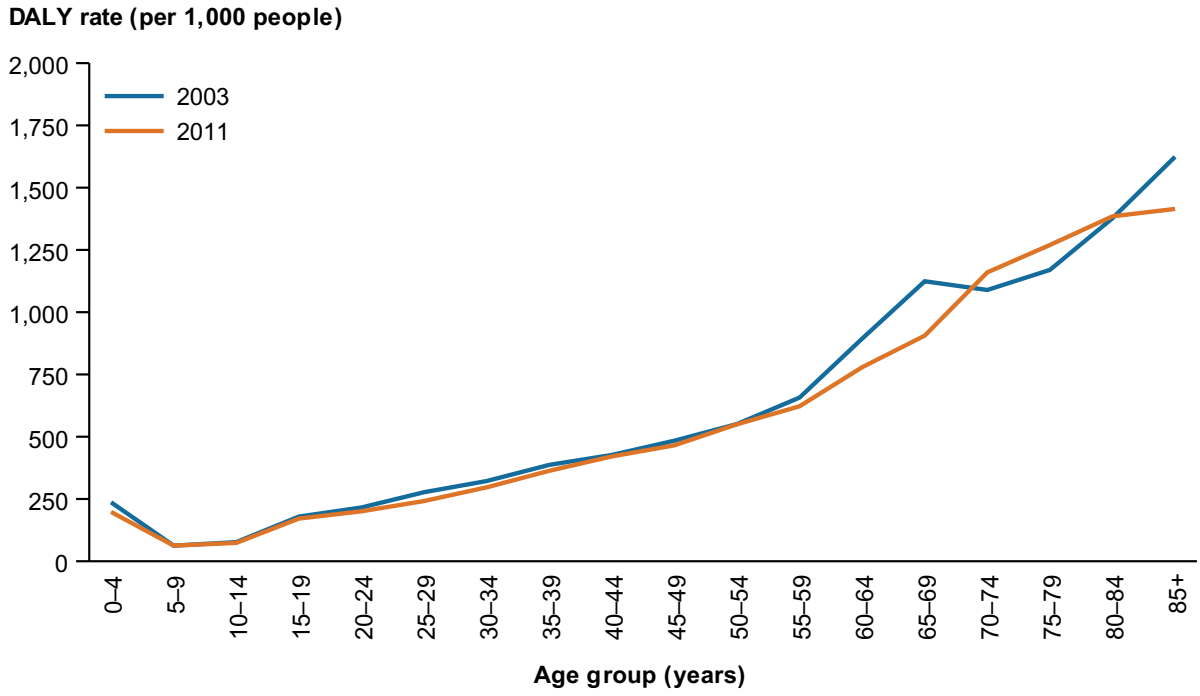
Note that it is possible to have different statistics reported which are going in different directions; for example, an increase in the rate ratio and a decrease in the rate difference. This suggests that there has been an increase in the relative difference between the 2003 and 2011 rates, but a decrease in the absolute rate difference. In such cases, the rate difference is used as the primary measure to use for assessing the change over time in this report.

9.1 Changes in rates of total disease burden

Overall change in disease burden

Age-specific DALY rates for Indigenous Australians were similar in 2003 and 2011 for ages 0 to 59; however rates in 2011 were lower in the 60–69 age group, and higher for those aged 70–84, compared with the 2003 rates (Figure 9.1).

After removing the impact of the increasing age and size of the Indigenous population (by using age-standardised rates), there was a slight decrease (5%) in rates of total disease burden between 2003 and 2011 (from 454 to 429 DALY per 1,000 Indigenous Australians).



Source: This figure is based on data in a supplementary table available online—Table S9.1.

Figure 9.1: Rates (per 1,000 people) of total burden (DALY) by age, Indigenous Australians, 2003 and 2011

Drivers of changes observed between 2003 and 2011

Changes in contribution of YLD and YLL

Fatal burden contributed a higher proportion of total DALY experienced by Indigenous Australians in 2003 than in 2011 (YLL:YLD ratio of 57:43 in 2003 compared with to 53:47 in 2011). This indicates that differences in DALY between 2 time points may sometimes mask opposing changes in fatal and non-fatal burden. The shift towards more non-fatal burden over time is consistent with the results of other recent burden of disease studies.

Drivers of change by disease group

- Increases in Indigenous age-standardised disease burden rates between 2003 and 2011 were observed for cancer (increase of 3 DALY per 1,000 people), and injuries (increase of 2 DALY per 1,000). There was also a small increase in the age-standardised DALY rate for mental & substance use disorders (1 DALY per 1,000), which was driven by an increase in non-fatal burden (see Section 9.2).
- Decreases in Indigenous age-standardised DALY rates between 2003 and 2011 were observed for cardiovascular diseases (decrease of 19 DALY per 1,000 people) and infectious diseases (decrease of 5 per 1,000). There was also a small decline for endocrine disorders, including diabetes (decrease of 3 DALY per 1,000), largely driven by declines in fatal burden which outweighed the increase observed in non-fatal burden (see Section 9.2).
- For all other disease groups, age-standardised DALY rates changed little between 2003 and 2011 (Table 9.1).

Table 9.1: Change in total burden (DALY) between 2003 and 2011, by disease group, Indigenous Australians

Disease group	2003 DALY ASR	2011 DALY ASR	ASR rate difference 2003 to 2011	ASR rate ratio 2011:2003
Mental/ substance use	56.4	57.8	1.4	1.0
Injuries	47.6	49.9	2.3	1.0
Cardiovascular	90.5	71.8	–18.7	0.8
Cancer	53.9	57.0	3.1	1.1
Respiratory	40.1	39.2	–0.9	1.0
Musculoskeletal	31.5	30.6	–1.0	1.0
Infant/congenital	11.6	9.9	–1.8	0.8
Endocrine	24.7	21.9	–2.8	0.9
Neurological	23.7	24.0	0.4	1.0
Gastrointestinal	18.7	16.4	–2.3	0.9
Infectious diseases	16.3	11.3	–5.0	0.7
Kidney/urinary	14.4	14.9	0.4	1.0
Oral	6.6	6.5	–	1.0
Blood/metabolic	5.6	6.2	0.6	1.1
Skin	4.2	3.9	–0.3	0.9
Hearing/vision	6.4	6.4	–	1.0
Reproductive/maternal	1.7	1.7	–	1.0
Total	**454.0**	**429.4**	**–24.5**	**0.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.
4. The numbers may not add to total for relevant columns due to rounding.

9.2 Changes in rates of non-fatal and fatal burden

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

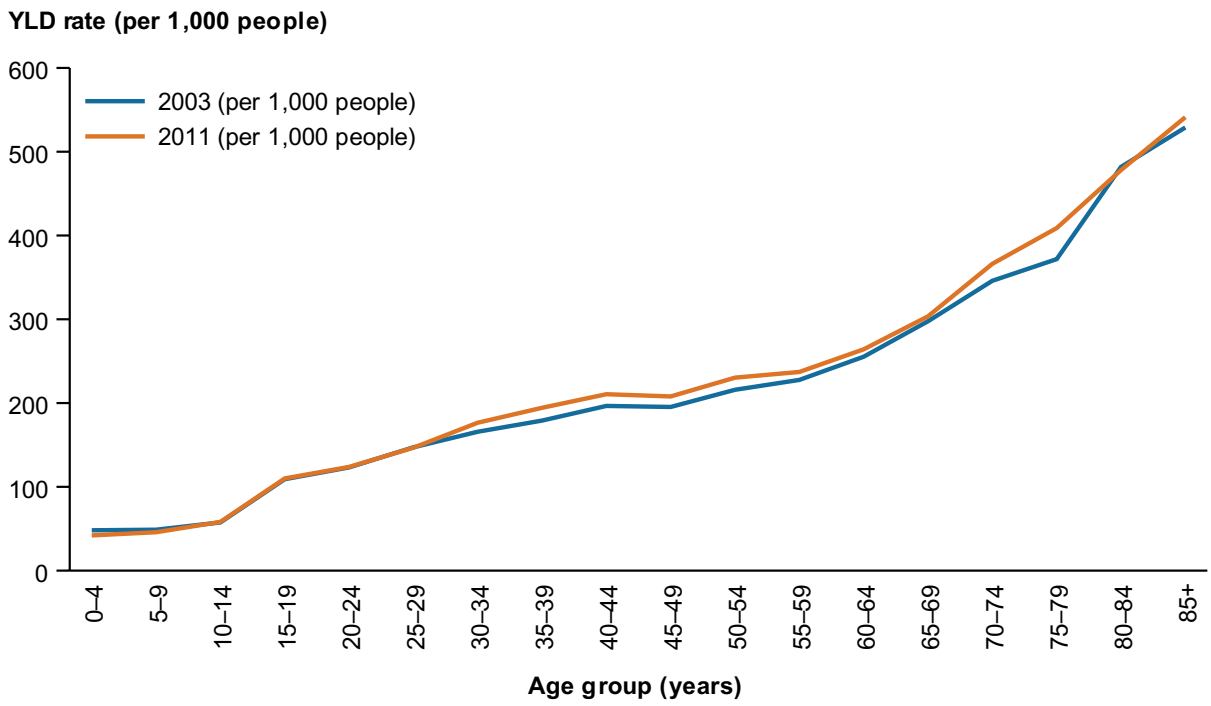
Changes in rates of non-fatal burden

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

Overall change in YLD rates

Age-specific rates of non-fatal burden (YLD) for Indigenous Australians were similar in 2003 and 2011 for all age groups up to around age 29 (Figure 9.2). Beyond age 30, the 2011 rate was slightly higher than for 2003.

After removing the impact of the increasing age and size of the Indigenous population, age-standardised YLD rates for Indigenous Australians increased slightly between 2003 and 2011 (from 176 to 184 YLD per 1,000 people; an increase of 4%).



Source: This figure is based on data in a supplementary table available online—Table S9.2.

Figure 9.2: Rates (per 1,000 people) of non-fatal burden (YLD) by age, Indigenous Australians, 2003 and 2011

Changes in YLD rates by disease group

Between 2003 and 2011, most disease groups showed little change in the age-standardised YLD rates for the Indigenous population. Increases were observed for injuries (increase of 5 YLD per 1,000 people; rate ratio 1.6), mental & substance use disorders (increase of 2 YLD per 1,000), endocrine disorders, including diabetes (increase of 1 YLD per 1,000; rate ratio 1.2) and respiratory diseases (increase of 1 YLD per 1,000).

Small decreases in Indigenous age-standardised rates of non-fatal burden were observed for neurological conditions and infectious diseases (decrease of around 1 YLD per 1,000 people between 2003 and 2011) (Table 9.2).

Table 9.2: Change in non-fatal burden (YLD) between 2003 and 2011, by disease group, Indigenous Australians

Disease group	2003 DALY ASR	2011 DALY ASR	ASR rate difference 2003 to 2011	ASR rate ratio 2011:2003
Mental/substance use	52.3	54.7	2.4	1.0
Musculoskeletal	29.3	29.0	–0.3	1.0
Respiratory	22.0	23.2	1.2	1.1
Neurological	15.3	14.4	–0.9	0.9
Injuries	8.1	13.0	4.9	1.6
Oral	6.5	6.5	–	1.0
Cardiovascular	9.6	9.1	–0.4	1.0
Infectious diseases	5.0	4.3	–0.6	0.9
Endocrine	4.2	4.8	0.7	1.2
Skin	3.4	3.3	–0.1	1.0
Hearing/vision	6.4	6.4	–	1.0
Blood/metabolic	2.8	2.9	0.1	1.0
Kidney/urinary	4.5	4.9	0.4	1.1
Gastrointestinal	2.4	2.4	–0.1	1.0
Infant/congenital	1.7	1.6	–0.1	0.9
Reproductive/maternal	1.4	1.6	0.2	1.1
Cancer	1.6	1.7	0.1	1.1
Total	**176.4**	**183.6**	**7.2**	**1.0**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.
4. The numbers may not add to total for relevant columns due to rounding.

Disease specific changes in YLD

There were some differences between 2003 and 2011 for many of the top ranking causes of non-fatal burden for Indigenous Australians (Table 9.3). There were higher age-standardised YLD rates in 2011 (indicating an increase since 2003) for falls (rate ratio of 1.8), asthma (rate ratio 1.4), diabetes (1.2), anxiety disorders (1.1) and depressive disorders (1.1).

There were lower age-standardised YLD rates in 2011 (indicating a decrease since 2003) for COPD (rate ratio of 0.9), upper respiratory conditions (rate ratio of 0.9) and other gastrointestinal infections (rate ratio of 0.8).

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

In terms of ranking, the same 5 diseases were the leading causes of non-fatal burden for Indigenous Australians in both 2003 and 2011. COPD increased in rank (from 8th to 6th), as did diabetes (from 12th to 9th).

CKD, although not ranked in the top 20 causes of burden in 2011, also showed notable increases in non-fatal burden between 2003 and 2011, both in terms of ranking (from 30th in 2003 to 24th in 2011) and in Indigenous age-standardised rates (2.6 YLD per 1,000 in 2003 compared to 3.1 YLD per 1,000 in 2011; rate ratio 1.2).

Table 9.3: Change in non-fatal burden (YLD) between 2003 and 2011, by top ranking specific diseases in 2011[(a)], Indigenous Australians

Disease	Rank 2003	2003 YLD ASR	2011 YLD ASR	ASR rate difference 2003 to 2011	ASR rate ratio 2011:2003	Rank 2011
Anxiety disorders	1	12.2	13.5	1.3	1.1	1
Alcohol use disorders	2	11.7	11.4	–0.3	1.0	2
Depressive disorders	3	10.6	11.7	1.1	1.1	3
Other musculoskeletal	4	15.1	15.1	–0.1	1.0	4
Asthma	5	7.3	10.2	2.9	1.4	5
COPD	8	10.7	9.5	–1.2	0.9	6
Schizophrenia	6	4.5	4.5	–	1.0	7
Back pain and problems	9	5.0	5.0	–	1.0	8
Diabetes	12	4.0	4.8	0.8	1.2	9
Dental caries	10	3.4	3.4	–	1.0	10
Drug use disorders (excluding alcohol)	13	2.7	3.1	0.4	1.1	11
Upper respiratory conditions	7	3.9	3.3	–0.5	0.9	12
Bipolar affective disorder	14	3.0	3.0	–	1.0	13
Falls	23	3.5	6.4	2.9	1.8	14
Epilepsy	17	3.3	3.5	0.2	1.1	15
Rheumatoid arthritis	16	4.7	4.7	–	1.0	16
Conduct disorder	15	1.5	1.5	–	1.0	17
Coronary heart disease	19	4.9	4.7	–0.2	1.0	18
Dementia	21	7.7	7.7	–	1.0	19
Other gastrointestinal infections	11	1.9	1.5	–0.5	0.8	20

(a) Rankings based on Indigenous YLD counts in each reference year—proportional contribution of each disease to total YLD.

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.

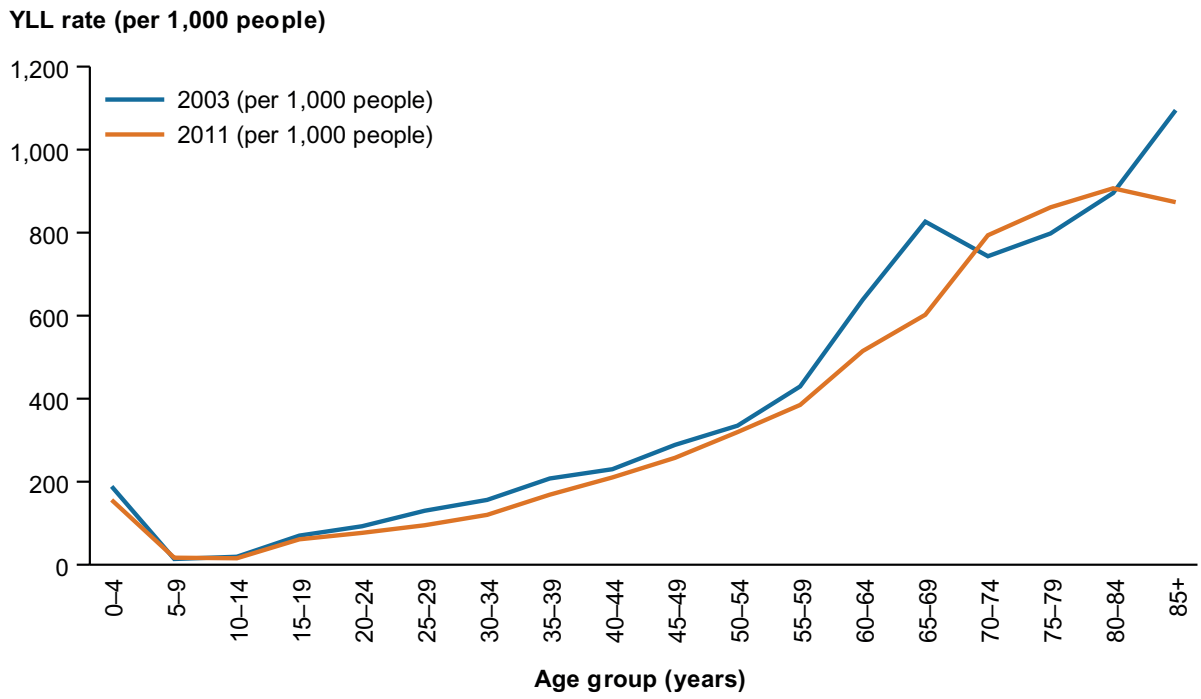
Changes in rates of fatal burden

Changes in YLL are influenced by both the number of deaths and the ages at which those deaths occur. As Indigenous deaths have been adjusted for under-identification for both time points, changes observed should not be impacted much by identification changes.

Overall change in YLL rates

After removing the impact of the increasing age and size of the Indigenous population, there was an 11% decrease in the age-standardised rates of fatal burden between 2003 and 2011 (from 278 to 246 YLL per 1,000 Indigenous Australians).

Age-specific rates of fatal burden for Indigenous Australians were similar in 2003 and 2011 for ages 0 to 19. For ages 20–69, Indigenous YLL rates were lower in 2011 than in 2003, and then increased above the 2003 rates for ages 70–84 (Figure 9.3).



Source: This figure is based on data in a supplementary table available online—Table S9.3.

Figure 9.3: Rates (per 1,000 people) of years of life lost (YLL) by age, Indigenous Australians, 2003 and 2011

Changes in YLL rates by disease group

For most disease groups there was a decline in the age-standardised rates of fatal burden (YLL) for Indigenous Australians between 2003 and 2011 (Table 9.4). The largest declines were observed for cardiovascular diseases (decline of 18 YLL per 1,000; rate ratio 0.8) and infectious diseases (decline of 4 YLL per 1,000; rate ratio 0.6). Smaller declines were also observed for endocrine disorders (including diabetes) and injuries.

There was a small increase in Indigenous age-standardised YLL rates between 2003 and 2011 for cancer (increase of 3 YLL per 1,000; rate ratio of 1.1), neurological conditions (increase of 1 YLL per 1,000; rate ratio of 1.1) and blood & metabolic disorders (rate ratio of 1.2).

Table 9.4: Change in fatal burden (YLL) between 2003 and 2011, by disease group, Indigenous Australians

	2003 YLL ASR	2011 YLL ASR	ASR rate difference 2003 to 2011	ASR rate ratio 2011:2003
Cardiovascular	80.9	62.7	–18.2	0.8
Cancer	52.3	55.3	3.0	1.1
Injuries	39.6	37.0	–2.6	0.9
Endocrine	20.5	17.1	–3.4	0.8
Respiratory	18.1	16.0	–2.0	0.9
Gastrointestinal	16.2	14.0	–2.2	0.9
Kidney/urinary	9.9	9.9	–	1.0
Neurological	8.4	9.7	1.2	1.1
Infant/congenital	9.9	8.3	–1.6	0.8
Infectious diseases	11.3	7.0	–4.4	0.6
Blood/metabolic	2.9	3.3	0.5	1.2
Mental/substance use	4.1	3.1	–1.0	0.8
Musculoskeletal	2.3	1.6	–0.7	0.7
Skin	0.8	0.6	–0.2	0.7
Other disease groups[(a)]	0.3	0.2	–0.2	0.5
Total	**277.6**	**245.8**	**–31.8**	**0.9**

(a) Includes reproductive & maternal conditions, oral disorders and hearing & vision disorders.

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.
4. The numbers may not add to total for relevant columns due to rounding.

Disease-specific changes in YLL rates

Table 9.5 shows the top ranking causes of fatal burden for Indigenous Australians in 2011 compared with 2003. There were substantial changes between 2003 and 2011 contributing to the overall decrease in YLL age-standardised rates:

- CHD had a much lower age-standardised YLL rate in 2011 compared with 2003 (decline of 13 YLL per 1,000 people; rate ratio 0.7). Stroke, diabetes and lower respiratory infections also had lower age-standardised YLL rates in 2011 than in 2003 (declines of between 3 and 4 YLL per 1,000).
- Liver cancer, lung cancer and poisoning showed increases in age-standardised YLL rates between 2003 and 2011. The increase for poisoning may in part be explained by changes in coding practices (see Section 10.2 Injuries in 'Chapter 10 Overview of results by disease group').

In terms of ranking, the same 4 diseases were the leading causes of fatal burden for Indigenous Australians in both 2003 and 2011. Lung cancer increased in rank (from 7th to 5th), as did COPD (from 10th to 7th).

Table 9.5: Change in fatal burden (YLL) between 2003 and 2011, by top ranking diseases in 2011[(a)], Indigenous Australians

Disease	Rank 2003	2003 YLD ASR	2011 YLD ASR	ASR rate difference 2003 to 2011	ASR rate ratio 2011:2003	Rank 2011
Coronary heart disease	1	49.5	36.6	–12.9	0.7	1
Suicide & self-inflicted injuries	2	12.2	12.2	0.1	1.0	2
Diabetes	3	20.0	16.9	–3.1	0.8	3
RTI—motor vehicle occupants	4	6.7	6.1	–0.6	0.9	4
Lung cancer	7	13.2	14.4	1.3	1.1	5
Chronic liver disease	5	10.6	9.3	–1.3	0.9	6
COPD	10	12.9	12.0	–1.0	0.9	7
Poisoning	15	3.7	5.5	1.8	1.5	8
Stroke	6	14.9	11.1	–3.7	0.7	9
Pre-term birth & LBW complications	12	1.9	2.3	0.4	1.2	10
Homicide & violence	9	4.3	4.2	–0.1	1.0	11
Chronic kidney disease	14	8.4	8.4	0.0	1.0	12
SIDS	13	1.8	1.4	–0.5	0.7	13
Other cardiovascular diseases	20	4.0	3.8	–0.2	1.0	14
Other unintentional injuries	11	3.9	2.1	–1.8	0.5	15
Lower respiratory infections	8	7.4	3.9	–3.5	0.5	16
Bowel cancer	25	4.1	4.3	0.2	1.1	17
Other disorders of infancy	19	1.1	1.0	–0.1	0.9	18
Birth trauma & asphyxia	16	1.4	1.0	–0.4	0.7	19
Liver cancer	43	2.0	4.0	2.0	2.0	20

(a) Rankings based on Indigenous YLL counts in each reference year—proportional contribution of each disease to total YLL.

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.

9.3 Changes in risk factors

This section describes changes in the total burden (DALY) attributable to selected risk factors experienced by Indigenous Australians between 2003 and 2011. 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, dietary risk factors (except fruit and vegetables), high blood plasma glucose, child sexual abuse and unimproved sanitation.

Overall change in attributable burden

The 13 risk factors able to be measured in 2003 contributed 32% of the total burden experienced by Indigenous Australians in 2003. These same risk factors contributed 33% of the total burden in 2011, indicating there was a small increase in the proportion of burden attributable to these common risk factors between the 2 reference years.

Changes in attributable burden by risk factor

After removing the impact of the increasing age and size of the Indigenous population (using age-standardised rates), large declines were observed in the rates of burden attributed to high blood pressure (decline of 9 DALY per 1,000; 23% decline); physical inactivity (decline of 8 DALY per 1,000; 22% decline), and high cholesterol (decline of 7 DALY per 1,000; 37% decline) between 2003 and 2011. Smaller declines were also observed for diet low in fruit and diet low in vegetables (Table 9.6).

Conversely, between 2003 and 2011, the age-standardised rates of attributable burden increased for intimate partner violence (increase of 1 DALY per 1,000; 23% increase).

There was little change in the age-standardised rates of attributable burden due to tobacco use, high body mass and alcohol use for Indigenous Australians between 2003 and 2011 (see Box 9.2 for further information).

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 attribution of risk factors to disease burden. Possible reasons behind each change are too complex to explore within the scope of this report. However, case studies of tobacco and high body mass are provided in Box 9.2.

Table 9.6: Change in attributable burden due to selected risk factors between 2003 and 2011, Indigenous Australians

Risk factor	2003 attributable DALY ASR per 1,000	2011 attributable DALY ASR per 1,000	ASR rate difference per 1,000	Change in ASR (%)	Rate ratio (2011:2003)
Tobacco use	74.9	72.5	–2.4	–3.2	1.0
High body mass	44.8	44.1	–0.7	–1.6	1.0
Alcohol use	31.2	29.1	–2.1	–6.8	0.9
Physical inactivity	36.8	28.8	–8.0	–21.7	0.8
High blood pressure	37.0	28.5	–8.5	–23.1	0.8
Diet low in fruit	16.7	13.5	–3.2	–19.2	0.8
Drug use	12.8	13.3	0.5	4.1	1.0
High cholesterol	19.6	12.4	–7.2	–36.7	0.6
Diet low in vegetables	12.1	9.6	–2.5	–20.9	0.8
Intimate partner violence	3.8	4.7	0.9	22.6	1.2
Occupational exposures and hazards	4.3	4.6	0.2	5.3	1.1
Unsafe sex	2.9	2.9	–	1.5	1.0
Low bone mineral density	0.7	0.7	–	–5.0	1.0
Joint effect of 13 listed risk factors	**182.1**	**171.4**	**–10.7**	**–5.9**	**0.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as 2011 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2011 ASR divided by 2003 ASR.
4. The rates in the table cannot be added together and do not add up to the joint effect row as the risk factors are analysed independently.

Box 9.2: Case studies of changes in attributable burden

Tobacco use

Despite the substantial decline in Indigenous smoking rates that has occurred since 2002 (from 49% to 42%), there was little change in the ASR (rate ratio 1.0) of attributable DALY for tobacco use in 2011 compared with that for 2003 (Table 9.6). 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 have increased, this was outweighed by a large decrease in the burden of 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

There was little change in the ASR (rate ratio 1.0) of attributable DALY for high body mass in 2011 compared with 2003 in the Indigenous population (Table 9.6). High body mass is linked to a number of different diseases—the most prevalent being cardiovascular diseases, followed by endocrine disorders (including diabetes), kidney & urinary diseases and cancer. There was a fall in the ASR for the burden of cardiovascular diseases due to high body mass, but this was balanced by an increase in the non-fatal burden of endocrine disorders and kidney & urinary diseases and a smaller increase in cancer.

9.4 Changes in the gap

Age-standardised rates, rate ratios and rate differences have been used as measures of the gap in disease burden between the Indigenous and non-Indigenous populations. As mentioned earlier, using age-standardised rates takes into account the differences in the age distributions of the 2 populations.

Changes in the overall health gap

After removing differences in population size and age structure, the overall gap in total disease burden between Indigenous and non-Indigenous Australians remained relatively stable between 2003 and 2011 (DALY rate differences of 248 and 244 per 1,000; rate ratios of 2.2 and 2.3 respectively) (Table 9.7). However the gap in non-fatal burden increased by 15% (increase in YLD rate difference from 78 to 90 YLD per 1,000 people), while the gap in fatal burden decreased by 9% (decrease in the YLL rate difference from 170 to 155 YLL per 1,000 people).

Table 9.7: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status, 2003 and 2011

	Indigenous age-standardised rate	Non-Indigenous age-standardised rate	ASR rate ratio	ASR rate difference
Total burden (DALY)				
2003	454.0	205.9	2.2	248.1
2011	429.4	185.0	2.3	244.4
Non-fatal burden (YLD)				
2003	176.4	98.2	1.8	78.2
2011	183.6	94.0	2.0	89.6
Fatal burden (YLL)				
2003	277.6	107.7	2.6	169.9
2011	245.8	91.0	2.7	154.8

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
3. ASR rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.

There was a slightly greater difference in the gap in total disease burden, fatal burden and non-fatal burden for males than females between 2003 and 2011. For example, there was a 17% increase in the YLD gap between Indigenous and non-Indigenous males compared to a 13% increase in the gap between Indigenous and non-Indigenous females; and there was a 9% decline in the YLL gap for males compared to an 8% decline for females (Appendix Table D3).

Changes in the gap by disease group

Table 9.8 presents age-standardised DALY rate ratios and rate differences for each disease group in 2003 and 2011 as well as an indication of the direction of the change in these measures of the gap between the 2 time points. Equivalent tables by sex and for fatal and non-fatal burden including the Indigenous and non-Indigenous age-standardised rates for 2003 and 2011 can be found in Appendix tables D4–D6.

Table 9.8: Gap measures of total burden (DALY rate ratios and rate differences per 1,000 people) by disease group, 2003 and 2011

	DALY Rate ratio			DALY Rate difference (per 1,000)			
Disease group	**2003**	**2011**	**Direction of change**	**2003**	**2011**	**Direction of change**	**Change in DALY rate difference 2003 to 2011**
Cardiovascular	2.6	2.8	↑	55.4	46.2	↓	–9.2
Mental/substance use	2.4	2.4	—	32.8	34.1	↑	1.4
Injuries	2.6	3.0	↑	29.6	33.3	↑	3.8
Respiratory	2.4	2.5	↑	23.2	23.5	↑	0.3
Cancer	1.4	1.7	↑	16.0	23.1	↑	7.1
Endocrine	6.1	5.4	↓	20.7	17.9	↓	–2.8
Kidney/urinary	6.6	6.8	↑	12.3	12.7	↑	0.4
Neurological	2.2	2.0	↓	13.1	11.8	↓	–1.3
Gastrointestinal	3.0	2.8	↓	12.5	10.6	↓	–1.9
Musculoskeletal	1.2	1.4	↑	5.4	8.7	↑	3.2
Infectious diseases	4.1	3.9	↓	12.4	8.4	↓	–3.9
Infant/congenital	1.9	1.9	—	5.7	4.7	↓	–1.0
Blood/metabolic	2.6	3.0	↑	3.5	4.2	↑	0.7
Hearing/vision	1.7	1.6	↓	2.5	2.4	↓	–0.1
Oral	1.6	1.6	—	2.4	2.3	↓	—
Skin	1.3	1.1	↓	0.9	0.5	↓	–0.4
Reproductive/maternal	1.0	1.0	—	—	—	—	—
Total all diseases	**2.2**	**2.3**	↑	**248.1**	**244.4**	↓	**–3.7**

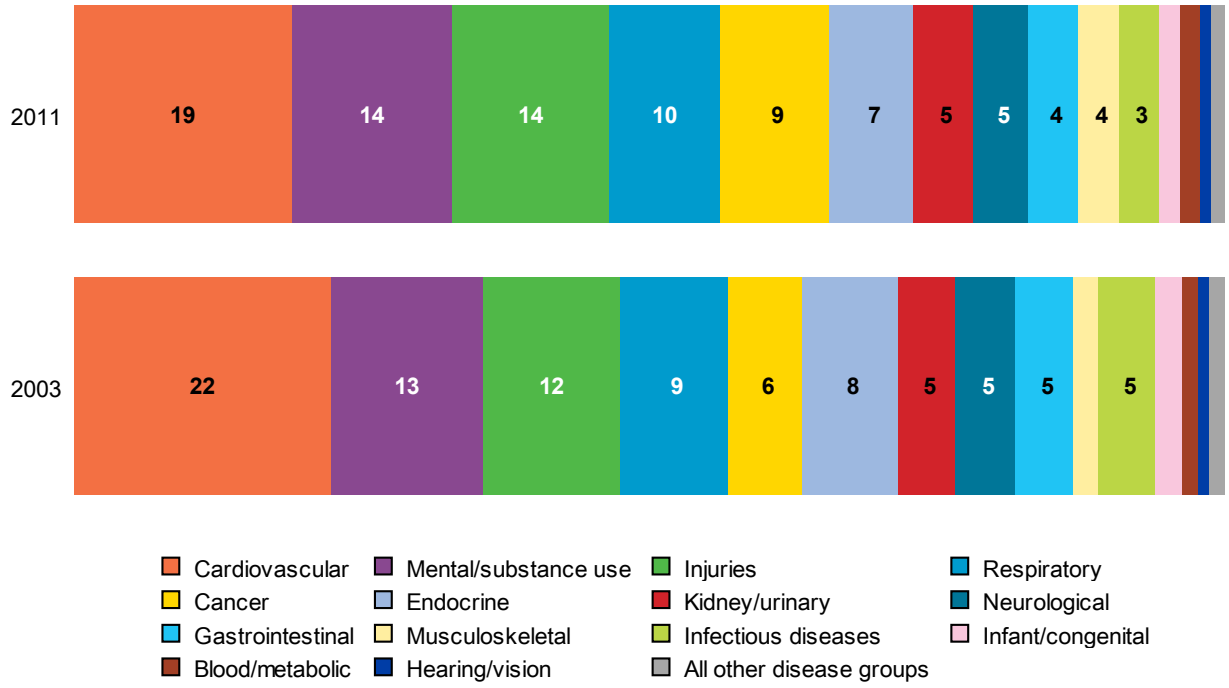
Notes

1. Rate differences and rate ratios are calculated based on rates age-standardised to the 2001 Australian Standard Population, and expressed per 1,000 people.
2. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
3. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
4. The numbers may not add to total for all columns due to rounding.

Over the period 2003 to 2011, there was an increase in the health gap between Indigenous and non-Indigenous Australians as measured by the DALY rate difference for about half of the 17 disease groups, although in most cases the increase was modest (less than 15%) (Table 9.8):

- The largest increases in the absolute gap were observed for cancer (increase in DALY rate difference of 7 per 1,000 people) and injuries (increase of 4 DALY per 1,000). These disease groups also had increases in the relative gap as measured by rate ratios.
- The largest decreases in the absolute gap were observed for cardiovascular diseases (decline in the DALY rate difference of 9 per 1,000) and infectious diseases (decline of 4 DALY per 1,000). These disease groups also had declines in the relative gap as measured by rate ratios.

Cardiovascular diseases, mental & substance use disorders and injuries were the 3 leading disease groups contributing to the gap in total burden in both 2003 and 2011 (as measured by the DALY rate difference) (Figure 9.4). However cardiovascular diseases were responsible for a smaller proportion of the gap in 2011 than in 2003 (19% compared to 22%). Conversely, injuries, cancer and musculoskeletal conditions were responsible for a larger proportion of the gap in 2011 than in 2003.



Note: Per cent labels are not shown for disease groups contributing less than 3% of gap.

Source: This figure is based on data in a supplementary table available online—Table S9.4.

Figure 9.4: Percentage contribution (%) of leading disease groups to the gap in total disease burden between Indigenous and non-Indigenous Australians (based on DALY rate differences), 2003 and 2011

Changes in the risk factors contributing to the gap

Between 2003 and 2011, the age-standardised rate of disease burden attributed to physical inactivity, high cholesterol and high blood pressure declined for both Indigenous and non-Indigenous Australians (Appendix Table D7). In terms of changes in the gap between Indigenous and non-Indigenous Australians for these risk factors there was:

- a narrowing of the gap (decrease in both the DALY rate ratio and rate difference) for physical inactivity, indicating that the declines in burden observed for the Indigenous population were greater than for the non-Indigenous population (Table 9.9).
- an increase in the DALY rate ratio but a decrease in the DALY rate difference for high blood pressure, indicating that the absolute difference in rates of burden due to this risk factor decreased between 2003 and 2011, but the relative difference has increased.

For tobacco use, high body mass and alcohol use, there was little change in measures of the gap in attributable burden between Indigenous and non-Indigenous Australians. However, the rate ratio for tobacco use has increased, which reflects a notable decline in the age-standardised DALY rate for tobacco use for non-Indigenous Australians compared with a smaller decline for Indigenous Australians. There was little change in the age-standardised rates of attributable burden for both Indigenous and non-Indigenous Australians for high body mass and alcohol use between 2003 and 2011.

Table 9.9: Measures of the gap in disease burden between Indigenous and non-Indigenous Australians attributable to risk factors (DALY rate ratios and rate differences per 1,000 people), 2011 and 2003

	DALY Rate ratio			DALY Rate difference (per 1,000)			
Risk factor	2003	2011	Direction of change	2003	2011	Direction of change	Change in DALY rate difference 2003 to 2011
Tobacco use	3.9	4.6	↑	55.6	56.9	—	1.3
High body mass	4.7	4.6	—	35.3	34.5	—	–0.8
Alcohol use	3.0	3.1	—	20.8	19.7	—	–1.1
Physical inactivity	3.5	3.3	↓	26.2	20.0	↓	–6.2
High blood pressure	2.8	3.3	↑	23.6	19.9	↓	–3.8
Diet low in fruit	3.6	4.0	↑	12.1	10.1	↓	–2.0
Drug use	4.2	4.2	—	9.7	10.1	↑	0.4
High cholesterol	2.7	3.0	↑	12.4	8.2	↓	–4.2
Diet low in vegetables	3.9	4.0	—	9.0	7.2	↓	–1.8
Intimate partner violence	4.3	5.4	↑	2.9	3.8	↑	0.9
Occupational exposures and hazards	1.7	1.8	↑	1.8	2.1	↑	0.3
Unsafe sex	3.4	3.9	↑	2.0	2.2	—	0.1
Low bone mineral density	1.7	2.8	↑	0.3	0.4	—	0.1

Notes

1. Rate differences and rate ratios are calculated based on rates age-standardised to the 2001 Australian Standard Population, and expressed per 1,000 people.
2. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR for each year.
3. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR for each year.

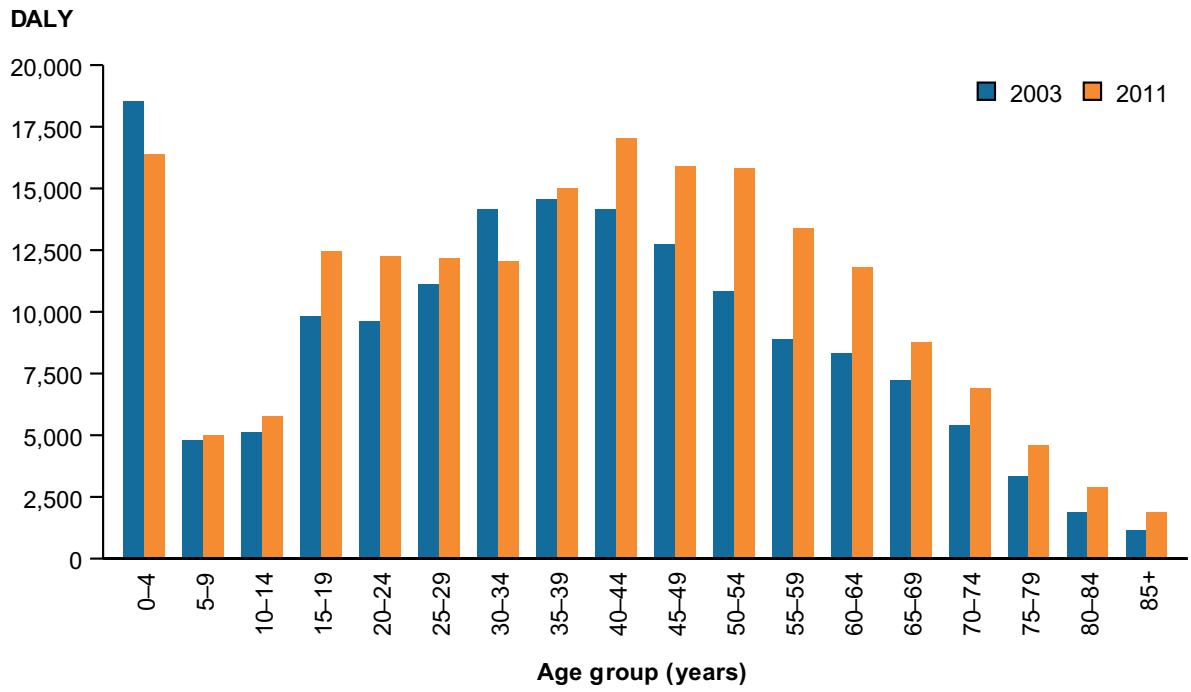
9.5 Changes in numbers of DALY, YLL and YLD

This section presents changes in the absolute number of DALY, YLL and YLD between 2003 and 2011 for Indigenous Australians. Increases in these numbers are generally expected due to changes in population size and ageing between 2003 and 2011. However changes in the underlying disease prevalence or mortality may also be contributing to the changes in the number of DALY, YLL and YLD observed, which is explored further in Section 9.6.

Change in number of DALY

The absolute number of total DALY for Indigenous Australians increased between 2003 and 2011 by 18% (from 161,729 to 190,227 DALY).The number of DALY increased between 2003 and 2011 for all age groups, with the exception of those aged 0–4 and 30–34 (Figure 9.5).

All disease groups except for infectious diseases and infant & congenital conditions contributed to the overall increase in DALY for Indigenous Australians (Table 9.10). Mental & substance use disorders and cancer contributed the most to the increased number of DALY for Indigenous Australians between 2003 and 2011. Kidney & urinary diseases and cancer had the greatest increase in the proportion of DALY for Indigenous Australians over this period (increases of 47% and 39% respectively).



Source: This figure is based on data in a supplementary table available online—Table S9.5.

Figure 9.5: Number of DALY by age, Indigenous Australians, 2003 and 2011

Table 9.10: Change in number of DALY between 2003 and 2011, by disease group, Indigenous Australians

	Number of DALY			
Disease group	**2003 DALY**	**2011 DALY**	**Change in DALY**	**Change in DALY (%)**
Mental/substance use	29,407	36,223	6,816	23.2
Injuries	23,989	28,790	4,801	20.0
Cardiovascular	22,572	23,771	1,199	5.3
Cancer	12,801	17,847	5,046	39.4
Respiratory	11,910	15,085	3,174	26.7
Musculoskeletal	10,111	12,704	2,593	25.6
Infant/congenital	11,979	10,770	–1,209	–10.1
Endocrine	6,086	7,863	1,778	29.2
Neurological	6,361	7,587	1,225	19.3
Gastrointestinal	6,221	6,896	675	10.9
Infectious diseases	7,570	6,069	–1,501	–19.8
Kidney/urinary	3,199	4,687	1,488	46.5
Oral	2,601	3,250	649	25.0
Blood/metabolic	2,292	3,002	710	31.0
Skin	2,058	2,383	325	15.8
Hearing/vision	1,681	2,188	507	30.2
Reproductive/maternal	891	1,112	222	24.9
Total	**161,729**	**190,227**	**28,498**	**17.6**

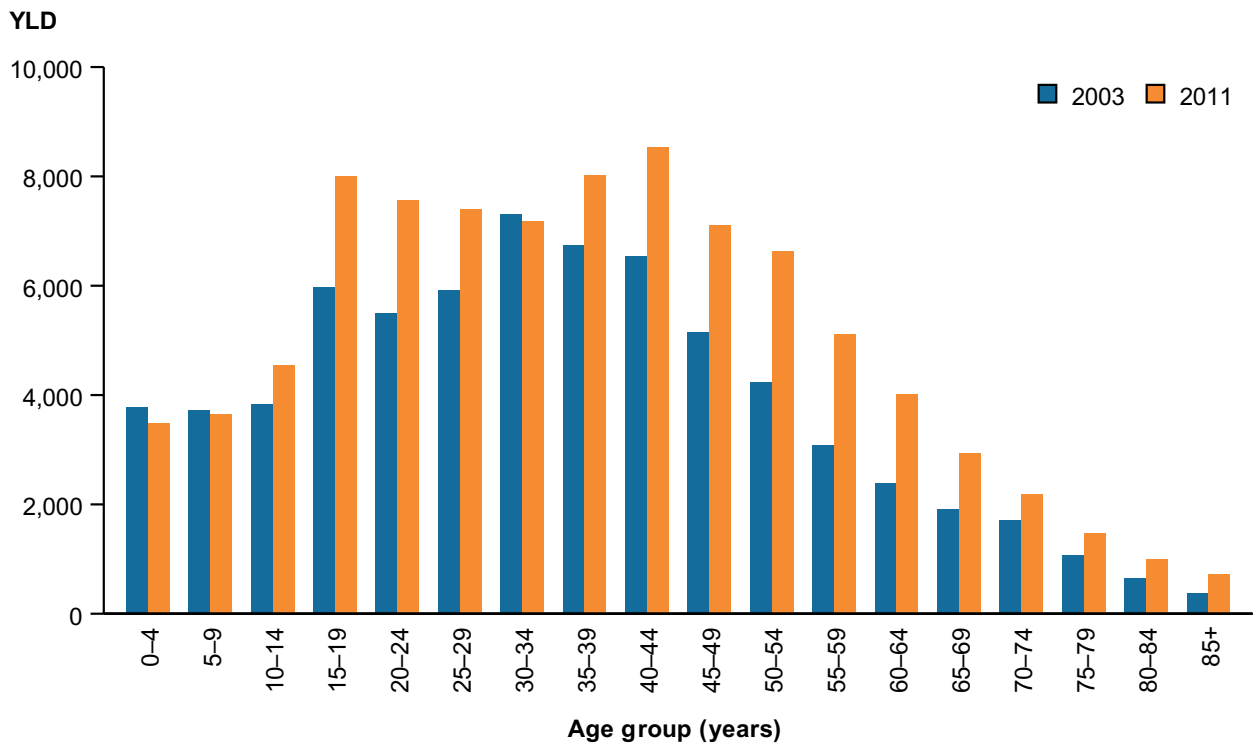
Notes

1. Change in DALY is calculated as 2011 DALY minus 2003 DALY.
2. Change in DALY (%) is calculated as 100 x (2011 DALY minus 2003 DALY) divided by 2003 DALY.
3. The numbers may not add to total for all columns due to rounding.

Change in number of YLD

There was a 28% increase in the total number of YLD between 2003 and 2011 for Indigenous Australians, from 69,856 to 89,564 YLD. The increase in YLD occurred in almost all age groups, and was largest in the 15–24 and 40–64 age groups (Figure 9.6).

All disease groups except for infectious diseases contributed to the overall increase in YLD for Indigenous Australians (Table 9.11). Mental & substance use disorders and musculoskeletal conditions contributed the most to the increased number of YLD for Indigenous Australians between 2003 and 2011. Injuries, kidney & urinary diseases and endocrine disorders (which includes diabetes) had the greatest increase in the proportion of YLD for Indigenous Australians over this period (increases of 90%, 73% and 54% respectively).



Source: This figure is based on data in a supplementary table available online—Table S9.6.

Figure 9.6: Number of YLD by age, Indigenous Australians, 2003 and 2011

Table 9.11: Change in number of YLD between 2003 and 2011, by disease group, Indigenous Australians

	Number of YLD			
Disease group	**2003 YLD**	**2011 YLD**	**Change in YLD**	**Change in YLD (%)**
Mental/substance use	27,950	34,968	7,018	25.1
Musculoskeletal	9,409	12,127	2,718	28.9
Respiratory	7,966	10,453	2,487	31.2
Neurological	3,951	4,723	772	19.6
Injuries	2,376	4,523	2,146	90.3
Oral	2,597	3,234	637	24.5
Cardiovascular	2,149	2,801	652	30.3
Infectious diseases	2,965	2,799	–166	–5.6
Endocrine	1,624	2,504	880	54.2
Skin	1,853	2,200	347	18.7
Hearing/vision	1,681	2,188	507	30.2
Blood/metabolic	1,416	1,690	274	19.4
Kidney/urinary	929	1,607	677	72.9
Gastrointestinal	992	1,220	228	22.9
Infant/congenital	927	1,037	109	11.8
Reproductive/maternal	746	1,014	268	35.9
Cancer	323	477	154	47.5
Total	**69,856**	**89,564**	**19,708**	**28.2**

Notes

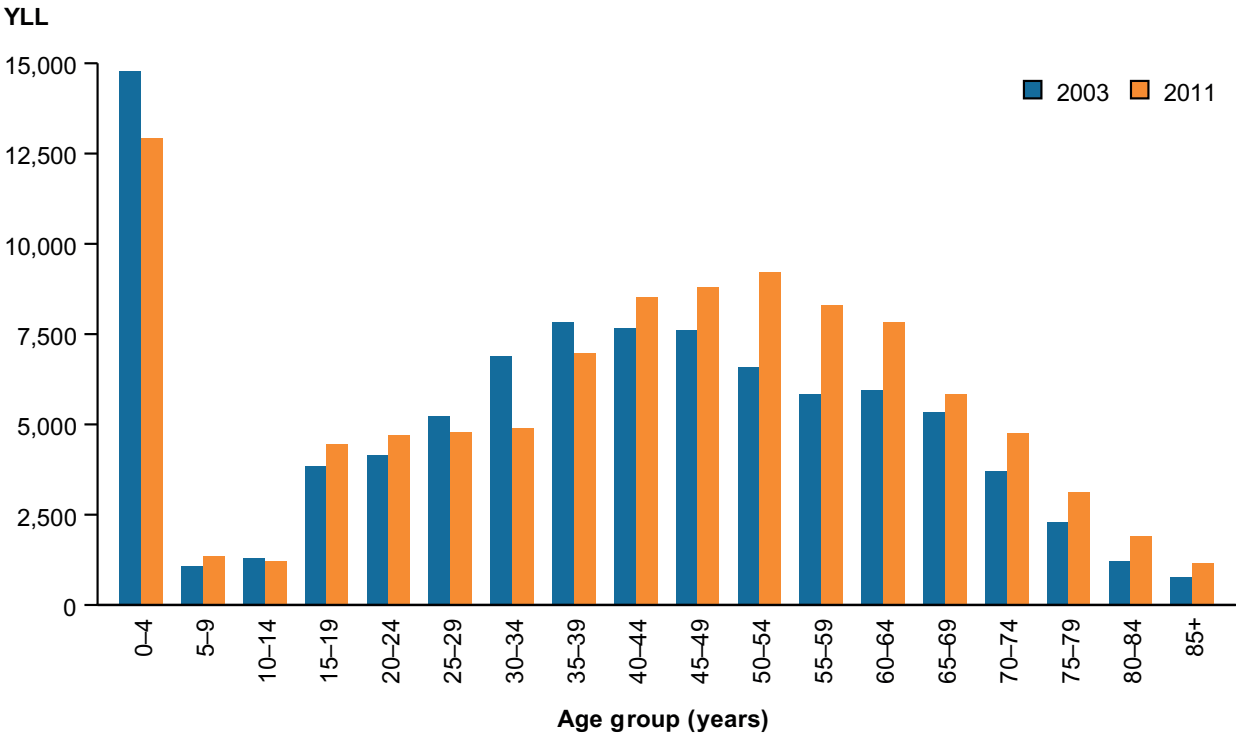
1. Change in YLD is calculated as 2011 YLD minus 2003 YLD.
2. Change in YLD (%) is calculated as 100 x (2011 YLD minus 2003 YLD) divided by 2003 YLD.
3. The numbers may not add to total for all columns due to rounding.

Change in number of YLL

Overall, the total YLL for Indigenous Australians was 9.6% higher in 2011 (100,663 YLL) compared with 2003 (91,873 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.

The change in number of YLL varied across age groups, and was largest at ages 45–59 (Figure 9.7).

Cancer and injuries contributed the most to the increased number of YLL for Indigenous Australians between 2003 and 2011 (Table 9.12). Blood & metabolic disorders, cancer and kidney & urinary diseases had the greatest increase in the proportion of YLL for Indigenous Australians over this period (increases of 50%, 39% and 36% respectively).



Source: This figure is based on data in a supplementary table available online—Table S9.7.

Figure 9.7: Number of YLL by age, Indigenous Australians, 2003 and 2011

Table 9.12: Change in number of YLL between 2003 and 2011, by disease group, Indigenous Australians

	Number of YLL			
Disease group	**2003 YLL**	**2011 YLL**	**Change in YLL**	**Change in YLL (%)**
Injuries	21,612	24,267	2,655	12.3
Cardiovascular	20,423	20,970	547	2.7
Cancer	12,478	17,370	4,893	39.2
Infant/congenital	11,052	9,734	–1,318	–11.9
Gastrointestinal	5,229	5,676	448	8.6
Endocrine	4,461	5,359	898	20.1
Respiratory	3,945	4,632	687	17.4
Infectious diseases	4,605	3,270	–1,335	–29.0
Kidney/urinary	2,270	3,081	811	35.7
Neurological	2,410	2,863	453	18.8
Blood/metabolic	876	1,312	436	49.7
Mental/substance use	1,457	1,255	–202	–13.9
Musculoskeletal	701	576	–125	–17.8
Skin	205	183	–22	–10.7
Other disease groups[(a)]	148	114	–35	23.3
Total	**91,873**	**100,663**	**8,790**	**9.6**

(a) Includes reproductive & maternal conditions, oral disorders and hearing & vision disorders.

Notes

1. Change in DALY is calculated as 2011 DALY minus 2003 DALY.
2. Change in DALY (%) is calculated as 100 x (2011 DALY minus 2003 DALY) divided by 2003 DALY.
3. The numbers may not add to total for all columns due to rounding.

9.6 Decomposition of changes in numbers

Distinguishing between changes due to population and changes due to disease

Age-standardised rates, rate ratios (which show how many times the rate of disease burden is from 1 time point to another) and rate differences (which show the difference in rate of disease burden from 1 time point relative to another) used here are helpful to tease out the changes in disease burden as distinct from the population size and structure. To help distinguish the impact of population increase compared with population ageing, as well as impacts of epidemiological changes (in disease prevalence, severity and mortality), we estimated:

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

(b) a hypothetical DALY/YLD/YLL for 2011 reflecting the population size increase and changes in the age and sex structure (that is with the total population size for 2011 and the age–sex structure for 2011, but with 2003 age–sex specific rates.

For change in the attributable burden due to risk factors, an additional scenario (c) was estimated which takes into account changes in risk factor exposure between 2003 and 2011.

Looking at the differences between the actual and hypothetical scenarios provides 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).
- risk factor exposure (for attributable burden only): measured as the difference between the estimates in scenarios (b) and (c).
- epidemiological change: measured as the difference between the 2011 estimates and scenario (b) (for total, non-fatal and fatal disease burden) or between the 2011 estimates and scenario (c) (for attributable burden).

Note that these scenarios do not take into account any additional changes which may be due to changes in Indigenous identification or improvements in Indigenous data quality.

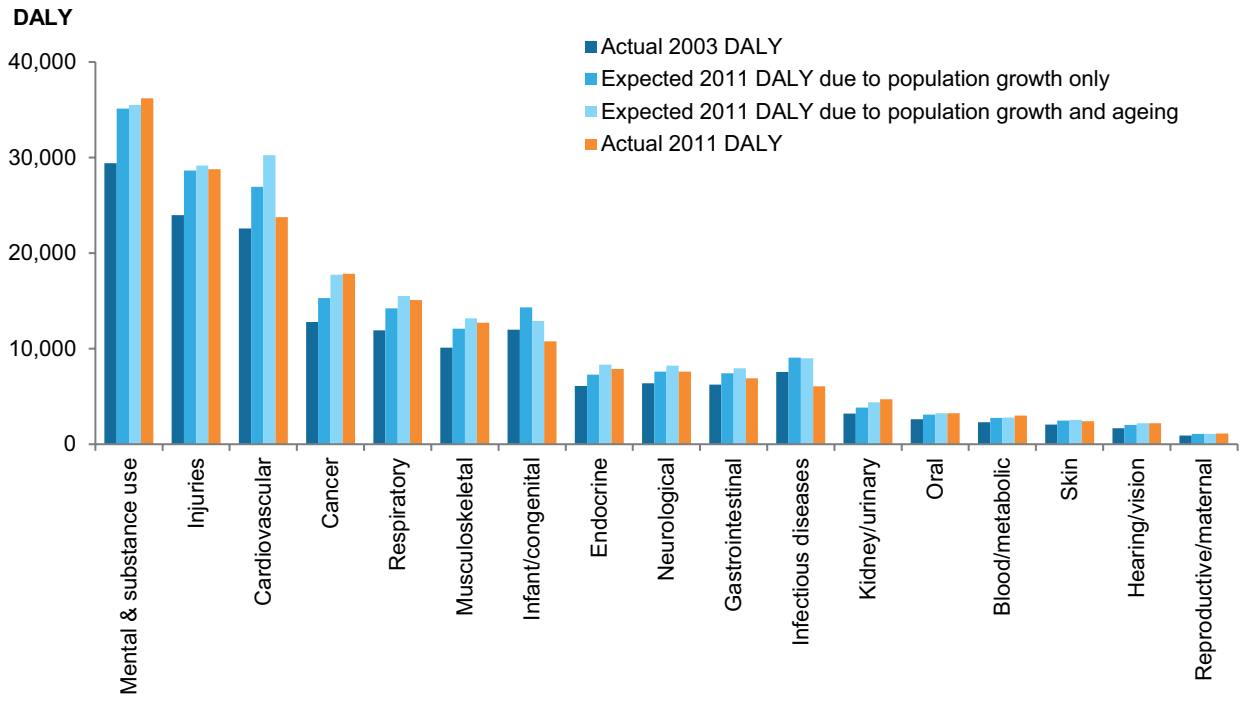
Figures 9.8, 9.9, 9.10 and tables 9.13, 9.14 and 9.15 compare the actual disease burden estimates for Indigenous Australians in 2011 for each disease group with those that would have been expected, based on population increase and ageing in the Aboriginal and Torres Strait Islander population (as estimated in the Census). Further information on the changes within each disease group, along with data quality considerations, is included in 'Chapter 10 Overview of results by disease group'.

Changes in overall disease burden due to population and epidemiological factors

The change in overall disease burden for Indigenous Australians between 2003 and 2011 was 17.6%, or an increase of 28,498 DALY. This was comprised of a 19.4% increase due to population growth, a 6.7% increase due to population ageing, and an 8.5% decrease due to epidemiological changes.

Generally, for most disease groups, the actual number of DALY in 2011 for Indigenous Australians was lower than would have been expected based on population growth and ageing (Figure 9.8; Table 9.13). This indicates an improvement in the underlying disease burden of these disease groups. Proportionally large gains were evident for cardiovascular diseases, infant & congenital conditions and infectious diseases.

Conversely, the number of actual DALY in 2011 for Indigenous Australians was higher than expected based on population changes for mental & substance use disorders, kidney & urinary diseases, blood & metabolic disorders and cancer. This could indicate an increase in the underlying prevalence or severity of conditions in these disease groups, an increase in the number of premature deaths or a decrease in the average age at death due to these disease groups, or a combination of these factors.



Source: Table 9.13.

Figure 9.8: Expected and actual DALY by disease group, 2003 to 2011, Indigenous Australians

Table 9.13: Decomposition of changes in DALY between 2003 and 2011, Indigenous Australians

Disease group	Actual 2003 DALY	Expected 2011 DALY due to population growth[a]	% change due to increasing population	Expected 2011 DALY due to increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing[c]	Actual 2011 DALY	% change from 2003 to 2011 due to disease[d]	Total % change from 2003 to 2011[e]
Mental/substance use	29,407	35,116	19.4	35,526	1.4	36,223	2.4	23.2
Injuries	23,989	28,646	19.4	29,169	2.2	28,790	–1.6	20.0
Cardiovascular	22,572	26,955	19.4	30,236	14.5	23,771	–28.6	5.3
Cancer	12,801	15,286	19.4	17,731	19.1	17,847	0.9	39.4
Respiratory	11,910	14,223	19.4	15,508	10.8	15,085	–3.6	26.7
Musculoskeletal	10,111	12,074	19.4	13,163	10.8	12,704	–4.5	25.6
Infant/congenital	11,979	14,305	19.4	12,893	–11.8	10,770	–17.7	–10.1
Endocrine	6,086	7,267	19.4	8,339	17.6	7,863	–7.8	29.2
Neurological	6,361	7,596	19.4	8,205	9.6	7,587	–9.7	19.3
Gastrointestinal	6,221	7,428	19.4	7,946	8.3	6,896	–16.9	10.9
Infectious diseases	7,570	9,040	19.4	9,003	–0.5	6,069	–38.8	–19.8
Kidney/urinary	3,199	3,821	19.4	4,397	18.0	4,687	9.1	46.5
Oral	2,601	3,106	19.4	3,251	5.6	3,250	0.0	25.0
Blood/metabolic	2,292	2,737	19.4	2,782	2.0	3,002	9.6	31.0
Skin	2,058	2,458	19.4	2,545	4.2	2,383	–7.9	15.8
Hearing/vision	1,681	2,007	19.4	2,195	11.2	2,188	–0.4	30.2
Reproductive/maternal	891	1,064	19.4	1,081	2.0	1,112	3.5	24.9
Total	**161,729**	**193,127**	**19.4**	**203,969**	**6.7**	**190,227**	**–8.5**	**17.6**

(a) Estimated by increasing DALY from 2003 by 19.4% to match the increase in the Indigenous Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to the 2011 Indigenous population.

(c) Calculated as the difference between the expected 2011 DALY due to increasing and ageing population and the expected 2011 DALY due to population growth, expressed as a proportion of the 2003 DALY.

(d) Calculated as the difference between the actual 2011 DALY and the expected 2011 DALY due to increasing and ageing population, expressed as a proportion of the 2003 DALY.

(e) Calculated as the difference between the actual 2011 DALY and the actual 2003 DALY, expressed as a proportion of the 2003 DALY.

Note: The numbers may not add to total for all columns due to rounding.

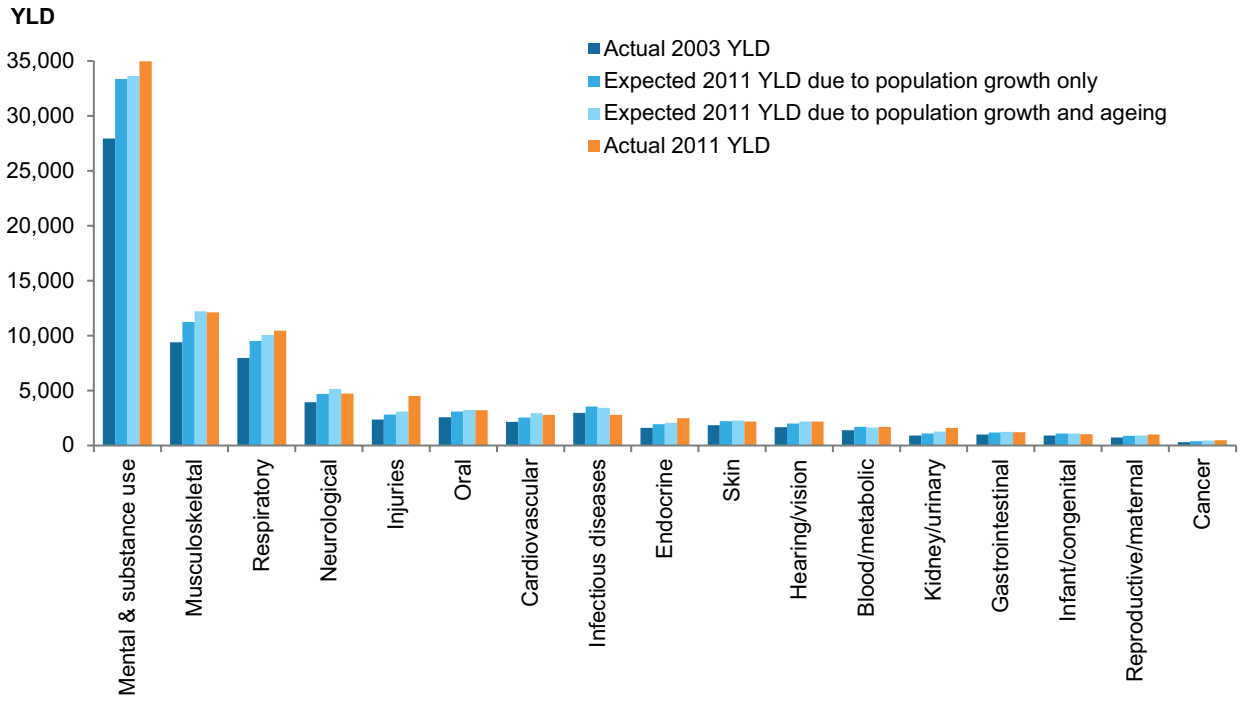
Changes in non-fatal burden

The change in non-fatal disease burden for Indigenous Australians between 2003 and 2011 was 28.2%, or an increase of 19,708 YLD. This comprised a 19.4% increase due to population growth, a 5.2% increase due to population ageing, and a 3.6% increase due to epidemiological changes.

For many disease groups, the actual number of YLD for Indigenous Australians in 2011 was similar to what would be expected based on population growth and ageing since 2003 (Figure 9.9; Table 9.14). However, YLD for infectious diseases, neurological conditions and infant & congenital conditions was lower than would have been expected over this time period, indicating a potential decrease in the underlying prevalence or severity of these diseases.

Conversely, there were larger than expected increases in the number of YLD for Indigenous Australians for injuries, mental & substance use disorders, endocrine disorders (including diabetes), kidney & urinary diseases, respiratory diseases, reproductive & maternal conditions and cancer.

While there has been some reduction in the non-fatal burden due to certain disease groups (in particular, in infectious diseases) between 2003 and 2011, increases in underlying disease prevalence for a number of disease groups, coupled with population growth and ageing, is increasing the overall amount of YLD in the Indigenous population.



Source: Table 9.14.

Figure 9.9: Expected and actual YLD by disease group, 2003 to 2011, Indigenous Australians

Table 9.14: Decomposition of changes in YLD between 2003 and 2011, Indigenous Australians

Disease group	Actual 2003 YLD	Expected 2011 YLD due to population growth[a]	% change due to increasing population	Expected 2011 YLD due to increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing[c]	Actual 2011 YLD	% change from 2003 to 2011 due to disease[d]	Total % change from 2003 to 2011[e]
Mental/substance use	27,950	33,376	19.4	33,660	1.0	34,968	4.7	25.1
Musculoskeletal	9,409	11,236	19.4	12,221	10.5	12,127	–1.0	28.9
Respiratory	7,966	9,512	19.4	10,075	7.1	10,453	4.7	31.2
Neurological	3,951	4,718	19.4	5,161	11.2	4,723	–11.1	19.6
Injuries	2,376	2,838	19.4	3,102	11.1	4,523	59.8	90.3
Oral	2,597	3,101	19.4	3,244	5.5	3,234	–0.4	24.5
Cardiovascular	2,149	2,567	19.4	2,956	18.1	2,801	–7.2	30.3
Infectious diseases	2,965	3,541	19.4	3,442	–3.4	2,799	–21.7	–5.6
Endocrine	1,624	1,940	19.4	2,078	8.5	2,504	26.2	54.2
Skin	1,853	2,212	19.4	2,270	3.1	2,200	–3.8	18.7
Hearing/vision	1,681	2,007	19.4	2,195	11.2	2,188	–0.4	30.2
Blood/metabolic	1,415	1,690	19.4	1,651	–2.8	1,690	2.8	19.4
Kidney/urinary	929	1,110	19.4	1,274	17.6	1,607	35.8	72.9
Gastrointestinal	992	1,185	19.4	1,237	5.2	1,220	–1.7	22.9
Infant/congenital	927	1,107	19.4	1,109	0.2	1,037	–7.8	11.8
Reproductive/maternal	746	891	19.4	917	3.4	1,014	13.1	35.9
Cancer	323	386	19.4	451	20.2	477	7.9	47.5
Total	**69,856**	**83,418**	**19.4**	**87,043**	**5.2**	**89,564**	**3.6**	**28.2**

(a) Estimated by increasing YLD from 2003 by 19.4% to match the increase in the Indigenous Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to the 2011 Indigenous population.

(c) Calculated as the difference between the expected 2011 YLD due to increasing and ageing population and the expected 2011 YLD due to population growth, expressed as a proportion of the 2003 YLD.

(d) Calculated as the difference between the actual 2011 YLD and the expected 2011 YLD due to increasing and ageing population, expressed as a proportion of the 2003 YLD.

(e) Calculated as the difference between the actual 2011 YLD and the actual 2003 YLD, expressed as a proportion of the 2003 YLD.

Note: The numbers may not add to total for all columns due to rounding.

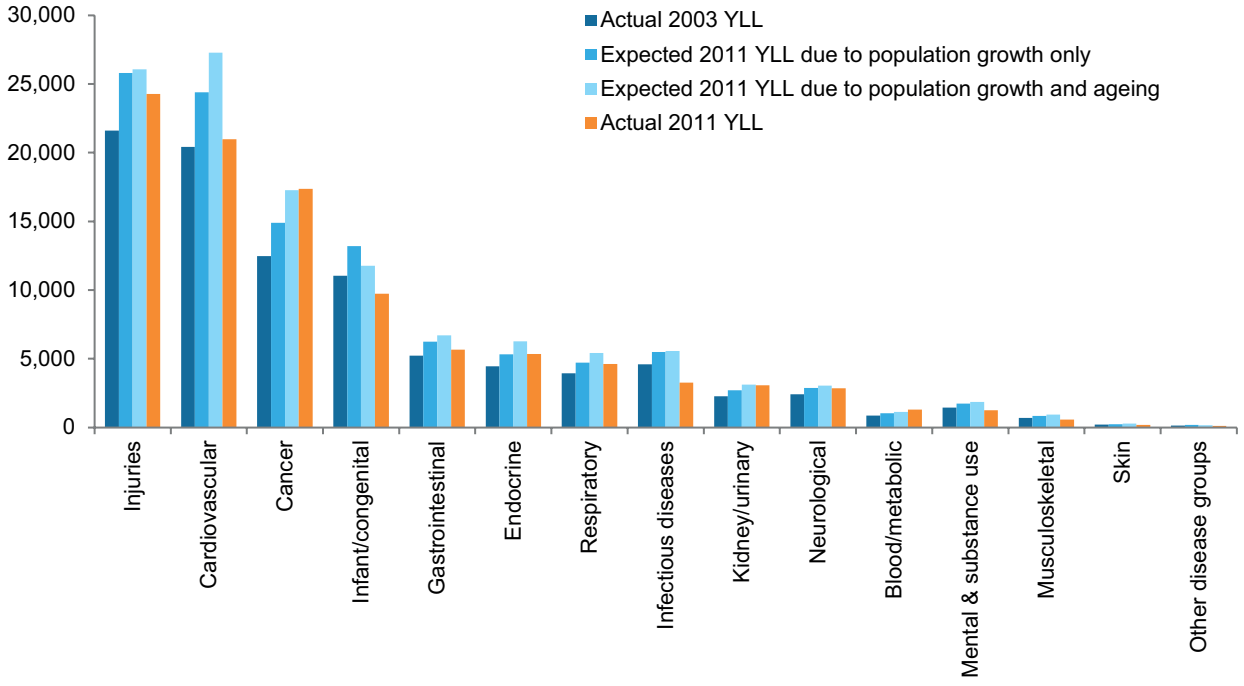
Changes in fatal burden

The change in the fatal disease burden for Indigenous Australians between 2003 and 2011 was 9.6%, or an increase of 8,790 DALY. This comprised a 19.4% increase due to population growth, a 7.9% increase due to population ageing, and a 17.7% decrease due to epidemiological changes.

In general for most disease groups, the actual number of YLL in 2011 for Indigenous Australians was lower than would have been expected based on population growth and ageing alone (Figure 9.10; Table 9.15). This indicates an improvement in the underlying mortality and/or age at death from these diseases. For Indigenous Australians, proportionally large gains were evident for cardiovascular diseases, infectious diseases, mental & substance use disorders and musculoskeletal conditions.

The number of Indigenous YLL in 2011 was higher than would be expected based on population changes since 2003 for blood & metabolic disorders, however the number of deaths in this group is quite small.

Note that differences between 2003 and 2011 YLL numbers for mental & substance use disorders and skin disorders are based on a small number of Indigenous deaths and the results are subject to volatility.



Source: Table 9.15.

Figure 9.10: Expected and actual YLL by disease group, 2003 to 2011, Indigenous Australians

Table 9.15: Decomposition of changes in YLL between 2003 and 2011, Indigenous Australians

Disease group	Actual 2003 YLL	Expected 2011 YLL due to population growth[a]	% change due to increasing population	Expected 2011 YLL due to increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing[c]	Actual 2011 YLL	% change from 2003 to 2011 due to disease[d]	Total % change from 2003 to 2011[e]
Injuries	21,612	25,808	19.4	26,066	1.2	24,267	–8.3	12.3
Cardiovascular	20,423	24,388	19.4	27,279	14.2	20,970	–30.9	2.7
Cancer	12,478	14,900	19.4	17,280	19.1	17,370	0.7	39.2
Infant/congenital	11,052	13,198	19.4	11,784	–12.8	9,734	–18.5	–11.9
Gastrointestinal	5,228	6,244	19.4	6,709	8.9	5,676	–19.8	8.6
Endocrine	4,461	5,327	19.4	6,261	20.9	5,359	–20.2	20.1
Respiratory	3,945	4,710	19.4	5,433	18.3	4,632	–20.3	17.4
Infectious diseases	4,605	5,499	19.4	5,562	1.4	3,270	–49.8	–29.0
Kidney/urinary	2,270	2,711	19.4	3,124	18.2	3,081	–1.9	35.7
Neurological	2,410	2,878	19.4	3,043	6.8	2,863	–7.5	18.8
Blood/metabolic	876	1,047	19.4	1,132	9.7	1,312	20.6	49.7
Mental/substance use	1,457	1,740	19.4	1,866	8.6	1,255	–41.9	–13.9
Musculoskeletal	701	837	19.4	942	14.9	576	–52.2	–17.8
Skin	205	245	19.4	275	14.5	183	–44.7	–10.8
Other disease groups	148	177	19.4	170	4.7	114	–42.6	–23.0
Total	**91,873**	**109,709**	**19.4**	**116,926**	**7.9**	**100,663**	**–17.7**	**9.6**

(a) Estimated by increasing YLL from 2003 by 19.4% to match the increase in the Indigenous Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to the 2011 Indigenous population.

(c) Calculated as the difference between the expected 2011 YLL due to increasing and ageing population and the expected 2011 YLL due to population growth, expressed as a proportion of the 2003 YLL.

(d) Calculated as the difference between the actual 2011 YLL and the expected 2011 YLL due to increasing and ageing population, expressed as a proportion of the 2003 YLL.

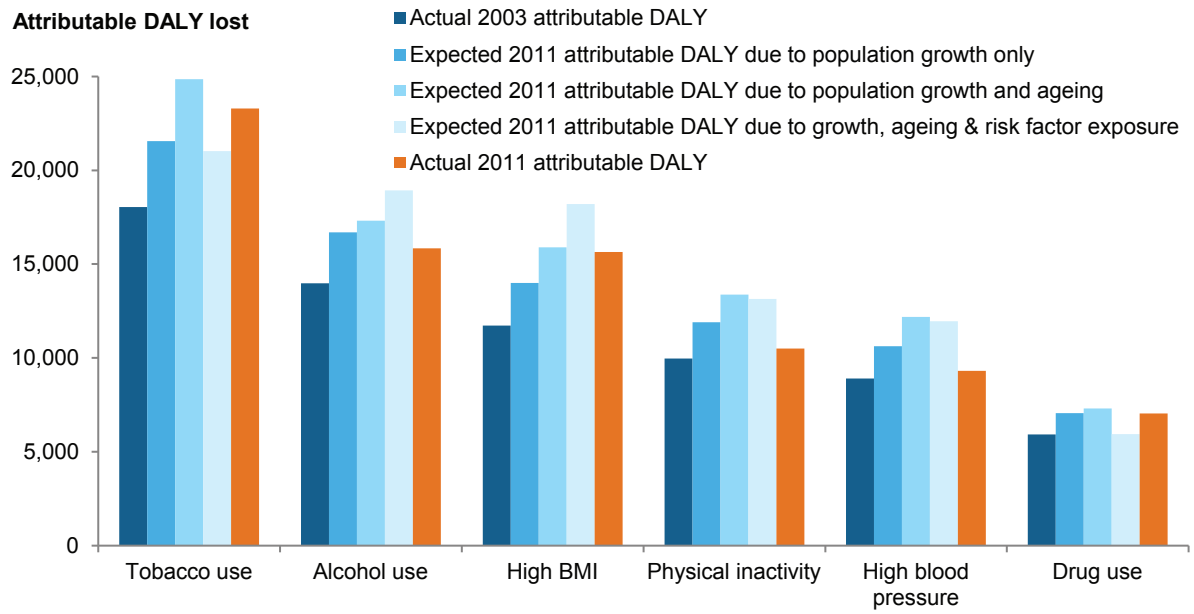
(e) Calculated as the difference between the actual 2011 YLL and the actual 2003 YLL, expressed as a proportion of the 2003 YLL.

Note: The numbers may not add to total for all columns due to rounding.

Changes in attributable burden due to risk factors

Figure 9.11 and Table 9.16 compare the actual estimates for 2011 for each risk factor to 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 per cent change in median age-adjusted PAF to the expected 2011 DALY due to population growth and ageing. These analyses consider only those risk factors that were included in both the 2003 and the 2011 estimates.

For most risk factors, the actual 2011 DALY for Indigenous Australians was lower than would have been expected based on population growth, ageing and changes in risk factor exposure (Figure 9.11). This indicates an improvement in the disease burden for specific diseases linked to these risk factors, potentially due to improved prevention or treatment of these diseases. The exceptions were tobacco use, drug use, intimate partner violence and occupational exposures and hazards, where the actual 2011 DALY were higher than expected (Table 9.16).



Source: Table 9.16.

Figure 9.11: Expected and actual attributable DALY for top 6 risk factors, 2003 to 2011, Indigenous Australians

Table 9.16: Decomposition of changes in attributable DALY between 2003 and 2011, Indigenous Australians

Risk factor	Actual 2003 attributable DALY	Expected 2011 attributable DALY due to population growth[a]	% change due to increasing population	Expected 2011 attributable DALY due to increasing and ageing population[b]	% change from 2003 to 2011 due to population ageing[c]	Expected 2011 attributable DALY due to risk factor exposure[d]	% change due to risk factor exposure[e]	Actual 2011 attributable DALY	% change from 2003 due to linked diseases[f]
Tobacco use	18,048	21,551	19.4	24,860	18.3	21,021	–15.4	23,300	10.8
Alcohol use	13,979	16,693	19.4	17,311	4.4	18,935	9.4	15,850	–16.3
High body mass	11,724	14,000	19.4	15,889	16.1	18,205	14.6	15,647	–14.1
Physical inactivity	9,967	11,902	19.4	13,378	14.8	13,150	–1.7	10,504	–20.1
High blood pressure	8,900	10,628	19.4	12,178	17.4	11,959	–1.8	9,310	–22.1
Drug use	5,914	7,062	19.4	7,300	4.0	5,938	–18.7	7,032	18.4
High cholesterol	5,721	6,832	19.4	7,586	13.2	6,676	–12.0	4,970	–25.6
Diet low in fruit	4,539	5,420	19.4	6,114	15.3	6,114	0.0	4,839	–20.9
Diet low in vegetables	3,311	3,954	19.4	4,420	14.1	4,470	1.1	3,447	–22.9
Intimate partner violence	1,856	2,216	19.4	2,239	1.2	2,242	0.1	2,679	19.5
Occupational exposures and hazards	1,569	1,874	19.4	2,045	10.9	1,854	–9.3	2,113	14.0
Unsafe sex	1,067	1,274	19.4	1,317	4.0	1,330	1.0	1,248	–6.1
Low bone mineral density	60	72	19.4	85	21.7	85	0.0	81	–4.8

(a) Estimated by increasing attributable DALY from 2003 by 19.4% to match the increase in the Indigenous Australian population between 2003 and 2011.

(b) Estimated by applying age-specific rates from 2003 to the 2011 Indigenous population.

(c) Calculated as the difference between the expected 2011 attributable DALY due to increasing and ageing population and the expected 2011 attributable DALY due to population growth, expressed as a proportion of the 2003 attributable DALY.

(d) Estimated by applying the change in age-adjusted median PAF between 2003 and 2011 to the expected 2011 attributable DALY due to increasing and ageing population, and adding to the expected 2011 attributable DALY due to increasing and ageing population.

(e) Estimated as the percentage change in age-adjusted median PAF between 2003 and 2011.

(f) Calculated as the difference between the actual 2011 attributable DALY and the expected 2011 attributable DALY due to risk factor exposure, expressed as a proportion of the expected 2011 attributable DALY due to risk factor exposure.

Note: The numbers may not add to total for all columns due to rounding.

10 Overview of results by disease group

Overview

A detailed analysis of the burden of disease (including DALY, YLL and YLD), the gap between Indigenous and non-Indigenous Australians and changes in the Indigenous burden between 2003 and 2011, is presented in this chapter for each of the following disease groups:

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

This chapter presents more detailed results for each disease group (ordered from highest to lowest burden in the Indigenous population), including changes since 2003, estimates of the gap between Indigenous and non-Indigenous Australians, and a short statement on data quality. More information on the quality of estimates is included at Appendix C and in the accompanying technical methods report for the ABDS (AIHW 2016b).

Before reading this chapter it is recommended to first read Chapters 4, 5 and 6 which provide a high level overview of results on the disease groups contributing the most to overall burden, non-fatal burden and fatal burden in the Indigenous population.

10.1 Mental & substance use disorders

Mental & substance use disorders encompasses a broad range of conditions including affective disorders (major depressive disorder, dysthymia and bipolar disorder), anxiety disorders, alcohol & drug use disorders, child behavioural & developmental disorders, schizophrenia, and intellectual disability.

It excludes suicidal behaviour, self-harm, drug poisoning and drug overdose (which are included in injuries) and dementia, a condition affecting the nervous system (which is included in neurological conditions).

In this disease group, cases of intellectual disability were only included where the underlying cause was unknown or was not modelled elsewhere in the study.

The residual cause 'other mental & substance use disorders' includes delirium, personality disorders and any remaining child disorders such as specific learning disorders, developmental disorders and sleep disorders. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Estimates for this disease group are aimed to reflect the burden of mental disorders that correspond to clinical definitions (for example, major depressive disorder) rather than broader measures of mental health commonly used when reporting information on the social and emotional wellbeing of Indigenous Australians such as psychological distress. For substance use disorders, burden was estimated for clinical drug/alcohol dependence only. As such, burden of disease estimates reported here will not capture the health loss experienced by Aboriginal and Torres Strait Islander peoples who are suffering from psychological distress and mental health issues but have not been clinically diagnosed with a disorder.

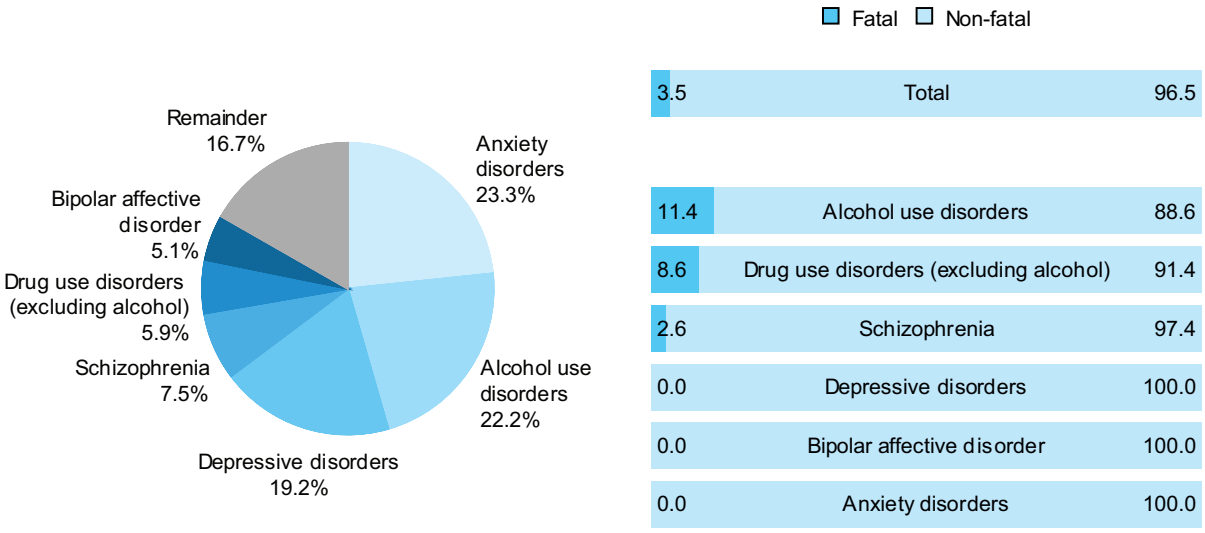
Overview

Mental & substance use disorders was responsible for 19% (36,223 DALY) of total burden that Indigenous Australians experienced in 2011, making it the leading disease group causing burden. It was also the leading cause of non-fatal burden, accounting for more than one-third (39%; 34,968 YLD) of all YLD.

The main causes of burden were anxiety disorders (representing 23% of the total burden from mental & substance use disorders), alcohol use disorders (22%), depressive disorders (19%), schizophrenia (8%) and drug use disorders (6%) (Figure 10.1.1).

Only a very small proportion (3.5%) of burden in this disease group was fatal (Figure 10.1.1), the large majority of which was due to alcohol use disorders (73% of fatal burden for mental & substance use disorders) and drug use disorders (15%).

Total burden (number of DALY) due to mental & substance use disorders peaked at ages 15–19 for Indigenous Australians, reflecting the high number of DALY estimated for this age group from a number of disorders including alcohol use disorders, depressive disorders, conduct disorder, ADHD and bipolar affective disorders (Figure 10.1.2).



Note: Remainder category includes all causes included in mental & substance use disorders not specifically listed in figure.

Figure 10.1.1: Mental & substance use disorders burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

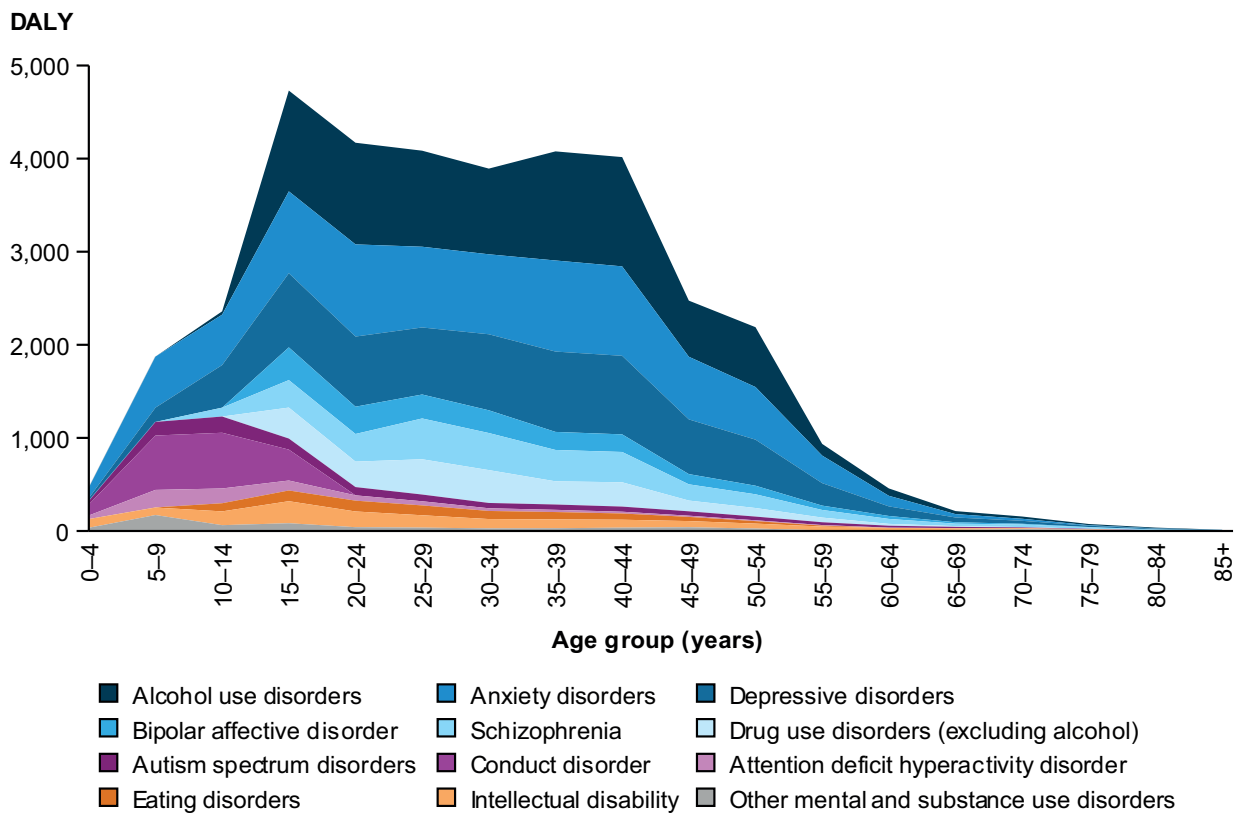


Figure 10.1.2: Mental & substance use disorder burden (DALY) by age and disease, Indigenous Australians, 2011

There were notable differences between males and females. Overall, a larger proportion of burden due to mental & substance use disorders was experienced by Indigenous males (56%; 20,088 DALY) than by Indigenous females (44%; 16,135 DALY) (Figure 10.1.3). This proportion also differed by the type of mental disorder. A larger proportion of burden was experienced by Indigenous males for autism spectrum disorders (83%), alcohol use disorders (75%), ADHD (70%), drug use disorders (70%) and schizophrenia (70%). By contrast, Indigenous females experienced a greater proportion of the burden for eating disorders (69%), bipolar affective disorders (63%), anxiety disorders (61%) and depressive disorders (58%).

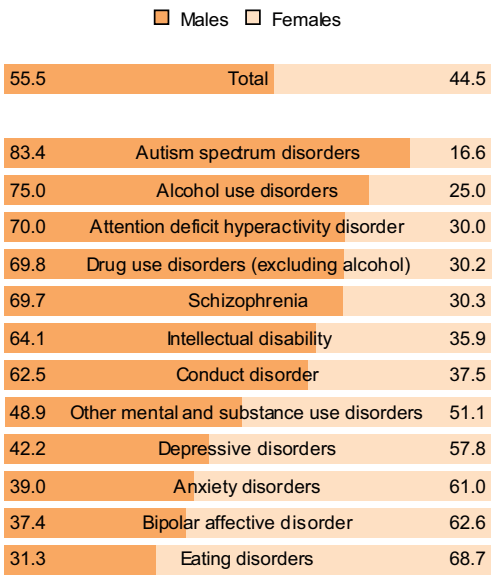


Figure 10.1.3: Mental & substance use disorders burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed around one-third (33%) to the burden for mental & substance use disorders. For this disease group, the biggest risk factors were alcohol use (22%) and childhood sexual abuse (8%) (Table 10.1.1).

Table 10.1.1: Proportion (%) of burden attributable to risk factors for mental & substance use disorders, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Alcohol use	22.2
Childhood sexual abuse	7.7
Drug use	5.9
Intimate partner violence	2.5
Joint effect of all risk factors	**33.1**

Notes

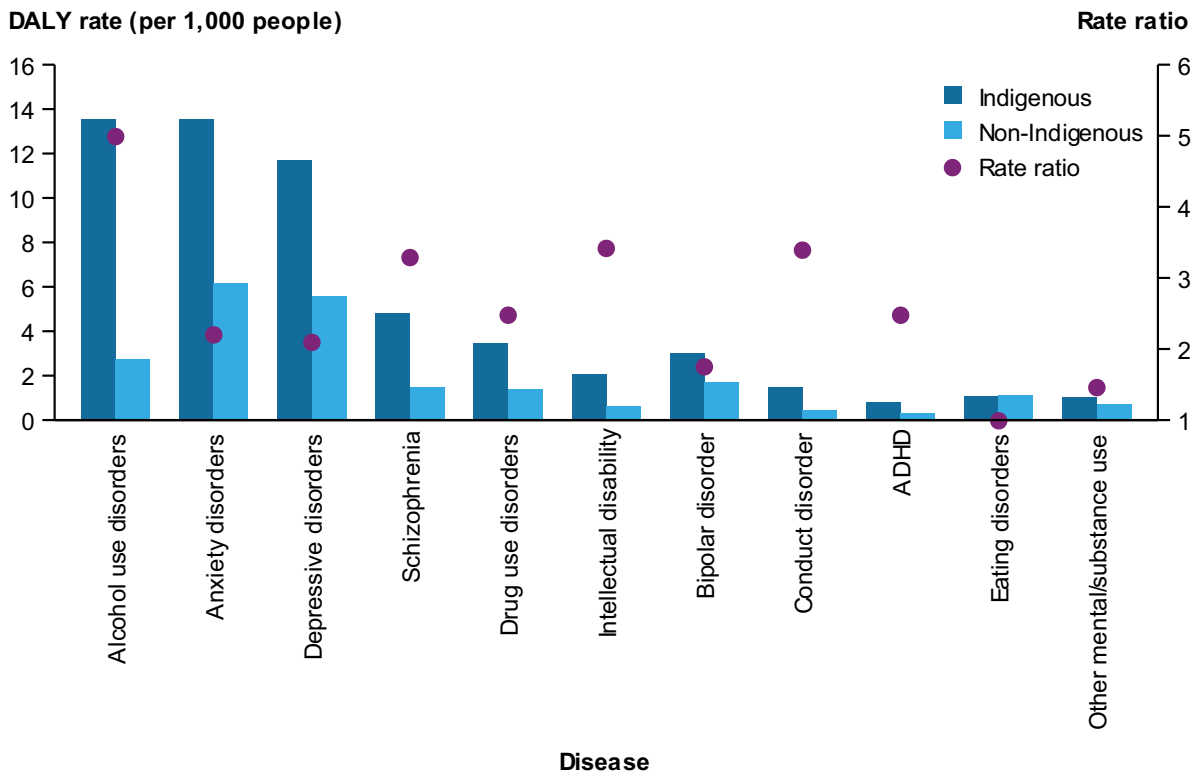
1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, the age-standardised rate of burden due to mental & substance use disorders for Indigenous Australians was 2.4 times the rate for non-Indigenous Australians (age-standardised rates of 57.8 and 23.6 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for alcohol use disorders (rate difference of 10.8 DALY per 1,000 people), anxiety disorders (rate difference of 7.4 DALY per 1,000) and depressive disorders (rate difference of 6.1 DALY per 1,000), 3 of the key contributors to the total burden due to mental & substance use disorders in both the Indigenous and non-Indigenous populations (Figure 10.1.4).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for alcohol use disorders (rate ratio of 5.0), intellectual disability (rate ratio of 3.4), conduct disorder (3.4) and schizophrenia (3.3).



Note: Autism spectrum disorders not reported due to data quality issues. Estimates in relation to conduct disorder should be interpreted with caution as they are also subject to data quality issues.

Source: Appendix Table D8.

Figure 10.1.4: Mental & substance use disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to mental & substance use disorders for Indigenous Australians increased slightly from 56 to 58 DALY per 1,000 people—an increase of 2.5% (Table 10.1.2). This was driven by an increase in the non-fatal burden for this disease group (5%), mainly from anxiety and depressive disorders (increases of around 1 YLD per 1,000; equivalent to an 11% increase in YLD).

Rates of fatal burden due to mental & substance use disorders decreased between 2003 and 2011 in the Indigenous population (from 4.1 to 3.1 YLL per 1,000; decrease of 24%).

Table 10.1.2: Mental & substance use disorders age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Anxiety disorders	12.2	13.5	1.3	10.8
Alcohol use disorders	11.7	11.4	–0.3	–2.9
Depressive disorders	10.6	11.7	1.1	10.7
Schizophrenia	4.5	4.5	—	—
Drug use disorders	2.7	3.1	0.4	13.6
All mental & substance use disorders[(a)]	**52.3**	**54.7**	**2.4**	**4.5**
		Fatal burden (YLL)[(b)]		
Anxiety disorders	—	—	—	n.p.
Alcohol use disorders	2.9	2.2	–0.7	n.p.
Depressive disorders	0.1	—	–0.1	n.p.
Schizophrenia	0.1	0.3	0.2	n.p.
Drug use disorders	0.5	0.4	–0.2	n.p.
All mental & substance use disorders[(a)]	**4.1**	**3.1**	**–1.0**	**–23.5**
		Total burden (DALY)		
Anxiety disorders	12.2	13.5	1.3	10.8
Alcohol use disorders	14.6	13.5	–1.1	–7.3
Depressive disorders	10.7	11.7	1.0	9.7
Schizophrenia	4.6	4.8	0.2	4.4
Drug use disorders	3.3	3.5	0.2	6.2
All mental & substance use disorders[(a)]	**56.4**	**57.8**	**1.4**	**2.5**

(a) Total includes burden due to the causes listed in the table as well as bipolar disorder, intellectual disability, ADHD, conduct disorder, autism spectrum disorders, eating disorders and other mental & substance use disorders.

(b) Rates of fatal burden by cause are too small to calculate reliable per cent rate difference estimates.

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

Data quality

Indigenous estimates of fatal burden (YLL) for mental & substance use disorders were calculated using deaths registered in the AIHW's National Mortality Database, adjusted for Indigenous under-identification, and are considered of reasonably high quality.

Estimates of the non-fatal burden of mental & substance use disorders for the Indigenous population are based on a range of indirect methods for deriving Indigenous prevalence estimates, and as such YLD and DALY estimates are considered of lower quality than YLL estimates. For example, many of the indirect methods were based on Indigenous: total population rate ratios from Queensland's Consumer Integrated Mental Health Application. This data collection is linked inpatient and community mental health services data and contains high quality ICD-10 clinician coded diagnosis information. It records information on people accessing Queensland public mental health services.

The same severity distributions as in the total Australian population were used for all disorders except alcohol use disorders, and intellectual disability. This was due to a lack of information on Indigenous-specific severity.

Estimates for autism spectrum disorders were not reported separately due to data quality issues (but are included in the total).

Non-fatal estimates for 2003 are derived using the same data sources and methods as used for 2011 estimates. If available, data specific to the 2003 reference year were used (for example hospitalisation rate ratios). In other cases, secondary data sources were examined to determine whether a likely change in prevalence would be expected between 2003 and 2011 (for example, changes over time in measured psychological distress from ABS health survey data were used to inform 2003 estimates for anxiety and depressive disorders); or expert advice was sought. As such, the 2003 Indigenous estimates for mental & substance use disorders presented here will differ to those published from the 2003 Indigenous burden of disease study (Vos et al. 2007) (which were also based on a number of indirect methods using data that was available at the time).

10.2 Injuries

In the Australian Burden of Disease Study (ABDS), 2 perspectives were used to report injury burden:

- **external cause** which describes the environmental events and circumstances that led to the injury, for example road traffic accident 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 (TBI) 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 to 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.

Both perspectives are shown in Table 10.2.1. The ICD-10 codes used to identify external causes can be found in ABDS methods report (AIHW 2016b).

Table 10.2.1: ABDS 2011 Disease list for injuries, by nature and external cause of injury

Nature of injury	External cause
Traumatic brain injury	Road traffic injuries—motorcyclists
Spinal cord injury	Road traffic injuries—motor vehicle occupants
Internal and crush injury	Other road traffic injuries
Poisoning	Other land transport injuries
Drowning and submersion injuries	Poisoning
Hip fracture	Falls
Tibia and ankle fracture	Fire, burns and scalds
Humerus fracture	Drowning
Other fractures	Other unintentional injuries
Dislocations	Suicide & self-inflicted injuries
Soft tissue injuries	Homicide and violence
Burn injuries	All other external causes of injury
Other injuries	

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

The scope of injuries is limited to those incurred from trauma, rather than those resulting from other health conditions, for example, health loss associated with surgical amputations due to diabetes, or chronic conditions such as chronic back pain, that 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 and those that present to an emergency department (ED). Injuries presenting only to a general practitioner or allied health professional and those for which no medical care is sought are excluded. It is assumed that they do not incur sufficient health loss to be included in the ABDS.

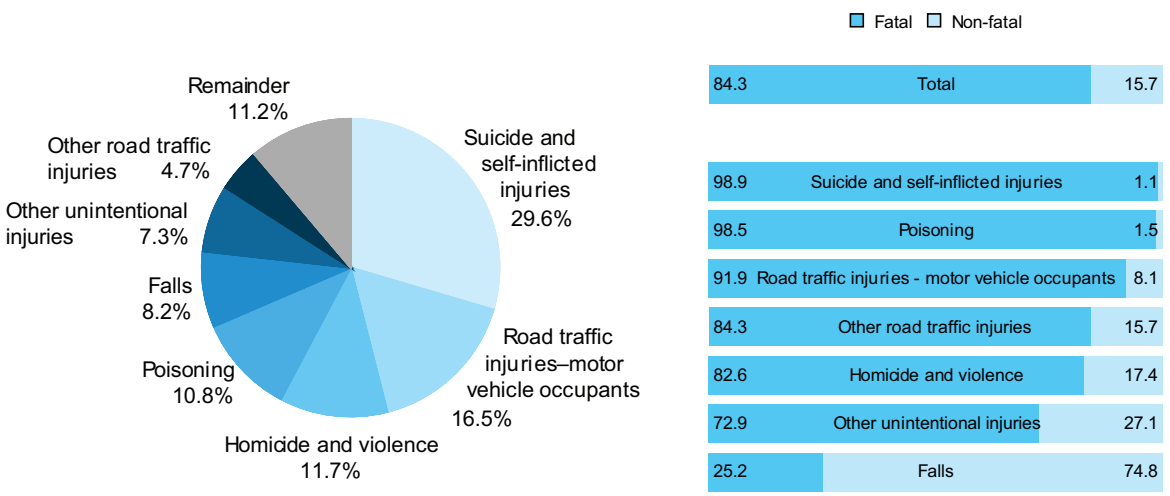
Overview

Overall in 2011, injuries were responsible for 28,790 (15%) of all DALY (24.1% of YLL and 5% of YLD) in Indigenous Australians, making it the second group of diseases causing burden (the leading cause for fatal burden and sixth leading cause for non-fatal burden). Most injury burden (84%) was due to early death (fatal burden), with only 16% of the burden due to non-fatal health loss.

By external cause

Using the external cause of injury perspective, suicide & self-inflicted injuries accounted for 30% of the total injuries burden, followed by road traffic injuries (RTI) of motor vehicle occupants (16.5%) and homicide & violence (12%) (Figure 10.2.1).

Although fatal burden was generally greater than non-fatal burden for injuries, the non-fatal burden from falls (75%) was greater than that for fatal. Where the cause of injury was suicide & self-inflicted injuries or poisoning, the resulting burden was almost all fatal (each 99%) (Figure 10.2.1).



Note: Remainder category includes all causes included in injuries (external cause) not specifically listed in figure.

Figure 10.2.1: Injuries burden, by external cause of injury: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The greatest impact of injury burden for Indigenous Australians was between ages 15 and 44. Figure 10.2.2 shows the impact by external cause and how it varied by age. Substantial impact from suicide & self-inflicted injuries, injuries incurred as occupants of motor vehicles in road traffic incidents, homicide & violence and poisoning were observed from around age 15 up to 54. The burden from falls increased from around age 40, becoming the major contributor from age 55.

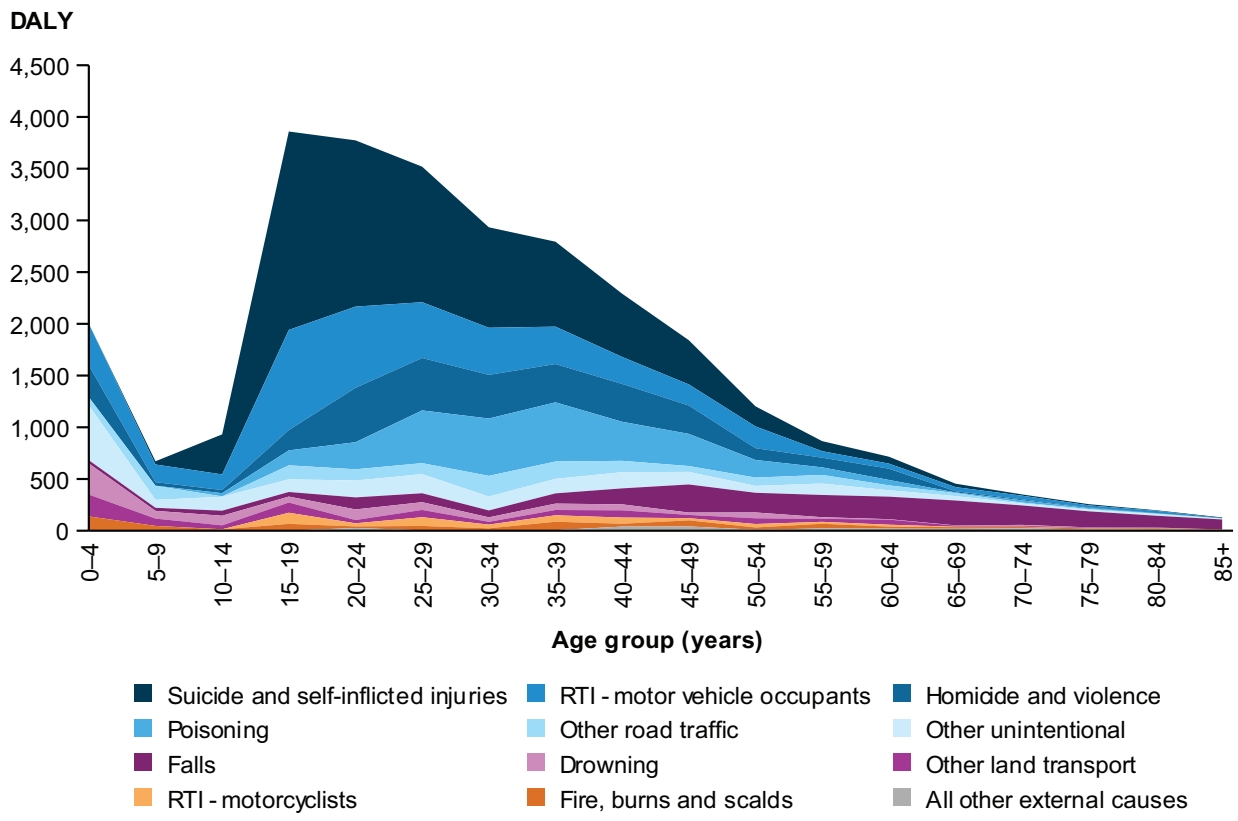


Figure 10.2.2: External cause of injury burden (DALY) by age and external cause, Indigenous Australians, 2011

The impact of burden from injuries differed by sex. Figure 10.2.3 shows that overall Indigenous males experienced more burden due to injuries than Indigenous females (68% and 32% respectively). For example, Indigenous males experienced 97% of the burden due to RTI involving motorcycles, 76% of the burden due to drowning and 70% of the burden due to suicide & self-inflicted injuries.

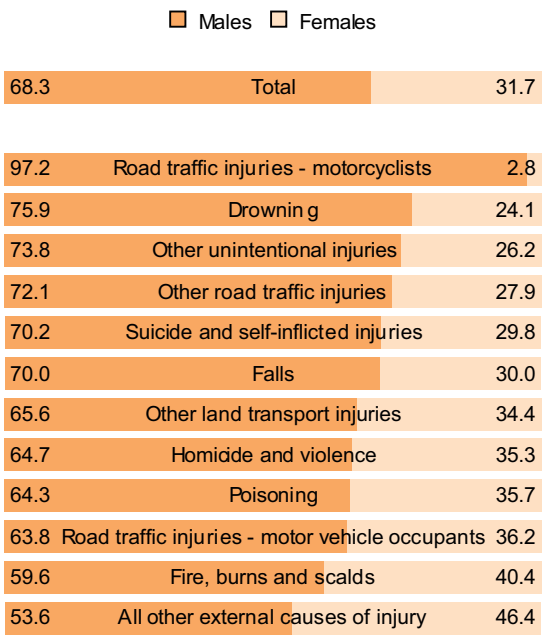
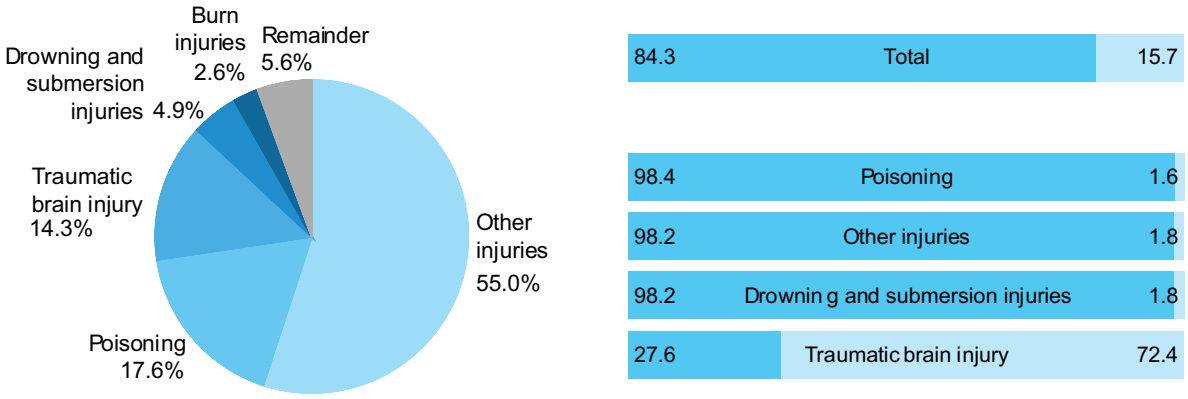


Figure 10.2.3: Injuries burden (DALY) by external cause, proportion for males and females, Indigenous Australians, 2011

By nature of injury

Using the nature of injury perspective, the broad group of 'other injuries' accounted for over half (55%) of the total injury burden in Indigenous Australians. This category includes amputations, open wounds, nerve injuries and all other injuries not aligned to an ABDS cause such as unspecified injuries. The other main contributors to the total burden were poisoning (18%), traumatic brain injury (14%), drowning (5%) and burns (3%).

Fatal burden was much greater than non-fatal burden for poisoning (98%) and all other injuries (98%) (Figure 10.2.4). 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 (72%).



Notes

1. Remainder category includes all causes included in injuries (by nature) not specifically listed in figure.
2. The category 'Other injuries' includes amputations, open wounds, nerve injuries and all other injuries not aligned to an ABDS cause such as unspecified injuries.

Figure 10.2.4: Injuries burden, by nature of injury: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed 29% to the burden for injuries. For this disease group, the biggest risk factors were alcohol use (19%) and drug use (7%) (Table 10.2.2).

Table 10.2.2: Proportion (%) of burden attributable to risk factors for injuries, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Alcohol use	18.5
Drug use	7.4
Intimate partner violence	6.2
Childhood sexual abuse	4.3
Low bone mineral density	0.3
Occupational exposures and hazards	0.2
Joint effect of all risk factors	**29.0**

Notes

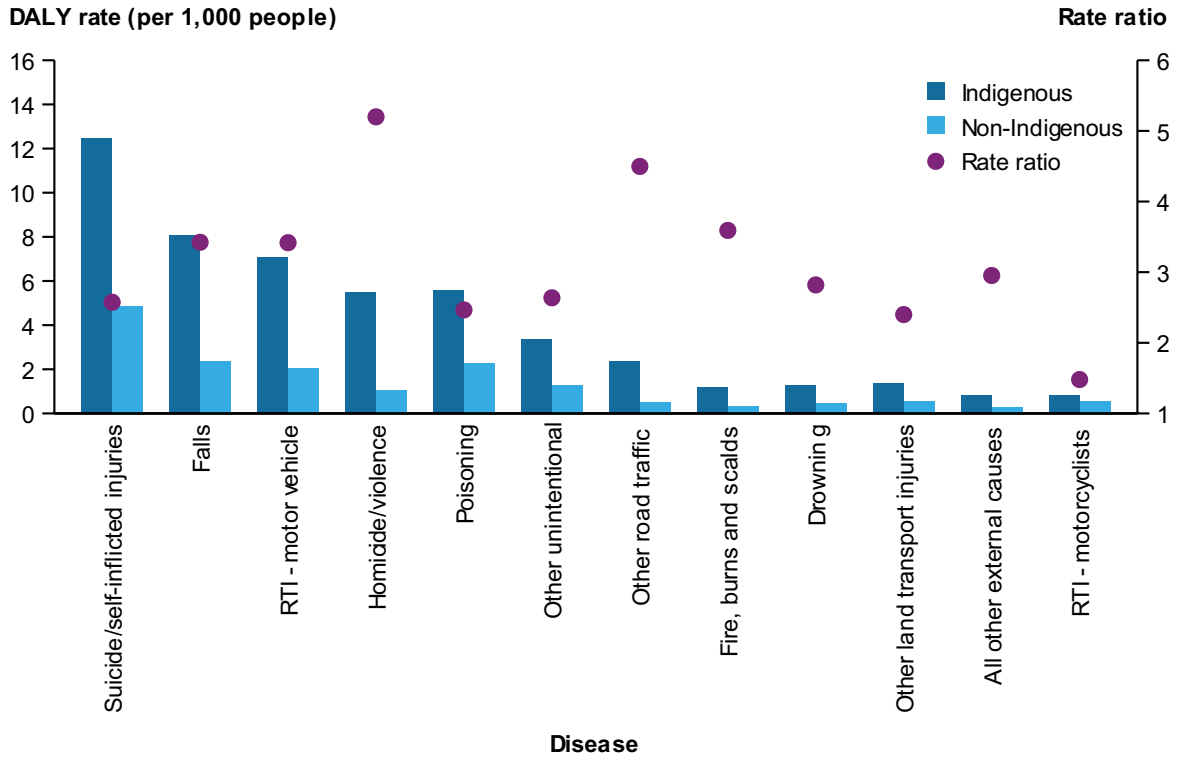
1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011 Indigenous Australians experienced burden due to injuries at 3 times the rate of non-Indigenous Australians (Appendix Table D9).

The greatest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for suicide & self-inflicted injuries (rate difference of 7.6 DALY per 1,000 people) and falls (rate difference of 5.7 DALY per 1,000).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians were for homicide & violence (rate ratio of 5.2), other RTI (rate ratio of 4.5), fires, burns & scalds (rate ratio of 3.6), falls (rate ratio of 3.4) and RTI—motor vehicle occupants (rate ratio of 3.4) (Figure 10.2.5).



Source: Appendix Table D9.

Figure 10.2.5: Injuries age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by external cause of injury, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to injuries for Indigenous Australians increased notably from 48 to 50 DALY per 1,000 people; an increase of 5% (Table 10.2.3). This was driven by an increase in the non-fatal burden for this disease group (61% increase), mainly from falls (increase of around 3 DALY per 1,000 people; equivalent to an 82% increase in YLD).

Rates of fatal burden due to injuries decreased between 2003 and 2011 in the Indigenous population (from 40 to 37 DALY per 1,000; decrease of 7%). Poisoning showed a notable increase in age-standardised rates of fatal burden (increase of around 2 DALY per 1,000 people; equivalent to a 48% increase); however, changes in coding practices may partly explain this.

Table 10.2.3: Injuries age-standardised YLD, YLL and DALY rates (per 1,000 people) by external cause of injury, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Suicide & self-inflicted injuries	0.2	0.2	—	—
RTI—motor vehicle occupants	0.7	1.0	0.3	41.6
Homicide & violence	0.7	1.2	0.5	66.2
Poisoning	0.1	0.1	—	—
Falls	3.5	6.4	2.9	82.4
Other unintentional injuries	1.0	1.3	0.4	36.8
Other RTI	0.3	0.6	0.2	70.6
All injuries[(a)]	**8.1**	**13.0**	**4.9**	**60.9**
		Fatal burden (YLL)		
Suicide & self-inflicted injuries	12.2	12.2	—	—
RTI—motor vehicle occupants	6.7	6.1	–0.6	–9.0
Homicide & violence	4.3	4.2	–0.1	–2.3
Poisoning	3.7	5.5	1.8	48.4
Falls	1.7	1.7	—	—
Other unintentional injuries	3.9	2.1	–1.8	–46.0
Other RTI	2.9	1.8	–1.1	–36.7
All injuries[(a)]	**39.6**	**37.0**	**–2.6**	**–6.5**
		Total burden (DALY)		
Suicide & self-inflicted injuries	12.3	12.5	0.1	1.0
RTI—motor vehicle occupants	7.4	7.1	–0.3	–4.2
Homicide & violence	5.1	5.5	0.4	7.8
Poisoning	3.8	5.6	1.8	47.7
Falls	5.2	8.1	2.9	56.1
Other unintentional injuries	4.8	3.4	–1.4	–29.6
Other RTI	3.2	2.4	–0.8	–25.5
All injuries[(a)]	**47.6**	**49.9**	**2.3**	**4.9**

(a) Total includes burden due to the causes listed in the table as well as drowning, other land transport injuries, fires, burns & scalds, RTI—motorcyclists and all other external causes of injury.

Notes: 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 injuries were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data, and are considered of reasonably high quality. Some adjustments were made for injury causes of death that did not align to the ABDS cause list; namely deaths where the intent was undetermined and deaths coded to unspecified factors.

Non-fatal injury burden estimates comprise 3 components as follows:

- Admitted cases based directly on national hospital admission data, adjusted for Indigenous under-identification and considered of high quality.
- Non-admitted cases estimated from national emergency care data, adjusted for under-identification using the same adjustment factors as for hospital admissions data—as no formal assessment has been undertaken to assess the level of under-identification in the ED data collection. There are issues with the quality and completeness of diagnosis information in ED data (that is, around 50% of ED presentations were not able to be included in analysis due to variations in coding classifications used to report the diagnosis). Estimates largely based on ED data should therefore be interpreted with caution.
- Prevalence of long-term sequelae was estimated directly using a portion of admitted cases according to previous burden studies. These cases were modelled in DISMOD II to obtain the prevalence of long-term sequelae of injury.

Injury deaths have the external cause of death 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. Uncertainties in this transformation process reduce the quality of injury deaths reported by nature of injury.

10.3 Cardiovascular diseases

The cardiovascular disease (CVD) group includes many different conditions affecting the heart and blood vessels. The main underlying cause of the most common diseases in this group—CHD 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 CHD, or to the brain (causing a stroke). Other causes in this disease group include rheumatic heart disease, peripheral vascular disease and cardiomyopathy. The residual cause 'other cardiovascular diseases' includes diseases such as secondary hypertension, pulmonary heart disease, ventricular fibrillation and flutter, diseases of capillaries and hypotension. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

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 (CHD, 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.

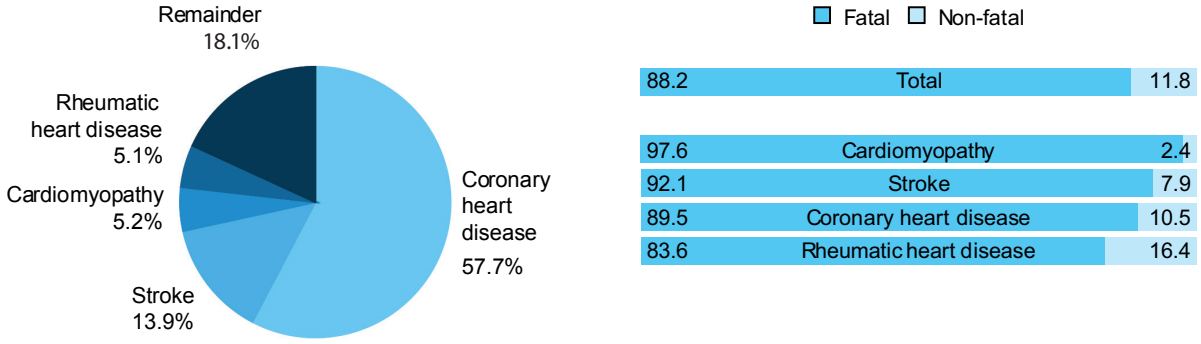
CVD is a major cause of morbidity and mortality among Indigenous Australians. It is more common in the Aboriginal and Torres Strait Islander population, and occurs at much younger ages compared to the non-Indigenous population.

Overview

CVD accounted for 12% (23,771 DALY) of total burden in Indigenous Australians in 2011, making it the disease group with the third greatest contribution to burden. This was driven primarily by fatal burden, which caused 21% of all YLL. The relative non-fatal burden was lower, at 3% of all YLD.

This disease group was dominated by CHD (accounting for 58% of CVD DALY) and stroke (14% of CVD DALY) (Figure 10.3.1). In terms of overall DALY, CHD caused the most of any disease or injury (7% of total DALY) and stroke ranked 15th (2% of total DALY).

Overall, 88% of the burden from the CVD group was fatal. The disease that had the highest proportion of fatal burden was cardiomyopathy (98% fatal). Similarly, fatal burden accounted for most of the total burden due to stroke (92%).



Note: Remainder category includes all causes included in cardiovascular diseases not specifically listed in figure.

Figure 10.3.1: Cardiovascular diseases burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The burden from CVD was low in childhood then increased rapidly from about age 30 in the Indigenous population (Figure 10.3.2). The large burden from CHD and stroke was evident from age 40 onwards. Burden from CHD rose steeply to its peak at ages 45–54, and then declined. For stroke, burden increased from ages 35–39 and continued until ages 60–64 when it began to decline.

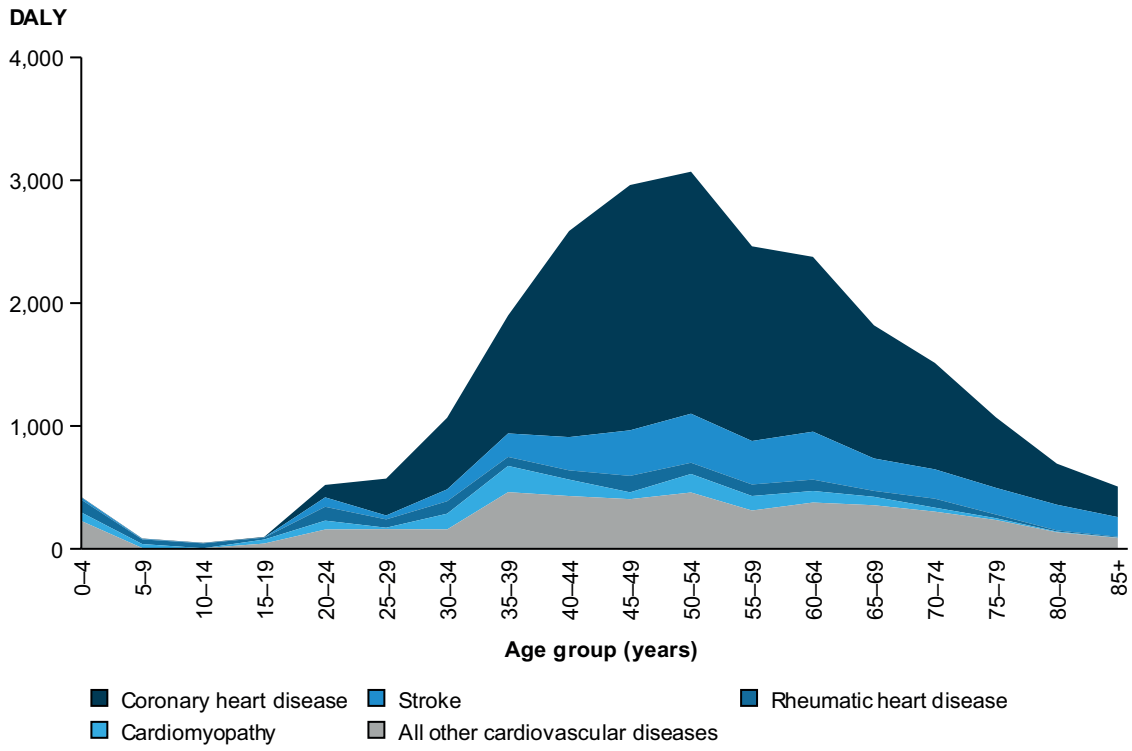


Figure 10.3.2: Cardiovascular diseases burden (DALY) by age and disease, Indigenous Australians, 2011

The overall burden from CVD was greater in Indigenous males than females (58% and 42%, respectively), but this varied by disease (Figure 10.3.3). Indigenous males experienced the majority of burden from aortic aneurysm (77%), hypertensive heart disease (72%) and CHD (67%), whereas Indigenous females experienced the majority of burden due to peripheral vascular disease (68%), rheumatic heart disease (61%), and stroke (58%).

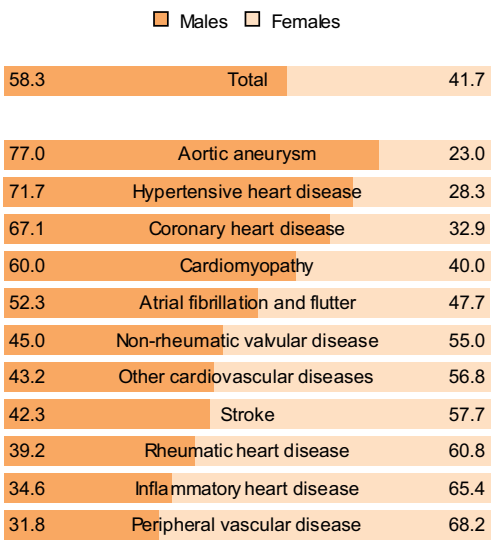


Figure 10.3.3: Cardiovascular diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed greatly to the burden for CVD (80%). For this disease group, the biggest risk factors were tobacco (39%), high blood pressure (35%) and high body mass (34%) (Table 10.3.1).

Table 10.3.1: Proportion (%) of burden attributable to risk factors for cardiovascular diseases, Indigenous Australians, 2011

Risk factor	Attributable burden (%)	Risk factor	Attributable burden (%)
Tobacco use	39.4	Diet low in omega-3 fatty acids	7.8
High blood pressure	35.4	Diet low in fibre	7.3
High body mass	33.8	Diet high in saturated fat	6.8
Physical inactivity	28.8	High blood plasma glucose	6.0
High cholesterol	20.9	Air pollution	3.6
Diet low in fruit	16.2	Alcohol use	3.3
Diet low in nuts and seeds	14.4	Diet high in sodium	2.9
Diet high in processed meat	14.0	Diet high in sweetened beverages	2.0
Diet low in vegetables	13.1		
Diet low in whole grains	11.8	**Joint effect of all risk factors**	**79.5**

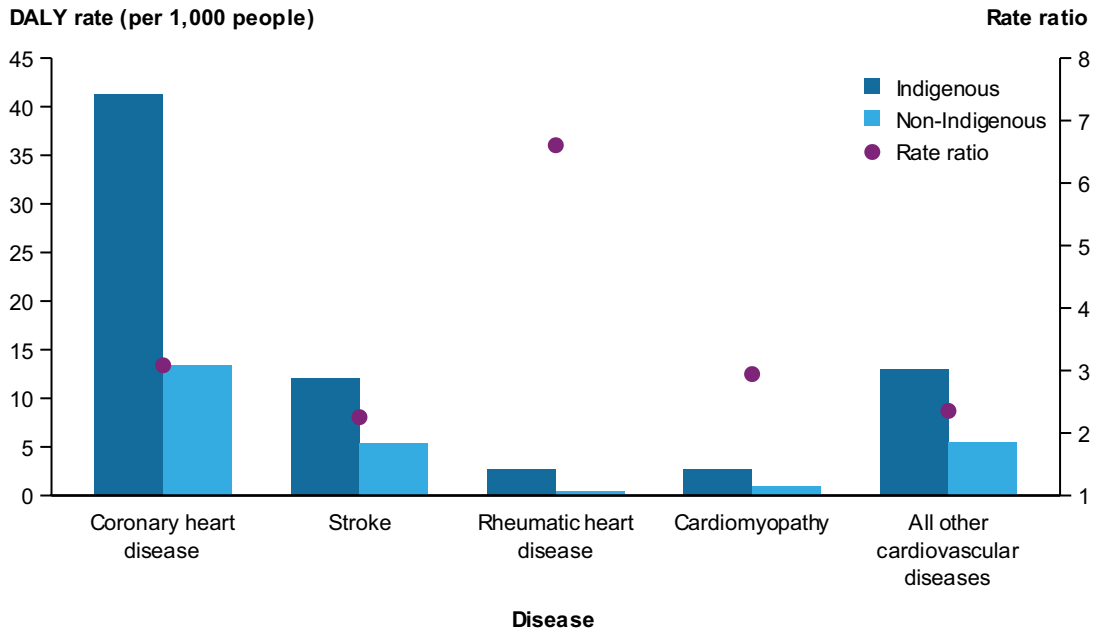
Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

Indigenous Australians experienced total rates of burden due to CVD at about 3 times the rate for non-Indigenous Australians (Appendix Table D10).

The largest absolute difference in DALY rates for CVD between Indigenous and non-Indigenous Australians was for CHD (rate difference of 28 DALY per 1,000 people) (Figure 10.3.4). Rheumatic heart disease represented the largest relative difference between Indigenous and non-Indigenous Australians with a rate ratio of 6.6, though contributing only 5% of DALY for the CVD group overall (Figure 10.3.4).



Source: Appendix Table D10.

Figure 10.3.4: Cardiovascular diseases age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to CVD for Indigenous Australians decreased notably from 91 to 72 DALY per 1,000 people, a drop of 21% (Table 10.3.2). This was driven mainly by a decrease in the fatal burden for this disease group (23%), mainly from CHD and stroke (decreases of 13 and 4 YLL per 1,000, respectively; equivalent to decreases of 26% and 25%, respectively).

Rates of non-fatal burden due to CVD were similar in 2003 and 2011 (9.6 and 9.1 YLD per 1,000 people).

Table 10.3.2: Cardiovascular diseases age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Coronary heart disease	4.9	4.7	–0.2	–4.0
Stroke	1.1	0.9	–0.1	–13.2
Cardiomyopathy	0.1	0.1	—	—
Rheumatic heart disease	0.6	0.5	–0.1	–20.2
All other cardiovascular diseases	2.9	2.9	—	—
All cardiovascular diseases	**9.6**	**9.1**	**–0.4**	**–4.5**
		Fatal burden (YLL)		
Coronary heart disease	49.5	36.6	–12.9	–26.0
Stroke	14.9	11.1	–3.7	–25.2
Cardiomyopathy	3.5	2.6	–0.9	–24.7
Rheumatic heart disease	2.8	2.3	–0.5	–17.5
All other cardiovascular diseases	10.3	10.0	–0.2	–2.4
All cardiovascular diseases	**80.9**	**62.7**	**–18.2**	**–22.5**
		Total burden (DALY)		
Coronary heart disease	54.4	41.3	–13.1	–24.1
Stroke	15.9	12.1	–3.9	–24.3
Cardiomyopathy	3.6	2.7	–0.9	–24.0
Rheumatic heart disease	3.4	2.8	–0.6	–18.0
All other cardiovascular diseases	13.2	13.0	–0.2	–1.7
All cardiovascular diseases	**90.5**	**71.8**	**–18.7**	**–20.6**

Notes: 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 cardiovascular diseases were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data, and are considered of reasonably high quality.

Since people with CVD are often treated in hospital, we were able to use detailed hospitalisation data to estimate the prevalence of many of the conditions in this disease group. These estimates have been adjusted for Indigenous under-identification in hospital recording systems. Prevalence data for many were based on state linked data from Western Australia subsequently applied to national hospital data, and some came directly from the hospital data. Data for 2 less common diseases (atrial fibrillation and peripheral vascular disease) were based on information from the New Zealand burden of disease study.

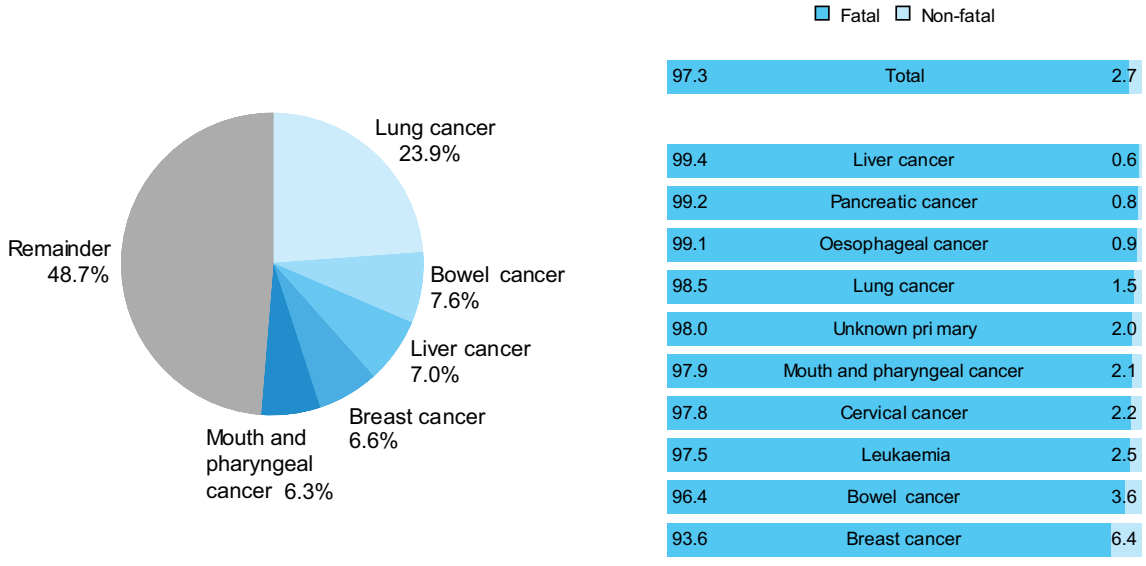
10.4 Cancer and other neoplasms

The cancer & other neoplasms disease group includes both malignant neoplasms (cancers) and benign, in situ and uncertain neoplasms. All neoplasms are included except uterine fibroids which are included under the reproductive & maternal disease group. For a complete list of individual cancers included in this study, see 'Appendix B: Methods overview' (Table B1).

Overview

In 2011, cancer & other neoplasms were responsible for 9.4% (17,847 DALY) of total Indigenous health loss in Australians, comprising 17% (17,370 YLL) of all fatal burden and 0.5% (477 YLD) of all non-fatal burden. It is the fourth most burdensome group of diseases. Cancer burden was almost entirely due to dying prematurely, with only 2.7% of this burden due to living with cancer.

Lung (24%), bowel (8%), liver (7%), breast (7%) and mouth & pharyngeal (6%) cancers accounted for half (51%) of the cancer burden among Indigenous Australians (Figure 10.4.1).



Note: Remainder category includes all causes included in cancer & other neoplasms not specifically listed in figure.

Figure 10.4.1: Cancer burden, by cancer type: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

Cancer burden in Indigenous Australians varied by the type of cancer and across the life course (Figure 10.4.2). For example, leukaemia appeared in the young age groups, bowel cancer started to emerge in young adulthood and peaked around ages 60–69, and many of the other cancers became apparent in older age groups. Lung cancer was the most dominant cancer from age 40 onwards, peaking at ages 60–64.

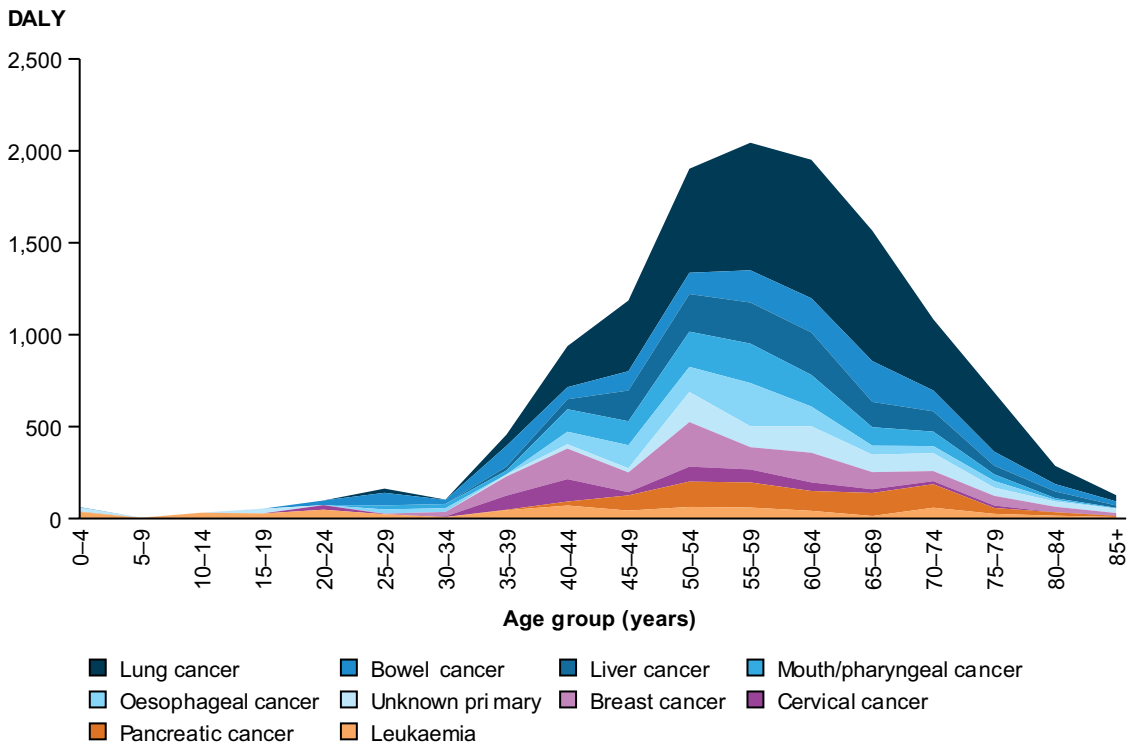


Figure 10.4.2: Cancer burden (DALY) by age and disease, leading 10 cancers, Indigenous Australians, 2011

The overall burden was higher in Indigenous males than females (except sex-specific cancers). Indigenous males experienced a greater share of burden due to mouth & pharyngeal cancer (81%), oesophageal cancer (77%) and liver cancer (63%) than Indigenous females. In contrast, Indigenous females experienced a greater share of burden from leukaemia (55%), and the entire burden due to the cervical and breast cancer (100%) (Figure 10.4.3).

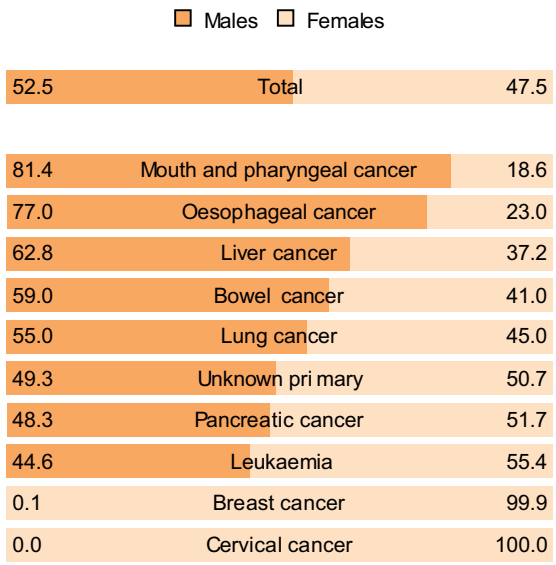


Figure 10.4.3: Cancer burden (DALY) for leading 10 cancers, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed greatly to the burden for cancer (54%). For this disease group, the biggest risk factors were tobacco use (39%) and diet low in fruit (5.5%) (Table 10.4.1).

Table 10.4.1: Proportion (%) of burden attributable to risk factors for cancer, Indigenous Australians, 2011

Risk factor	Attributable burden (%)	Risk factor	Attributable burden (%)
Tobacco use	39.0	Diet low in milk	0.9
Diet low in fruit	5.5	Diet high in processed meat	0.7
High body mass	5.3	Diet low in fibre	0.6
Physical inactivity	4.8	Diet high in red meat	0.4
Unsafe sex	3.4	Diet low in calcium	0.3
Drug use	3.1	Air pollution	0.1
Alcohol use	2.8	Diet high in sodium	0.1
Occupational exposures	1.9		
Diet low in vegetables	1.8	**Joint effect of all risk factors**	**54.0**

Notes

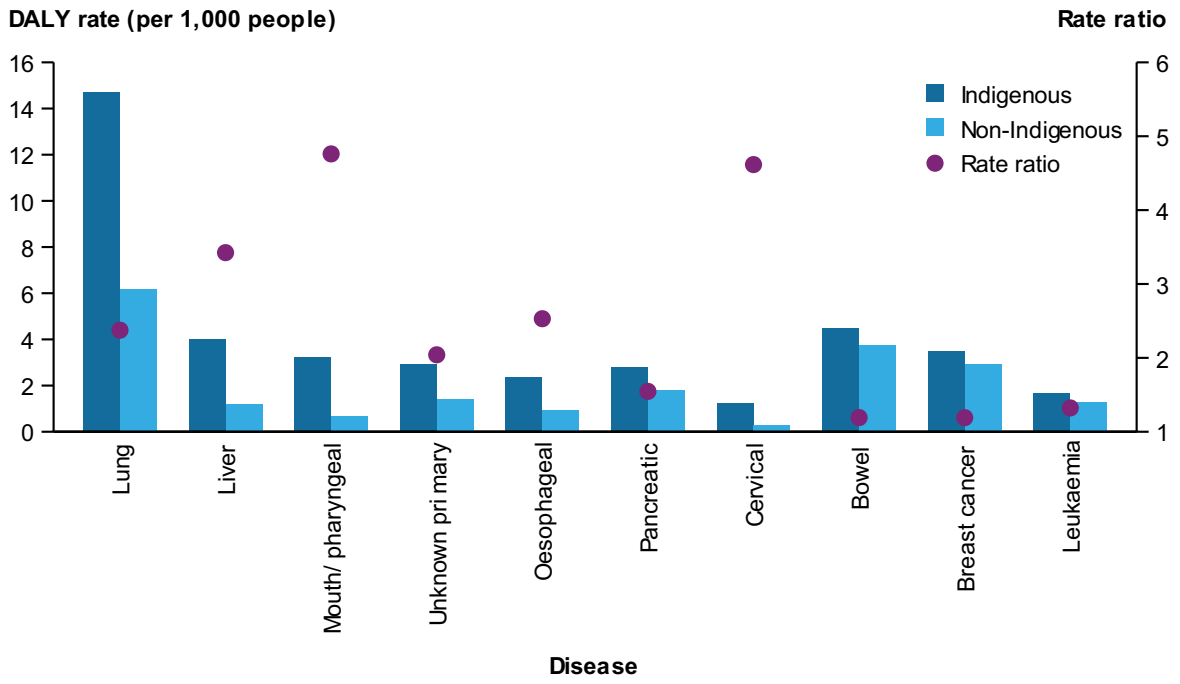
1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced 1.7 times the total burden due to cancer than non-Indigenous Australians (DALY rate per 1,000 of 57 and 34 respectively). Rate ratios were highest for laryngeal cancer (4.9 times—not shown in Figure 10.4.4 due to small numbers), followed by mouth & pharyngeal cancer (4.8 times) and cervical cancer (4.6 times). The largest absolute differences in DALY age-standardised rates were seen for lung cancer (8.5 DALY per 1,000 people), followed by liver cancer (2.8 DALY per 1,000 people) and mouth & pharyngeal cancer (2.6 DALY per 1,000 people) (Figure 10.4.4).

The high prevalence of risk factors among Indigenous Australians, such as smoking, risky alcohol consumption and higher levels of chronic infections may explain the high burden of lung and liver cancers.

Evidence that is available on the participation in cervical screening by Indigenous women suggests that Indigenous women are under-screened (AIHW 2015a; Cunningham et al. 2008). This may have led to higher burden of cervical cancer in Indigenous women.



Note: Appendix Table D11.

Figure 10.4.4: Cancer age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, leading 10 cancers, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to cancer for Indigenous Australians increased from 54 to 57 DALY per 1,000 people; an increase of 6% (Table 10.4.2). This was driven by an increase in the fatal burden for this disease group (6%), mainly from liver and lung cancer (increases of 2 and 1 YLL respectively; equivalent to 96% and 10% increases in YLL).

Rates of non-fatal burden due to cancer were very similar in 2003 and 2011 (1.6 and 1.7 YLD per 1,000, respectively).

Table 10.4.2: Cancer age-standardised YLD, YLL and DALY rates (per 1,000 people), leading 10 cancers, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Lung cancer	0.2	0.3	—	—
Bowel cancer	0.2	0.2	—	—
Liver cancer	—	—	—	—
Breast cancer	0.2	0.3	—	—
Mouth & pharyngeal cancer	0.1	0.1	—	—
Oesophageal cancer	—	—	—	—
Unknown primary	0.1	0.1	—	—
Pancreatic cancer	—	—	—	—
Leukaemia	0.1	—	—	—
Cervical cancer	—	—	—	—
Total 10 cancers	*1.0*	*1.0*	—	—
All cancers	**1.6**	**1.7**	**0.1**	**5.9**
		Fatal burden (YLL)		
Lung cancer	13.2	14.4	1.3	9.6
Bowel cancer	4.1	4.3	0.2	5.2
Liver cancer	2.0	4.0	2.0	96.3
Breast cancer	3.6	3.2	–0.3	–9.4
Mouth & pharyngeal cancer	2.9	3.2	0.3	10.1
Oesophageal cancer	2.8	2.3	–0.4	–15.5
Unknown primary	3.1	2.8	–0.2	–7.7
Pancreatic cancer	2.1	2.8	0.6	28.6
Leukaemia	1.7	1.6	–0.1	–4.5
Cervical cancer	1.0	1.2	0.2	15.5
Total 10 cancers	*36.5*	*39.9*	*3.4*	*9.4*
All cancers	**52.3**	**55.3**	**3.0**	**5.7**

Table 10.4.2 (continued): Cancer age-standardised YLD, YLL and DALY rates (per 1,000 people), leading 10 cancers, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Total burden (DALY)		
Lung cancer	13.4	14.7	1.3	9.6
Bowel cancer	4.3	4.5	0.2	5.1
Liver cancer	2.1	4.0	2.0	96.2
Breast cancer	3.8	3.5	–0.3	–8.2
Mouth & pharyngeal cancer	2.9	3.2	0.3	9.8
Oesophageal cancer	2.8	2.4	–0.4	–15.6
Unknown primary	3.2	2.9	–0.3	–8.2
Pancreatic cancer	2.2	2.8	0.6	28.4
Leukaemia	1.8	1.7	–0.1	–4.7
Cervical cancer	1.1	1.2	0.2	14.8
Total 10 cancers	*37.4*	*40.9*	*3.4*	*9.2*
All cancers	**53.9**	**57.0**	**3.1**	**5.7**

Notes: 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 cancer & other neoplasms for Indigenous Australians were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data, and are considered of reasonably high quality. Adjustments were made for coding of deaths due to cancers of unknown primary site based on distributions from linked data from the Western Australian and South Australian cancer registries.

Indigenous data for all non-fatal estimates of malignant neoplasms (except non-melanoma skin cancer) were sourced from the Australian Cancer Database and National Hospitals Morbidity Database (adjusted for under-identification using AIHW hospital adjustment factors).

The quality of Indigenous status in cancer incidence data varies by jurisdiction and year of collection. Information on Indigenous status on the Australian Cancer Database was considered to be of sufficient completeness for reporting for New South Wales, Victoria (post 2008), Queensland, Western Australia and the Northern Territory. For those states and territories (the ACT, Tasmania and South Australia) where information on Indigenous status was considered of insufficient completeness for reporting, Indigenous incidence and prevalence estimates were based on the rate of the other states applied to respective state populations.

It should be noted that incidence and prevalence data were only available to 2009 for New South Wales and the 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 Indigenous estimates.

Non-fatal estimates for non-melanoma skin cancer were modelled from a combination of admitted hospitals data and mortality data.

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

More information on the quality of each cancer & other neoplasms estimate is included in 'Appendix C: Quality framework'.

10.5 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
- chronic obstructive pulmonary disease (COPD)
- sarcoidosis (with lung involvement)
- interstitial lung disease (ILD)
- pneumoconiosis
- upper respiratory conditions (mainly allergic rhinitis—also known as hay fever)
- other respiratory diseases (including bronchiectasis and respiratory disease due to inhalation of chemicals, gases, fumes and vapours).

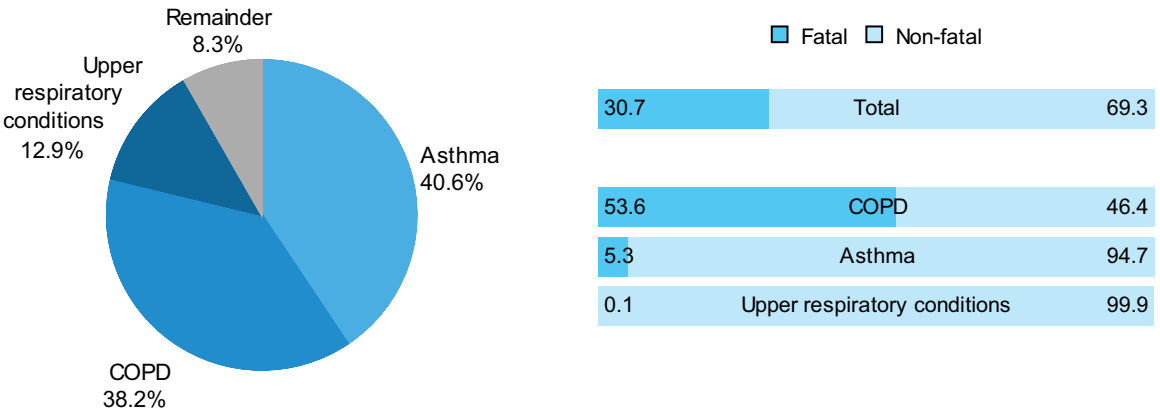
This disease group excludes any acute respiratory infections, influenza or pneumonia, which are part of the infectious diseases group and nasal skin infections, which are part of the skin disorders group.

Australian mortality and morbidity data both indicate that Indigenous Australians experience higher rates of death and illness due to the more common respiratory diseases, particularly asthma and COPD (AIHW 2013a).

Overview

Respiratory diseases contributed 7.9% (15,085 DALY) of total burden in Indigenous Australians in 2011, making it the fifth most burdensome disease group. The contributions to the overall fatal and non-fatal burden in Australia from respiratory diseases were 4.6% (4,632 YLL) and 11.7% (10,453 YLD), respectively.

Asthma (41%), COPD (38%) and upper respiratory conditions (mainly allergic rhinitis) (13%) accounted for most (92%) of the burden from respiratory diseases (Figure 10.5.1). The burden from this disease group was mostly non-fatal, accounting for over 69% of the overall burden due to respiratory diseases.



Note: Remainder category includes all causes included in respiratory diseases not specifically listed in figure.

Figure 10.5.1: Respiratory diseases burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The burden due to respiratory diseases differed by age for individual diseases (Figure 10.5.2). Asthma and upper respiratory conditions affected all ages but peaked at ages 10–14 and 20–24, respectively. In contrast, COPD contributed to the total respiratory burden from ages 35–39, where DALY increased steadily by age, peaking at 60–64.

Indigenous estimates for the other diseases included in this disease group (sarcoidosis, ILD and pneumoconiosis) are based on very small numbers so are combined in the 'All other respiratory conditions' category for analysis presented in the remainder of this section.

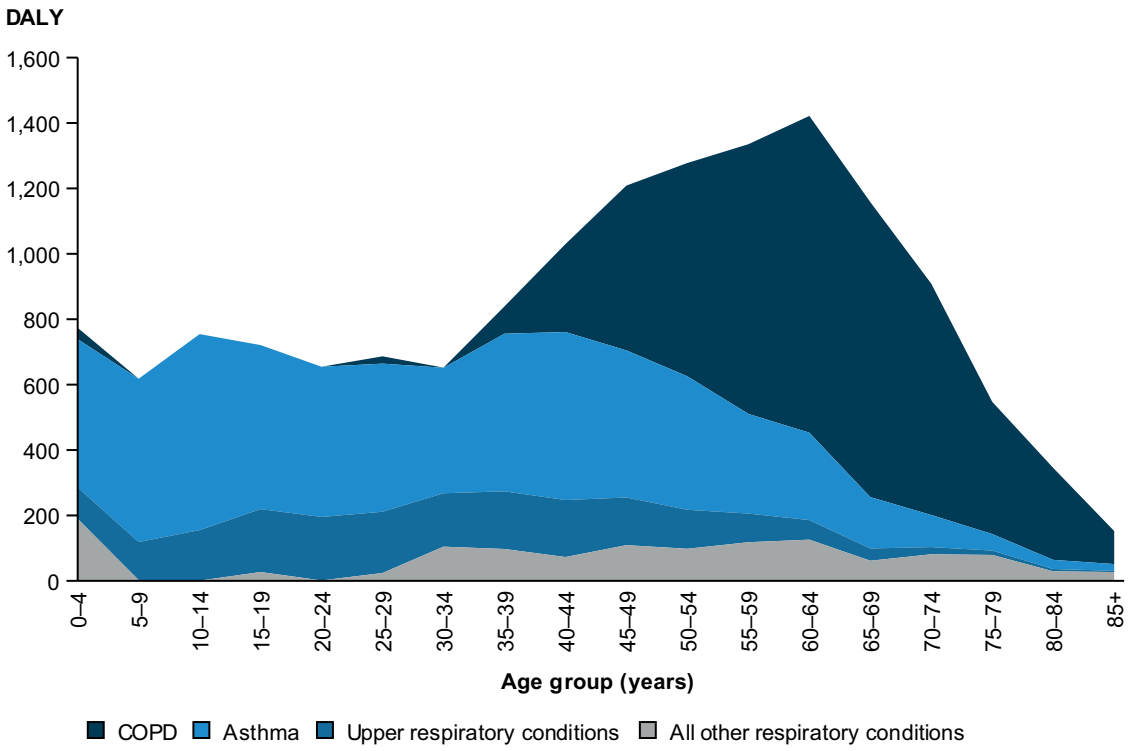


Figure 10.5.2: Respiratory diseases burden (DALY) by age and disease, Indigenous Australians, 2011

Overall, Indigenous females experienced more burden due to respiratory diseases than Indigenous males in 2011 (55% of total respiratory burden compared with 45%) (Figure 10.5.3). For all respiratory diseases, except the all other respiratory diseases category, Indigenous females experienced slightly more burden than Indigenous males.

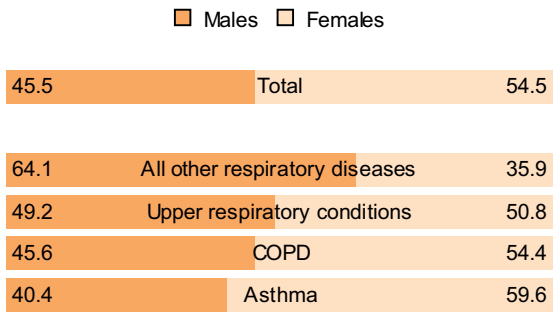


Figure 10.5.3: Respiratory diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed greatly to the burden for respiratory diseases (45%). For this disease group, the biggest risk factor was tobacco use (45%) (Table 10.5.1).

Table 10.5.1: Proportion (%) of burden attributable to risk factors for respiratory diseases, Indigenous Australians, 2011

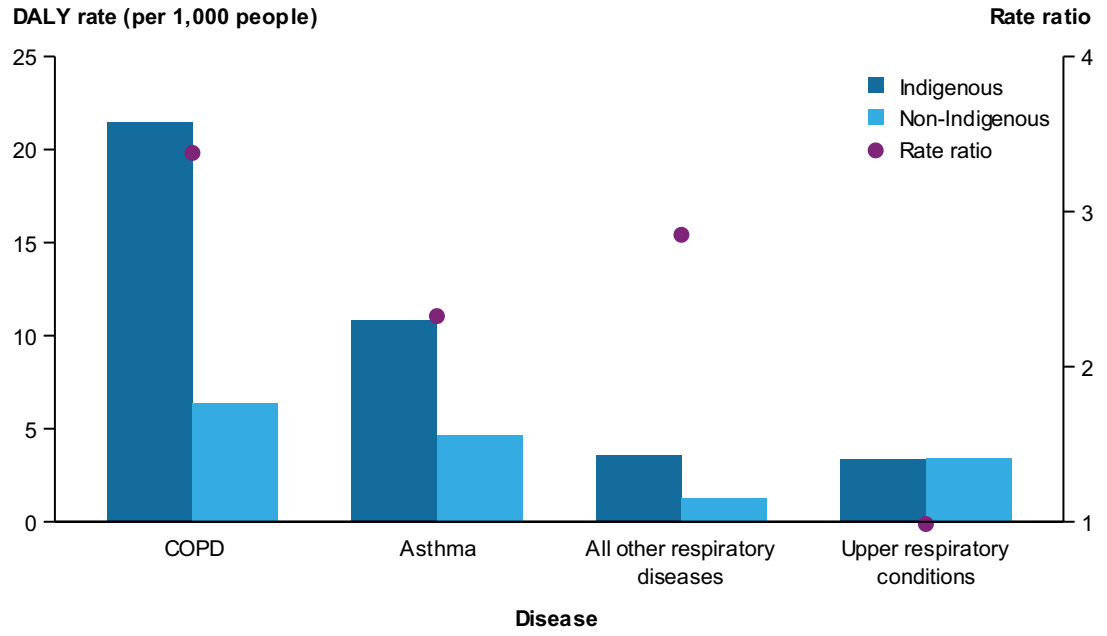
Risk factor	Attributable burden (%)
Tobacco use	41.7
Occupational exposures and hazards	4.4
Air pollution	0.1
Joint effect of all risk factors	**44.6**

Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced 2.5 times the total burden due to respiratory diseases than non-Indigenous Australians. The largest absolute differences in rates of burden were seen for COPD (15.1 DALY per 1,000 people) and asthma (6.2 DALY per 1,000 people) (Figure 10.5.4). The largest relative differences were also seen for COPD (rate ratio of 3.4) and asthma (rate ratio of 2.3).



Note: Appendix Table D12.

Figure 10.5.4: Respiratory diseases age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to respiratory diseases remained relatively stable overall (40 and 39 DALY per 1,000 people, respectively), although the rate of non-fatal burden increased notably (5% increase, from 22 to 23 YLD per 1,000 people) (Table 10.5.2). This increase in non-fatal burden was driven mainly by an increase in non-fatal burden due to asthma (increase of 3 YLD per 1,000; equivalent to a 40% increase). The increase due to asthma was offset by decreases in the non-fatal burden due to COPD and upper respiratory conditions (decreases of around 1 YLD per 1,000; equivalent to decreases of 12% and 14%, respectively).

Rates of fatal burden due to respiratory diseases remained relatively stable between 2003 and 2011 (18 and 16 YLL, respectively).

Table 10.5.2: Respiratory diseases age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Asthma	7.3	10.2	2.9	40.1
COPD	10.7	9.5	–1.2	–11.6
Upper respiratory conditions	3.9	3.3	–0.5	–13.7
All respiratory diseases[(a)]	**22.0**	**23.2**	**1.2**	**5.3**
		Fatal burden (YLL)		
Asthma	1.2	0.6	–0.6	–48.4
COPD	12.9	12.0	–1.0	–7.4
Upper respiratory conditions	0.2	0.0	–0.2	–98.0
All respiratory diseases[(a)]	**18.1**	**16.0**	**–2.0**	**–11.2**
		Total burden (DALY)		
Asthma	8.4	10.8	2.4	28.1
COPD	23.7	21.5	–2.2	–9.3
Upper respiratory conditions	4.1	3.3	–0.8	–18.7
All respiratory diseases[(a)]	**40.1**	**39.2**	**–0.9**	**–2.2**

(a) Total includes burden due to the causes listed in the table as well as ILD, pneumoconiosis, sarcoidosis and other respiratory diseases.

Notes: 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 respiratory diseases in Indigenous Australians were calculated using Indigenous deaths registered in the National Mortality Database adjusted for Indigenous under-identification in mortality data. They are considered of reasonably high quality. Deaths from pneumonitis are considered intermediate causes of death so these were redistributed to disease groups containing the most likely direct cause.

Non-fatal burden estimates for respiratory diseases were derived from multiple sources of data. Indigenous prevalence estimates for asthma and upper respiratory disease were calculated from self-reported data from the AATSIHS. The data from this survey is considered of reasonable quality.

Data for the prevalence of COPD in Indigenous Australians were sourced from the results of a clinical study, and therefore are considered of high quality and more accurate than self-reported data; however, the clinical study did not provide sufficient breakdowns of COPD by age and sex for Indigenous Australians. Hospitalisations data, adjusted for under-identification were used to inform these breakdowns.

The prevalence of sarcoidosis, ILD and pneumoconiosis were derived using adjusted deaths and hospitalisation data. As these conditions are considered rare in the Indigenous population, estimates were based on very small numbers of Indigenous Australians, and so they were not reported separately in most analysis presented in this section.

10.6 Musculoskeletal conditions

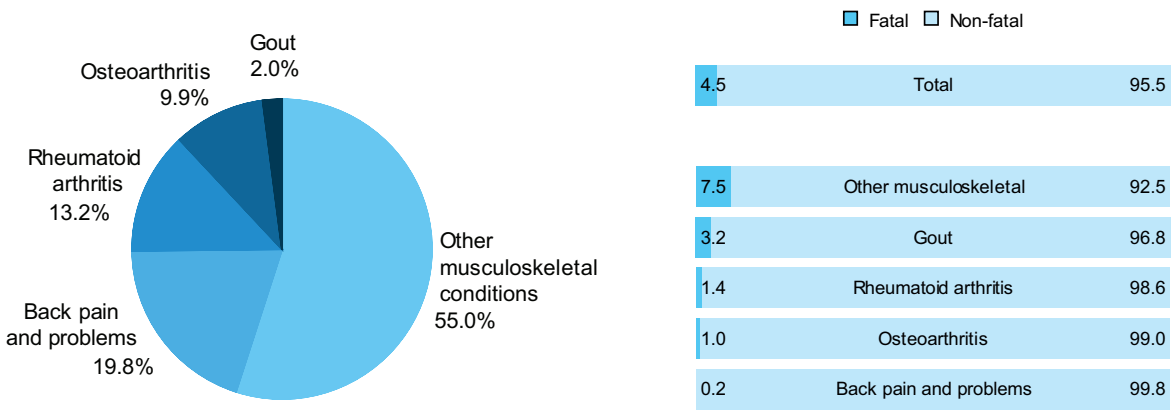
Musculoskeletal conditions are the most common chronic conditions in Australia. They are diseases and disorders of the bones, muscles and their attachments (for example, joints and ligaments). This disease group include osteoarthritis, gout, rheumatoid arthritis, back pain and problems, along with the residual 'other musculoskeletal conditions' (which includes a range of conditions such as other and ill-defined arthritis, chronic pains in joints, muscles and other soft tissue, and systematic lupus erythematous). See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Osteoporosis was considered a risk factor and the burden attributed to this risk factor was analysed, see 'Chapter 7 Contribution of risk factors to burden'.

Overview

In 2011, musculoskeletal conditions accounted for 6.7% (12,704 DALY) of total burden in Indigenous Australians. Most of this was due to other musculoskeletal conditions and back pain & problems, which accounted for 55% and 20% respectively of the burden due to musculoskeletal conditions (Figure 10.6.1).

As musculoskeletal conditions are often chronic, the majority of total burden for each disease was predominately non-fatal (Figure 10.6.1). Overall, non-fatal burden accounted for 96% of the total burden due to musculoskeletal conditions in Indigenous Australians.



Note: The category 'other musculoskeletal conditions' includes a range of conditions such as other and ill-defined arthritis, chronic pains in joints, muscles and other soft tissue, and systematic lupus erythematous.

Figure 10.6.1: Musculoskeletal conditions burden, by disease: a) proportion of disease group total and b) proportions due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The number of DALY due to musculoskeletal conditions in Indigenous Australians increased with age and peaked at ages 40–44 (Figure 10.6.2). Over two-thirds of the overall burden due to musculoskeletal conditions (70%) existed in those aged of 30–64. Very little burden due to musculoskeletal conditions was present in younger age groups.

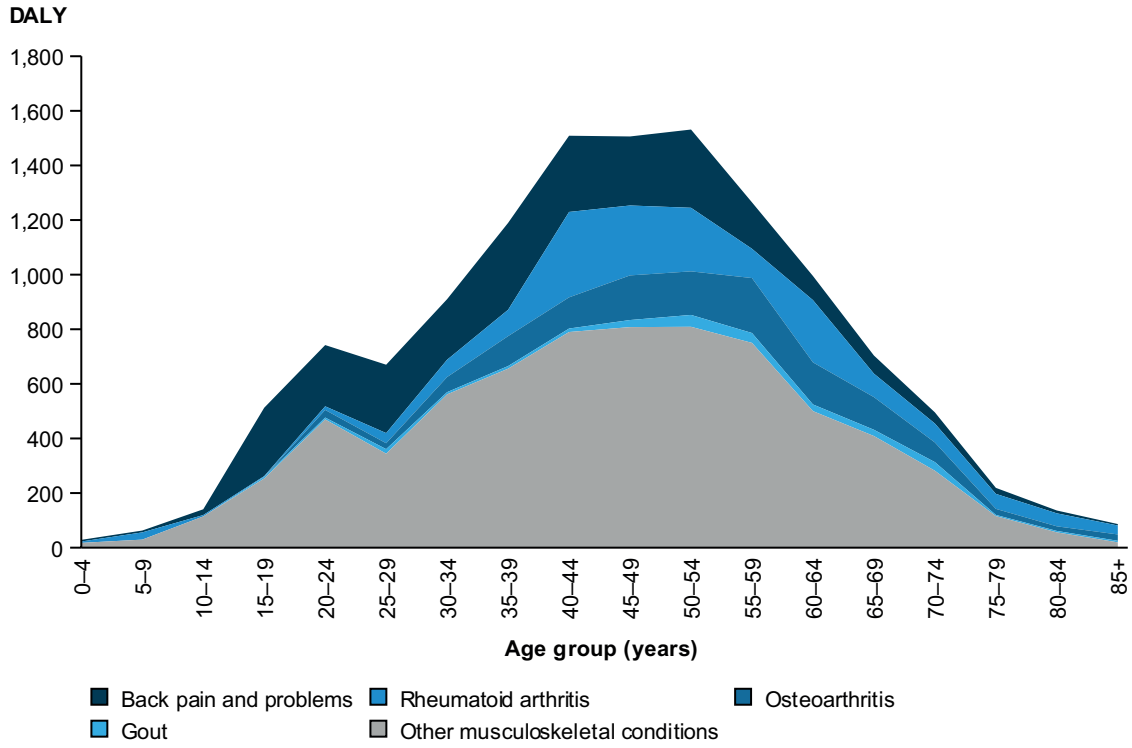


Figure 10.6.2: Musculoskeletal conditions burden (DALY) by age and disease, Indigenous Australians, 2011

Indigenous females experienced slightly more (56%) of the burden due to musculoskeletal conditions than Indigenous males (44%). Indigenous females experienced the majority of burden across all musculoskeletal conditions with the exception of gout, where Indigenous males experienced the majority of burden (74%) (Figure 10.6.3).

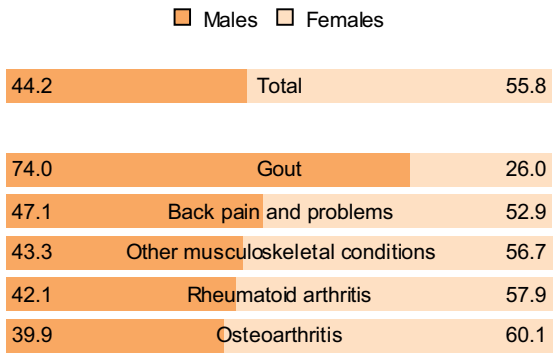


Figure 10.6.3: Musculoskeletal conditions burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed 4% to the burden for musculoskeletal conditions. For this disease group, the biggest risk factor was occupational exposures and hazards (4%) (Table 10.6.1).

Table 10.6.1: Proportion (%) of burden attributable to risk factors for musculoskeletal conditions, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Occupational exposures and hazards	3.7
High body mass	0.3
Joint effect of all risk factors	**3.9**

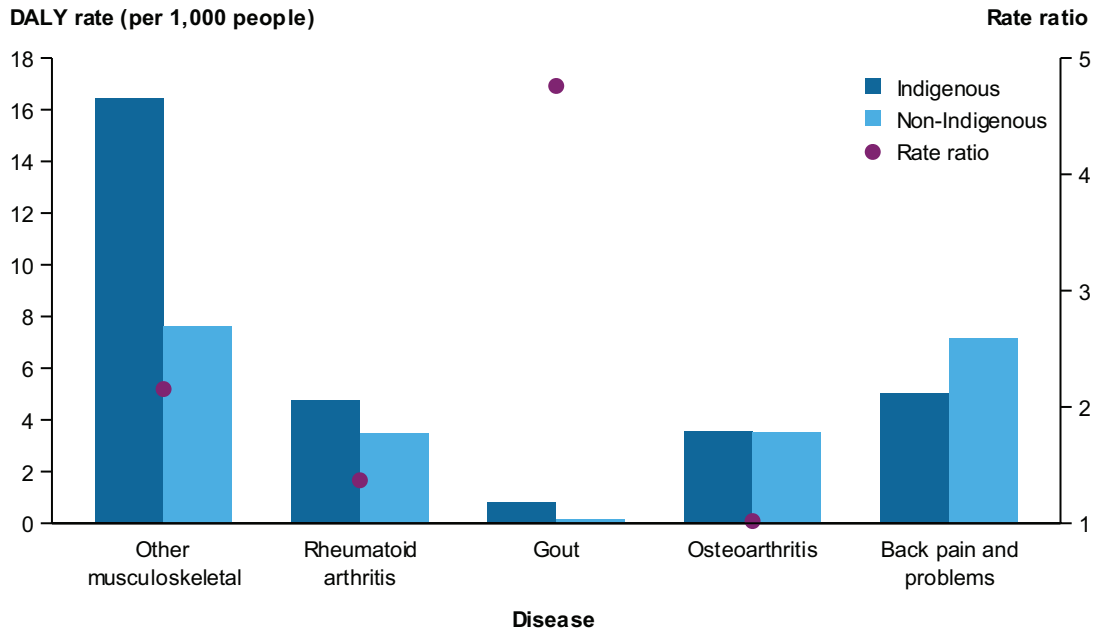
Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced 1.4 times the total burden (DALY) due to musculoskeletal conditions than non-Indigenous Australians (Appendix Table D13).

The largest absolute and relative differences between Indigenous and non-Indigenous Australians in rates of burden due to musculoskeletal conditions were seen for other musculoskeletal conditions (rate ratio of 2.2; rate difference of 8.8 DALY per 1,000 people) and rheumatoid arthritis (rate ratio of 1.4 and rate difference of 1.3 DALY per 1,000 people). Although the relative difference for gout was large (rate ratio of 4.8) the DALY rates for this condition were very small, at less than 1 DALY per 1,000 in both Indigenous and non-Indigenous Australians (Figure 10.6.4).



Note: Rate ratio not shown on graph if ratio is less than 1.

Source: Appendix Table D13.

Figure 10.6.4: Musculoskeletal conditions age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to musculoskeletal conditions for Indigenous Australians remained relatively stable (32 to 31 DALY, respectively) (Table 10.6.2). The rate of non-fatal burden for this disease group also remained stable over this time period (29 YLD per 1,000 people).

Table 10.6.2: Musculoskeletal conditions age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Other musculoskeletal	15.1	15.1	—	—
Back pain & problems	5.0	5.0	—	—
Rheumatoid arthritis	4.7	4.7	—	—
Osteoarthritis	3.7	3.5	–0.2	–4.9
Gout	0.8	0.8	—	—
All musculoskeletal conditions	**29.3**	**29.0**	**–0.3**	**–1.0**
		Fatal burden (YLL)		
Other musculoskeletal	1.7	1.4	–0.4	–21.6
Back pain & problems	0.1	—	–0.1	–85.4
Rheumatoid arthritis	0.2	0.1	–0.2	–62.2
Osteoarthritis	0.1	0.1	—	—
Gout	—	—	—	—
All musculoskeletal conditions	**2.3**	**1.6**	**–0.7**	**–29.4**
		Total burden (DALY)		
Other musculoskeletal	16.9	16.4	–0.5	–2.7
Back pain & problems	5.1	5.0	–0.1	–2.4
Rheumatoid arthritis	4.9	4.8	–0.1	–2.7
Osteoarthritis	3.8	3.6	–0.3	–6.7
Gout	0.8	0.8	—	—
All musculoskeletal conditions	**31.5**	**30.6**	**–1.0**	**–3.0**

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

Data quality

The key data source for the non-fatal burden was the 2012–13 AATSIHS. This data source provides estimates of self-reported prevalence that is deemed suitable for quantifying health loss.

Except for gout, the severity distribution was derived from self-reported information on pain captured in the AATSIHS. The proportions in each severity level of gout were derived from GBD 2013.

10.7 Infant and congenital conditions

The infant & congenital disease 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 in 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.

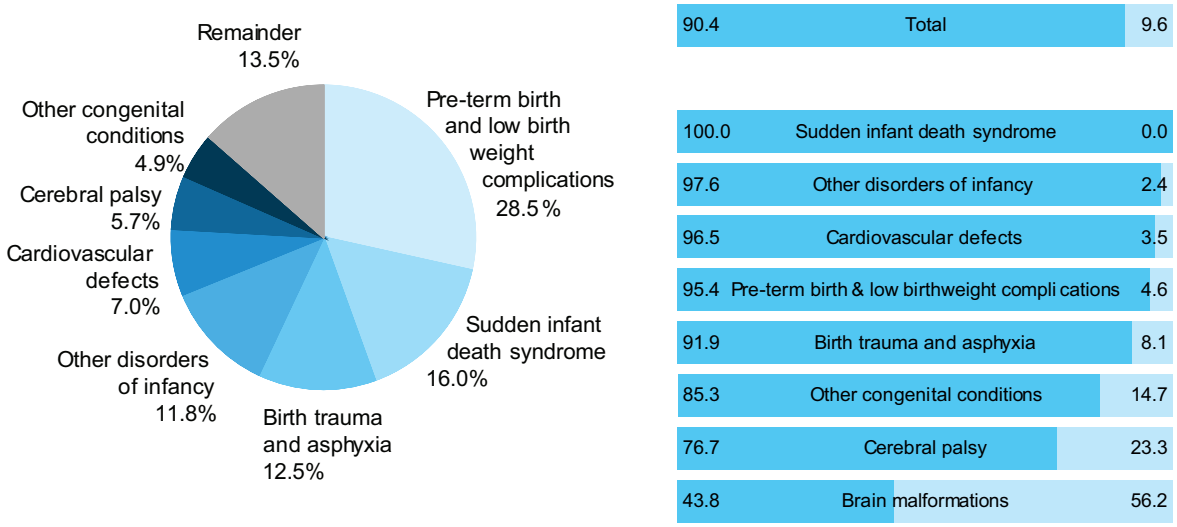
There are 3 residual causes in this group which each include a range of conditions; 'other disorders of infancy' (for example, neonatal diabetes mellitus and umbilical polyp of newborn), 'other congenital conditions' (for example, congenital malformations of the respiratory and musculoskeletal systems) and 'other chromosomal abnormalities' (for example, Edwards syndrome and fragile X chromosome). See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Overview

In 2011, infant & congenital conditions contributed 5.7%, of total burden in Indigenous Australians (10,770 DALY). The impact of this disease group primarily occurs during infancy and early childhood, with little ongoing burden at older ages.

The leading causes of burden were pre-term & LBW complications (28.5%), SIDS (16%) and birth trauma & asphyxia (13%) (Figure 10.7.1).

Premature death (fatal burden) was responsible for 90% of the overall burden in Indigenous Australians for this disease group. This large proportion occurred because most of these deaths were within the first year of life, which showed the influence of age at death on the measure of fatal burden. SIDS was included in fatal burden estimates only. There was a high proportion of non-fatal burden from cerebral palsy (23%) and brain malformations (56%), which was largely due to lifelong consequences of motor and cognitive impairment.



Note: Remainder category includes all causes included in infant & congenital conditions not specifically listed in figure.

Figure 10.7.1: Infant & congenital conditions burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

Overall, Indigenous males experienced more than half the burden (57%) due to infant & congenital conditions compared to Indigenous females (Figure 10.7.2). For all conditions, except other chromosomal abnormalities, neural tube defects and gastrointestinal malformations, Indigenous males experienced a greater share of burden than Indigenous females.

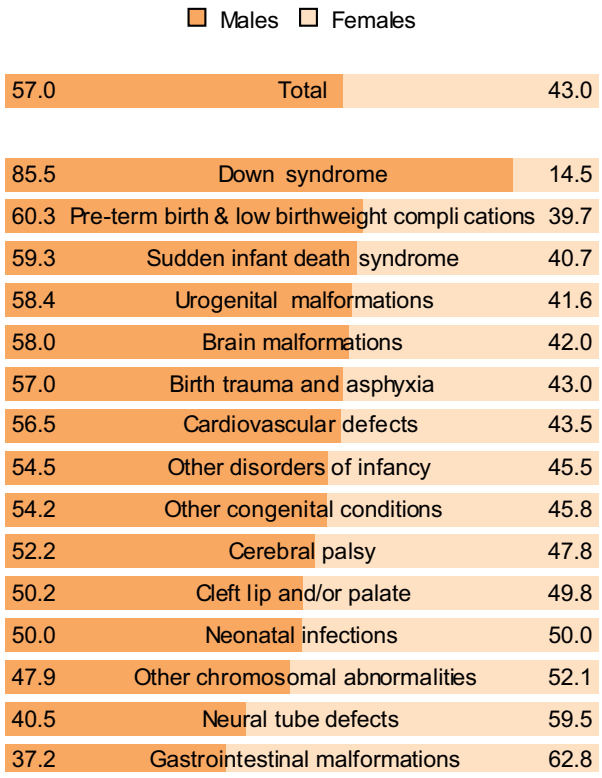


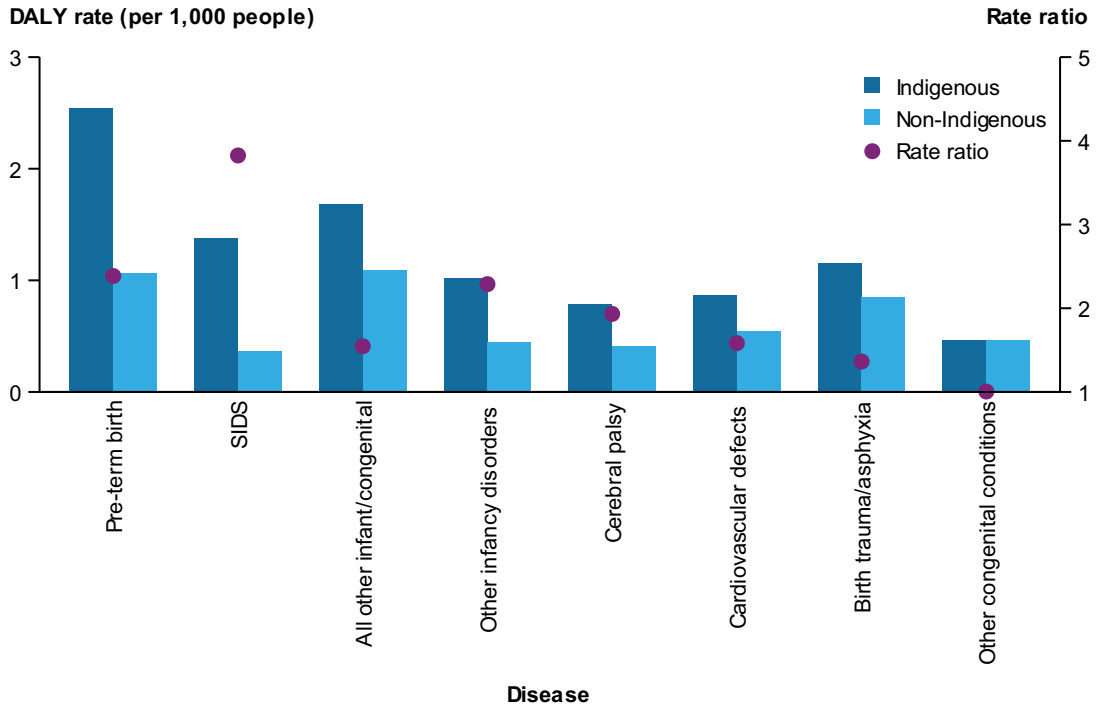
Figure 10.7.2: Infant & congenital conditions burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

None of the risk factors considered in this study were linked to the conditions in this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced rates of burden (DALY) due to infant & congenital conditions at twice the rate of non-Indigenous Australians. The largest absolute differences in DALY rates for infant & congenital conditions were seen for pre-term birth & LBW complications (1.5 DALY per 1,000 people) and SIDS (1.0 DALY per 1,000) (Figure 10.7.3). SIDS represented the largest relative difference between Indigenous and non-Indigenous Australians with a rate ratio of 3.8.



Source: Appendix Table D14.

Figure 10.7.3: Infant & congenital conditions age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to infant & congenital conditions for Indigenous Australians was relatively stable (12 and 10 DALY per 1,000 people, respectively) (Table 10.7.1). There was a decrease in the fatal burden for this disease group (17%), mainly driven by decreases in SIDS and birth trauma & asphyxia (decreases of around 0.5 YLL per 1,000; equivalent to decreases of 25% and 31%, respectively).

Rates of non-fatal burden due to infant & congenital conditions remained relatively stable between 2003 and 2011 in the Indigenous population (1.7 and 1.6 YLD per 1,000 people, respectively).

Table 10.7.1: Infant & congenital conditions age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Pre-term birth & LBW complications	0.2	0.2	—	—
SIDS	0.0	0.0	—	. .
Birth trauma & asphyxia	0.2	0.2	—	—
Other disorders of infancy	—	—	—	—
Cardiovascular defects	0.1	—	—	—
All infant & congenital conditions[(a)]	**1.7**	**1.6**	**–0.1**	**–8.0**
		Fatal burden (YLL)		
Pre-term birth & LBW complications	1.9	2.3	0.4	23.2
SIDS	1.8	1.4	–0.5	–25.2
Birth trauma & asphyxia	1.4	1.0	–0.4	–31.1
Other disorders of infancy	1.1	1.0	–0.1	–6.1
Cardiovascular defects	1.2	0.8	–0.4	–30.7
All infant & congenital conditions[(a)]	**9.9**	**8.3**	**–1.6**	**–16.5**
		Total burden (DALY)		
Pre-term birth & LBW complications	2.1	2.5	0.4	21.2
SIDS	1.8	1.4	–0.5	–25.2
Birth trauma & asphyxia	1.6	1.2	–0.4	–27.9
Other disorders of infancy	1.1	1.0	–0.1	–5.2
Cardiovascular defects	1.2	0.9	–0.4	–30.7
All infant & congenital conditions[(a)]	**11.6**	**9.9**	**–1.8**	**–15.2**

(a) Total includes burden due to the causes listed in the table as well as cerebral palsy, brain malformations, other congenital conditions, neural tube defects, gastrointestinal malformations, neonatal infections, Down syndrome, urogenital malformations, other chromosomal abnormalities and cleft lip and/or palate.

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 infant & congenital conditions were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification, and are considered of reasonably high quality.

Key data sources for non-fatal burden estimates included the National Perinatal Data Collection, the National Hospital Morbidity Database (adjusted for Indigenous under-identification), and the Western Australian Register of Developmental Anomalies. These sources were able to provide fairly reliable live birth Indigenous prevalence estimates from birth to the first year of life. However, there were limited sources to estimate prevalence of 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.

10.8 Endocrine disorders

The endocrine disease group contains only 2 specific diseases:

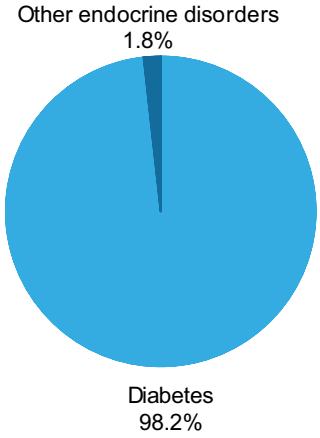
- diabetes mellitus (diabetes) including type 1, type 2 and other diabetes types. It excludes gestational diabetes (which is included in reproductive & maternal conditions)
- other endocrine disorders including thyroid disorders and disorders of other endocrine glands. It excludes polycystic ovarian syndrome (which is included in reproductive & maternal conditions).

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 CHD and CKD. 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 diseases and kidney & urinary diseases, respectively.

Overview

Endocrine disorders contributed 4.1% (7,863 DALY) of total health loss among Indigenous Australians in 2011. Most of this burden was due to diabetes, which was 1 of the 5 leading causes of total burden among Indigenous Australians (7,725 DALY).

Endocrine disorders caused more fatal (68%) than non-fatal burden (32%) (Figure 10.8.1).



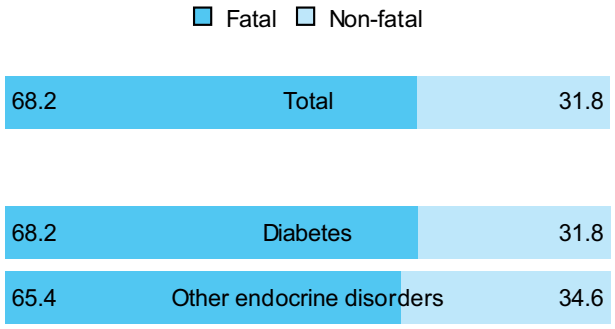


Figure 10.8.1: Endocrine disorders burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The burden due to endocrine disorders varies across the life course. For Indigenous children aged 0–4, burden due to other endocrine disorders is most prominent (Figure 10.8.2). Diabetes was the major source of burden in the remaining age groups with the number of DALY peaking at ages 50–54.

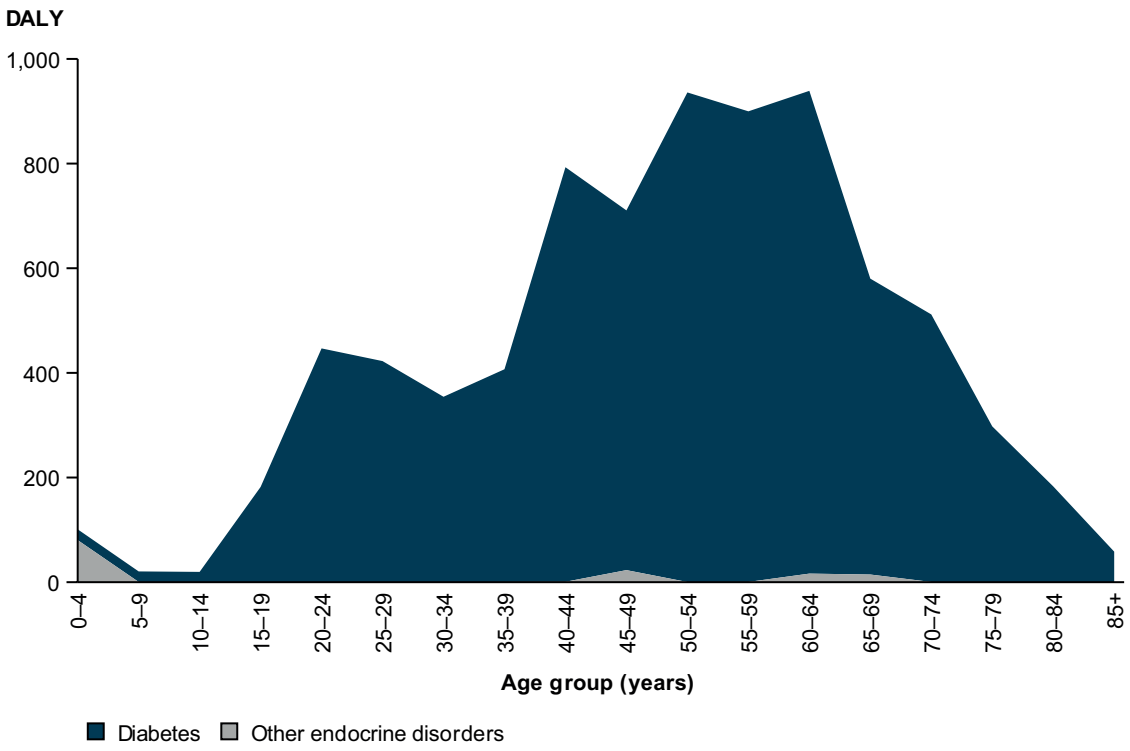


Figure 10.8.2: Endocrine disorders burden (DALY) by age and disease, Indigenous Australians, 2011

Indigenous females (51%) had a slightly larger share of burden from diabetes compared to Indigenous males (49%) and a much larger share of burden from other endocrine disorders (87% compared to 13%) (Figure 10.8.3).

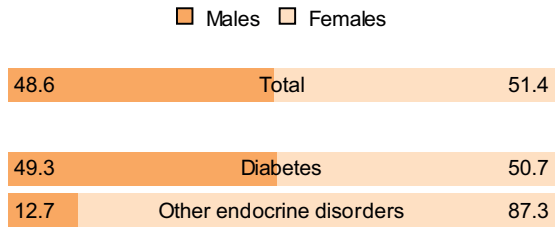


Figure 10.8.3: Endocrine disorders burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed greatly to the burden for endocrine disorders (90%). For this disease group, the biggest risk factors were high blood plasma glucose (89.5%), high body mass (62%) and physical inactivity (36%) (Table 10.8.1).

Table 10.8.1: Proportion (%) of burden attributable to risk factors for endocrine disorders, Indigenous Australians, 2011

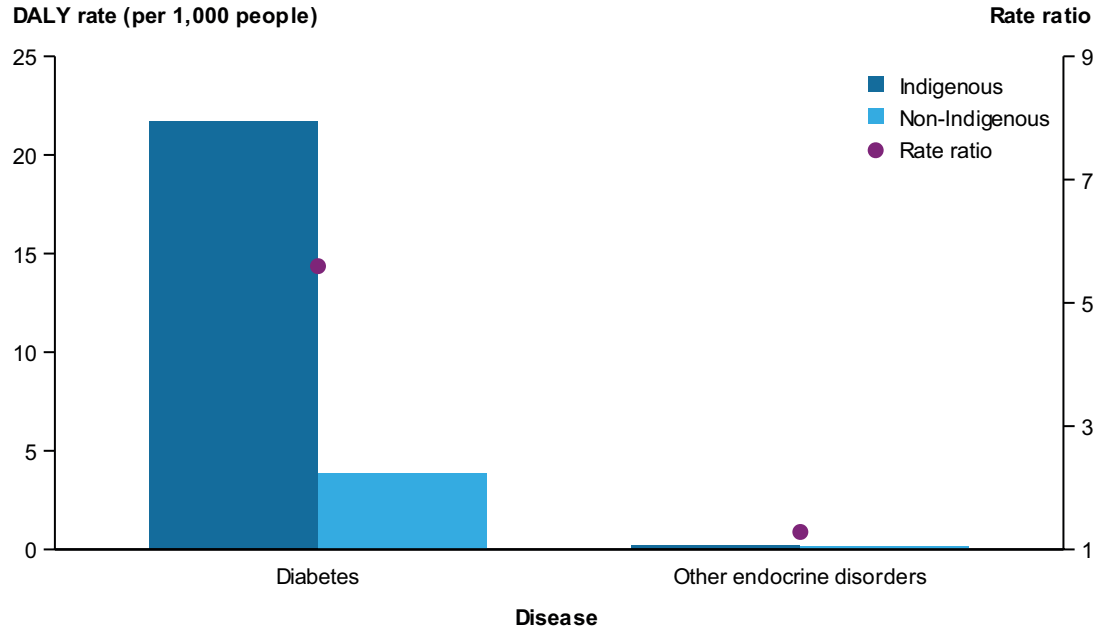
Risk factor	Attributable burden (%)	Risk factor	Attributable burden (%)
High blood plasma glucose	89.5	Diet low in nuts and seeds	9.8
High body mass	62.3	Tobacco use	8.2
Physical inactivity	35.6	Diet high in red meat	6.6
Diet high in sweetened beverages	32.9	Alcohol use	0.7
Diet high in processed meat	23.1		
Diet low in whole grains	19.0	**Joint effect of all risk factors**	**89.5**

Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced rates of overall burden due to endocrine disorders at over 5 times the rate experienced by non-Indigenous Australians (Figure 10.8.4). This was mostly due to the much higher rates of burden due to diabetes (rate ratio of 5.6; rate difference of 18 DALY per 1,000 people).



Source: Appendix Table D15.

Figure 10.8.4: Endocrine disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to endocrine disorders for Indigenous Australians decreased slightly from 25 to 22 DALY per 1,000 people; a decrease of 11% (Table 10.8.2). This was largely driven by declines in fatal burden (3 YLL per 1,000 people; 17% decrease) which outweighed the increase observed in non-fatal burden (1 YLD per 1,000 people; 16% increase).

Diabetes had a notably higher age-standardised rate of non-fatal burden in 2011 than 2003 (5 compared to 4 YLD per 1,000, respectively; 20% increase), and a lower rate of fatal burden (17 compared to 20 YLL per 1,000 people, respectively; 15% decrease).

Table 10.8.2: Endocrine disorders age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Diabetes	4.0	4.8	0.8	19.7
Other endocrine disorders	0.2	0.1	–0.1	–63.5
All endocrine disorders	**4.2**	**4.8**	**0.7**	**15.6**
		Fatal burden (YLL)		
Diabetes	20.0	16.9	–3.1	–15.3
Other endocrine disorders	0.5	0.1	–0.3	–70.3
All endocrine disorders	**20.5**	**17.1**	**–3.4**	**–16.7**
		Total burden (DALY)		
Diabetes	24.0	21.7	–2.3	–9.5
Other endocrine disorders	0.7	0.2	–0.5	–68.3
All endocrine disorders	**24.7**	**21.9**	**–2.8**	**–11.2**

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 endocrine disorders were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data, and are considered of reasonably high quality.

Overall Indigenous diabetes prevalence rates in 2011 were drawn from measurement data in the AATSIHS based on blood samples from survey respondents which is considered 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.

Diabetes complication estimates rely on epidemiological studies to quantify the proportion of people with diabetes with each complication (for example, vision loss due to diabetes) to be able to accurately measure the level of the specific conditions in that population. Consequently samples are drawn from specific regions of Australia for this purpose which may result in differences across regions not being identified.

10.9 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 (GBS), along with the residual 'other neurological conditions'. It excludes infections of the nervous system which is included under infectious diseases; and cerebral palsy which is included in infant & congenital conditions.

The residual cause 'other neurological conditions' includes a range of conditions such as dystonia, narcolepsy and Bell palsy. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

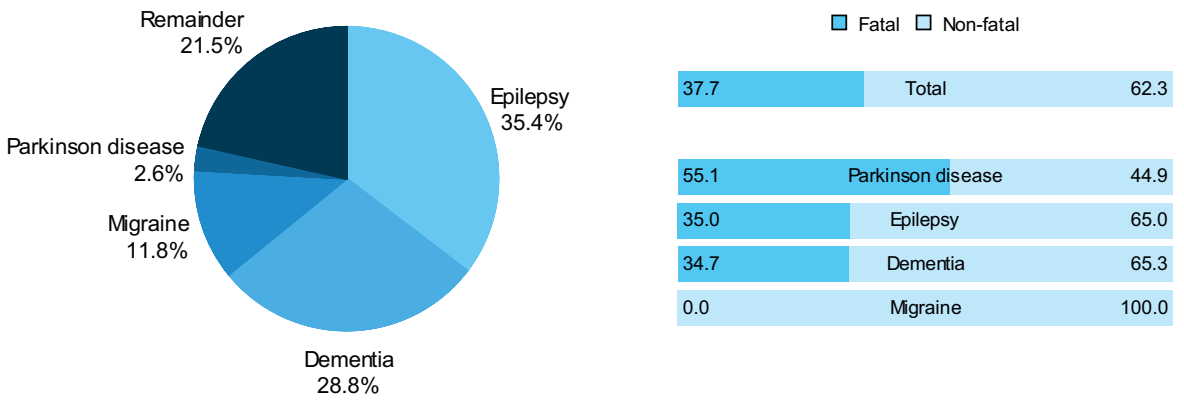
Parkinson disease, multiple sclerosis, motor neurone disease and GBS are rare in the Indigenous population.

Overview

Overall in 2011, neurological conditions were responsible for 4.0% (7,587 DALY) of total burden among Indigenous Australians. Most of this burden was due to dementia and epilepsy, which together accounted for 64% of the total burden due to neurological conditions.

Neurological conditions contributed more to non-fatal burden (5.3% of total non-fatal burden) than fatal burden (2.8% of fatal burden). This is because the most burdensome diseases (dementia, epilepsy and migraine) contributed more non-fatal burden than fatal burden (Figure 10.9.1).

As shown in Figure 10.9.2, the burden due to neurological conditions varies across the life course. Dementia caused the majority of burden among Indigenous Australians aged 55 and over.



Note: Remainder category includes all causes included in neurological conditions not specifically listed in figure.

Figure 10.9.1: Neurological conditions, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

Epilepsy contributed the most burden among Indigenous Australians aged 5–54, and was the only neurological disease that caused burden in all age groups.

The burden caused by migraine was higher in the young to middle age groups (under 45). Similar to dementia, Parkinson disease contributed more burden in the older age groups.

Overall, neurological conditions caused slightly more burden among Indigenous females than Indigenous males (52% compared to 48%) (Figure 10.9.3). This is mainly due to a higher proportion of burden due to migraine, multiple sclerosis, dementia and other neurological conditions among Indigenous females.

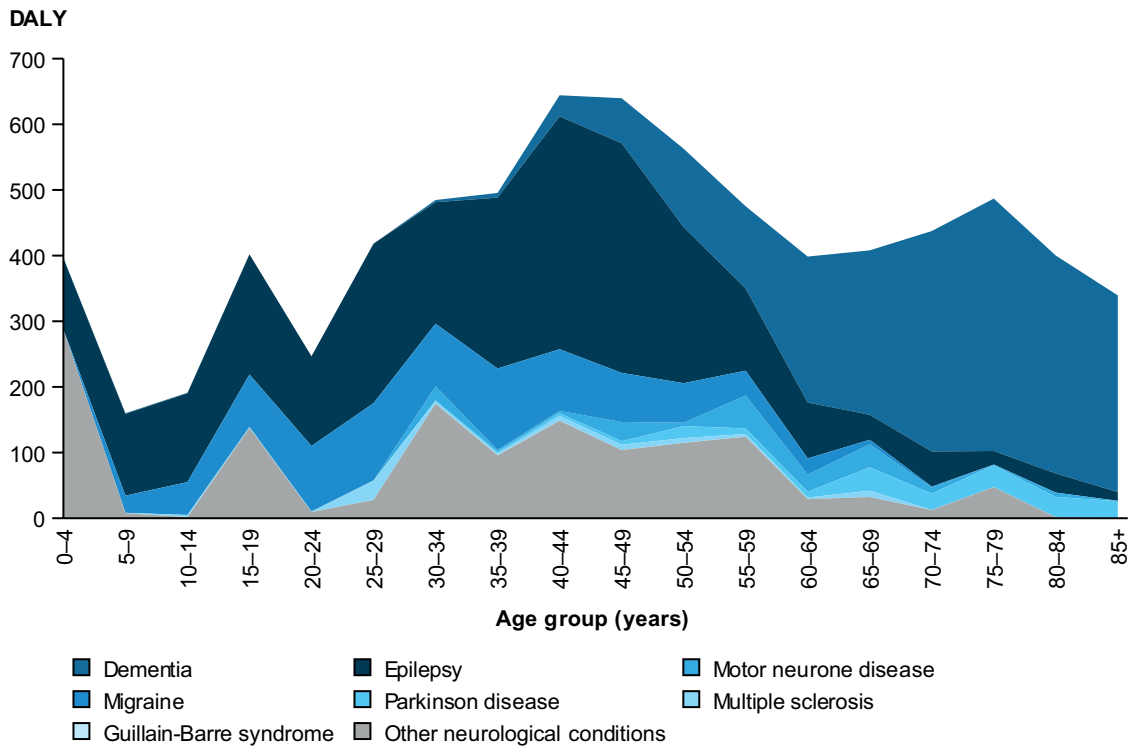


Figure 10.9.2: Neurological conditions burden (DALY) by age and disease, Indigenous Australians, 2011

Epilepsy and Parkinson disease represented a higher proportion of burden among Indigenous males than Indigenous females.

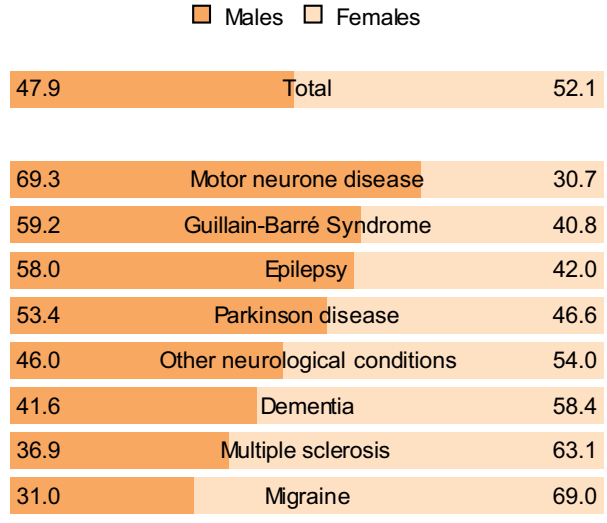


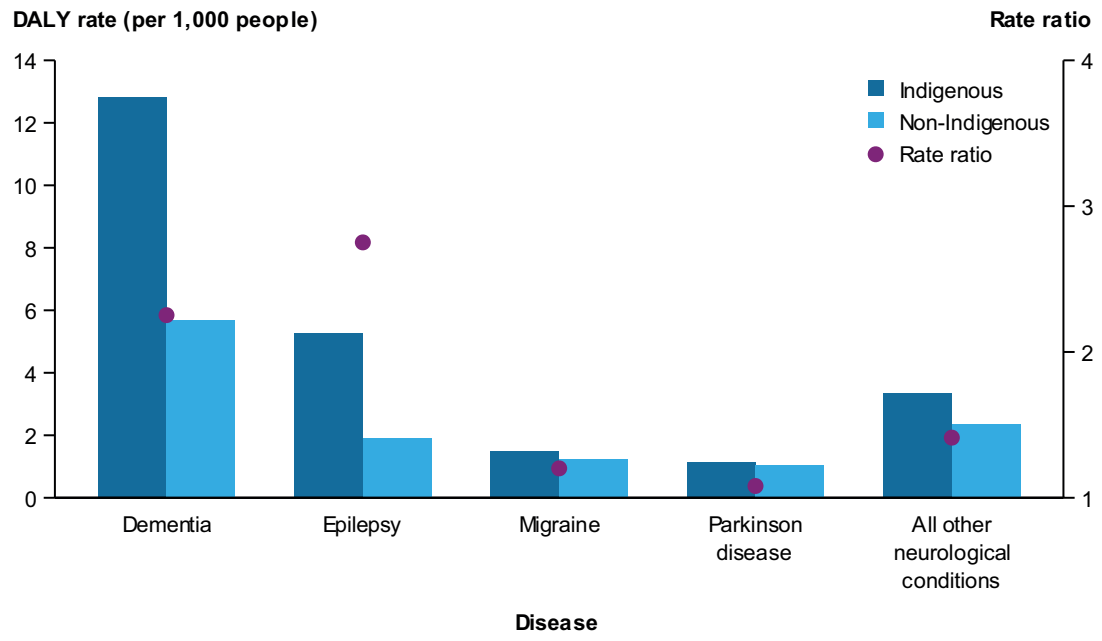
Figure 10.9.3: Neurological conditions burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The only risk factor associated with neurological conditions in the current study was alcohol use, which contributed 1.4% to the burden for this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced double the rate of overall burden due to neurological conditions compared to the rate experienced by non-Indigenous Australians (Appendix Table D16). This was mostly due to dementia (rate ratio of 2.3; rate difference of 7.1 DALY per 1,000 people) and epilepsy (rate ratio of 2.8; rate difference of 3.3 DALY per 1,000) (Figure 10.9.4).



Source: Appendix Table D16.

Figure 10.9.4: Neurological conditions age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to neurological conditions for Indigenous Australians was relatively stable (24 DALY per 1,000 people) (Table 10.9.1). Over the same period, there was a small increase in the age-standardised rate of fatal burden for this disease group (15%), mainly from dementia (increase of around 2 YLL per 1,000 people, equivalent to a 54% increase).

Rates of non-fatal burden due to neurological conditions decreased slightly between 2003 and 2011 in the Indigenous population (from 15 to 14 YLD per 1,000 people; decrease of 6%).

Table 10.9.1: Neurological conditions age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Epilepsy	3.3	3.5	0.2	7.2
Dementia	7.7	7.7	—	—
Migraine	1.7	1.5	–0.2	–11.0
Parkinson disease	0.5	0.5	—	—
All neurological conditions[(a)]	**15.3**	**14.4**	**–0.9**	**–5.7**
		Fatal burden (YLL)		
Epilepsy	2.6	1.8	–0.8	–32.1
Dementia	3.3	5.1	1.8	53.9
Migraine	0.0	0.0	—	. .
Parkinson disease	0.6	0.7	0.1	18.4
All neurological conditions[(a)]	**8.4**	**9.7**	**1.2**	**14.7**
		Total burden (DALY)		
Epilepsy	5.8	5.3	–0.6	–10.2
Dementia	11.0	12.8	1.8	16.2
Migraine	1.7	1.5	–0.2	–11.0
Parkinson disease	1.0	1.1	0.1	10.0
All neurological conditions[(a)]	**23.7**	**24.0**	**0.4**	**1.5**

(a) Total includes burden due to the causes listed in the table as well as motor neurone disease, multiple sclerosis, GBS and other neurological conditions.

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 neurological conditions were calculated using Indigenous deaths registered in the National Mortality Database which were adjusted for Indigenous under-identification in mortality data. They are considered of reasonably high quality.

Non-fatal burden estimates for neurological conditions were derived from a variety of sources with varying data quality. This included hospitalisations data adjusted for Indigenous under-identification (for epilepsy) WA linked hospitals and deaths data (for motor neurone disease) and the AATSIHS (for migraine).

Data from 2 small-scale epidemiological studies in the Indigenous population were used to model national Indigenous prevalence estimates for dementia. As this condition causes the greatest burden of all the neurological conditions included in the ABDS, these estimates could be improved with a national study of dementia in the Indigenous population.

Indirect methods were used to derive Indigenous non-fatal burden estimates for Parkinson disease, multiple sclerosis and GBS. For example, national prevalence rates, which were based on international studies, were applied to the Indigenous population for Parkinson disease as there was no recent Australian or Indigenous Australian data. These estimates could be improved with more direct Indigenous prevalence estimates, and should be interpreted with caution.

10.10 Gastrointestinal disorders

The gastrointestinal (GI) disease group 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:

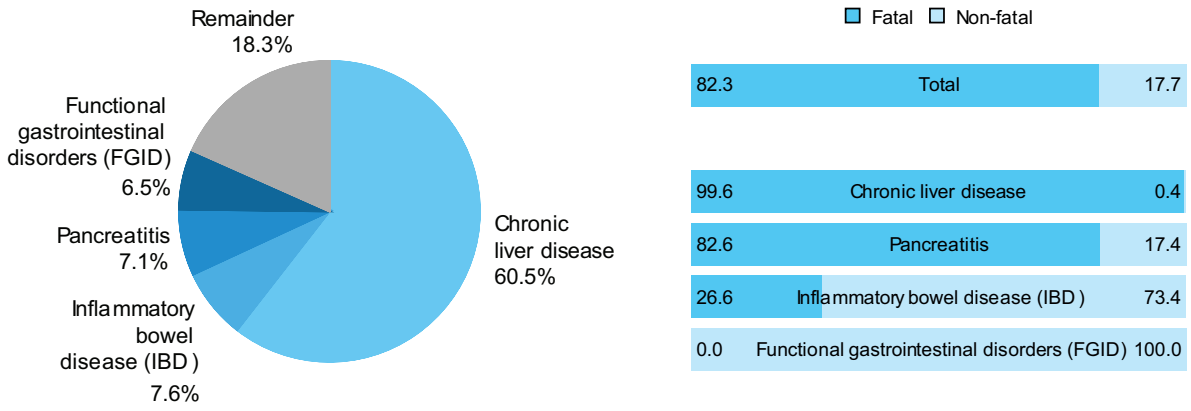
- diseases of the mouth (included in oral disorders)
- congenital GI disorders (included in infant & congenital conditions)
- GI infections (included in infectious diseases; specifically: salmonella, campylobacter, rotavirus and other gastrointestinal infections)
- GI cancers (included in cancer & other neoplasms).

Estimates are presented separately for chronic liver disease (CLD), pancreatitis and inflammatory bowel disease. All other gastrointestinal disorders included in the GI disease group are grouped under the category 'all other GI disorders' due to small numbers for the Indigenous population. This includes gastroduodenal disorders, diverticulitis, vascular disorders of intestine, gastro oesophageal reflux disease, gallbladder and bile duct disease, abdominal wall hernia, functional gastrointestinal disorders, appendicitis and intestinal obstruction (without hernia). See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Overview

GI disorders accounted for 3.6% (6,896 DALY), of total Indigenous health loss in Australia in 2011, 5.6% (5,676 YLL) of all fatal burden and 1.4% (1,220 YLD) of all non-fatal burden.

The majority of total burden due to GI disorders in Indigenous Australians was fatal burden (82%). In particular, CLD, which accounted for nearly two-thirds (61%) of the total GI burden, was predominantly fatal burden. Similarly, around 83% of the burden due to pancreatitis (which accounted for 7% of total GI burden) was due to fatal burden (Figure 10.10.1). Conversely, for inflammatory bowel disease, which accounted for 8% of total GI burden in the Indigenous population, 73% of the burden was non-fatal.



Note: Remainder category includes all causes included in gastrointestinal disorders not specifically listed in figure.

Figure 10.10.1: Gastrointestinal disorders burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

As shown in Figure 10.10.2, the burden due to GI disorders varied across the life course. The small amount of burden in children under 15 was mostly due to inflammatory bowel disease and other GI disorders, such as functional gastrointestinal disorders and gastro-oesophageal reflux disease. Between ages 15–30, inflammatory bowel disease was a major source of burden. CLD was the main cause of burden in Indigenous Australians aged 30–69.

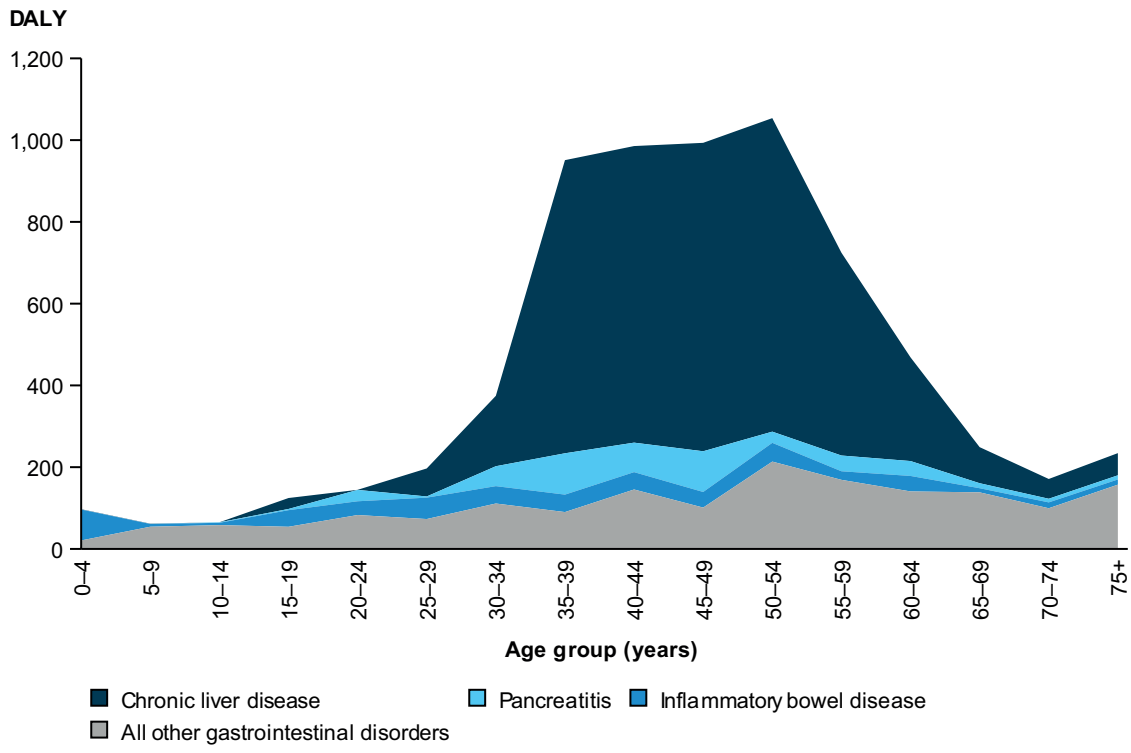


Figure 10.10.2: Gastrointestinal disorders burden (DALY) by age and disease, Indigenous Australians, 2011

The overall GI burden was slightly higher for Indigenous males than females (55% and 45% respectively), but this varied by disease (Figure 10.10.3). For example, Indigenous males experienced the majority of burden from pancreatitis (77%), whereas Indigenous females experienced around 55% of the burden from inflammatory bowel disease.

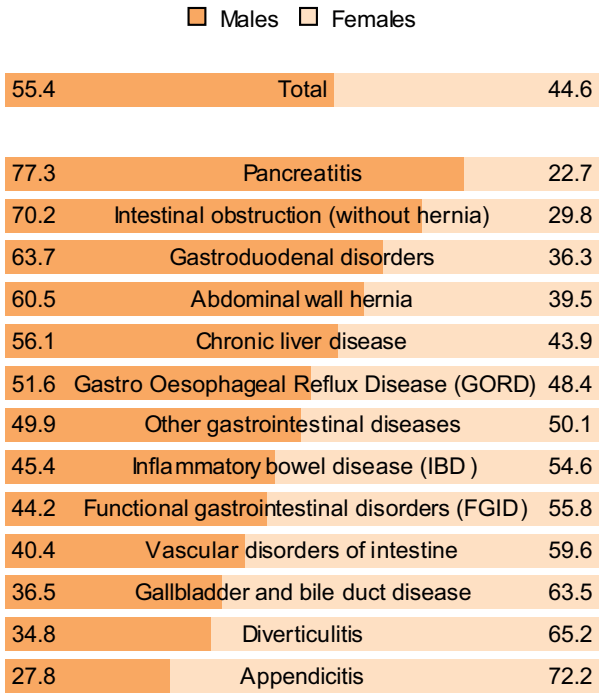


Figure 10.10.3: Gastrointestinal disorders burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed 40% to the burden for gastrointestinal disorders. For this disease group, the biggest risk factors were drug use (31%) and alcohol use (15%) (Table 10.10.1).

Table 10.10.1: Proportion (%) of burden attributable to risk factors for gastrointestinal disorders, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Drug use	30.9
Alcohol use	14.6
Unsafe sex	6.2
Joint effect of all risk factors	**40.4**

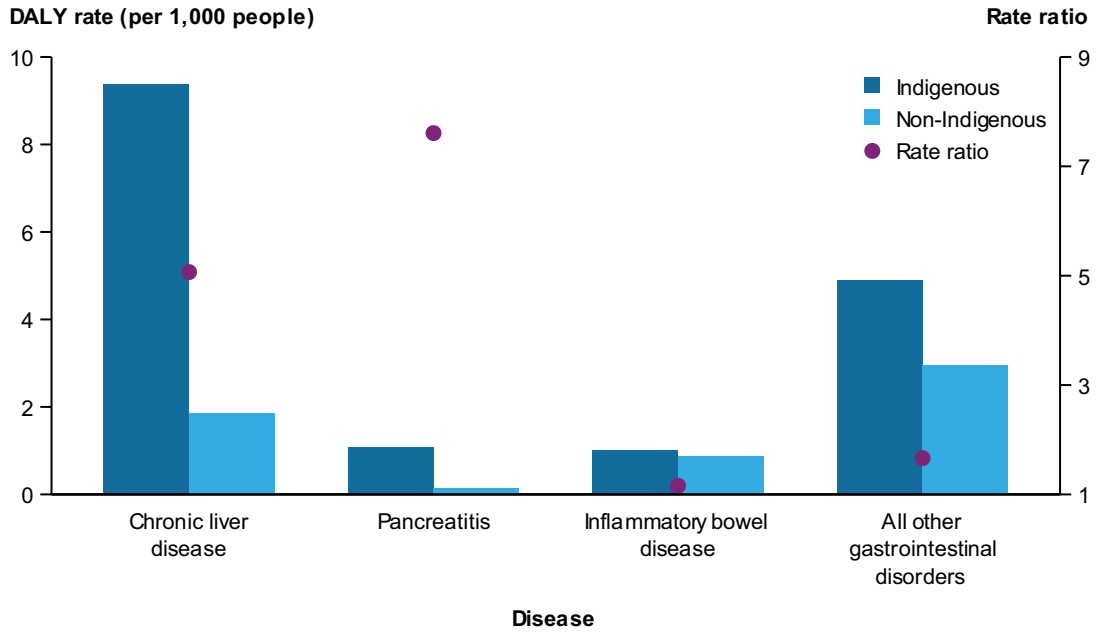
Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

When looking at rate ratios, the burden caused by gastrointestinal disorders was almost 3 times more for Indigenous Australians than for non-Indigenous Australians (Appendix Table D17).

The largest absolute difference in DALY rates for GI disorders between Indigenous and non-Indigenous Australians was for CLD with a rate difference of 7.5 per 1,000 people. Pancreatitis represented the largest relative difference between the Indigenous and non-Indigenous Australians with a rate ratio of 7.6 (Figure 10.10.4).



Source: Appendix Table D17.

Figure 10.10.4: Gastrointestinal disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to gastrointestinal disorders for Indigenous Australians remained relatively stable (19 and 16 DALY per 1,000 people, respectively) (Table 10.10.2). Over the same period there was a slight decrease in the rate of fatal burden for this disease group (14%), mainly from CLD (decrease of around 1 YLL per 1,000 people; equivalent to a 12% decrease).

Rates of non-fatal burden due to gastrointestinal disorders remained stable between 2003 and 2011 in the Indigenous population (2.4 YLD per 1,000 people).

Table 10.10.2: Gastrointestinal disorders age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Chronic liver disease	—	—	—	—
Inflammatory bowel disease (IBD)	0.7	0.7	—	—
Pancreatitis	0.3	0.2	–0.1	–38.3
All gastrointestinal disorders[(a)]	**2.4**	**2.4**	**—**	**—**
		Fatal burden (YLL)		
Chronic liver disease	10.6	9.3	–1.3	–11.8
Inflammatory bowel disease (IBD)	0.4	0.3	–0.1	–32.3
Pancreatitis	1.3	0.9	–0.3	–26.7
All gastrointestinal disorders[(a)]	**16.2**	**14.0**	**–2.2**	**–13.6**
		Total burden (DALY)		
Chronic liver disease	10.6	9.4	–1.2	–11.7
Inflammatory bowel disease (IBD)	1.2	1.0	–0.1	–12.2
Pancreatitis	1.5	1.1	–0.4	–28.8
All gastrointestinal disorders[(a)]	**18.7**	**16.4**	**–2.3**	**–12.1**

(a) Total includes burden due to the causes listed in the table as well as all causes included in gastrointestinal disorders group not specifically listed.

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 GI disorders were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data, and are considered of reasonably high quality.

YLD estimates for many GI conditions rely on the assumption that for health loss to be counted, the condition will be severe enough for the patient to seek medical care, either through hospital or a general practitioner, and this must be a medically confirmed diagnosis. Conditions self-managed in the community via over-the-counter medications are not included in these estimates.

Estimates for acute GI conditions, severe enough to require hospitalisation and surgical care, such as pancreatitis and a number of conditions included in the 'all other GI disorders' category (for example, appendicitis, hernia and gallbladder disease) are sourced directly from national hospitalisations data. These estimates have been adjusted for Indigenous under-identification in hospital recording systems and are considered of reasonably high quality.

Estimates for long-term conditions such as CLD and gastroduodenal disease (included in the 'all other GI disorders' category) are sourced from national hospitalisations data which has been adjusted to account for multiple hospital admissions using patient to separation ratios from Western Australian linked data. These estimates would be improved with access to national linked hospitalisations data.

Estimates for inflammatory bowel disease, which is chronic and remitting/recurring in nature are based on data from Australian epidemiological studies based on small, discrete geographical areas. As no suitable data sources were identified for Indigenous Australians for this condition, national prevalence rates were applied to the Indigenous population to derive prevalence. These estimates could be improved with studies of wider and Indigenous populations.

10.11 Infectious diseases

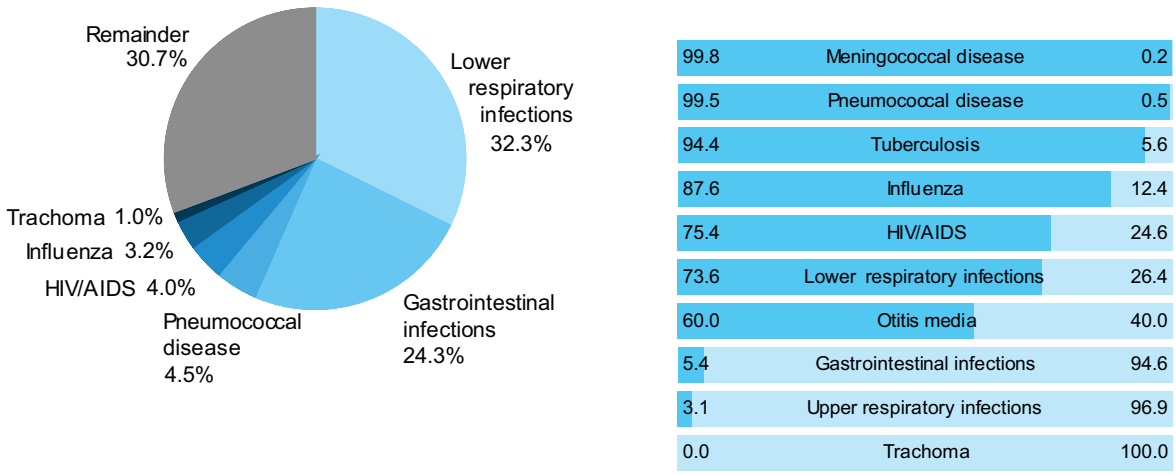
The infectious diseases group includes 32 diseases caused by pathogenic microorganisms, such as viruses, bacteria and parasites. Within the disease group, individual causes have been defined either by the pathogen responsible for disease (for example, hepatitis B virus) or the site of infection (for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

Overview

Infectious diseases were responsible for 3.2% (6,069 DALY) of the total burden of disease and injury in Indigenous Australians in 2011.

Within the disease group, the causes responsible for the largest share of DALY were lower respiratory infections (32%), gastrointestinal infections (24%), pneumococcal disease (5%), HIV/AIDS (4%) and influenza (3%) (Figure 10.11.1). The complete list of causes in this disease group can be found in Appendix Table B1.

Across the entire infectious diseases group, 54% 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 disease burden by cause. For example, premature death was responsbile for more than 99% of the burden due to meningococcal and pnuemococcal diseases but only 3% of upper respiratory infections. This is because for many causes in the infectious diseases group, the duration of the disease is relatively short, and so YLD are small, while at the same time, although the number of deaths that occur is small, they happen at relatively young ages, so YLL are large.



Note: Remainder category includes all causes included in infectious diseases not specifically listed in figure.

Figure 10.11.1: Infectious diseases burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

The total infectious diseases burden (number of DALY) peaked at ages 0–4 for Indigenous Australians (Figure 10.11.2), driven primarily by gastrointestinal infections (responsible for 40% of the infectious burden in this age group) and lower respiratory infections (19% of the burden in this age group). These 2 causes combined contributed between 37% and 76% of the infectious diseases burden in each age group.

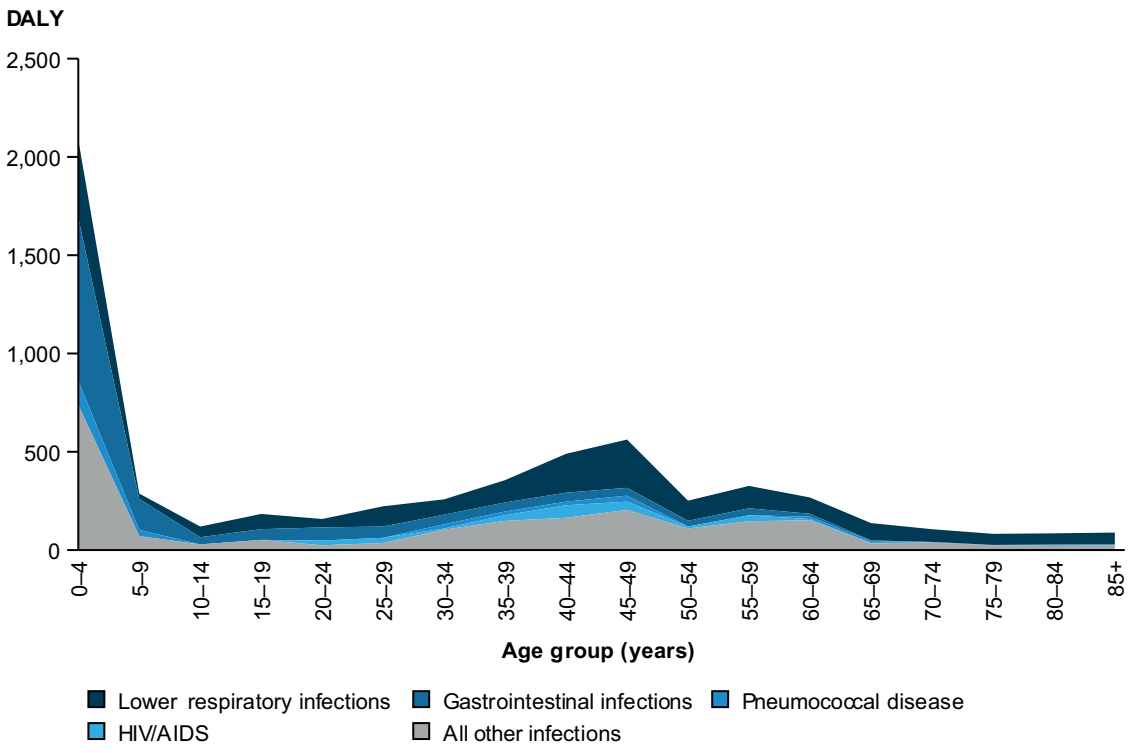


Figure 10.11.2: Infectious diseases burden (DALY) by age and disease, Indigenous Australians, 2011

Overall, a slightly larger proportion of burden due to infectious diseases was experienced by Indigenous males (53%; 3,194 DALY) than by Indigenous females (47%; 2,875 DALY) (Figure 10.11.3). However, these proportions differed by cause. Over three-quarters (77%) of the burden due to HIV/AIDS and more than two-thirds of the burden due to influenza (72%) was experienced by males. Conversely, 62% of the burden due to upper respiratory infections was experienced by females.

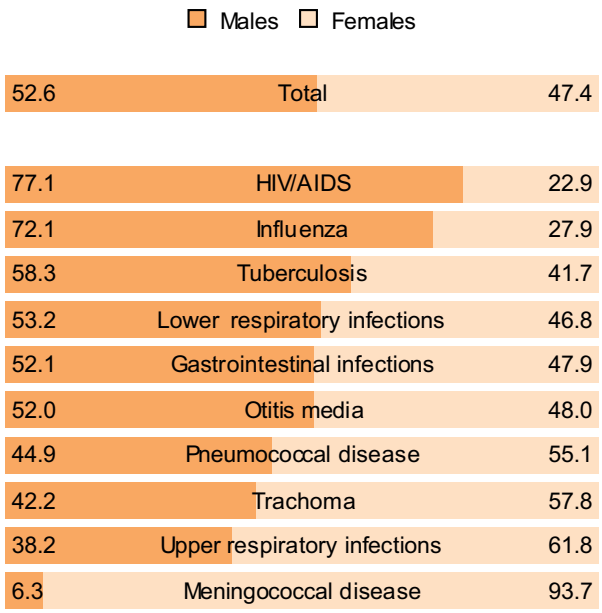


Figure 10.11.3: Infectious diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed 7% to the burden for infectious diseases. For this disease group, the biggest risk factors were unsafe sex (4%) and tobacco use (2%) (Table 10.11.1).

Table 10.11.1: Proportion (%) of burden attributable to risk factors for infectious diseases, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Unsafe sex	3.6
Tobacco use	1.9
Drug use	1.2
Alcohol use	0.4
Unimproved sanitation	0.3
Air pollution	0.0
Joint effect of all risk factors	**6.8**

Notes

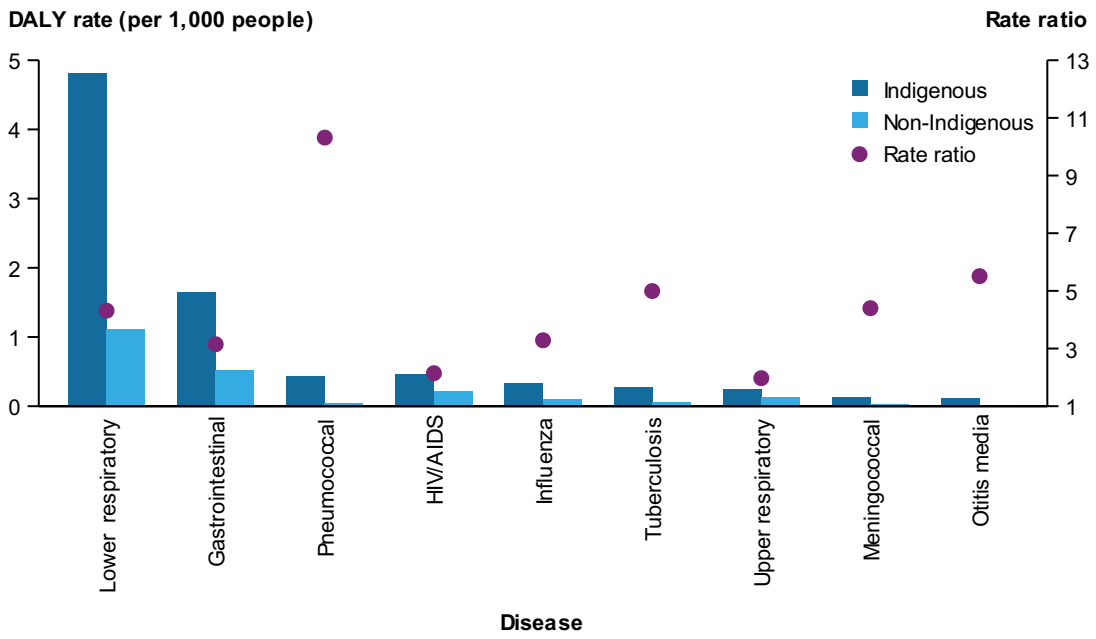
1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced the burden of disease due to infectious diseases at 4 times the rate of non-Indigenous Australians (age-standardised rates of 11.3 and 2.9 per 1,000 people respectively) (Appendix Table D18).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for lower respiratory infections (rate difference of 3.7 DALY per 1,000 people), gastrointestinal infections (1.1 DALY per 1,000 people) and pneumococcal disease (0.4 per 1,000 people) (Figure 10.11.4).

The largest relative differences in DALY rates between the 2 populations were observed for pneumococcal disease (rate ratio of 10.3), otitis media (5.5) and tuberculosis (5.0).



Source: Appendix Table D18.

Figure 10.11.4: Infectious diseases age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to infectious diseases for Indigenous Australians decreased notably from 16 to 11 DALY per 1,000 people; a decrease of 31% (Table 10.11.2). This was driven by decreases in both the fatal and non-fatal burden for this disease group (38% and 13%, respectively). The drop in fatal burden was mainly due to a decrease in the rate of fatal burden due to lower respiratory infections (decrease of around 4 YLL per 1,000 people; equivalent to a 48% decrease).

Table 10.11.2: Infectious diseases age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Lower respiratory infections	1.0	0.9	–0.1	–8.6
Gastrointestinal infections	2.0	1.5	–0.5	–24.9
Pneumococcal disease	—	—	—	—
HIV/AIDS	0.1	0.1	—	—
Influenza	0.1	—	—	—
Upper respiratory infections	0.3	0.2	–0.1	–20.0
All infectious diseases[(a)]	**5.0**	**4.3**	**–0.6**	**–12.8**
		Fatal burden (YLL)		
Lower respiratory infections	7.4	3.9	–3.5	–47.7
Gastrointestinal infections	0.1	0.1	—	—
Pneumococcal disease	0.2	0.4	0.2	80.7
HIV/AIDS	0.4	0.3	–0.1	–21.2
Influenza	0.3	0.3	—	—
Upper respiratory infections	0.1	0.0	–0.1	–60.5
All infectious diseases[(a)]	**11.3**	**7.0**	**–4.4**	**–38.4**
		Total burden (DALY)		
Lower respiratory infections	8.4	4.8	–3.6	–43.0
Gastrointestinal infections	2.1	1.6	–0.5	–23.2
Pneumococcal disease	0.3	0.4	0.2	52.2
HIV/AIDS	0.5	0.5	—	—
Influenza	0.3	0.3	—	—
Upper respiratory infections	0.3	0.2	–0.1	–30.6
All infectious diseases[(a)]	**16.3**	**11.3**	**–5.0**	**–30.6**

(a) Total includes burden due to the causes listed in the table as well as all causes included in infectious diseases group not specifically listed.

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

Data quality

The fatal burden estimates for infectious diseases are drawn from the National Mortality Database, and were adjusted for Indigenous under-identification. They are considered of high quality.

Non-fatal estimates are obtained from multiple sources of data.

The National Notifiable Diseases Surveillance System (NNDSS) was a primary data source for non-fatal estimates within the disease group. Notifications to NNDSS represent a proportion of the total disease incidence and this needs to be taken into account when interpreting NNDSS data. Moreover, the notified fraction of diseases varies by jurisdiction, over time and by disease. Wherever possible, data have been adjusted for under-notification or validated with alternate data sources. Identification of Indigenous notifications in all states and territories is incomplete. Consistent with current AIHW practices in reporting Indigenous disease notification rates, only jurisdictions with completeness of Indigenous status exceeding 50% have been included in the analysis (AHMAC 2012). Rates produced from these jurisdictions have been applied nationally, with consideration of the degree to which the included jurisdictions are likely to be nationally representative.

As NHMD data can capture multiple admissions for a single person, separation rates do not usually reflect disease incidence. Therefore, separations have been corrected for this using Western Australian linked data. Like most administrative data sources, Indigenous Australians are under-identified in the NHMD. Indigenous hospitalisation data has therefore been corrected for under-identification using standard correction factors published by the AIHW.

Due to the acute nature of most infectious diseases, data are generally reported as incidence. Therefore, durations of health loss were applied to derive point prevalence. Durations for most causes were sourced from previous global burden of disease studies, while for gastrointestinal infections, durations produced by Kemmeren and others (2006) were used.

10.12 Kidney and urinary diseases

The kidney & urinary disease group includes CKD, enlarged prostate, kidney stones and the residual other kidney & urinary diseases group. Other kidney & urinary diseases includes a range of diseases such as cystitis, stress incontinence and acute prostatitis. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

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

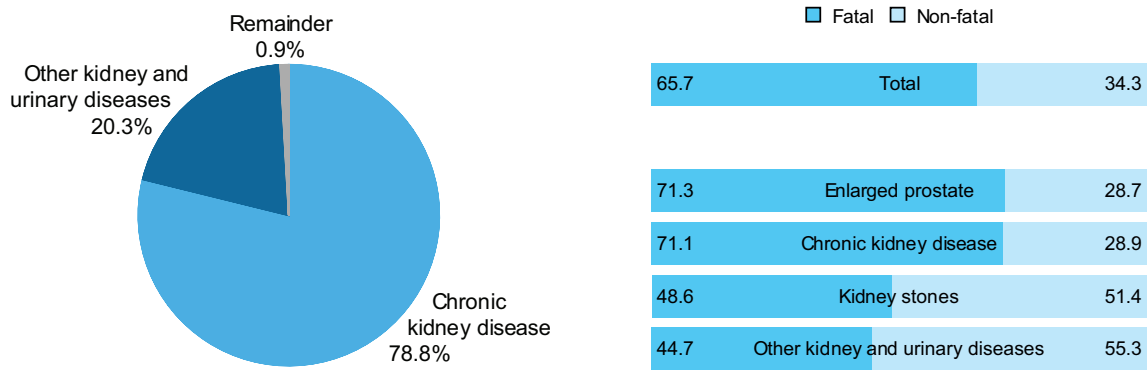
CKD is a substantial health problem in Indigenous Australians. CKD among Indigenous people is multifactorial, and many of its risk factors are associated with social disadvantage and accelerated lifestyle change (Hoy et al. 1998). Indigenous people—particularly those living in remote communities—are at greater risk of developing CKD, and early kidney damage is common (AIHW 2011). CKD is often associated with low birthweight and reduced kidney functioning through inflammation and infection, and other morbidities such as diabetes and high blood pressure. Levels of CKD among Aboriginal and Torres Strait Islander people are high, with prevalence rates currently twice those of non-Indigenous people (ABS 2014a). The high disease burden among Indigenous people leads to high death rates.

Although end-stage kidney disease—the most severe form of CKD—usually occurs in older age, in Indigenous people it occurs more often in middle age. The need for dialysis, which involves strict treatment protocols and frequent treatment—normally 4–5 hour sessions 3 times per week for in-centre dialysis—has an extensive impact on health, lifestyle and social and emotional wellbeing, especially among Indigenous Australians living in rural and remote areas who often need to relocate to access treatment (AIHW 2011).

Overview

The kidney & urinary disease group accounted for 2.5% of total disease burden in Indigenous Australians in 2011 (4,687 DALY). Kidney & urinary disease accounted for a greater proportion of total fatal burden (3.1%, 3,081 YLL) than total non-fatal burden (1.8%, 1,607 YLD).

CKD and other kidney & urinary diseases were the largest contributors to burden due to kidney & urinary diseases in Indigenous Australians, accounting for 79% and 20% of the total burden, respectively (Figure 10.12.1). Enlarged prostate and kidney stones together accounted for less than 1% of the total burden due to kidney & urinary diseases in Indigenous Australians (0.8% enlarged prostate, 0.1% kidney stones).



Note: Remainder category includes all causes included in kidney & urinary diseases not specifically listed in figure.

Figure 10.12.1: Kidney & urinary diseases burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

As shown in Figure 10.12.2, the burden from CKD increased rapidly in those aged 40–44, peaking at ages 55–59. Overall, over 80% of the burden from CKD occurred in those aged 40–74.

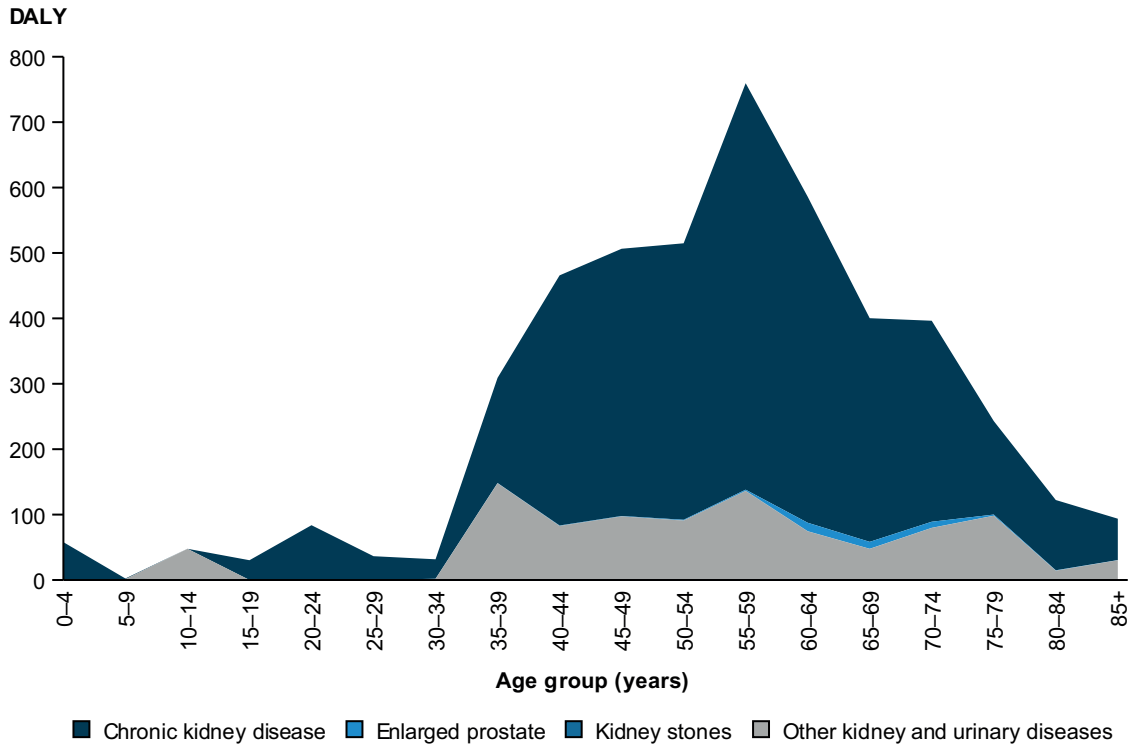


Figure 10.12.2: Kidney & urinary diseases burden (DALY) by age and disease, Indigenous Australians, 2011

As shown in Figure 10.12.3, the burden from kidney & urinary diseases was greater in females than males (55% and 45%, respectively). The burden from CKD was greater in females (59%, 2,170 DALY) than in males (41%, 1,526 DALY), while burden from other kidney & urinary diseases was greater in males than females (58% compared with 42%).

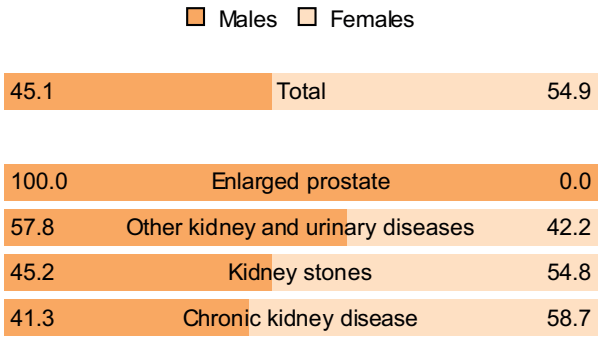


Figure 10.12.3: Kidney & urinary diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed greatly to the burden for kidney & urinary diseases (48%). For this disease group, the biggest risk factors were high body mass (37%) and high blood pressure (19%) (Table 10.12.1).

Table 10.12.1: Proportion (%) of burden attributable to risk factors for kidney & urinary diseases, Indigenous Australians, 2011

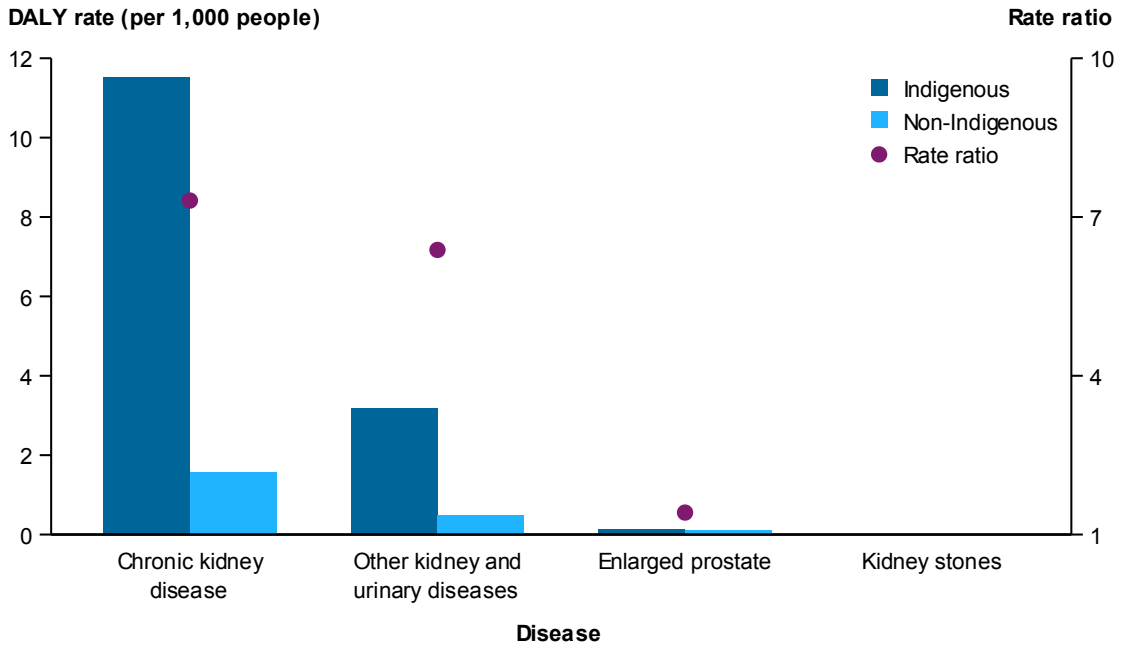
Risk factor	Attributable burden (%)
High body mass	36.6
High blood pressure	19.2
High blood plasma glucose	5.4
Joint effect of all risk factors	**48.3**

Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.
2. The percentages in the table do not add up to the joint effect as the risk factors were analysed independently.

Comparisons with non-Indigenous

The burden from kidney & urinary diseases was significantly greater in Indigenous Australians compared to non-Indigenous Australians. Taking into account differences in age structure, the burden from CKD was 7.3 times greater for Indigenous Australians than non-Indigenous Australians (age-standardised DALY rates of 11.5 and 1.6 per 1,000 people respectively) (Figure 10.12.4).



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D19.

Figure 10.12.4: Kidney & urinary disease age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to kidney & urinary diseases for Indigenous Australians remained relatively stable (14 and 15 DALY per 1,000 people, respectively) (Table 10.12.2). Although the overall non-fatal rate for kidney & urinary diseases remained relatively stable over this period (4.5 and 4.9 YLD per 1,000 people), there was a notable increase in the rate non-fatal burden for CKD (from 2.6 to 3.1 YLD per 1,000 people; an increase of 20%).

Table 10.12.2: Kidney & urinary diseases age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Chronic kidney disease	2.6	3.1	0.5	19.8
Other kidney & urinary diseases	1.8	1.7	–0.1	–4.2
All kidney & urinary diseases[(a)]	**4.5**	**4.9**	**0.4**	**9.7**
		Fatal burden (YLL)		
Chronic kidney disease	8.4	8.4	—	—
Other kidney & urinary diseases	1.5	1.5	—	—
All kidney & urinary diseases[(a)]	**9.9**	**9.9**	**—**	**—**
		Total burden (DALY)		
Chronic kidney disease	11.0	11.5	0.5	4.7
Other kidney & urinary diseases	3.3	3.2	–0.1	–2.3
All kidney & urinary diseases[(a)]	**14.4**	**14.9**	**0.4**	**3.0**

(a) Total includes burden due to the causes listed in the table as well as enlarged prostate and kidney stones.

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 kidney & urinary diseases were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification in mortality data and are considered of reasonably high quality.

For non-fatal burden estimates in Indigenous Australians, CKD prevalence rates in 2011 for different stages of the disease were drawn from a number of data sources all of which are considered of reasonably high quality:

- the AATSIHS: measurement data of blood samples from survey respondents for early stages of CKD
- the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA) of people with treated end-stage kidney disease (on dialysis or living with a kidney transplant)
- linked data from national mortality and ANZDATA databases: used 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 of early stages of CKD, so trends in the later stages of the disease using ANZDATA were applied.

10.13 Oral disorders

The oral disorders disease group includes burden due to dental caries & pulpitis, periodontal disease, tooth loss, embedded and impacted teeth, and diseases of the salivary glands, lips, oral mucosa and tongue. Dental caries includes burden due to failed restorations (for example, when a filling fails and the original decay is re-exposed).

The residual cause 'other oral disorders' includes a range of disorders such as impacted teeth and diseases of the salivary glands. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

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.

Although Indigenous Australians traditionally had better oral health than non-Indigenous Australians, since the start of the 20th century foods that contribute to dental decay have become more common in rural and remote areas. Combined with poorer access to dental care and fluoridated water, these changes in diet have contributed to increasing rates of dental decay in the Indigenous population (Shearer & Jamieson, 2012).

Overview

Overall in 2011, oral disorders made up 1.7% (3,250 DALY) of total burden among Indigenous Australians. Most of this burden was non-fatal (99.5% YLD; 0.5% YLL).

This disease group was characterised by low mortality (very few deaths were caused by oral disorders) and relatively little health loss for each individual. However, as oral disorders were highly prevalent in Indigenous Australians, the non-fatal burden of oral disorders was notable. Dental caries made up the majority (68%, 2,206 DALY) of the burden due to oral disorders, followed by periodontal disease (17%, 561 DALY) and severe tooth loss (15%, 477 DALY) (Figure 10.13.1).

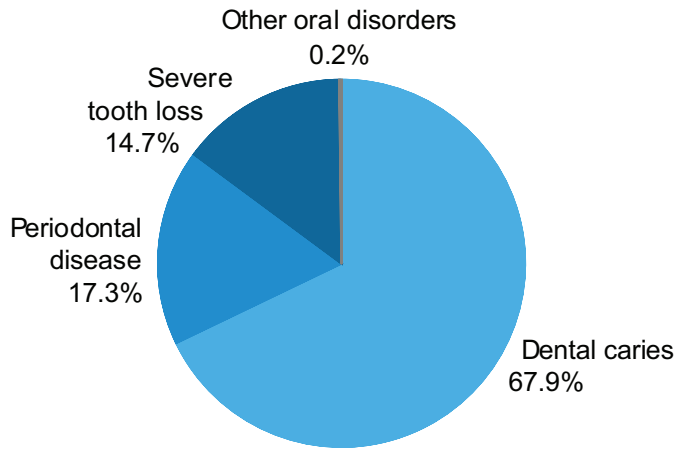


Figure 10.13.1: Oral disorders, by disease, proportion of disease group total, Indigenous Australians, 2011

As shown in Figure 10.13.2, the burden due to oral disorders varies by age, depending on the cause. Dental caries burden is most prominent in Indigenous children. By comparison, periodontal disease and severe tooth loss burden peaked at ages 40–54 and 55–64, respectively.

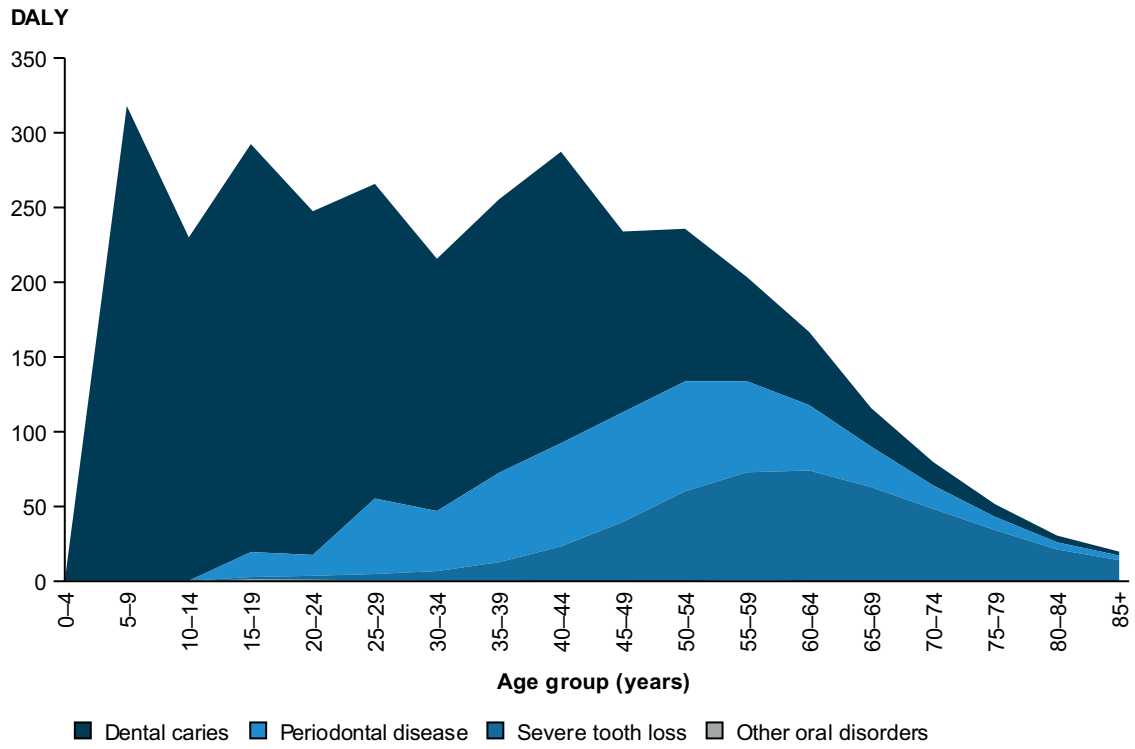


Figure 10.13.2: Oral disorders burden (DALY) by age and disease, Indigenous Australians, 2011

Overall Indigenous males experienced slightly more burden due to oral disorders than Indigenous females (1,710 DALY and 1,540 DALY, respectively). Indigenous males experienced more burden than Indigenous females for periodontal disease and dental caries, with the greatest difference being for periodontal disease (made up of 60% male and 40% female burden). However, Indigenous females experienced slightly more burden from severe tooth loss and other oral disorders (Figure 10.13.3).

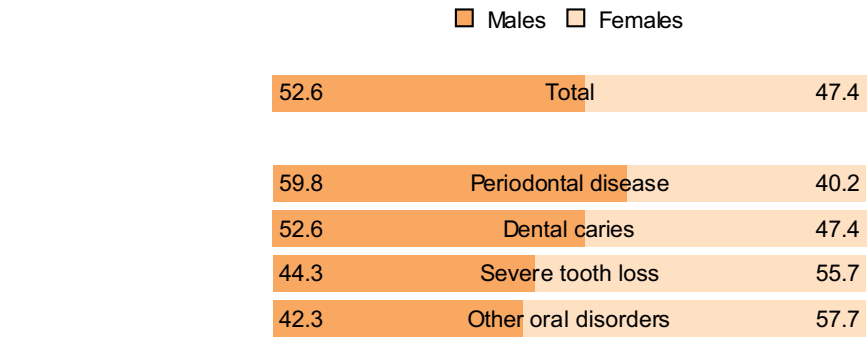


Figure 10.13.3: Oral disorders burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

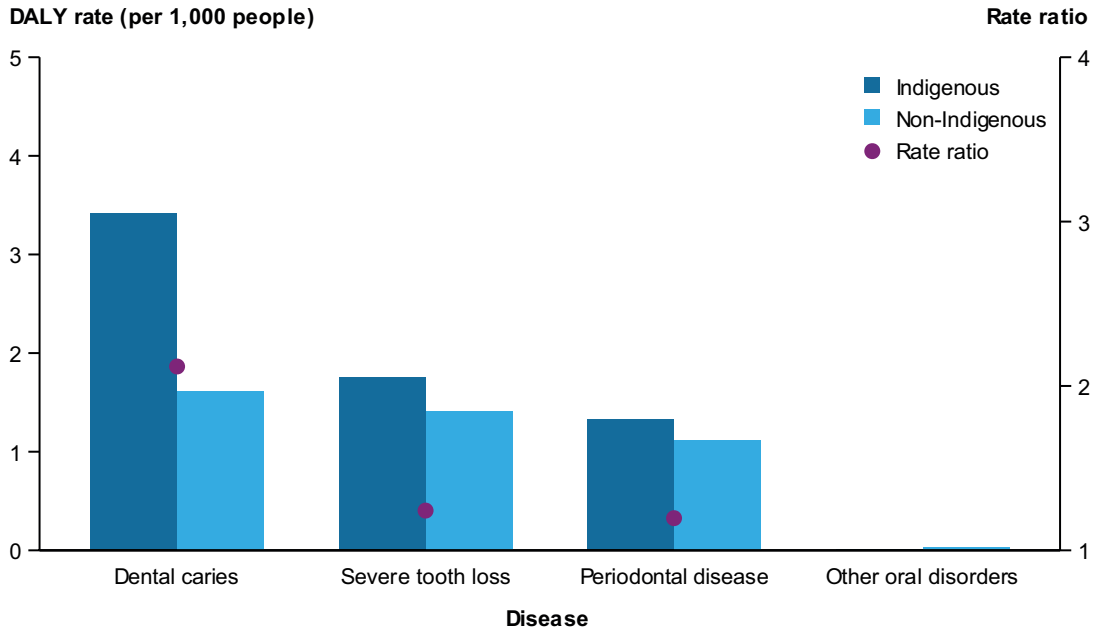
Risk factor contribution

None of the risk factors considered in this study were linked to the conditions in this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced a higher rate of overall burden from oral disorders than non-Indigenous Australians (age-standardised rates of 6.5 and 4.2 DALY per 1,000, respectively) (Appendix Table D20).

The largest relative and absolute difference in DALY rates between Indigenous and non-Indigenous Australians were observed for dental caries, for which Indigenous Australians experienced rates twice as high as non-Indigenous Australians (Figure 10.13.4). Indigenous Australians also had slightly higher rates of burden due to severe tooth loss and periodontal disease compared to non-Indigenous Australians (rate ratio of 1.2).



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D20.

Figure 10.13.4: Oral disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to oral disorders for Indigenous Australians remained stable (7 DALY per 1,000 people) (Table 10.13.1). The rate of non-fatal burden also remained stable between the 2 years (7 YLD per 1,000 people), and there was little or no fatal burden due to oral disorders in either year.

Table 10.13.1: Oral disorders age-standardised YLD, YLL and DALY rates (per 1,000 people), Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
Non-fatal burden (YLD)	6.5	6.5	—	—
Fatal burden (YLL)	0.1	—	—	—
Total burden (DALY)	**6.6**	**6.5**	**—**	**—**

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 oral disorders were calculated using Indigenous deaths registered in the National Mortality Database, adjusted for Indigenous under-identification, and are considered of reasonably high quality.

Estimates of non-fatal burden of oral disorders for Indigenous 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 for these causes could be improved with an updated survey with a larger Indigenous sample. Estimates for Indigenous children with dental caries were based on Indigenous: national rate ratios obtained from the 2009 and 2003–2004 Child dental health surveys.

10.14 Blood and metabolic disorders

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

The burden of iron-deficiency anaemia does not include anaemia due to haemolytic anaemia, gastro-duodenal disorders, CKD and maternal haemorrhage as it is included in the burden of each of these diseases.

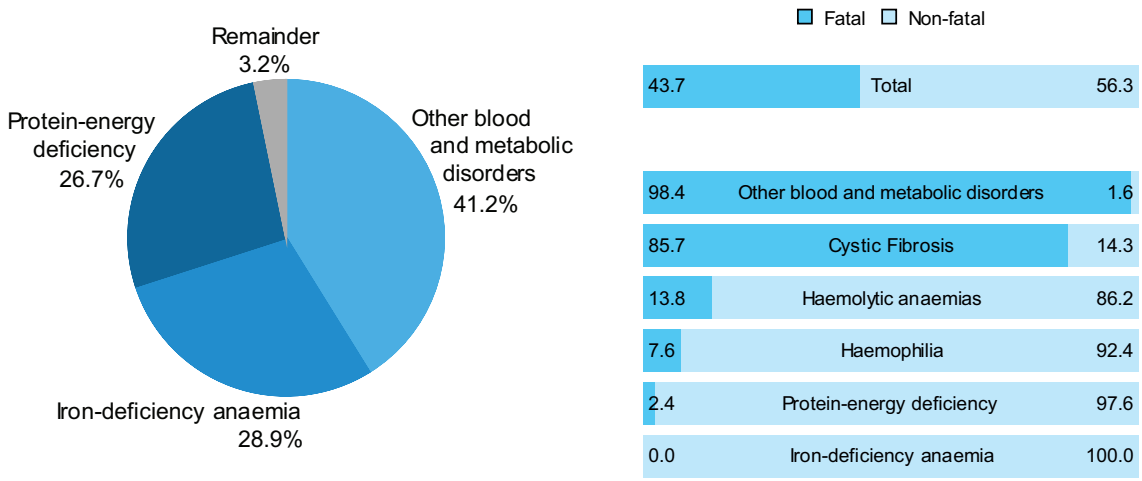
Of note, protein-energy deficiency (protein-energy malnutrition) in young children is distinctive to the Indigenous Australian population. Also, genetically linked conditions, including cystic fibrosis and haemophilia, are not common in the Indigenous Australian population.

The residual cause 'other blood & metabolic disorders' includes a range of diseases such as nutritional anaemias (excluding iron deficiency anaemia), acquired haemolytic anaemias, coagulation defects, immune mechanism disorders, mineral or vitamin deficiencies and metabolic disorders. Separate estimates for these diseases were not calculated in the ABDS due either to definitional and reporting issues (with some of these diseases being risk factors or sequela of other conditions on the cause list), or conceptual models not available for non-fatal estimates.

Overview

In 2011, blood & metabolic disorders made up 1.6% (3,002 DALY) of total burden in Indigenous Australians. Overall, other blood & metabolic disorders was the leading contributor to total burden due to this disease group (41%) followed by iron-deficiency anaemia (29%) and protein-energy deficiency (27%) (Figure 10.14.1).

The majority of burden due to blood & metabolic disorders was non-fatal burden (56%); however, this varied by disorder (Figure 10.14.1). Premature mortality was responsible for 98% of the burden from other blood & metabolic disorders, whereas iron-deficiency anaemia caused almost no fatal burden. The burden from protein-energy deficiency was 98% non-fatal. Cystic fibrosis burden was predominantly due to fatal burden; however, this estimate was based on very few Indigenous deaths.



Note: Remainder category includes all causes included in blood & metabolic disorders not specifically listed in figure.

Figure 10.14.1: Blood & metabolic disorders burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

As shown in Figure 10.14.2, the burden due to blood & metabolic disorders varied by age depending on the disorder. Newborns and infants experienced almost all the burden due to protein-energy deficiency. The main cause of burden from blood & metabolic disorders in Indigenous children, adolescents and young adults was iron-deficiency anaemia. From the age of 35, iron-deficiency anaemia burden decreased and the burden from other blood & metabolic disorders increased.

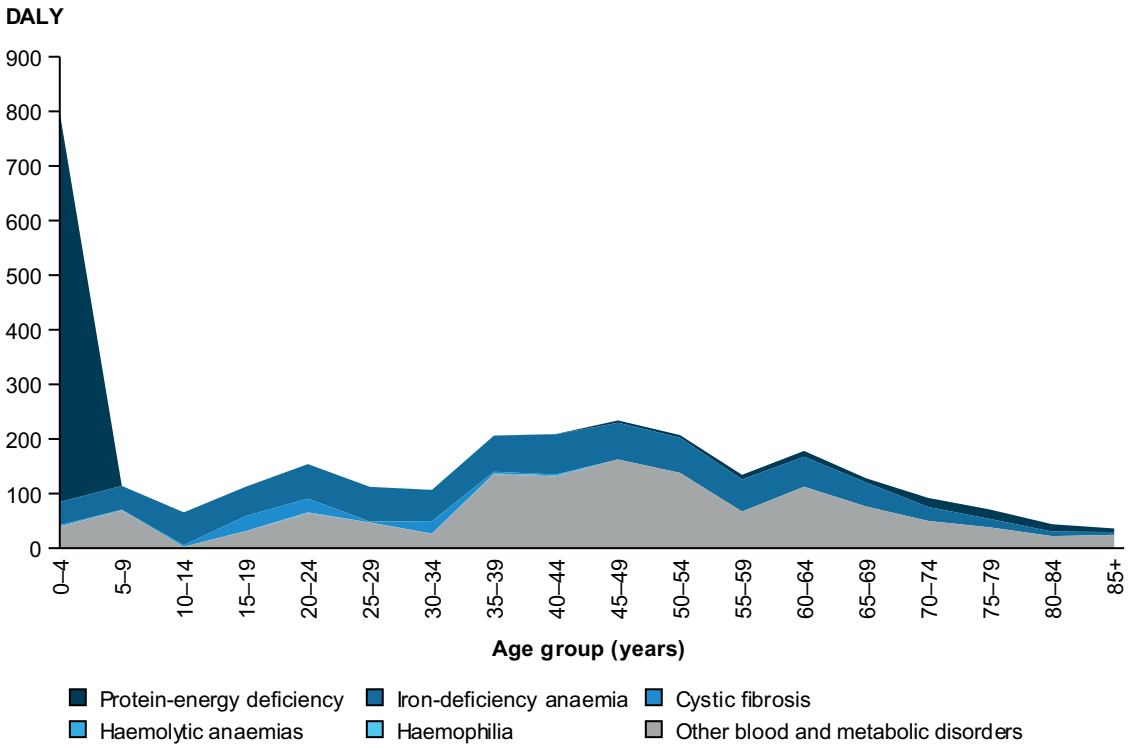


Figure 10.14.2: Blood & metabolic disorders burden (DALY) by age and disease, Indigenous Australians, 2011

Overall, Indigenous females experienced 61% of the burden from blood & metabolic disorders; however, this varied by disorder (Figure 10.14.3). Indigenous males experienced 81% of the burden from haemophilia, unsurprisingly as the prevalence and severity of haemophilia is higher in males. Indigenous females experienced a greater proportion of burden from iron-deficiency anaemia—mainly due to the increased prevalence of this condition in women during their reproductive years.

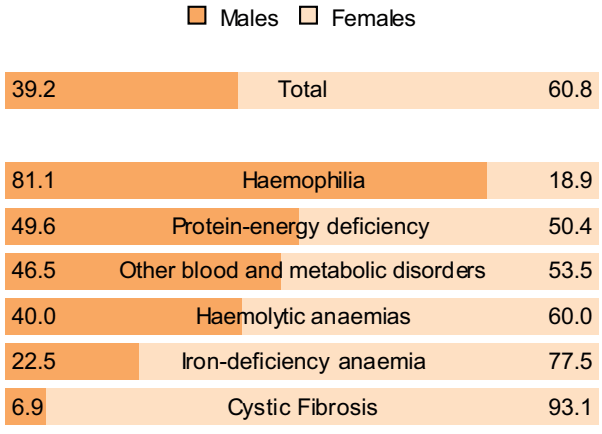


Figure 10.14.3: Blood & metabolic disorders burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011

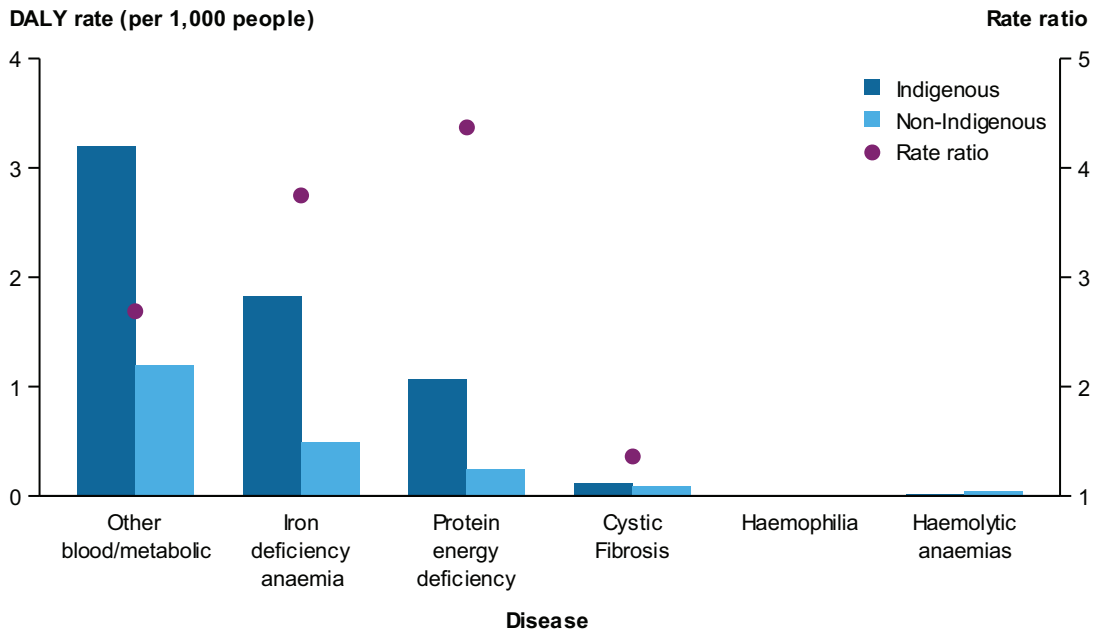
Risk factor contribution

The only risk factor associated with blood & metabolic disorders in the current study was iron deficiency, which contributed 29% to the burden for this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced 3 times the rate of burden (DALY) compared to non-Indigenous Australians due to blood & metabolic conditions, however this varied by disorder (Figure 10.14.4). The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians for blood & metabolic disorders were observed for other blood & metabolic disorders, iron-deficiency anaemia and protein-energy deficiency.

The largest relative differences in DALY rates for blood & metabolic disorders between Indigenous and non-Indigenous Australians were observed for protein-energy deficiency and iron-deficiency anaemia (rate ratios of 4.4 and 3.7, respectively).



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D21.

Figure 10.14.4: Blood & metabolic disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to blood & metabolic disorders for Indigenous Australians remained relatively stable (5.6 and 6.2 DALY per 1,000 people, respectively) (Table 10.14.1). Over the same period, there was a small increase in the rate of fatal burden for this disease group (16%), mainly from other blood & metabolic disorders (increase of 0.6 YLL per 1,000 people; increase of 25%).

Table 10.14.1: Blood & metabolic disorders age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Iron-deficiency anaemia	1.7	1.8	0.1	4.3
Other blood and metabolic disorders	—	0.1	—	—
All blood & metabolic disorders[(a)]	**2.8**	**2.9**	**0.1**	**4.0**
		Fatal burden (YLL)		
Iron-deficiency anaemia	0.1	—	–0.1	–99.0
Other blood and metabolic disorders	2.5	3.1	0.6	24.9
All blood & metabolic disorders[(a)]	**2.9**	**3.3**	**0.5**	**15.6**
		Total burden (DALY)		
Iron-deficiency anaemia	1.8	1.8	—	—
Other blood and metabolic disorders	2.6	3.2	0.6	25.4
All blood & metabolic disorders[(a)]	**5.6**	**6.2**	**0.6**	**10.0**

(a) Total includes burden due to the causes listed in the table as well as protein-energy deficiency, cystic fibrosis, haemolytic anaemias, haemophilia and other blood & metabolic disorders.

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 Indigenous deaths registered in the National Mortality Database which were adjusted for Indigenous under-identification and are considered of high quality. Deaths from amyloidosis and electrolyte and fluid imbalance disorders are considered intermediate causes so they were redistributed to disease groups containing the most likely direct cause.

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

Non-fatal estimates for haemophilia, haemolytic anaemia and cystic fibrosis were obtained from hospitalisation data and were adjusted using ratios of Indigenous–non Indigenous separations and for under-identification. Individuals with symptoms manageable outside of hospital are not included in analysis; therefore estimates may underestimate health loss from less severe cases. However, it is known these conditions are not highly prevalent in this population.

10.15 Skin disorders

The skin disorders disease group includes burden due to chronic and acute skin conditions, including skin infections. It excludes burden due to skin neoplasms (which is included in cancer & other neoplasms). Scabies is included in the skin infections (including cellulitis) cause. The residual cause 'other skin disorders' includes a range of diseases such as pilonidal cysts, bullous disorders and urticaria. See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Overview

Overall in 2011, skin disorders made up 1.3% (2,383 DALY) of total burden among Indigenous Australians, 0.2% (183 YLL) of all fatal burden and 2.5% (2,200 YLD) of all non-fatal burden. This disease group was characterised by low mortality (few deaths were caused by skin disorders) and relatively little health loss for each individual. However, skin disorders were also highly prevalent in the Australian Indigenous community; therefore at a population level the non-fatal burden of skin disorders was notable.

The 3 largest contributors to burden due to skin disorders, which together accounted for almost 80% of the total burden for skin disorders in Indigenous Australians, were dermatitis & eczema (38%), acne (30%) and psoriasis (10%) (Figure 10.15.1). However, the majority of burden due to these 3 causes was non-fatal (Figure 10.15.1).

Fatal burden made up 7.7% of the total burden due to skin disorders in Indigenous Australians. Two causes contributed almost all (99%) of the fatal burden due to skin disorders; skin infections (70% of fatal burden for skin disorders) and ulcers (29%).

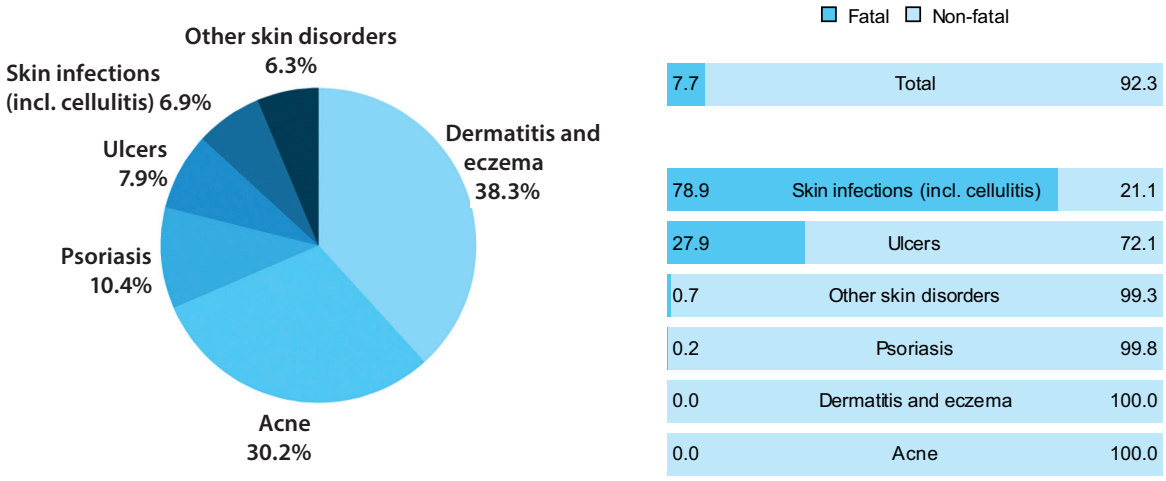


Figure 10.15.1: Skin disorders burden, by disease: a) proportion of disease group total and b) proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2011

As shown in Figure 10.15.2, the burden due to skin disorders varies across the life course. Acne burden is most prominent in Indigenous adolescents and young adults with little to no burden in children and older adults. Whereas, in general, burden (in terms of rates) due to ulcers and skin infections increases with age.

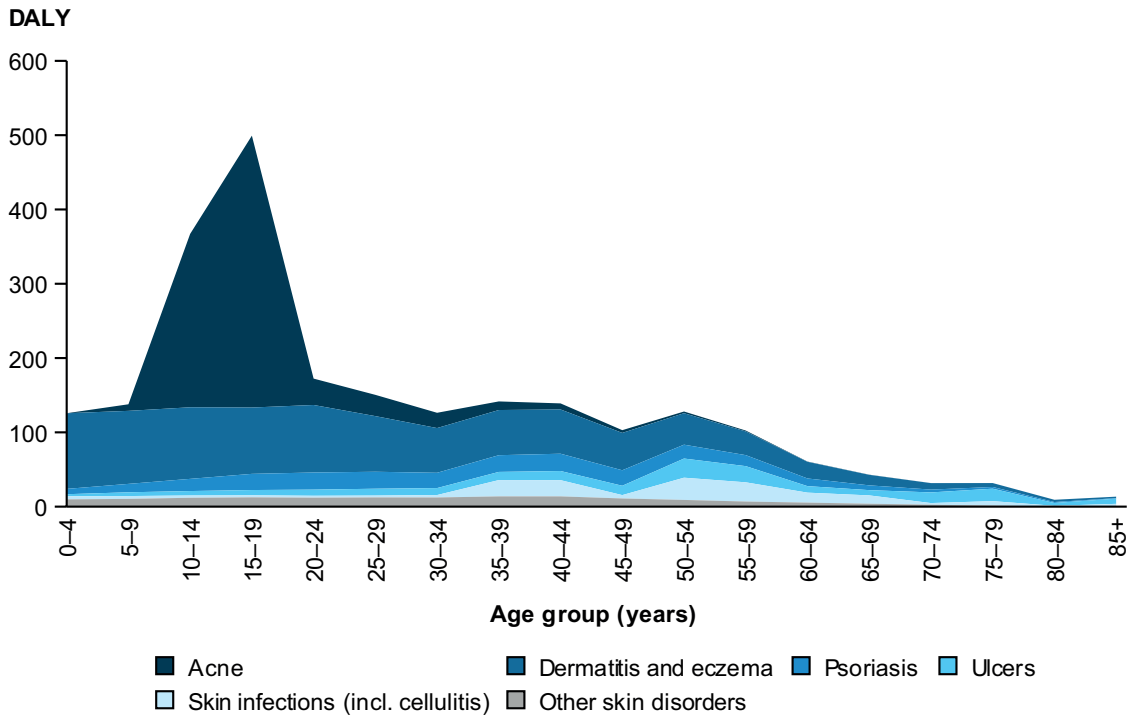


Figure 10.15.2: Skin disorders burden (DALY) by age and disease, Indigenous Australians, 2011

Overall, Indigenous females experienced slightly more burden due to skin disorders than Indigenous males (1,213 and 1,170 DALY, respectively). Similarly, for all skin causes except ulcers, Indigenous females experienced slightly more burden than Indigenous males, with the greatest difference being for psoriasis (45% males and 55% females).

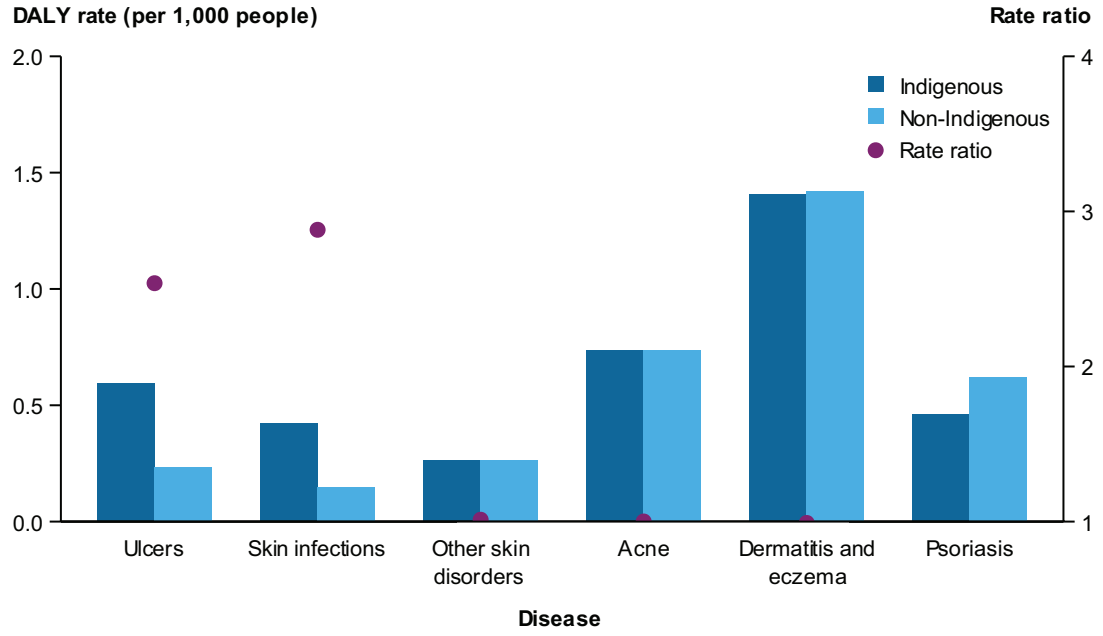
Risk factor contribution

None of the risk factors considered in this study were linked to the conditions in this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced a similar rate of overall burden from skin disorders as non-Indigenous Australians (DALY rate ratio of 1.1) (Appendix Table D22).

The largest relative and absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for ulcers and skin infections (including cellulitis). Indigenous Australians had almost 3 times the burden from these 2 causes as non-Indigenous Australians (Figure 10.15.3). In contrast, Indigenous Australians had lower rates of burden from psoriasis than non-Indigenous Australians.



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D22.

Figure 10.15.3: Skin disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to skin disorders for Indigenous Australians remained stable (4 DALY per 1,000 people, respectively) (Table 10.15.1). The rates of fatal and non-fatal burden were also stable (1 YLL and 3 YLD per 1,000 people, respectively).

Table 10.15.1: Skin disorders age-standardised YLD, YLL and DALY rates (per 1,000 people), Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
Non-fatal burden (YLD)	3.4	3.3	–0.1	–3.5
Fatal burden (YLL)	0.8	0.6	–0.2	–23.5
Total burden (DALY)	**4.2**	**3.9**	**–0.3**	**–7.9**

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 skin disorders were calculated using Indigenous deaths registered in the National Mortality Database which were adjusted for Indigenous under-identification in mortality data. These are considered of reasonably high quality.

The data quality of the non-fatal estimates for skin disorders is mixed across the various diseases. Prevalence data were modelled from a variety of sources including, national Indigenous health surveys (for example, psoriasis), hospitalisation data adjusted for Indigenous under-identification (for example, skin infections), national estimate proportions applied to the Indigenous population (for example, dermatitis & eczema; acne) or indirect methods (for example, ulcers).

Data for the 2 causes with the greatest burden, dermatitis & eczema and acne, were based on older clinical examination epidemiology studies with no Indigenous identifier (Kilkenny et al. 1998; Plunkett et al. 1999), with assumptions made about the applicability of the data to the 2011 Indigenous population. Estimates for these causes could be improved with the inclusion of more recent or Indigenous specific data. See 'Appendix C: Quality framework' for more details.

10.16 Hearing and vision disorders

Hearing & vision disorders include the burden of visual disorders, hearing loss and auditory system disorders (for example, Meniere 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, otitis media and trachoma) in the infectious diseases group. Visual impairment caused by trachoma and diabetes are captured in their respective diseases.

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

This group includes 2 residual categories; 'other vision disorders' (which includes a range of disorders such as vision loss due to eye injuries and disorders of the vitreous body) and 'other hearing & vestibular disorders' (which includes otitis externa and diseases of the inner ear). See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

Overview

Overall, in 2011, hearing & vision disorders contributed 1.2% of total burden in Indigenous Australians (2,188 DALY). Conditions in this group do not directly cause death; however it is acknowledged that vision loss may be associated with increased risk of mortality (McCarty et al. 2001). Therefore DALY estimates are equal to the YLD estimates in this disease group.

Hearing loss accounted for 62% of the total burden for hearing & vision disorders in Indigenous Australians in 2011 and 19% was due to vision loss (Figure 10.16.1). Other hearing & vestibular disorders (17%) and other vision disorders (2%) accounted for the remainder.

The overall burden from hearing & vision disorders was similar in Indigenous males and females (Figure 10.16.1). Indigenous females experienced slightly more burden from vision loss than Indigenous males; however, this is due to more women living to older ages as opposed to the disease occurring more in females.

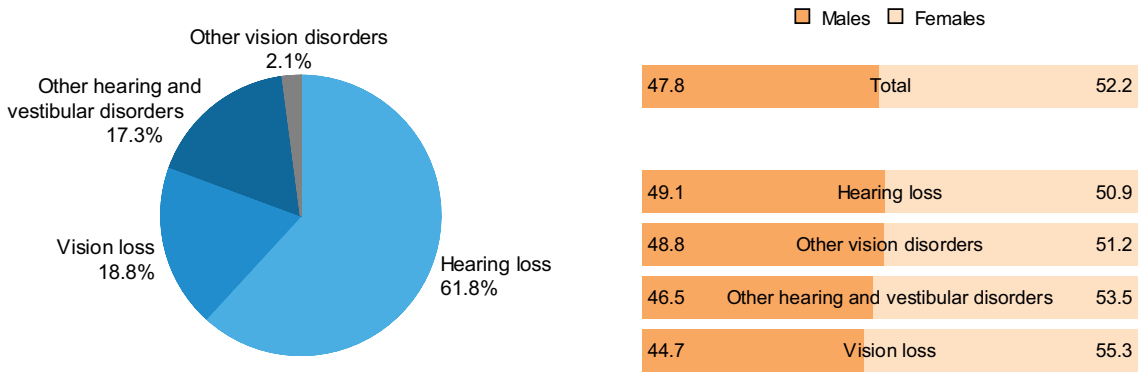


Figure 10.16.1: Hearing & vision disorders burden, by disease: a) proportion of disease group total and b) proportion for males and females, Indigenous Australians, 2011

As shown in Figure 10.16.2, burden from hearing loss and other hearing and vestibular disorders rose steeply across child hood, and remained high across adulthood, peaking at ages 40–44 and then declining from ages 50–54. The onset of vision loss in Indigenous Australians contributes to burden from around age 40 and contributed a higher proportion of burden than hearing loss among Indigenous Australians aged 75 and over.

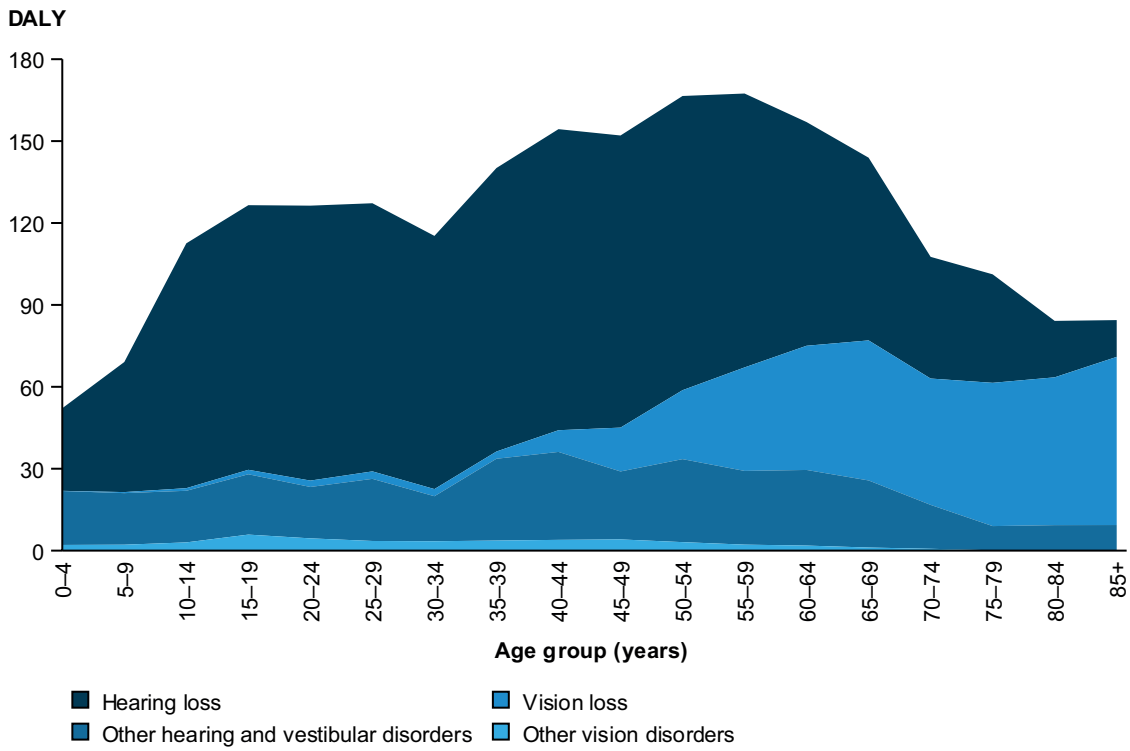


Figure 10.16.2: Hearing & vision disorders burden (DALY) by age and disease, Indigenous Australians, 2011

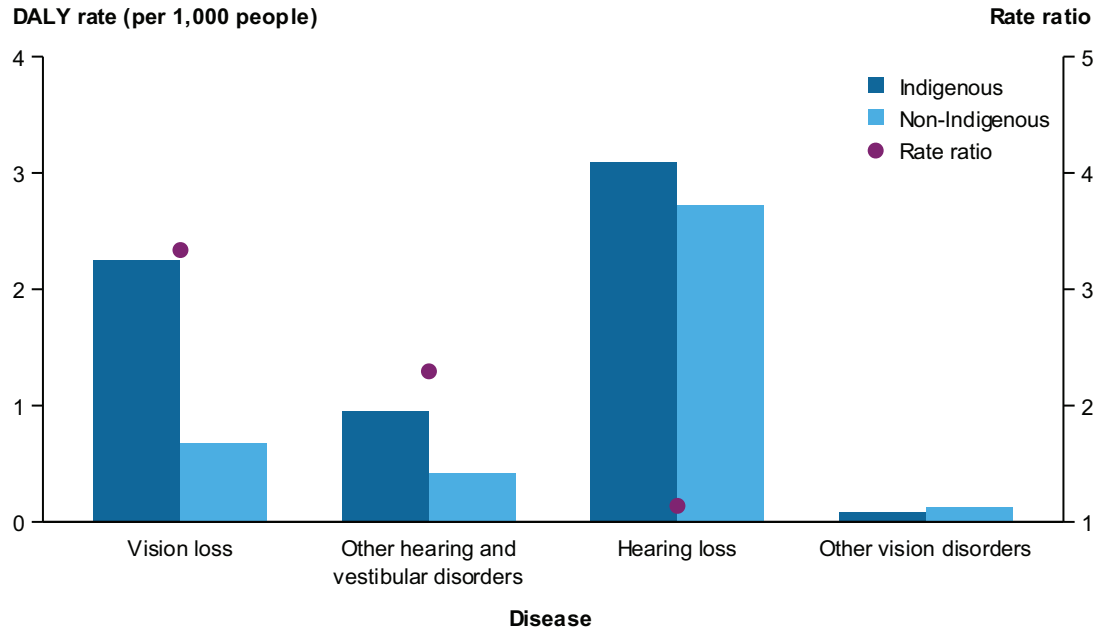
Risk factor contribution

The only risk factor associated with hearing & vision disorders in the current study was occupational exposures and hazards, which contributed 27% to the burden for this disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced burden (DALY) from hearing & vision disorders at 1.6 times the rate of than non-Indigenous Australians (Appendix Table D23).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians for hearing & vision disorders was due to vision loss (rate difference of 1.6 DALY). The largest relative difference in DALY rates between Indigenous and non-Indigenous Australians was also for vision loss, for which Indigenous Australians experienced more than 3 times the burden (Figure 10.16.3). This does not include vision loss caused by trachoma or diabetes.



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D23.

Figure 10.16.3: Hearing & vision disorders age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to hearing & vision disorders for Indigenous Australians was stable (6 DALY per 1,000 people) (Table 10.16.1).

Table 10.16.1: Hearing & vision disorders age-standardised DALY rates (per 1,000 people), Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
Total burden (DALY)[(a)]	6.4	6.4	—	—

(a) Conditions in this group do not directly cause death, therefore DALY estimates are equal to the YLD estimates in this disease group and there are no YLL estimates.

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 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 are not considered the direct plausible cause of mortality. Associated fatal sequelae (such as infections or vascular conditions) are the more likely direct cause of death.

Hearing loss

Estimates were derived from the AATSIHS. Self-reported data relies 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 GBD 2010 was used in the analyses; however, this was adjusted using hearing data from the Northern Territory to account for differences in hearing loss in the Indigenous population.

Vision loss

Vision loss burden was estimated using the 2008 National Indigenous Eye Health Survey that included ophthalmological examinations to assess eye conditions and subsequent vision loss. Data were collected from numerous Indigenous Australian community sites nationally and is considered of high quality. An update of these estimates will be possible following the release of data from the latest National Indigenous Eye Health Survey (expected in mid-2016).

10.17 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 excluded from this group.

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 causes.

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.

This group includes 2 residual categories: 'other maternal conditions' (which includes placental disorders, labour complications and maternal care) and 'other reproductive conditions' (which includes a range of conditions such as testicular torsion, menstrual disorders, vaginal fistulas and conditions affecting female reproductive organs that were not included separately in the cause list). See Appendix A of the ABDS methods report (AIHW 2016b) for a full list of ICD-10 codes.

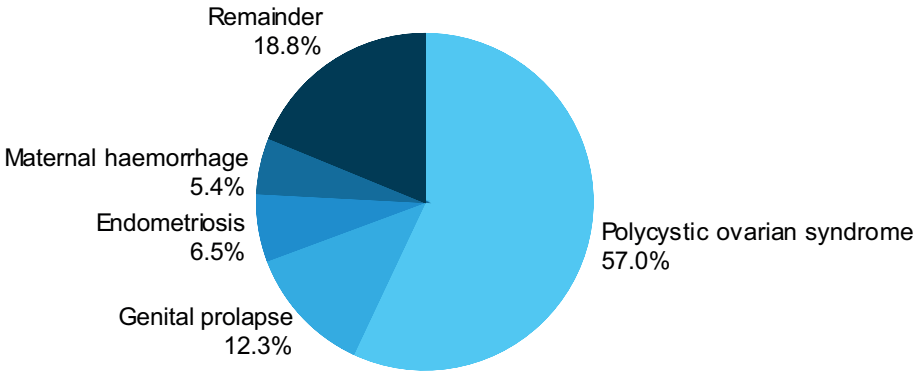
Overview

In 2011, reproductive & maternal conditions contributed 0.6% (1,112 DALY) of total burden in Indigenous Australians. Most of this burden was non-fatal (91% YLD; 9% YLL) and predominantly due to reproductive conditions (86%; 957 DALY).

The burden from maternal conditions was small as it was experienced only by expectant or recently delivered mothers, however maternal conditions contributed all of the fatal burden (98 YLL) from reproductive & maternal conditions.

Overall, 69% of the burden is attributable to 2 conditions: polycystic ovarian syndrome (57%) and genital prolapse (12%) (Figure 10.17.1).

Genital prolapse, infertility and other reproductive conditions were the only conditions in this group experienced by both males and females. Indigenous males experienced 7% of the health loss from reproductive & maternal conditions. Over half (61%) of the health loss in males was due to genital prolapse.



Note: Remainder category includes all causes included in reproductive & maternal conditions not specifically listed in figure.

Figure 10.17.1: Reproductive & maternal conditions, by disease, proportion of disease group total, Indigenous Australians, 2011

Burden from reproductive & maternal conditions was most evident during the reproductive years, with DALY peaking at ages 25–29. 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 and infertility mostly affected women at ages 20–49 (Figure 10.17.2).

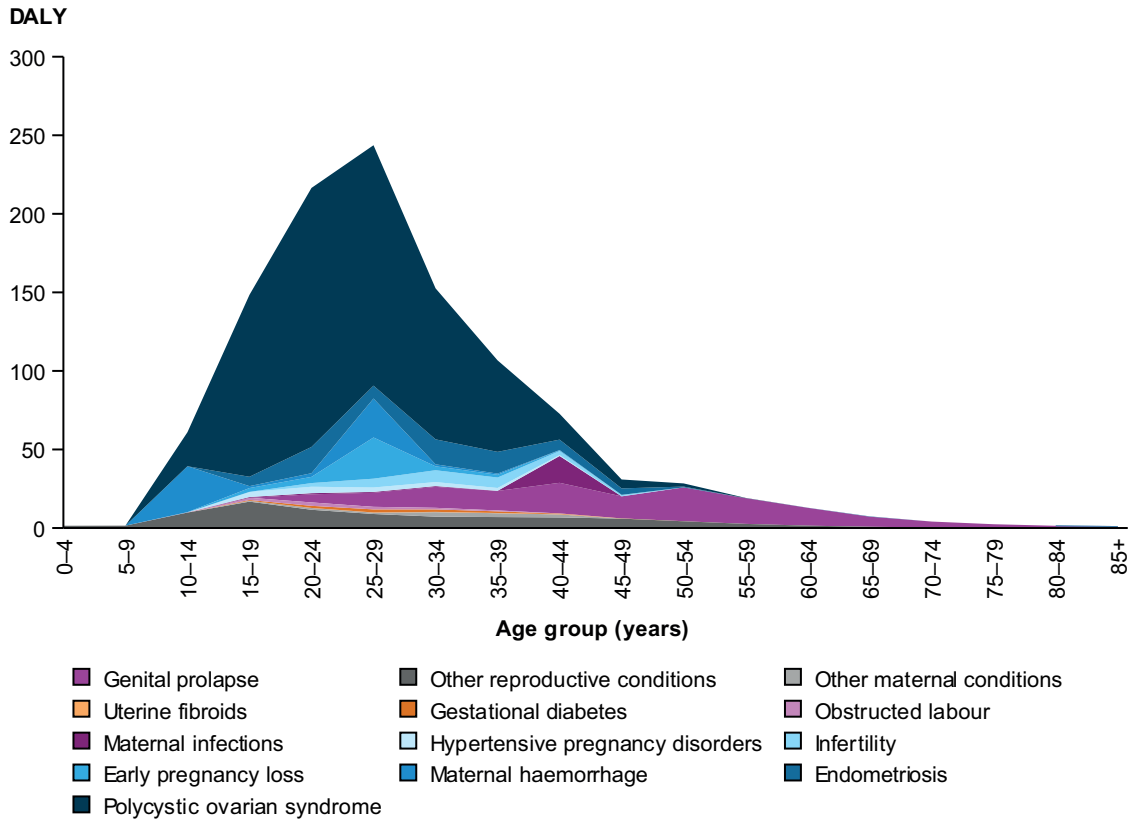


Figure 10.17.2: Reproductive & maternal conditions DALY by age and disease, Indigenous Australians, 2011

Risk factor contribution

The joint effect of all risk factors combined contributed around 2% to the burden for reproductive & maternal conditions. For this disease group, the 2 risk factors were intimate partner violence (1%) and iron deficiency (1%) (Table 10.17.1).

Table 10.17.1: Proportion (%) of burden attributable to risk factors for reproductive & maternal conditions, Indigenous Australians, 2011

Risk factor	Attributable burden (%)
Intimate partner violence	0.9
Iron deficiency	0.9
Joint effect of all risk factors	**1.8**

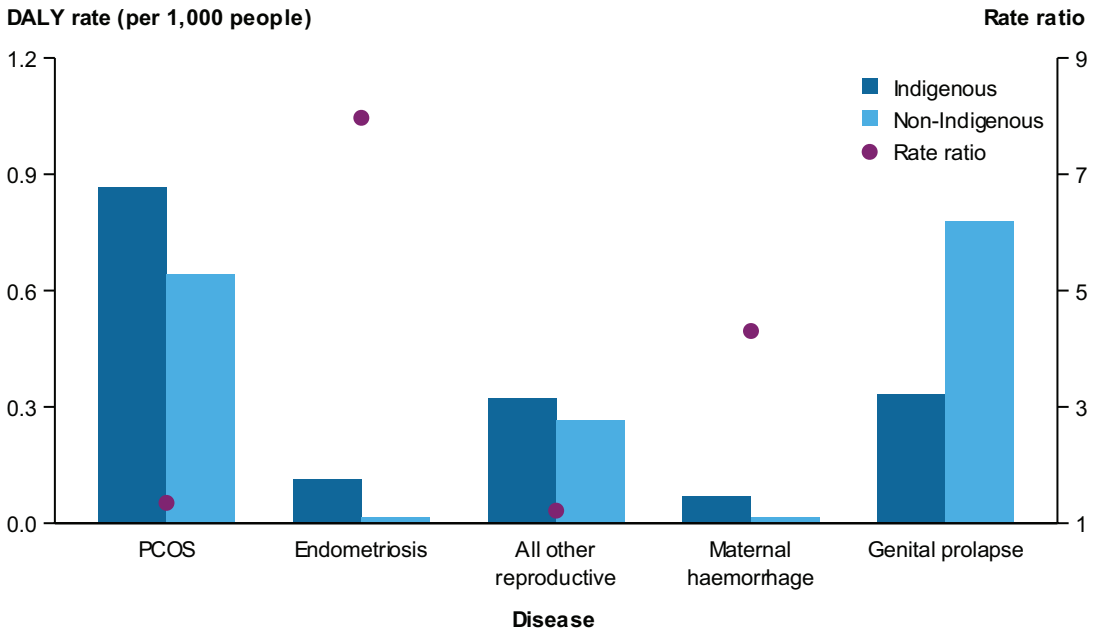
Note: Attributable burden is expressed as a percentage of total burden (DALY) for the disease group.

Comparisons with non-Indigenous

In 2011, Indigenous Australians experienced similar rates of burden (DALY) as non-Indigenous Australians due to reproductive & maternal conditions, however this varied by condition.

In relative terms, Indigenous Australians experienced burden from endometriosis at 8 times the rate of non-Indigenous Australians and maternal haemorrhage at over 4 times the rate (Figure 10.17.3).

The largest difference in DALY rates between the 2 populations was observed for polycystic ovarian syndrome (rate difference of 0.2 DALY per 1,000) (Appendix Table D24).



Note: Rate ratios not shown on graph if ratio is less than 1.

Source: Appendix Table D24.

Figure 10.17.3: Reproductive & maternal conditions age-standardised DALY rates (per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2011

Changes since 2003

Between 2003 and 2011, the age-standardised rate of total burden due to reproductive & maternal conditions for Indigenous Australians remained relatively stable (1.3 and 1.4 DALY per 1,000, respectively) (Table 10.17.2).

Table 10.17.2: Reproductive & maternal conditions age-standardised YLD, YLL and DALY rates (per 1,000 people) by disease, Indigenous Australians, 2003 and 2011

	2003	2011	Rate difference 2003 to 2011	Rate difference (%)
		Non-fatal burden (YLD)		
Polycystic ovarian syndrome	0.7	0.9	0.1	16.8
Genital prolapse	0.3	0.3	—	—
Endometriosis	0.1	0.1	—	—
All reproductive & maternal conditions[(a)]	**1.2**	**1.3**	**0.1**	**12.3**
		Fatal burden (YLL)		
Polycystic ovarian syndrome	0.0	0.0	0.0	..
Genital prolapse	—	0.0	—	—
Endometriosis	0.0	0.0	0.0	..
All reproductive & maternal conditions[(a)]	**0.1**	**0.1**	—	—
		Total burden (DALY)		
Polycystic ovarian syndrome	0.7	0.9	0.1	16.8
Genital prolapse	0.4	0.3	—	—
Endometriosis	0.1	0.1	—	—
All reproductive & maternal conditions[(a)]	**1.3**	**1.4**	**0.2**	**13.1**

(a) Total includes burden due to the causes listed in the table as well as all causes included in reproductive & maternal conditions not specifically listed.

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 reproductive & maternal conditions were calculated using deaths registered in the National Mortality Database and are considered of high quality. The few deaths coded to reproductive & maternal conditions that are 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 adjusted for Indigenous under-identification, as the majority of births occur in hospitals. Abortive procedures performed in non-hospital settings were also included, and adjusted using Australian epidemiological studies and rate ratios of Indigenous: non-Indigenous hospitalisations.

Polycystic ovarian syndrome and endometriosis YLD estimates were obtained from national, self-reported surveys and general practitioner visits. It is expected that if an individual was suffering from these conditions, they would visit their local doctor and receive a diagnosis. Symptomatic uterine fibroids and severe endometriosis require surgical intervention, therefore hospital admission data adjusted for under-identification was used for severe estimates. This assumes that individuals would seek immediate treatment and may be underestimated if treatment for severe cases is not sought within the year.

It was assumed the same rate of infertility is experienced in the Indigenous population as in the national population. Genital prolapse estimates were sourced from a large international population based study, and adjusted using rate ratios of Indigenous: non-Indigenous hospitalisations.

11 Detailed results by risk factor

Overview

Analysis of the burden due to the following risk factors is presented in this chapter:

- tobacco use
- alcohol use
- high body mass
- physical inactivity
- high blood pressure
- high blood plasma glucose
- drug use
- high cholesterol
- childhood sexual abuse
- all dietary risk factors combined.

This chapter presents more details on the burden attributable to the leading risk factors for Indigenous Australians in 2011 (non-dietary factors contributing to at least 2% of total burden, and all dietary factors combined). This includes non-fatal, fatal and total burden for each disease linked to these risk factors. The diseases linked to each risk factor were adopted from other studies, notably GBD 2010.

Before reading this chapter it is recommended to first read 'Chapter 7 Contribution of risk factors to burden' which provides a high level overview of the Indigenous burden of disease attributable to the 29 risk factors included in the ABDS and the methods used.

11.1 Overall contribution of risk factors to disease burden and gap

Table 11.1.1 shows the proportion of total Indigenous disease burden and proportion of the gap in disease burden attributable to each of the risk factors included in the study. Results in the remainder of this chapter are presented in order of each individual risk factor's contribution to the total burden experienced by Indigenous Australians in 2011, with the burden of the combined dietary factors at the end.

Table 11.11.1: Proportion of total burden attributed to each risk factor for Indigenous Australians, and proportion of the gap in total burden attributed to each risk factor, 2011

Risk factor	Per cent (%) of total Indigenous DALY	% of the health gap[(a)]	Risk factor	Per cent (%) of total Indigenous DALY	% of the health gap[(a)]
Behavioural			**Dietary**		
Tobacco use	12.3	23.3	Diet high in processed meat	2.8	4.3
Alcohol use	8.3	8.1	Diet low in fruit	2.5	4.1
Physical inactivity	5.5	8.2	Diet low in whole grains	2.3	3.9
Drug use	3.7	4.1	Diet low in vegetables	2.3	2.9
Childhood sexual abuse	2.1	2.6	Diet low in nuts and seeds	1.6	3.6
Intimate partner violence	1.4	1.6	Diet high in sweetened beverages	1.6	3.1
Unsafe sex	0.7	0.9	Diet low in omega-3 fatty acids	1.0	1.8
Metabolic			Diet low in fibre	1.0	1.3
High body mass	8.2	14.1	Diet high in saturated fat	0.9	1.2
High blood pressure	4.9	8.1	Diet high in sodium	0.4	0.6
High blood plasma glucose	4.6	8.8	Diet high in red meat	0.3	0.5
High cholesterol	2.6	3.4	Diet low in milk	0.1	0.1
Iron deficiency	0.5	0.5	Diet low in calcium	<0.1%	<0.1
Low bone mineral density	<0.1%	0.2			
Environmental					
Occupational exposures and hazards	1.1	0.9			
Air pollution	<0.1%	0.7	**Joint effect of all diet risk factors**	**9.7**	**15.2**
Unimproved sanitation	<0.1%	n.a.	**Joint effect of all risk factors**	**36.9**	**51.4**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

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. A combined risk factor analysis was conducted for all risk factors included in the study, following methods used in previous global burden of disease studies (Ezzati et al. 2004). This showed that 37% of the total burden experienced by Indigenous Australians in 2011 was attributed to these 29 risk factors. In addition, an analysis of all of the dietary risk factors combined was also undertaken. This showed that while the individual contribution of each dietary risk factor was relatively small, their joint effect was responsible for 10% of the burden experienced by Indigenous Australians.

Estimates of the joint effects of all risk factors, and the dietary risk factors included in this study, should be interpreted with caution. The methods generally used in burden of disease studies rest on the assumption that each risk factor is independent, and do not usually take into account known interactions and relationships between risk factors, and the way these interactions affect disease outcomes. However, evidence from previous global studies and expert advice have been used to inform broad adjustments for interactions, in order to approximate the joint effects of multiple risk factors.

More information on the methods used for risk factor analysis is included at 'Appendix B: Methods overview', and in the ABDS methods report (AIHW 2016b).

11.2 Tobacco use

Tobacco use was responsible for 12% of the total burden of disease and injury in Indigenous Australians in 2011 (Table 11.2.1). This included the risks associated with past tobacco use, current use and exposure to second-hand smoke in the home. Although tobacco use during pregnancy is a known risk factor for low birthweight and other poor health outcomes such as SIDS, it was not possible to include this as a risk factor in ABDS 2011.

Tobacco use contributed to the burden for a large number of diseases. CHD was the leading disease outcome of tobacco use (6,747 DALY), followed by COPD, lung cancer and stroke. Tobacco caused 93% of the lung cancer burden and 87% of the COPD burden (Table 11.2.1). It was also responsible for 71% of the oesophageal cancer burden and 64% of the mouth & pharyngeal cancer burden.

Table 11.2.1: Burden (number and percentage of linked disease) attributable to tobacco use, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	6,747	49.2
COPD	4,993	86.8
Lung cancer	3,970	93.3
Stroke	1,456	44.1
Asthma	985	16.1
Mouth & pharyngeal cancer	719	63.8
Diabetes	643	8.3
Oesophageal cancer	599	70.5
Liver cancer	503	40.3
Other cardiovascular diseases	697	38.9
All other diseases and injuries	2,070	. .
Total	**23,381**	**12.3**

Note: The numbers may not add to total for all columns due to rounding.

Across all these disease outcomes, 81% of the burden was due to premature mortality; however, this varied by disease. For example, fatal outcomes made up almost all of the attributable liver, oesophageal and lung cancer burden but only 6% of the asthma burden (Figure 11.2.1).

More than half (56%) of the disease burden attributed to tobacco was experienced by Indigenous males (Figure 11.2.1). The male proportion of the attributable burden was largest in mouth & pharyngeal cancer (82%) and diabetes (81%) and smallest in asthma (34%) and stroke (38%).

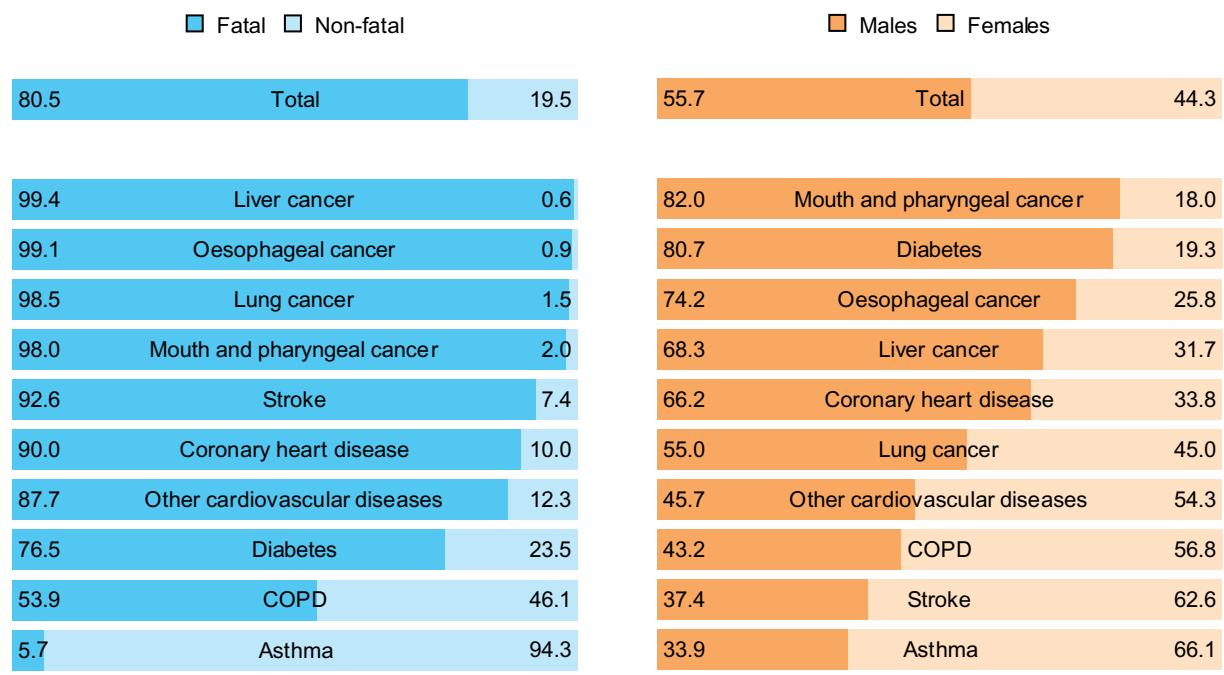


Figure 11.2.1: Proportion of burden attributable to tobacco use by a) fatal versus non–fatal burden, and b) sex, top 10 diseases, Indigenous Australians, 2011

Figure 11.2.2 shows the disease burden attributed to tobacco use in Indigenous Australians aged 25 and over, reflecting the ages at which most of the attributable burden was experienced in the Indigenous population. There was a small amount of burden attributed to tobacco use before the age of 25 (in particular due to exposure to second-hand smoke) which is not shown in these figures.

Burden attributed to tobacco use was relatively low in Indigenous Australians aged 25–34 but increased with age with rates peaking in ages 70–74 for Indigenous males and females (Figure 11.2.2). At ages 25–49, the majority of the burden was experienced as CHD, after which lung cancer and COPD made up an increasing share of the smoking burden. The burden was greater in males than females, with the difference in DALY rates increasing with age.

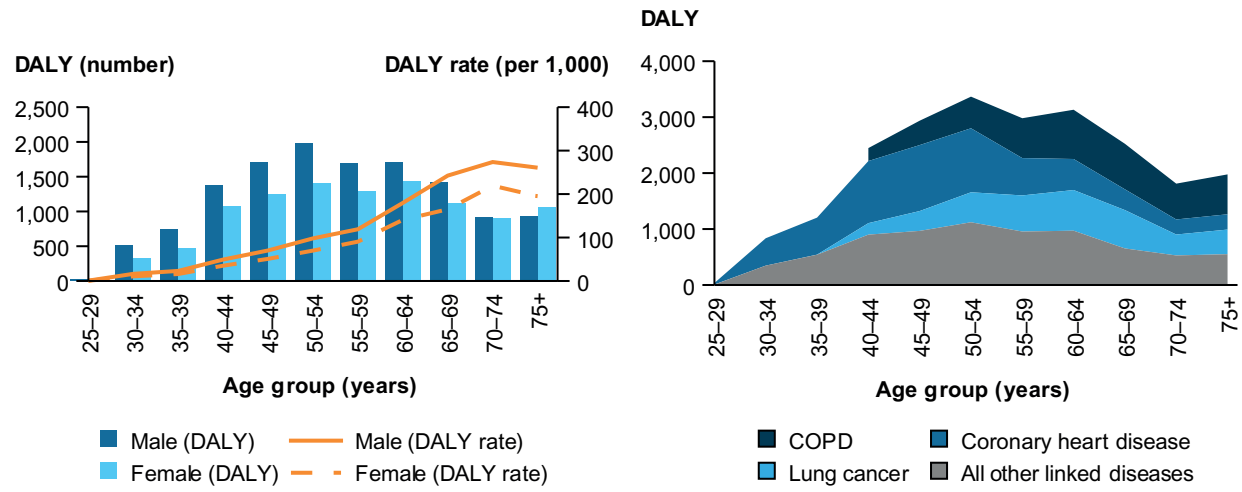


Figure 11.2.2: Tobacco burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

Tobacco use was the risk factor with the greatest contribution to the gap in disease burden between Indigenous and non-Indigenous Australians in 2011, responsible for 23% of the total (Table 11.2.2).

Table 11.2.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to tobacco use, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	**Indigenous**	**Non-Indigenous**	**Rate ratio**	**Rate difference**	**% of health gap[(a)]**
Tobacco use	72.5	15.6	4.6	56.9	23.3
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.3 Alcohol use

Alcohol use was responsible for 8% of the total burden of disease and injury in Indigenous Australians in 2011 (Table 11.3.1). This captures both the immediate impact of alcohol consumption (resulting in injury) and the long–term impact (chronic diseases).

Of the total alcohol attributable burden, around half (51%) was due to alcohol use disorders (8,037 DALY), 11% due to suicide & self-inflicted injuries (1,701 DALY) and a further 7% due to injuries sustained as an occupant of a motor vehicle (1,119 DALY).

Alcohol use was responsible for the entire burden due to alcohol use disorders, 24% of the burden of RTI (motor vehicle occupants and other RTI), 24% of the burden due to CLD, and 20% of the burden due to suicide & self-inflicted injuries (Table 11.3.1).

Table 11.3.1: Burden (number and percentage of linked disease) attributable to alcohol use, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Alcohol use disorders	8,037	100.0
Suicide & self-inflicted injuries	1,701	20.0
RTI—motor vehicle occupants	1,119	23.6
Chronic liver disease	1,001	24.0
Coronary heart disease	634	4.6
Homicide & violence	626	18.5
Poisoning	541	17.4
Other RTI	327	24.0
Liver cancer	289	23.2
Falls	264	11.2
All other diseases and injuries	1,311	..
Total	**15,850**	**8.3**

Note: The numbers may not add to total for all columns due to rounding.

Across all disease outcomes, the alcohol attributable burden was split fairly evenly between fatal (49%) and non-fatal outcomes (51%) (Figure 11.3.1); however, this differed by disease. For example, almost 100% of the burden attributed to CLD, liver cancer, suicide & self-inflicted injuries and poisoning was due to fatal outcomes, compared to only 11% of alcohol use disorders.

Indigenous males contributed three-quarters of the attributable burden across all disease and injury outcomes of alcohol exposure (Figure 11.3.1). The male proportion was highest for falls (89%), suicide & self-inflicted injuries (86%), homicide & violence and poisoning (84% each) and lowest for CLD (56%).

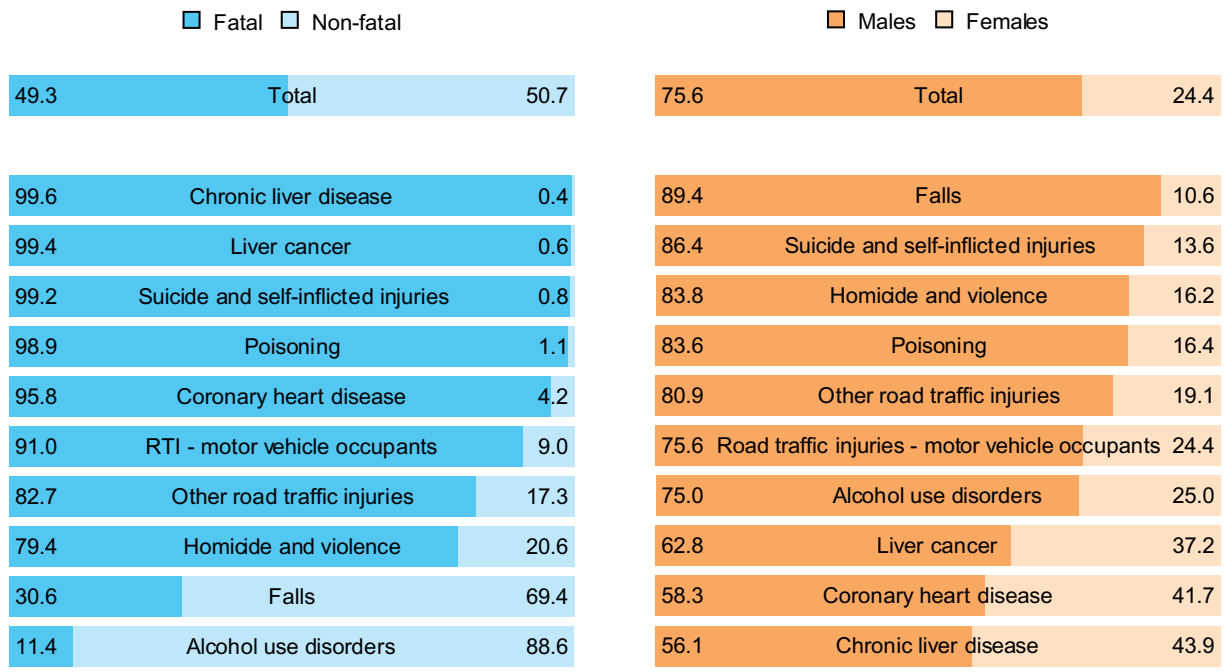


Figure 11.3.1: Proportion of burden attributable to alcohol use by a) fatal versus non-fatal burden, and b) sex, top 10 diseases, Indigenous Australians, 2011

The burden attributed to alcohol was measured in Indigenous Australians aged 15 and over. Alcohol use disorders made up over 50% of the alcohol-attributable burden at ages 15–44. RTI motor vehicle occupants and suicide combined contributed to more than 20% of the disease burden attributed to alcohol for ages 15–34 (Figure 11.3.2).

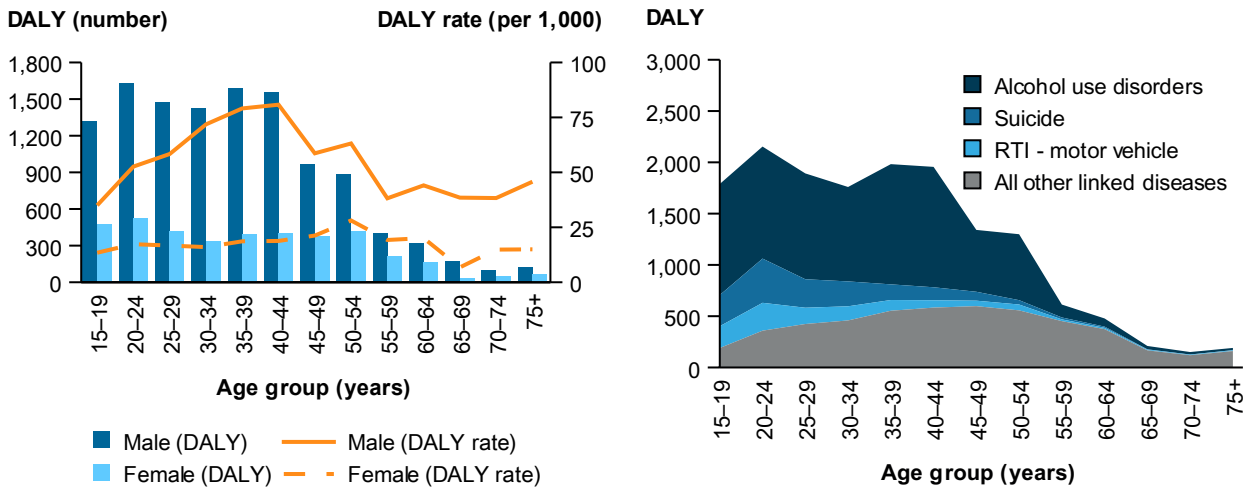


Figure 11.3.2: Alcohol burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

Alcohol use was responsible for 8% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.3.2).

Table 11.3.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to alcohol use, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	**Indigenous**	**Non-Indigenous**	**Rate ratio**	**Rate difference**	**% of health gap[(a)]**
Alcohol use	29.1	9.4	3.1	19.7	8.1
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.4 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 weight and height measurements. High body mass was responsible for 8% of the burden of disease in Indigenous Australians in 2011 (Table 11.4.1).

CHD and diabetes were the 2 leading disease outcomes of high body mass (5,326 and 4,902 DALY respectively). High body mass contributed to 64% of the total burden of diabetes, 46% of CKD burden, and 39% of CHD burden (Table 11.4.1).

Table 11.4.1: Burden (number and percentage of linked disease) attributable to high body mass, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Coronary heart disease	5,326	38.8
Diabetes	4,902	63.5
Chronic kidney disease	1,716	46.4
Stroke	930	28.2
Other cardiovascular diseases	810	45.2
Cardiomyopathy	430	34.7
All other diseases and injuries	1,533	..
Total	**15,647**	**8.2**

Note: The numbers may not add to total for all columns due to rounding.

The burden attributed to high body mass was largely due to fatal outcomes (82%) (Figure 11.4.1). The fatal proportion ranged from 98% of the cardiomyopathy burden to 71% of the CKD burden.

Indigenous males experienced 55% of the total burden due to high body mass (Figure 11.4.1). Males made up a greater proportion of the burden due to CHD (69%) and cardiomyopathy (61%) but a smaller proportion of the burden due to stroke (42%) and CKD (42%).

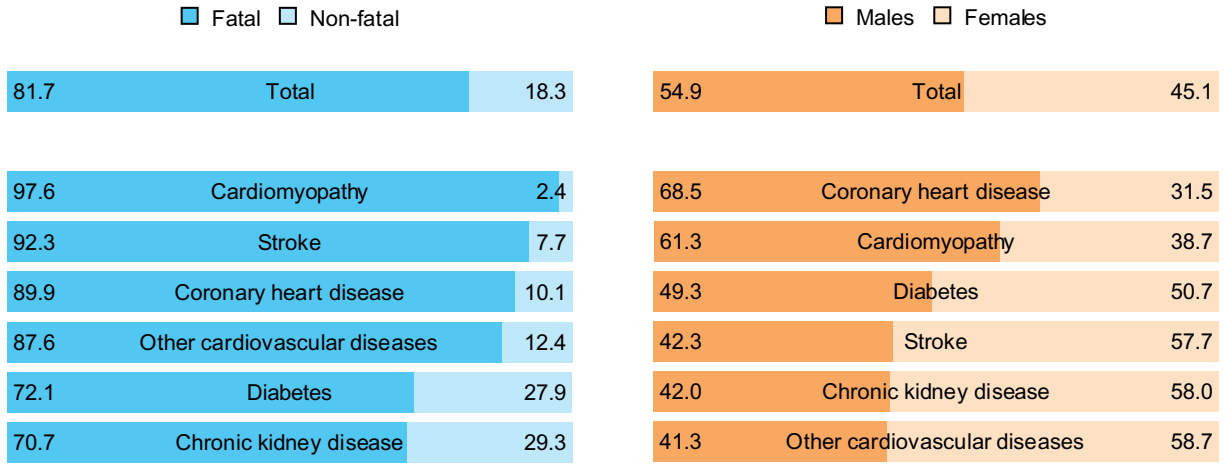


Figure 11.4.1: Proportion of burden attributable to high body mass by a) fatal versus non-fatal burden, and b) sex, top 6 diseases, Indigenous Australians, 2011

The contribution of high body mass to disease burden was estimated for individuals aged 25 and older. Rates of health loss increased with advancing age, reaching a peak at ages 70–74. Across all age groups, CHD and diabetes were each responsible for around one-third of the burden attributed to high body mass in the Indigenous population (Figure 11.4.2).

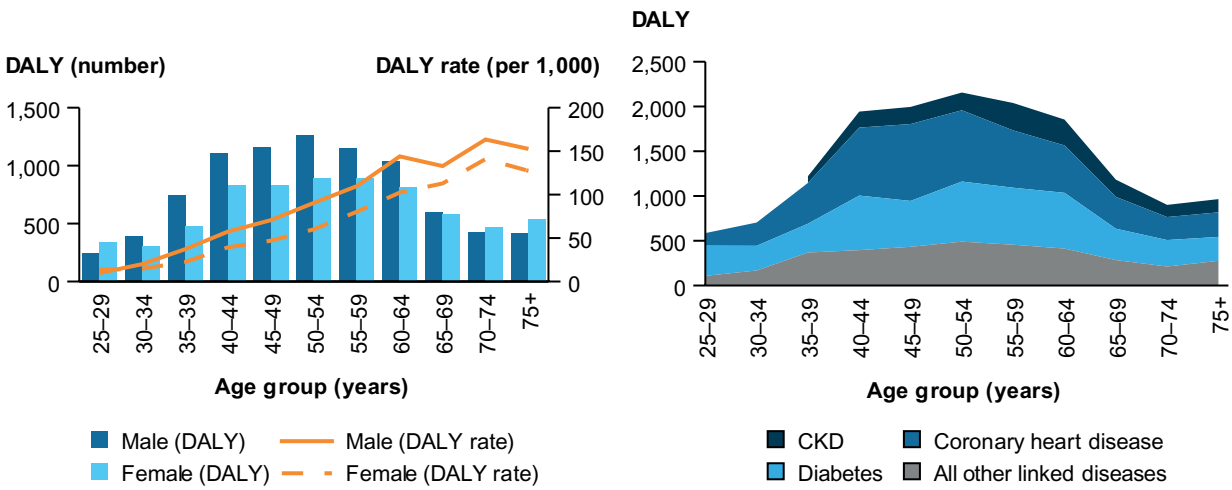


Figure 11.4.2: Burden attributable to high body mass a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

High body mass was responsible for 14% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.4.2).

Table 11.4.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to high body mass, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	Indigenous	Non-Indigenous	Rate ratio	Rate difference	% of health gap[(a)]
High body mass	44.1	9.5	4.6	34.5	14.1
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.5 Physical inactivity

Physical inactivity accounted for 5.5% of the total burden of disease and injury among Indigenous Australians in 2011 (Table 11.5.1). CHD and diabetes were the 2 leading disease outcomes of physical inactivity (6,002 and 2,801 DALY respectively). Physical inactivity contributed to 44% of the total burden due to CHD and 36% of the burden due to diabetes.

Table 11.5.1: Burden (number and percentage of linked disease) attributable to physical inactivity, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	Number	Per cent
Coronary heart disease	6,002	43.8
Diabetes	2,801	36.3
Stroke	848	25.7
Bowel cancer	439	32.4
Breast cancer	414	35.3
Total	**10,504**	**5.5**

Note: The numbers may not add to total for all columns due to rounding.

Around 85% of the attributable burden from physical inactivity was due to fatal outcomes. This varied by disease, with the fatal proportion of the attributable burden largest in bowel cancer (96%) and lowest in diabetes (70%) (Figure 11.5.1).

Overall, Indigenous males experienced more than half (57%) of the burden attributed to physical inactivity. This proportion was highest in CHD (68%) and lowest in stroke (41%) and breast cancer (0%) (Figure 11.5.1).

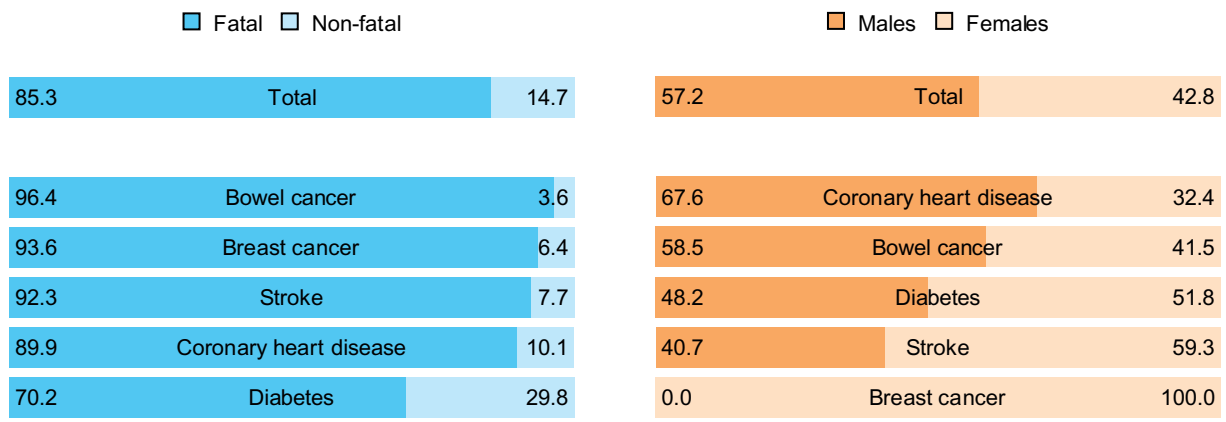


Figure 11.5.1: Proportion of burden attributable to physical inactivity by a) fatal versus non-fatal burden, and b) sex, top 5 diseases, Indigenous Australians, 2011

The burden attributable to physical inactivity was measured in Indigenous Australians 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 Indigenous Australians aged 25–34 but rates increased with age, peaking at around age 70. From age 30 onwards CHD was responsible for over half of the burden attributed to physical inactivity in the Indigenous population (Figure 11.5.2).

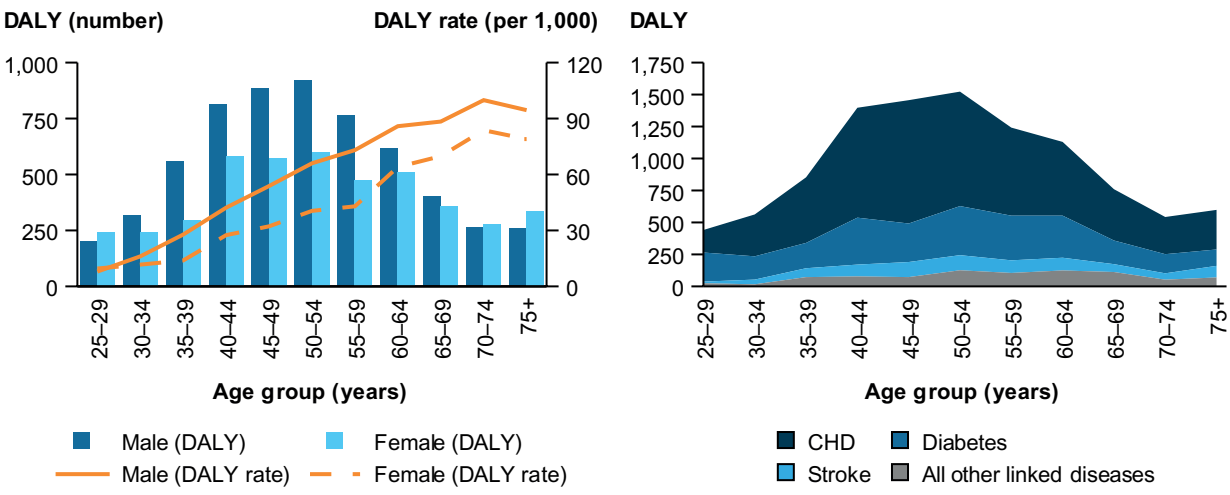


Figure 11.5.2: Physical inactivity burden a) DALY (count and rates per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

Physical inactivity was responsible for 8% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.5.2).

Table 11.5.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to physical inactivity, 2011

Risk factor	Age-standardised DALY rate per 1,000		Rate ratio	Rate difference	% of health gap[(a)]
	Indigenous	Non-Indigenous			
Physical inactivity	28.8	8.8	3.3	20.0	8.2
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.6 High blood pressure

High blood pressure contributed 5% of the burden of disease experienced by Indigenous Australians in 2011 (Table 11.6.1).

CHD and stroke were the 2 leading disease outcomes attributed to high blood pressure for Indigenous Australians (5,040 and 1,999 DALY respectively). High blood pressure contributed to 64% of the total burden due to hypertensive heart disease, 61% of the stroke burden, and 37% of the CHD burden (Table 11.6.1).

Table 11.6.1: Burden (number and percentage of linked disease) attributable to high blood pressure, by disease, Indigenous Australians, 2011

Linked disease	DALY	
	Number	Per cent
Coronary heart disease	5,040	36.7
Stroke	1,999	60.6
Chronic kidney disease	898	24.3
Other cardiovascular diseases	450	25.1
Cardiomyopathy	275	22.2
Atrial fibrillation and flutter	190	29.2
Hypertensive heart disease	146	63.6
Rheumatic heart disease	138	11.5
All other diseases	176	. .
Total	**9,310**	**4.9**

Note: The numbers may not add to total for all columns due to rounding.

Of the burden attributed to high blood pressure, 88% was due to fatal outcomes (Figure 11.6.1). A higher proportion of fatal burden was evident in all disease outcomes with the exception of atrial fibrillation and flutter (29% fatal).

Indigenous males experienced 60% of the total burden attributed to high blood pressure (Figure 11.6.1). Males experienced a greater share of the attributable burden due to hypertensive heart disease (72%), CHD (70%) and cardiomyopathy (67%) while females experienced a greater share of the burden attributed to rheumatic heart diseases (58%), CKD (57%) and stroke (56%).

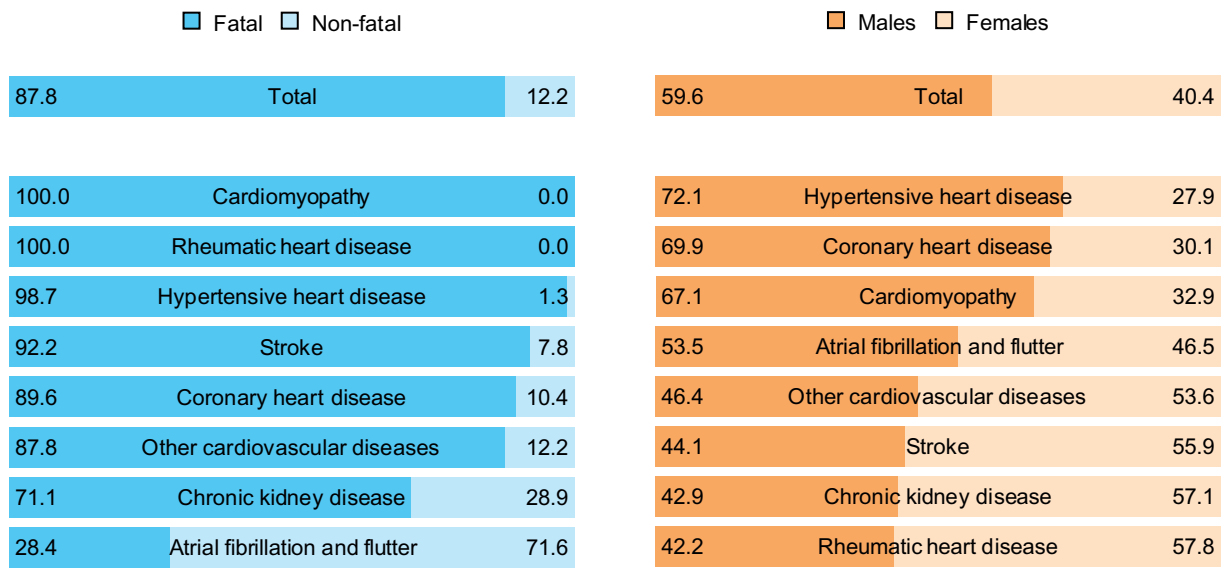


Figure 11.6.1: Proportion of burden attributable to high blood pressure by a) fatal versus non-fatal burden, and b) sex, top 8 diseases, Indigenous Australians, 2011

High blood pressure burden increased with age, with rates peaking in the 75+ age group for both Indigenous males and females (Figure 11.6.2). The majority of burden occurred at ages 45–69. This was mainly the result of a high number of Indigenous Australians living with cardiovascular diseases and CKD in this age range, coupled with premature deaths in the older ages.

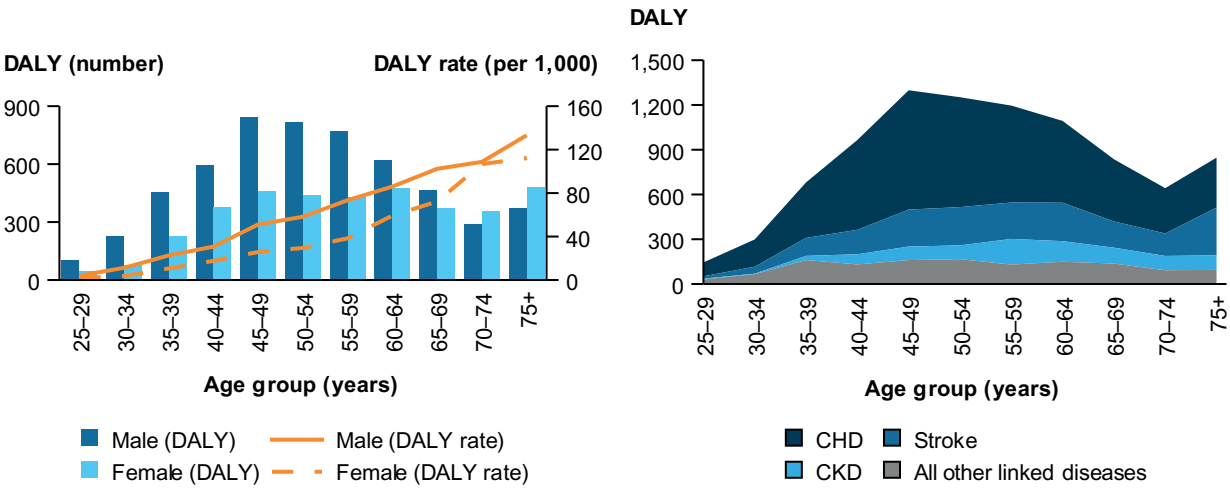


Figure 11.6.2: High blood pressure burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

High blood pressure was responsible for 8% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.6.2).

Table 11.6.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to high blood pressure, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	**Indigenous**	**Non-Indigenous**	**Rate ratio**	**Rate difference**	**% of health gap[(a)]**
High blood pressure	28.5	8.6	3.3	19.9	8.1
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.7 High blood plasma glucose

High blood plasma glucose is a marker of diabetes and contributes to the onset of cardiovascular and kidney disease.

Diabetes and CHD were the 2 leading disease outcomes attributed to high blood plasma glucose for Indigenous Australians (7,036 and 1,137 DALY respectively). High blood plasma glucose was responsible for 4.6% of total burden in Indigenous Australians in 2011 (Table 11.7.1). It contributed to 91% of the burden due to diabetes, 9% of the burden due to stroke and 8% of the burden due to CHD.

Table 11.7.1: Burden (number and percentage of linked disease) attributable to high blood plasma glucose, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Diabetes	7,036	91.1
Coronary heart disease	1,137	8.3
Stroke	286	8.7
Chronic kidney disease	251	6.8
Total	**8,710**	**4.6**

Note: The numbers may not add to total for all columns due to rounding.

Overall, around three-quarters (76%) of the burden due to high blood plasma glucose was due to fatal outcomes. The highest proportion of fatal burden was for stroke (92%) and CHD (89%) (Figure 11.7.1).

The burden attributable to high blood plasma glucose was fairly evenly split between Indigenous males (51%) and females (49%) (Figure 11.7.1). However, this proportion varied depending on the disease outcome, with the male proportion ranging from 67% of the CHD burden to 41% of the CKD burden.

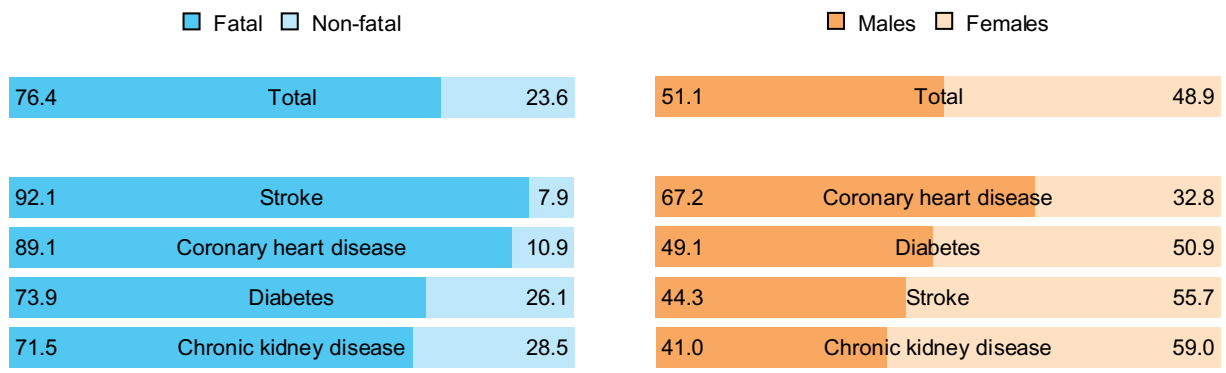


Figure 11.7.1: Proportion of burden attributable to high blood plasma glucose by a) fatal versus non-fatal burden, and b) sex, by disease, Indigenous Australians, 2011

Rates of overall burden due to high blood plasma glucose increased with age and peaked at ages 70–74 for Indigenous males and 75+ for Indigenous females (Figure 11.7.2). As diabetes causes the vast majority of the burden (responsible for more than 80% of the burden across all age groups), the overall attributable burden by age largely reflects the diabetes burden.

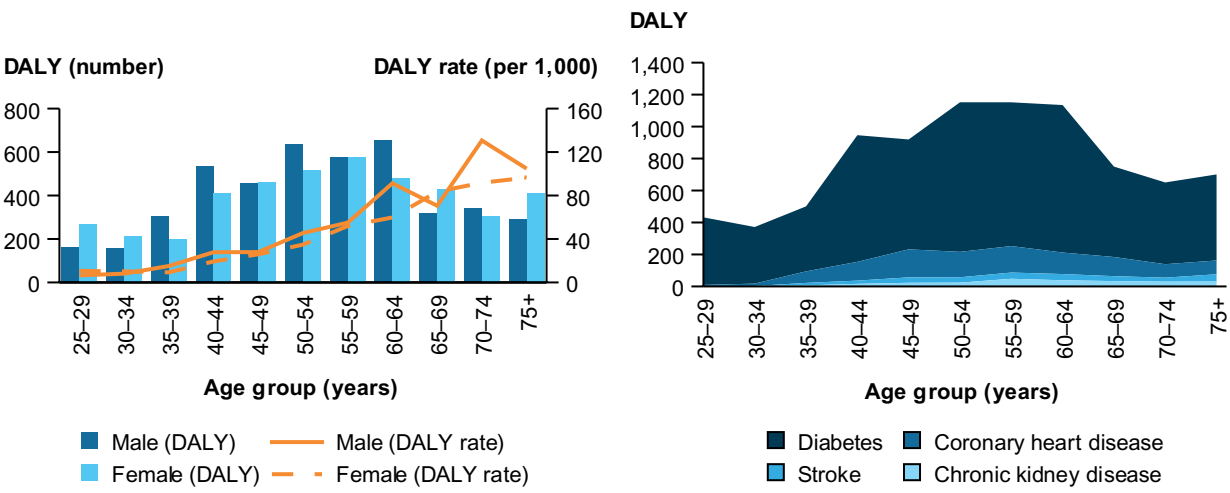


Figure 11.7.2: High blood plasma glucose burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

High blood plasma glucose was responsible for 9% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.7.2).

Table 11.7.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to high blood plasma glucose, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	Indigenous	Non-Indigenous	Rate ratio	Rate difference	% of health gap[(a)]
High blood plasma glucose	26.2	4.7	5.6	21.5	8.8
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.8 Drug use

Drug use contributed to 3.7% of the total burden of disease and injury experienced by Indigenous Australians in 2011 (Table 11.8.1). This captures the impact of injecting drug use as well as cocaine, opioid, amphetamine and cannabis dependence.

Drug use disorders, CLD and suicide & self-inflicted injuries were the leading disease outcomes attributed to drug use for Indigenous Australians (around 2,100 DALY each). Drug use accounted for 51% of the total CLD burden and 45% of the liver cancer burden (Table 11.8.1).

Table 11.8.1: Burden (number and percentage of linked disease) attributable to drug use, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	Number	Per cent
Drug use disorders (excluding alcohol)	2,141	100.0
Chronic liver disease	2,134	51.1
Suicide & self-inflicted injuries	2,126	25.0
Liver cancer	559	44.9
HIV/AIDS	40	16.6
Blood-borne viruses[(a)]	32	. .
Total	**7,032**	**3.7**

(a) Blood-borne viruses include the combined burden due to acute hepatitis B and C.

Note: The numbers may not add to total for all columns due to rounding.

Across all disease and injury outcomes linked to drug use, 72% of the burden was due to premature mortality (Figure 11.8.1). Almost all of the attributed CLD, liver cancer (99%) and suicide & self-inflicted injuries (99%) burden were due to fatal outcomes, compared to 9% of drug use disorders.

Indigenous males experienced the majority of the attributable burden due to drug use (70%), but this proportion was much higher for suicide & self-inflicted injuries (82%) (Figure 11.8.1).

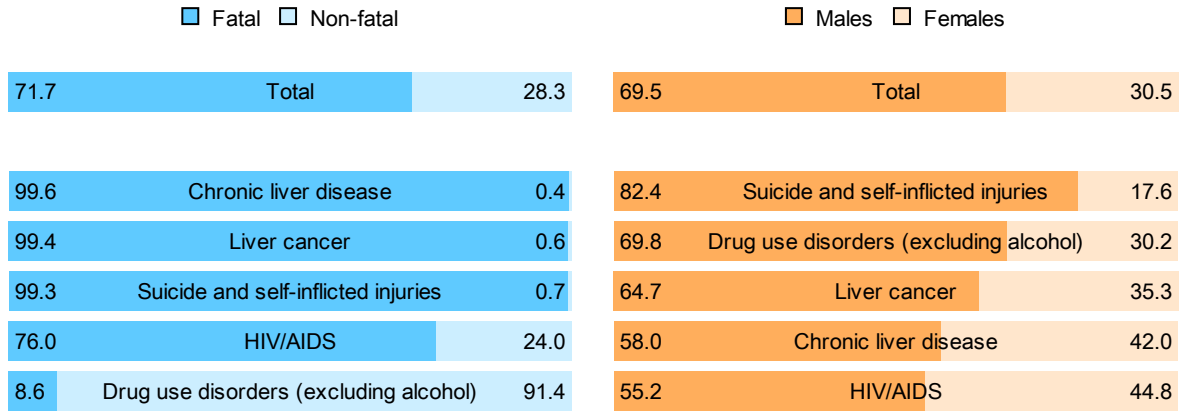


Figure 11.8.1: Proportion of burden attributable to drug use by a) fatal versus non-fatal burden, and b) sex, by disease, Indigenous Australians, 2011

The total number of DALY attributed to drug use was highest at ages 15–44 for both Indigenous males and females, after which it began to fall (Figure 11.8.2). Suicide & self-inflicted injuries and drug use disorders made up more than 90% of the burden at ages 15–34, after which the contribution of CLD (due to chronic viral hepatitis) made up the majority of burden attributed to drug use.

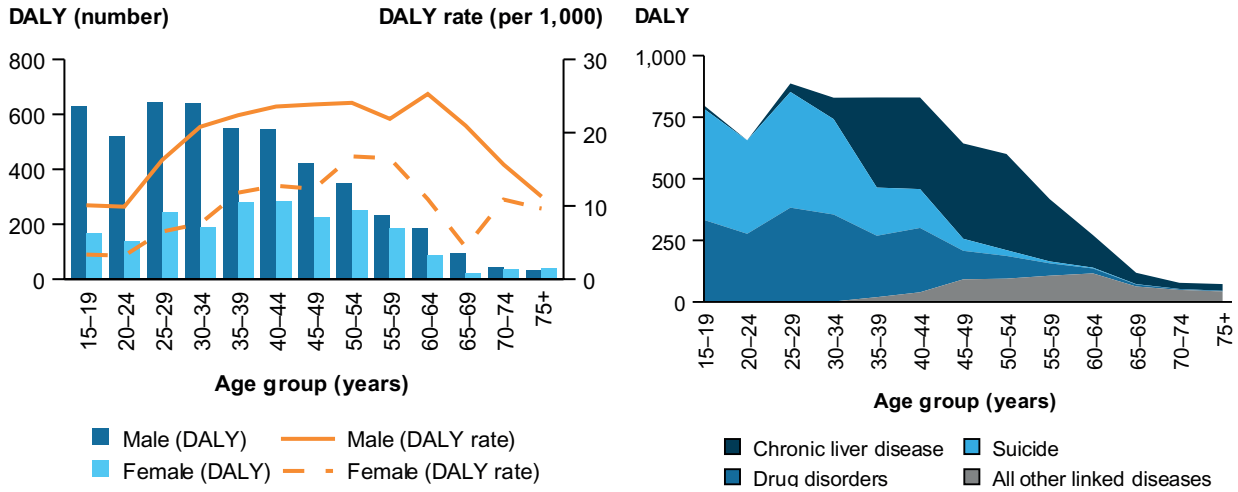


Figure 11.8.2: Drug use burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

Drug use was responsible for 4% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.8.2).

Table 11.8.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to drug use, 2011

Risk factor	Age-standardised DALY rate per 1,000		Rate ratio	Rate difference	% of health gap[(a)]
	Indigenous	Non-Indigenous			
Drug use	13.3	3.2	4.2	10.1	4.1
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.9 High cholesterol

High cholesterol contributed 2.6% of the burden of disease experienced by Indigenous Australians in 2011 (Table 11.9.1). CHD and stroke were the 2 disease outcomes attributed to high cholesterol for Indigenous Australians (responsible for 4,522 and 448 DALY respectively). High cholesterol was responsible for 33% of the CHD burden and 14% of the stroke burden.

Table 11.9.1: Burden (number and percentage of linked disease) attributable to high cholesterol, by disease, Indigenous Australians, 2011

Linked disease	DALY	
	Number	Per cent
Coronary heart disease	4,522	33.0
Stroke	448	13.6
Total	**4,970**	**2.6**

Note: The numbers may not add to total for all columns due to rounding.

Around 91% of the burden attributed to high cholesterol was fatal (Figure 11.9.1). Males experienced 69% of the burden attributed to CHD. However, Indigenous females experienced a greater share of burden due to stroke (60%).

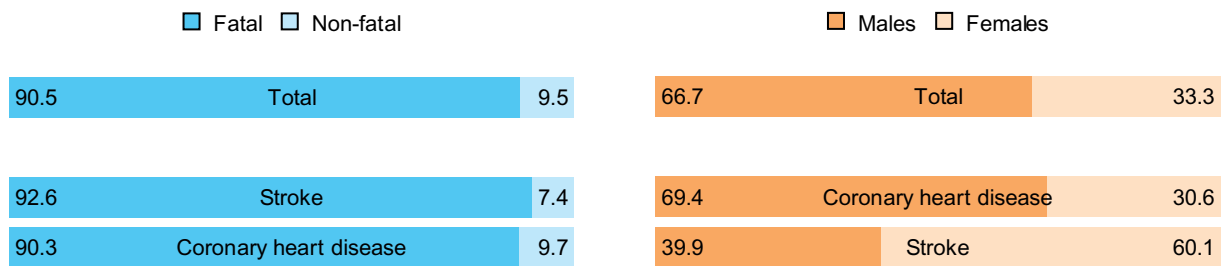


Figure 11.9.1: Proportion of burden attributable to high cholesterol by a) fatal versus non-fatal burden and b) sex, by disease, Indigenous Australians, 2011

The burden attributable to high cholesterol was measured in individuals aged 25 and over. The burden was low in Indigenous males and females aged 25–29 but increased with age peaking at ages 45–54 (Figure 11.9.2). Across all age groups, CHD accounted for more than 85% of the burden attributed to high cholesterol.

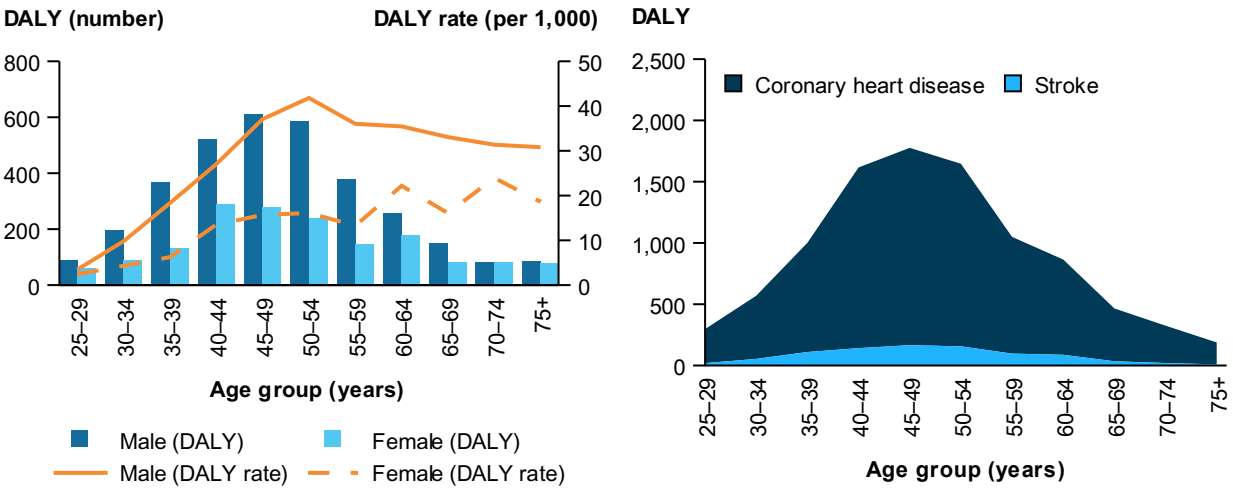


Figure 11.9.2: High cholesterol burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

High cholesterol was responsible for 3% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.9.2).

Table 11.9.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to high cholesterol, 2011

	Age-standardised DALY rate per 1,000				
Risk factor	Indigenous	Non-Indigenous	Rate ratio	Rate difference	% of health gap[(a)]
High cholesterol	12.4	4.2	3.0	8.2	3.4
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.10 Childhood sexual abuse

The impact of childhood sexual abuse was measured in Indigenous males and females aged 15 and over. The attributable burden reflects the health outcomes experienced later in life as a result of sexual abuse during childhood such as mental & substance use disorders.

Childhood sexual abuse accounted for 2% of the total burden of disease and injury experienced by Indigenous Australians in 2011 due to 3 outcomes experienced later in life: depressive disorders, alcohol use disorders and suicide & self-inflicted injuries (Table 11.10.1). It contributed to 21% of the burden (DALY) due to alcohol use disorders, 16% of depressive disorders burden and 14% of suicide & self-inflicted injuries burden.

Table 11.10.1: Burden (number and percentage of linked disease) attributable to childhood sexual abuse, by disease, Indigenous Australians, 2011

	DALY	
Linked disease	Number	Per cent
Alcohol use disorders	1,643	20.5
Suicide & self-inflicted injuries	1,226	14.4
Depressive disorders	1,137	16.3
Total	**4,007**	**2.1**

Note: The numbers may not add to total for all columns due to rounding.

Around one-third (36%) of the burden attributable to childhood sexual abuse was fatal and two-thirds non-fatal (Figure 11.10.1). The attributable burden linked to suicide & self-inflicted injuries was almost all fatal (98%), while the burden linked to depressive disorders was all non-fatal.

A larger proportion of the burden from childhood sexual abuse was experienced by Indigenous females (57%) than Indigenous males (Figure 11.10.1).

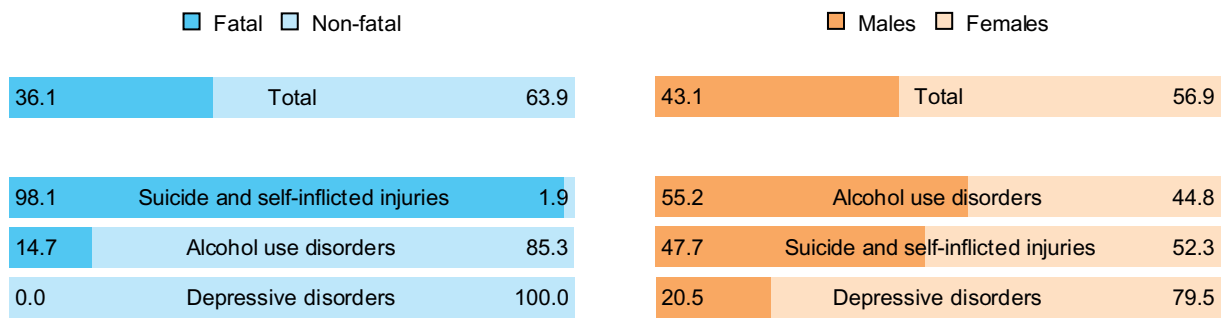


Figure 11.10.1: Proportion of burden attributable to childhood sexual abuse by a) fatal versus non-fatal burden and b) sex, by disease, Indigenous Australians, 2011

As mentioned previously, the impact of childhood sexual abuse was measured in individuals aged 15 and over. The total burden was highest at ages 15–44 (Figure 11.10.2). Rates of attributable burden peaked at ages 35–39 for females and 35–44 for males. The proportion of the burden attributed to childhood sexual abuse by linked disease was similar across all age groups.

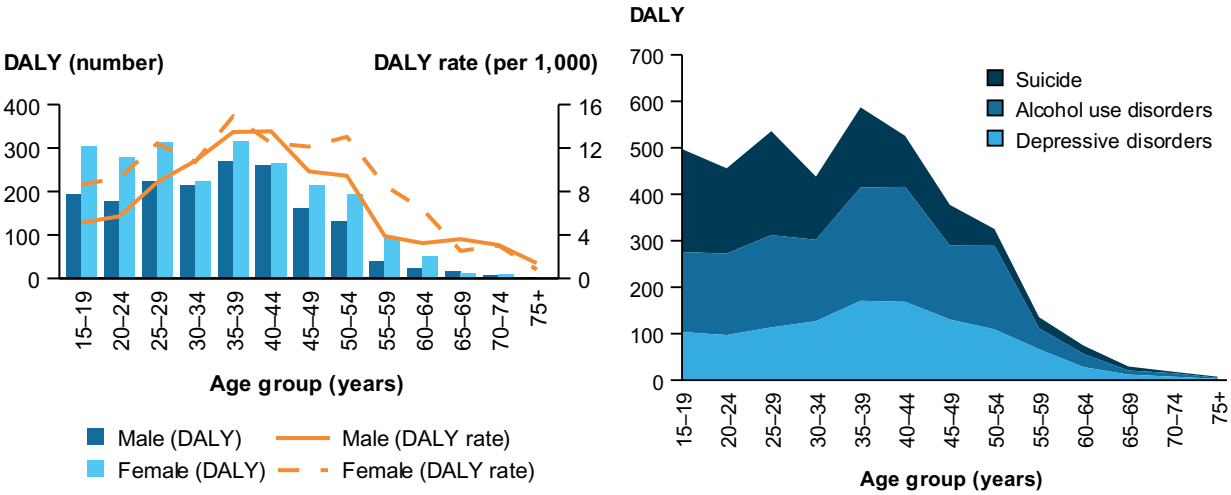


Figure 11.10.2: Childhood sexual abuse burden a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

Childhood sexual abuse was responsible for 2.6% of the total gap in disease burden between Indigenous and non-Indigenous Australians in 2011 (Table 11.10.2).

Table 11.10.2: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to childhood sexual abuse, 2011

Risk factor	Age-standardised DALY rate per 1,000		Rate ratio	Rate difference	% of health gap[(a)]
	Indigenous	Non-Indigenous			
Childhood sexual abuse	7.0	0.6	11.8	6.4	2.6
All 29 risk factors combined	*188.8*	*63.3*	*3.0*	*125.5*	*51.4*
Total burden	**429.4**	**185.0**	**2.3**	**244.4**	**100.0**

(a) This column represents the contribution of each risk factor to the total health gap as measured by the DALY rate difference between Indigenous and non-Indigenous Australians. The 29 risk factors included in the study represent only a subset of all possible risk factors that may contribute to disease burden, and as such these statistics do not represent a measure of the contribution of all risk factors to the overall health gap between Indigenous and non-Indigenous Australians.

11.11 All dietary risk factors combined

This study included 13 dietary risk factors, capturing the impact of diets high in processed meats, red meat, sodium, saturated fat and sweetened beverages; and diets low in omega-3 fatty acids, fibre, fruit, vegetables, milk, nuts and seeds, and whole grains.

A combined risk factor analysis has been conducted for these 13 dietary risk factors following methods used in previous global burden of disease studies (Ezzati et al. 2004). However, as previously noted, these combined estimates should be treated with caution as the methods generally used in burden of disease studies rest on the assumption that each risk factor is independent, and do not usually take into account known interactions and relationships between risk factors, and the way these interactions affect disease outcomes. Evidence from previous global studies and expert advice have been used to inform broad adjustments for interactions, in order to approximate the joint effects of multiple risk factors.

Following this approach, the 13 dietary risk factors combined were responsible for just under 10% of the total burden of disease experienced by Indigenous Australians in 2011 (Table 11.11.1).

Table 11.11.1: Burden attributable to dietary risk factors, by risk factor, Indigenous Australians, 2011

	DALY	
Linked disease	**Number**	**Per cent**
Diet high in processed meat	5,260	2.8
Diet low in fruit	4,839	2.5
Diet low in whole grains	4,292	2.3
Diet low in vegetables	3,447	1.8
Diet low in nuts and seeds	4,182	2.2
Diet high in sweetened beverages	3,054	1.6
Diet low in fibre	1,838	1.0
Diet low in omega-3 fatty acids	1,845	1.0
Diet high in saturated fat	1,608	0.8
Diet high in sodium	699	0.4
Diet high in red meat	597	0.3
Diet low in milk	167	0.1
Diet low in calcium	54	—
All dietary risk factors combined	**18,400**	**9.7**

Overall, 86.5% of burden attributable to all dietary risk factors combined for Indigenous Australians was due to premature mortality (Figure 11.11.1). Almost the entire cancer burden attributable to the dietary risk factors combined was fatal, while 29% of the burden due to diabetes was non-fatal. Indigenous males experienced a greater share (62%) of the total burden attributable to diet than Indigenous females (38%) and a greater share of the burden for all linked diseases except for stroke (Figure 11.11.1).

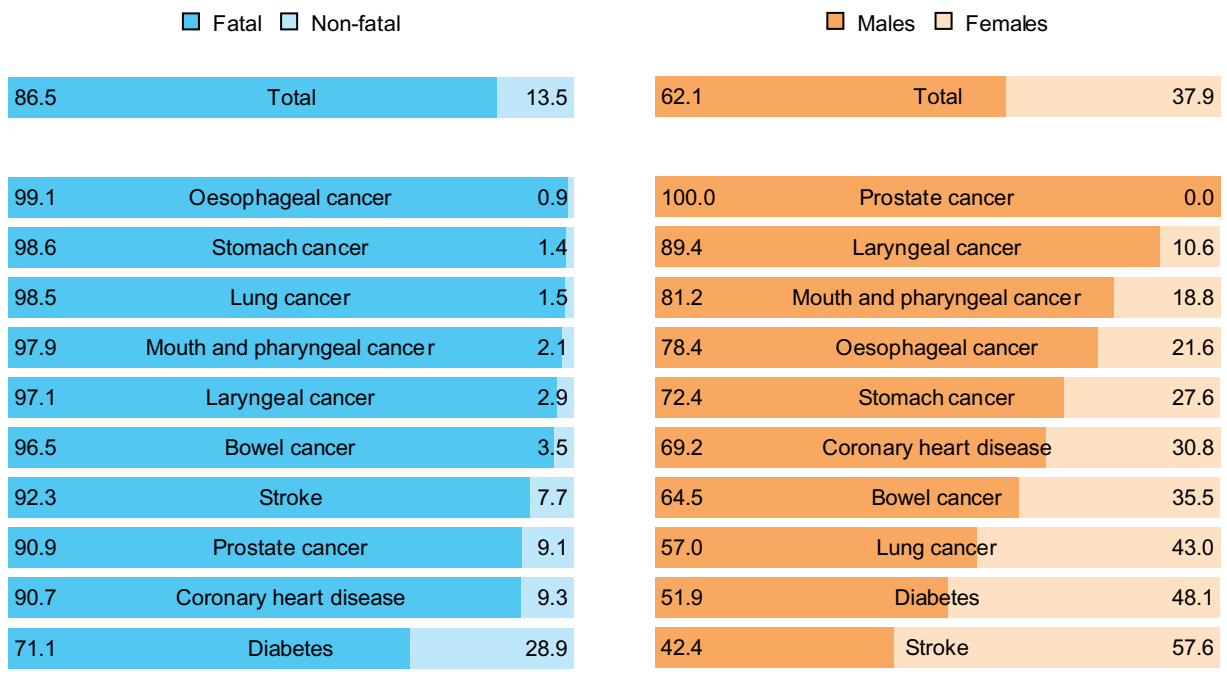


Figure 11.11.1: Proportion of burden attributable to all dietary risk factors combined by a) fatal versus non-fatal burden and b) sex, by disease, Indigenous Australians, 2011

The burden attributable to all dietary risk factors combined increased with age, with rates peaking at 70–74 for both males and females (Figure 11.11.2). In terms of number of DALY, most of the burden attributable to all dietary risk factors was experienced in the middle age groups (40–64). CHD and stroke accounted for more than half of the attributable burden due to dietary risk factors in all age groups in the Indigenous population.

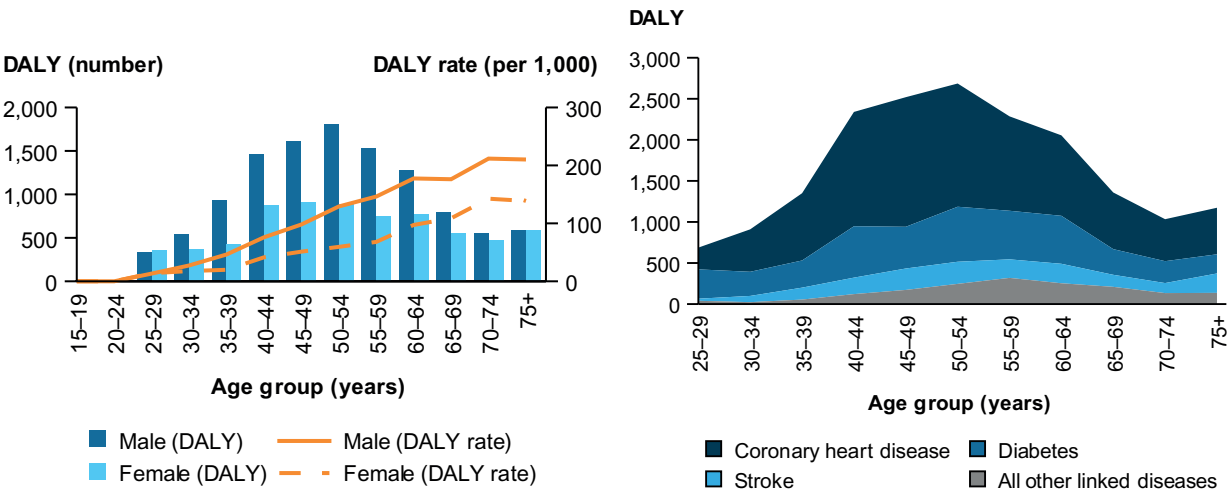


Figure 11.11.2: Burden attributable to all dietary risk factors combined a) DALY (count and rate per 1,000 people) by age and sex, and b) DALY (count) by age and disease, Indigenous Australians, 2011

12 Variation across geographic and population groups

What it means: differences across Australia

This section looks at how the impact of diseases and injuries varies between different parts of Australia, and between areas where people are generally more disadvantaged compared with areas where they are generally less disadvantaged.

Differences between states and territories

Information on years of healthy life lost (the burden) due to diseases and injuries in 2011 was only available for Indigenous Australians in New South Wales, Queensland, Western Australia and the Northern Territory.

Indigenous Australians in Western Australia and the Northern Territory lost more years of healthy life per person (499 and 498) compared with those in New South Wales and Queensland. Mental and substance use disorders, cardiovascular diseases, injuries and cancer were the biggest causes of the burden in all 4 places.

The largest gap between Indigenous and non-Indigenous Australians was in Western Australia. Indigenous Australians in Western Australia lost almost 3 times as many years of healthy life per person (2.8 times) as non-Indigenous Australians.

Differences between cities and regional and remote areas

Indigenous Australians in remote areas lost the most years of healthy life per person, more than in cities and regional areas across Australia.

Mental and substance use disorders, such as anxiety and alcohol use disorders, caused the most burden in cities and regional areas. Injuries, including suicide, caused the most burden in remote areas.

The largest gap between Indigenous and non-Indigenous Australians was in remote areas. Indigenous Australians in remote areas lost more than twice as many years of healthy life per person (2.4 times) as non-Indigenous Australians. In cities and regional areas Indigenous people lost about twice as many healthy years per person as non-Indigenous Australians.

Differences between levels of disadvantage

Indigenous Australians in the most disadvantaged areas lost more than twice as many years of healthy life per person (2.4 times) compared with Indigenous people in the least disadvantaged areas.

This chapter focuses on the variation in burden of disease and injury across states and territories, remoteness areas and socioeconomic groups within the Indigenous population and compared to the non-Indigenous population. Such variation reflects a complex interaction of factors, such as demographic, socioeconomic and environmental variations, and variation in access to services and in the prevalence of risky health behaviours.

Subnational estimates are presented for:

- Four states and territories: New South Wales, Queensland, Western Australia and the Northern Territory. Estimates are not presented for the other states and territories due to small numbers of Indigenous deaths and lack of suitable mortality adjustment factors.
- Five remoteness categories at the national level (*Major cities, Inner regional, Outer regional, Remote* and *Very remote*).

- Five levels (quintiles) of socioeconomic disadvantage at the national level for the Indigenous population only. The IRSEO index was used for Indigenous estimates (Biddle 2013). As a comparable index for the non-Indigenous population is not available, measures of the gap in socioeconomic disadvantage are not presented.

It should be noted that the sum of the Indigenous and non-Indigenous YLD and DALY estimates for each subnational category (3 states and a territory in the case of the state and territory section and all states and territories in the case of the remoteness and socioeconomic status sections) will not always equal the subnational estimate published for the total Australian population in the *AIHW's report Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016a). This is because different methods and/or data sources may have been used to calculate these estimates.

12.1 Burden of disease by state and territory

This section focuses on the variability of burden across states and territories, rather than the detailed estimates for each jurisdiction. It is important to note that variations in patterns of disease burden across states and territories reflect not just differences in mortality and morbidity but a complex interaction of a number of other factors, such as demographic (including the age structure of the population and the proportion of the population that is Indigenous) and socioeconomic variations. For example, the Northern Territory (NT) is quite different to other states and territories. 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 to other states and territories.

Indigenous burden of disease estimates are reported for 4 states and territories: New South Wales, Queensland, Western Australia and the Northern Territory. Estimates for these 4 jurisdictions combined are also included. State and territory-level estimates are not presented for Victoria, South Australia, Tasmania and the Australian Capital Territory, due to a number of issues relating to the calculation of Indigenous YLL estimates (which are also used in the calculation of DALY estimates). This includes the small number of Indigenous deaths reported for these jurisdictions each year, and individual mortality adjustment factors not being available from the ABS for these states and territories.

National estimates for the Indigenous population are also provided for comparison purposes. For fatal burden, these were calculated using national mortality adjustment factors; and for non-fatal burden, these were largely calculated using national prevalence estimates sourced from national data collections rather than based on state-level data to build the national estimates. More information on the methods used to calculate both national and subnational Indigenous burden of disease estimates in the ABDS is provided in 'Appendix B: Method overview'.

Results are generally presented as age-standardised rates, a method that removes the influence of differences in population size and age structure.

Total burden

The overall pattern of disease burden among Indigenous Australians across the 4 jurisdictions roughly mirrored the pattern of Indigenous population distribution, with the highest total burden in New South Wales and the lowest in the Northern Territory (Table 12.1.1). Western Australia and the Northern Territory accounted for a higher proportion of burden (15% and 13%, respectively) than population (13% and 10%, respectively).

Table 12.1.1: Number and proportion of population and total burden (DALY), by state/territory, Indigenous Australians, 2011

	NSW	Qld	WA	NT	NSW, Qld, WA & NT combined	Australia
Indigenous population (no.)	208,476	188,954	88,270	68,850	**554,550**	669,881
Indigenous population %	31.1	28.2	13.2	10.3	**82.8**	100.0
DALY no.	56,133	50,443	28,679	24,206	**159,461**	190,227
DALY %	29.5	26.5	15.1	12.7	**83.8**	100.0
YLD no.	28,138	24,463	11,969	8,506	**73,076**	89,564
YLD %	31.4	27.3	13.4	9.5	**81.6**	100.0
YLL no.	27,996	25,980	16,710	15,700	**86,386**	100,663
YLL %	27.8	25.8	16.6	15.6	**85.8**	100.0

Note: The numbers may not add to total for all columns due to rounding.

Among the 4 jurisdictions for which Indigenous burden estimates have been calculated, age-standardised DALY rates were the highest in the Northern Territory (499 per 1,000 people) and Western Australia (498 per 1,000 people), followed by Queensland and New South Wales (419 and 409 per 1,000 people respectively).

Western Australia had the highest rates of non-fatal burden for Indigenous Australians (age-standardised rate of 193 YLD per 1,000), while the Northern Territory had the highest rates of fatal burden (329 YLL per 1,000). There was greater variation in Indigenous rates of fatal burden across the 4 states and territories than in rates of non-fatal burden (Table 12.1.2).

Table 12.1.2: DALY, YLD and YLL counts and age-standardised rates (per 1,000 people[(a)]), by state/territory, Indigenous Australians, 2011

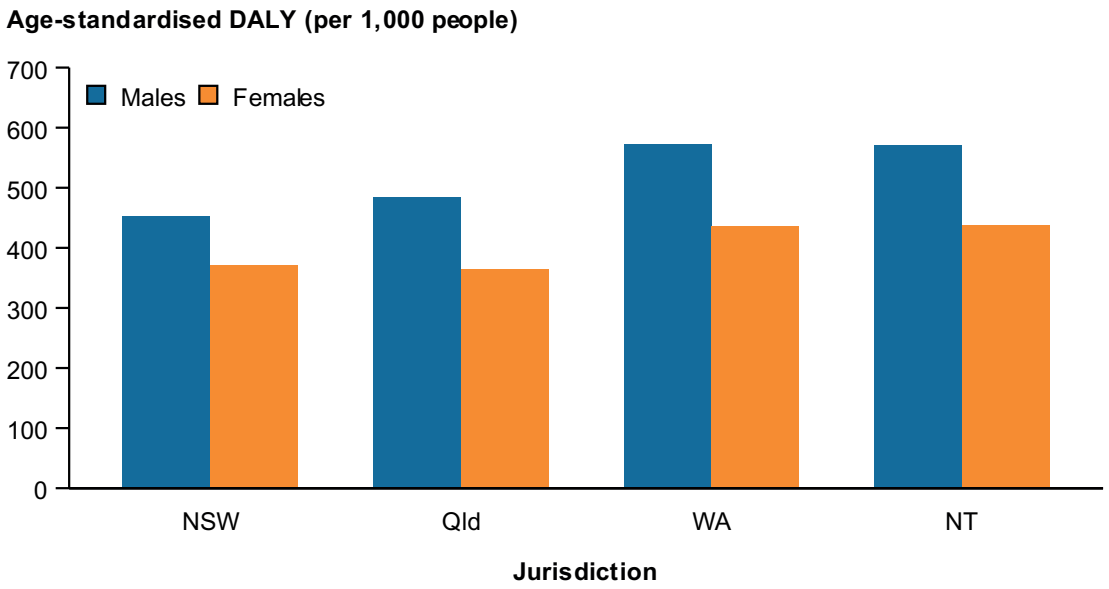
	Total burden		Non-fatal burden		Fatal burden[(b)]		
State/territory	**DALY**	**ASR**	**YLD**	**ASR**	**YLL**	**ASR**	**Deaths**
NSW	56,133	408.7	28,138	180.9	27,996	227.8	924
Qld	50,443	419.2	24,463	185.9	25,980	233.3	771
WA	28,679	498.3	11,969	193.1	16,710	305.2	477
NT	24,206	498.9	8,506	170.3	15,700	328.5	416
NSW, Qld, WA & the NT combined	**159,461**	**436.4**	**73,076**	**182.1**	**86,386**	**254.3**	**2,588**
Australia	190,227	429.4	89,564	183.6	100,663	245.8	3,054

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

(b) Deaths used in the calculation of YLL estimates have been adjusted for Indigenous under-identification using ABS adjustment factors (see Appendix Table B4).

The relatively small non-fatal burden in the Northern Territory appears contrary to other evidence, such as greater rates of hospitalisation for many diseases among Indigenous Australians in that jurisdiction compared with others. This results from the method used to distribute the non-fatal burden across jurisdictions (see 'Appendix B: Methods overview'), and the particular disease groups causing the most non-fatal burden. The method involved applying the jurisdictional distribution pattern for the disease groups to the national Indigenous YLD estimates, using either hospitalisation data or health survey data. The distribution for the disease groups that contributed the most tot the non-fatal burden for Indigenous Australians—mental & substance use disorders, respiratory diseases and musculoskeletal conditions—was drawn from the 2012–13 AATSIHS. This survey found lower prevalence of these 3 types of conditions in the Northern Territory compared with the 3 states included in this analysis.

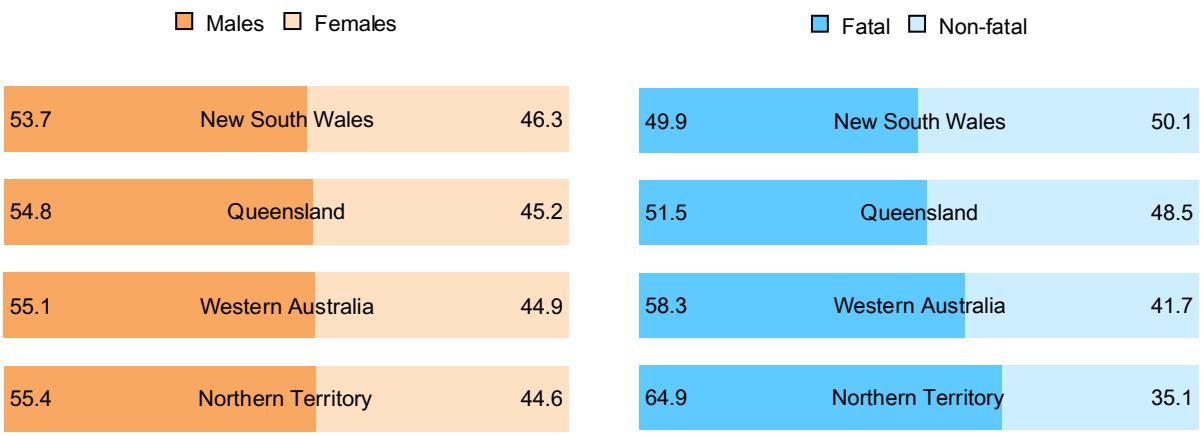
The same general pattern in DALY rates by state and territories was evident for Indigenous males and females, with higher rates for males than females (Figure 12.1.1).



Source: This figure is based on data in a supplementary table available online—Table S12.1.1.

Figure 12.1.1: Age-standardised DALY rates (per 1,000 people) for Indigenous Australians, by sex and state/territory (NSW, Qld, WA and the NT), 2011

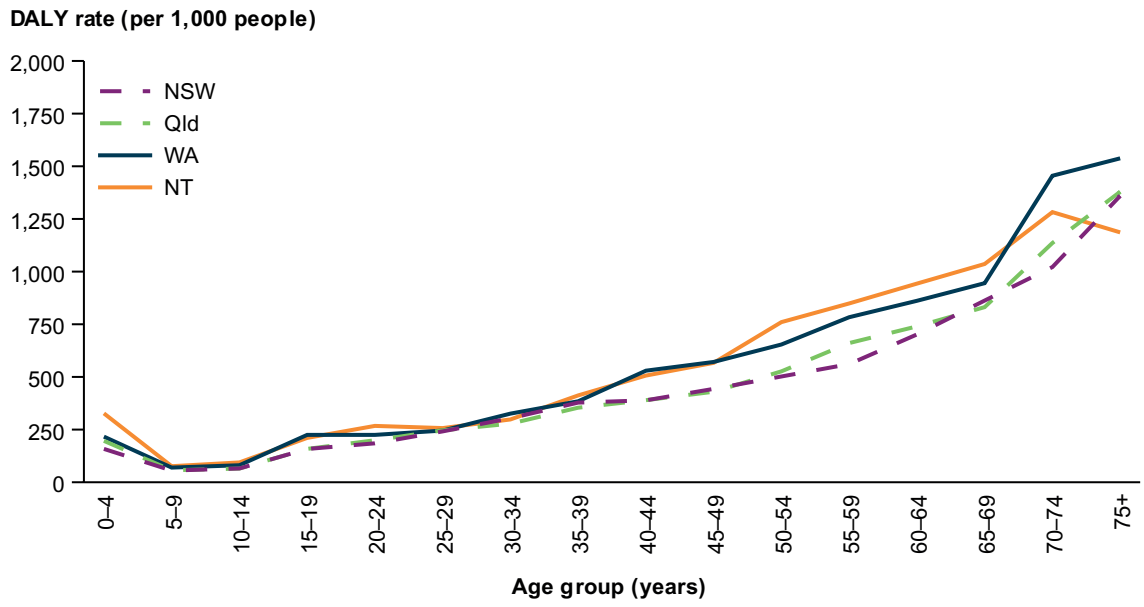
Proportions of total burden were slightly higher for males than for females across all 4 jurisdictions (Figure 12.1.2.). Distributions by fatal and non-fatal burden show that fatal burden contributed to a larger proportion of total burden in the Northern Territory than in the other 3 states.



Source: This figure is based on data in a supplementary table available online—Table S12.1.2.

Figure 12.1.2: Proportion of burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and state/territory (NSW, Qld, WA and the NT), 2011

DALY rates for Indigenous Australians typically increased with age in all 4 jurisdictions and were fairly similar up until around age 40 (Figure 12.1.3). From age 40 onwards DALY rates were generally higher for Indigenous persons living in Western Australia and the Northern Territory than in the other 2 jurisdictions.



Source: This figure is based on data in a supplementary table available online—Table S12.1.3.

Figure 12.1.3: Age specific DALY rates for Indigenous Australians, by age and state/territory (NSW, Qld, WA and the NT), 2011

Total burden by disease group

Table 12.1.3 compares Indigenous age-standardised DALY rates by disease group, and Figure 12.1.4 presents the leading disease groups contributing to total burden in the Indigenous population for New South Wales, Queensland, Western Australia and the Northern Territory in 2011:

- Both Western Australia and the Northern Territory had high rates of disease burden (DALY) for Indigenous Australians due to injuries, cardiovascular diseases, kidney & urinary diseases, endocrine disorders (including diabetes), infectious diseases and gastrointestinal disorders compared to New South Wales and Queensland.
- Western Australia had the highest Indigenous age-standardised DALY rates for neurological conditions; and the Northern Territory had the highest rates for kidney & urinary diseases, infant & congenital conditions and blood & metabolic disorders (Table 12.1.3).
- New South Wales had the highest DALY rates for respiratory diseases; and both Queensland and New South Wales had higher DALY rates for musculoskeletal conditions compared to Western Australia and the Northern Territory.

Table 12.1.3: Age-standardised DALY rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2011

Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & NT combined[(a)]	Australia [(a)]
Cardiovascular	67.9	66.3	89.4	89.1	73.5	71.8
Mental & substance use	62.4	61.8	56.6	48.2	59.2	57.8
Cancer	60.0	57.3	65.9	64.0	60.5	57.0
Respiratory	44.3	35.9	34.9	33.9	38.9	39.2
Injuries	40.2	43.0	71.4	71.4	50.0	49.9
Musculoskeletal	31.0	32.8	26.4	21.3	29.5	30.6
Neurological	23.7	23.3	27.4	23.6	24.1	24.0
Endocrine	18.2	22.7	33.7	31.6	23.6	21.9
Gastrointestinal	13.3	15.2	21.6	20.1	16.1	16.4
Infectious diseases	9.2	9.8	16.0	19.6	11.7	11.3
Kidney/urinary	9.0	13.7	19.6	31.1	14.8	14.9
Infant/congenital	8.2	11.3	8.6	14.1	10.0	9.9
Hearing/vision	6.4	7.0	6.8	5.3	6.5	6.4
Blood/metabolic	4.9	6.5	6.9	10.5	6.3	6.2
Oral	4.5	6.7	7.1	8.3	6.1	6.5
Skin	3.8	3.9	4.3	4.7	4.0	3.9
Reproductive/maternal	1.6	1.8	1.8	2.0	1.7	1.7
Total	**408.7**	**419.2**	**498.3**	**498.9**	**436.4**	**429.4**

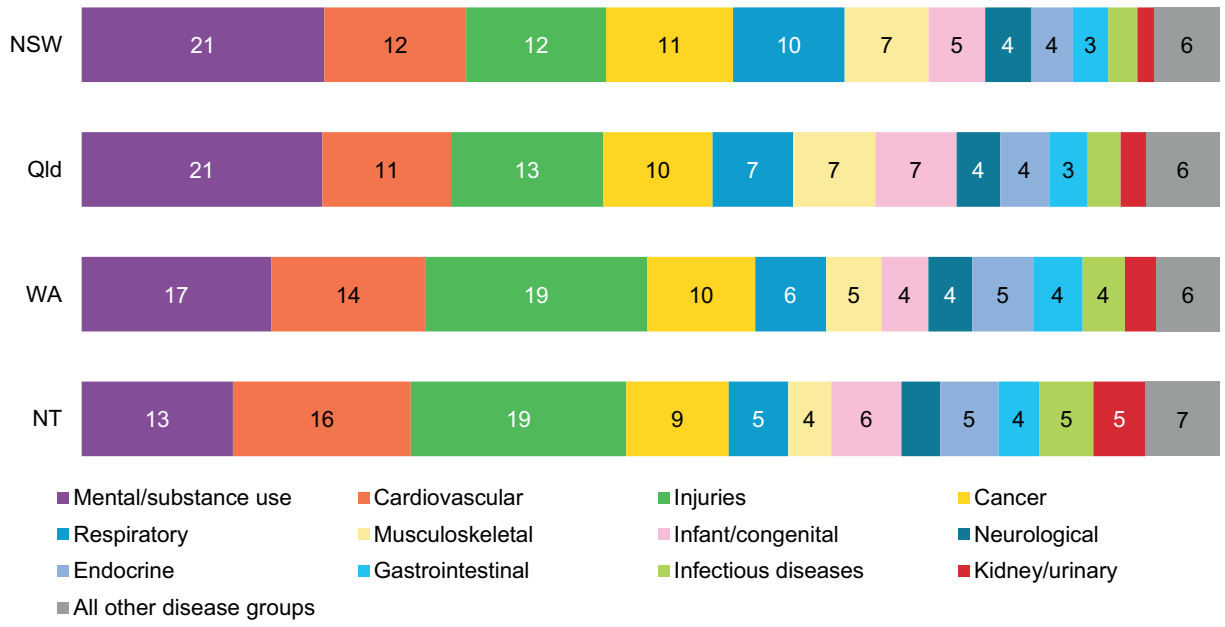
(a) Estimates for the 4 jurisdictions combined and Australia are not directly comparable as different methods and/or data sources may have been used to calculate the state/territory level estimates and the national estimates for the Indigenous population.

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

Mental & substance use disorders were the leading cause of total burden for Indigenous Australians in New South Wales and Queensland, contributing 21% of DALY in both states (Figure 12.1.4). It was the second leading cause of total burden in Western Australia, contributing 17% of DALY. Mental & substance use disorders ranked lower in the Northern Territory (third) and contributed 13% of DALY.

Injuries were the leading cause of burden for Indigenous Australians in Western Australia and the Northern Territory (19% of DALY), the second leading cause of burden in Queensland (13%) and third in New South Wales (12%).

Cardiovascular diseases were the second leading cause of disease burden for Indigenous Australians in New South Wales and the Northern Territory (12% and 16% of DALY, respectively).



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.1.4.

Figure 12.1.4: Leading causes of total burden (proportion of DALY %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2011

Non-fatal burden

There was relatively little variation in Indigenous rates of non-fatal burden across the 4 states and territories by disease group (Table 12.1.4). The greatest differences were observed for:

- Mental & substance use disorders, where Indigenous age-standardised YLD rates were highest in New South Wales (58 per 1,000 people) and lowest in the Northern Territory (42 per 1,000)
- Musculoskeletal conditions, where Indigenous YLD rates were highest in Queensland and New South Wales (31 and 30 per 1,000, respectively) and lowest in the Northern Territory (18 per 1,000)
- Respiratory diseases, where Indigenous YLD rates were highest in New South Wales (28 per 1,000) and lowest in the Northern Territory (11 per 1,000).

While the Northern Territory had the lowest rates of non-fatal burden for these 3 disease groups, they had the highest rates of YLD for a number of disease groups including injuries, oral disorders, infectious diseases, blood & metabolic disorders and kidney & urinary diseases.

Table 12.1.4: Age-standardised YLD rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2011

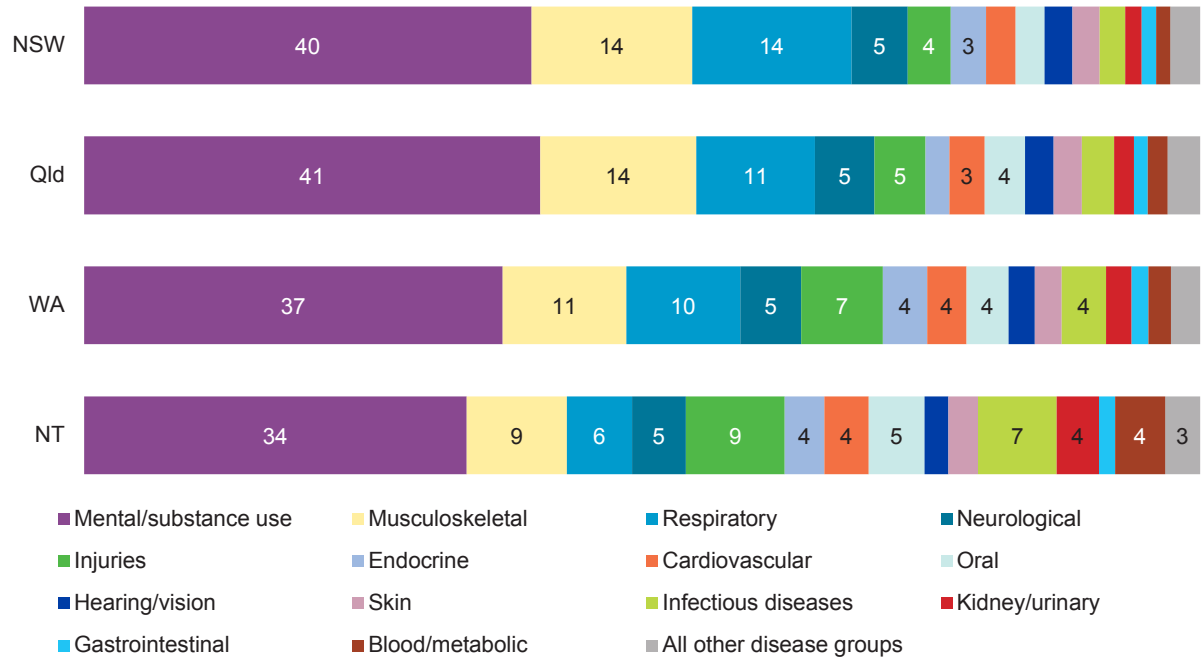
Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & NT combined[(a)]	Australia[(a)]
Mental & substance use	57.7	56.4	52.2	42.1	54.1	54.7
Musculoskeletal	30.0	30.6	24.9	17.8	27.8	29.0
Respiratory	27.5	21.7	21.5	10.8	22.5	23.2
Neurological	13.3	15.4	16.0	12.3	14.2	14.4
Injuries	9.6	12.3	20.2	21.3	13.5	13.0
Cardiovascular	7.4	9.7	11.1	11.1	9.1	9.1
Hearing/vision	6.4	7.0	6.6	5.3	6.4	6.4
Endocrine	5.5	3.7	7.0	5.5	5.1	4.8
Oral	4.5	6.6	7.1	8.3	6.1	6.5
Kidney/urinary	3.8	5.1	6.8	9.9	5.4	4.9
Skin	3.3	3.4	3.3	3.3	3.3	3.3
Infectious diseases	3.2	4.0	5.7	9.2	4.6	4.3
Gastrointestinal	2.3	2.2	2.7	2.3	2.3	2.4
Blood/metabolic	1.9	2.7	3.3	6.5	2.9	2.9
Infant/congenital	1.6	1.6	1.4	1.5	1.5	1.6
Cancer	1.5	1.8	1.6	1.3	1.6	1.7
Reproductive/maternal	1.5	1.7	1.6	1.8	1.6	1.6
Total	**180.9**	**185.9**	**193.1**	**170.3**	**182.1**	**183.6**

(a) Estimates for the 4 jurisdictions combined and Australia are not directly comparable as different methods and/or data sources may have been used to calculate the state/territory level estimates and the national estimates for the Indigenous population.

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

Mental & substance use disorders and musculoskeletal conditions were ranked as the top 2 leading causes of non-fatal burden for all the states and territory, but contributed quite different proportions to total YLD across the states and territory (Figure 12.1.5). For example, the proportions contributed to YLD for mental & substance use disorders ranged from 34% in the Northern Territory to 41% in Queensland:

- Respiratory diseases ranked as the third leading cause of non-fatal burden in all the states, but only ranked in fifth position in the Northern Territory.
- Injuries ranked as the third leading cause of non-fatal burden in the Northern Territory and contributed 9% to total YLD.
- Neurological conditions ranked as fourth leading contributors to total YLD in New South Wales and Queensland (contributing 5.0% and 5.3% respectively), and ranked fifth leading contributor in Western Australia (contributing to 5.4% of total YLD).



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.1.5.

Figure 12.1.5: Leading causes of non-fatal burden (proportion of YLD %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2011

Fatal burden

In contrast to non-fatal burden, rates of fatal burden experienced by Indigenous Australians in 2011 differed considerably across the 4 states and territories for most disease groups. Large differences were observed for injuries, cardiovascular diseases, endocrine disorders and kidney & urinary diseases (Table 12.1.5):

- For injuries, Indigenous age-standardised YLL rates ranged from just over 30 per 1,000 in New South Wales and Queensland to just over 50 per 1,000 in the Northern Territory and Western Australia.
- For cardiovascular diseases, Indigenous YLL rates ranged from 57 per 1,000 in Queensland to 78 per 1,000 in Western Australia and the Northern Territory.
- For endocrine disorders (which includes diabetes), Indigenous YLL rates ranged from 13 per 1,000 in New South Wales, to 19 per 1,000 in Queensland and over 25 per 1,000 in the Northern Territory and Western Australia.
- For kidney & urinary diseases, Indigenous YLL rates ranged from 5 per 1,000 in New South Wales to 21 per 1,000 in the Northern Territory.

Table 12.1.5: Age-standardised YLL rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2011

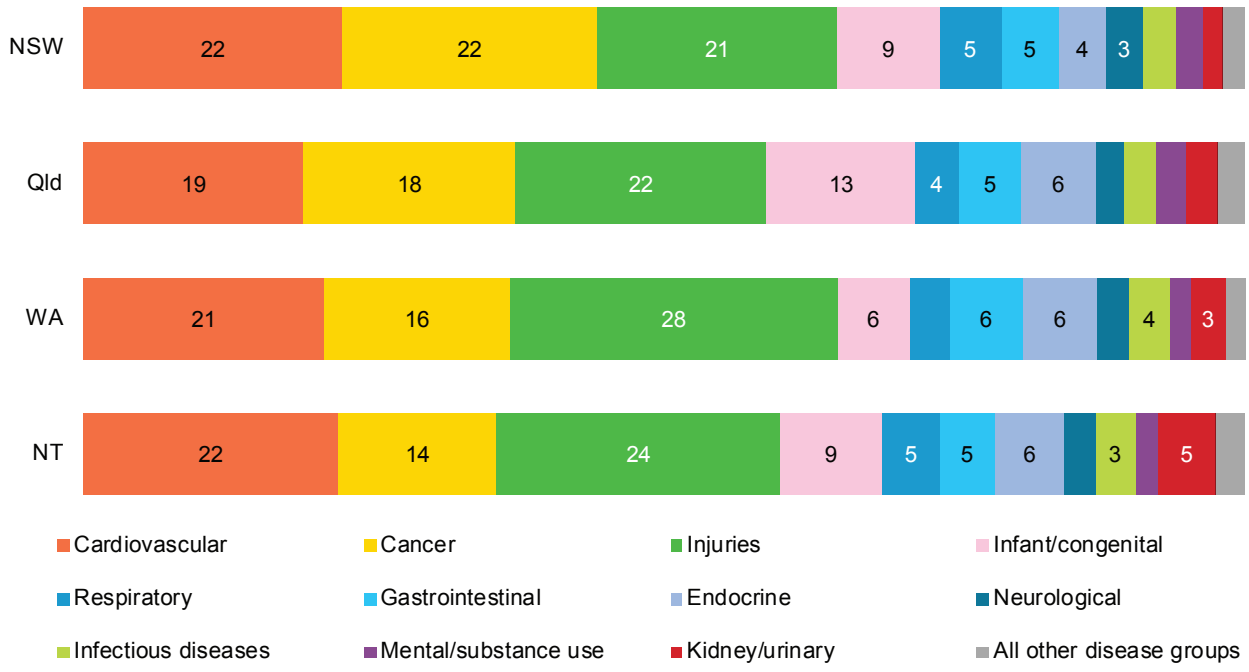
Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & NT combined[(a)]	Australia [(a)]
Cardiovascular	60.5	56.5	78.3	78.0	64.3	62.7
Cancer	58.5	55.5	64.3	62.7	58.9	55.3
Injuries	30.6	30.8	51.2	50.1	36.5	37.0
Respiratory	16.8	14.3	13.4	23.0	16.3	16.0
Endocrine	12.7	19.0	26.7	26.1	18.5	17.1
Gastrointestinal	11.0	13.1	18.9	17.8	13.8	14.0
Neurological	10.4	7.9	11.3	11.3	9.9	9.7
Infant/congenital	6.6	9.8	7.2	12.6	8.5	8.3
Infectious diseases	6.1	5.8	10.2	10.4	7.1	7.0
Kidney/urinary	5.2	8.6	12.8	21.2	9.4	9.9
Mental & substance use	4.7	5.4	4.4	6.1	5.0	3.1
Blood/metabolic	3.1	3.8	3.6	4.0	3.4	3.3
Musculoskeletal	0.9	2.1	1.4	3.5	1.7	1.6
Skin	0.5	0.5	1.0	1.4	0.7	0.6
Reproductive/maternal	0.1	0.1	0.2	0.2	0.2	0.1
Hearing/vision	–	–	0.2	–	–	–
Oral	–	0.1	–	–	–	–
Total	**227.8**	**233.3**	**305.2**	**328.5**	**254.3**	**245.8**

(a) Estimates for the 4 jurisdictions combined and Australia are not directly comparable as different methods and/or data sources may have been used to calculate the state/territory level estimates and the national estimates for the Indigenous population.

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

Cardiovascular diseases, injuries and cancer ranked in the top 3 leading causes of fatal burden for all the states and territory:

- Injuries were the leading cause of fatal burden for Indigenous Australians in Queensland, Western Australia and the Northern Territory, contributing 22%, 28% and 24% of YLL respectively (Figure 12.1.6). Injuries ranked lower in New South Wales (third) and contributed 21% of YLL.
- Cardiovascular diseases were the leading cause of fatal burden for Indigenous Australians in New South Wales (contributing to 22% of YLL), and were ranked second in the other 3 states and territory.
- Kidney & urinary diseases ranked as the sixth leading cause of death in the Northern Territory, contributing 5% of YLL.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.1.6.

Figure 12.1.6: Leading causes of fatal burden (proportion of YLL %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2011

Gap in burden between Indigenous and non-Indigenous Australians

This section presents a comparison of estimates of burden between Indigenous and non-Indigenous Australians in 2011 for the 4 states and territories, and estimates of the gap between the 2 population groups, as measured by rate ratios and rate differences.

In Western Australia, Indigenous Australians experienced a rate of total burden at 2.8 times the rate of non-Indigenous Australians. Western Australia had the greatest absolute disparity in total burden between Indigenous and non-Indigenous Australians (rate difference of 317 DALY per 1,000 people) followed by the Northern Territory (rate difference of 255 DALY per 1,000) (Table 12.1.6).

Indigenous Australians in New South Wales, Queensland and the Northern Territory experienced rates of total burden at 2.3, 2.2 and 2.0 times those of non-Indigenous Australians, respectively (Table 12.1.6).

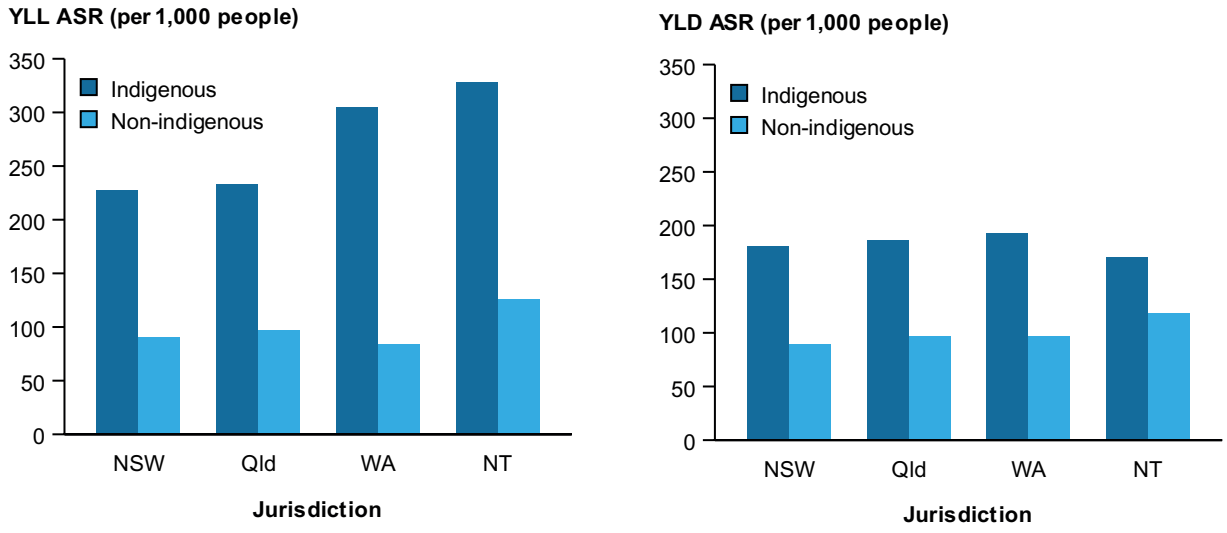
The lower rate ratio for the Northern Territory compared to the other 3 jurisdictions is mainly driven by a higher DALY rate for the non-Indigenous population, and a lower YLD rate for the Indigenous population. The higher DALY rate for the Northern Territory non-Indigenous population is consistent with findings reported by the AIHW for the total Australian population in which age-standardised DALY rates for the Northern Territory were higher than the other 7 states and territories, and around 1.5 times as high as the national rate (AIHW 2016a). As described previously, the lower YLD rate for the Indigenous population in the Northern Territory is largely driven by lower rates reported for the 3 disease groups contributing the most to non-fatal burden: mental & substance use disorders, musculoskeletal conditions and respiratory diseases. This is consistent with the findings by remoteness for which Indigenous YLD rates for these 3 disease groups were higher in *Major cities* compared to *Remote* areas.

Table 12.1.6: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences by Indigenous status, state/territory (NSW, Qld, WA and the NT) and Australia, 2011

	Age-standardised DALY rate per 1,000		Health gap	
State/territory	Indigenous	Non-Indigenous	Rate difference	Rate ratio
NSW	408.7	180.0	228.8	2.3
Qld	419.2	194.4	224.7	2.2
WA	498.3	181.1	317.2	2.8
NT	498.9	243.7	255.2	2.0
NSW, Qld, WA & the NT combined	**436.4**	**184.8**	**251.6**	**2.4**
Australia	429.4	185.0	244.4	2.3

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

The gap in overall burden between Indigenous and non-Indigenous Australians was greater for fatal than non-fatal burden for all 4 states and territories. For example, rate differences for fatal burden ranged from 137 YLL per 1,000 in New South Wales to 221 per 1,000 in Western Australia, while rate differences for non-fatal burden ranged from 52 YLD per 1,000 in the Northern Territory to 96 per 1,000 in Western Australia (Figure 12.1.7).



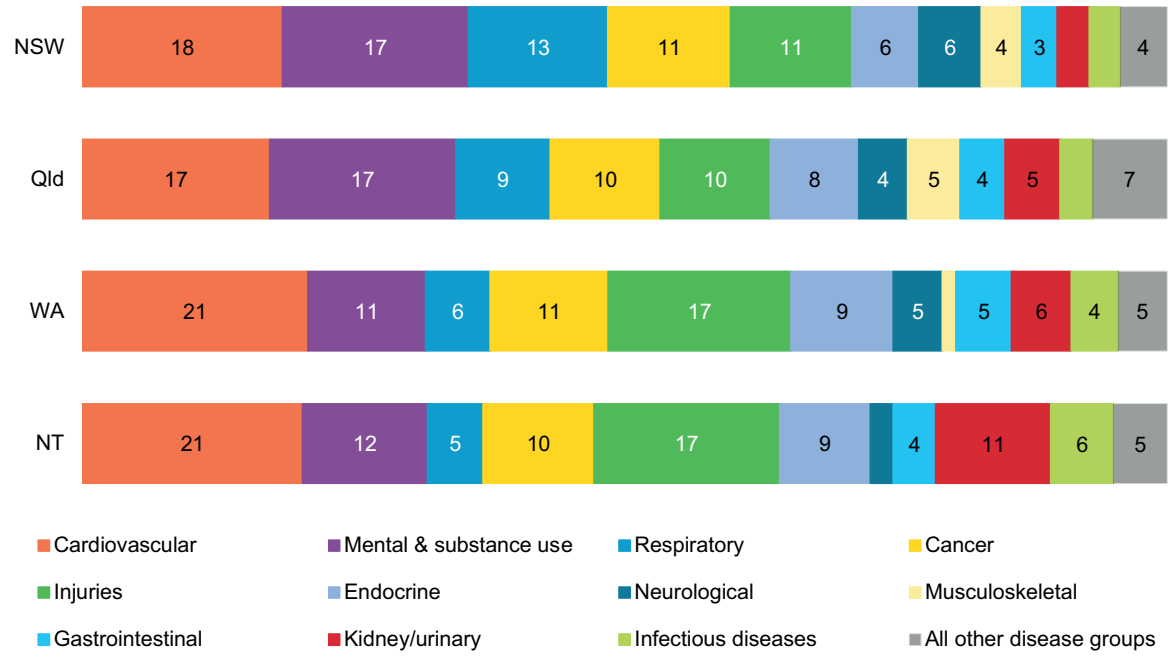
Source: This figure is based on data in a supplementary table available online—Table S12.1.7.

Figure 12.1.7: Age-standardised YLL and YLD rates, by Indigenous status and state/territory (NSW, Qld, WA and the NT), 2011

Figure 12.1.8 shows the top disease groups contributing to the gap in total burden between Indigenous and non-Indigenous Australians in 2011 for New South Wales, Queensland, Western Australia and the Northern Territory.

Cardiovascular diseases was the top disease group contributing to the gap in all 4 states and territories (although the percentage contribution to the gap varied between the states and territories; for example it contributed 17% of the gap in Queensland and 21% of the gap in Western Australia):

- Injuries were the second leading contributor to the gap in the Northern Territory (17%) and Western Australia (17%), while mental & substance use disorders was ranked second in New South Wales and Queensland (contributing 17% in each state).
- Endocrine disorders contributed 9% of the gap in Western Australia and the Northern Territory and 8% in Queensland.
- Cancer contributed to between 10% and 11% of the gap for all states and territories for which estimates are reported.
- Respiratory diseases ranked higher and contributed a larger proportion of the overall gap in burden in New South Wales (13%) than in any of the other 3 jurisdictions.



Note: Per cent labels are not shown for disease groups contributing less than 3% of gap.

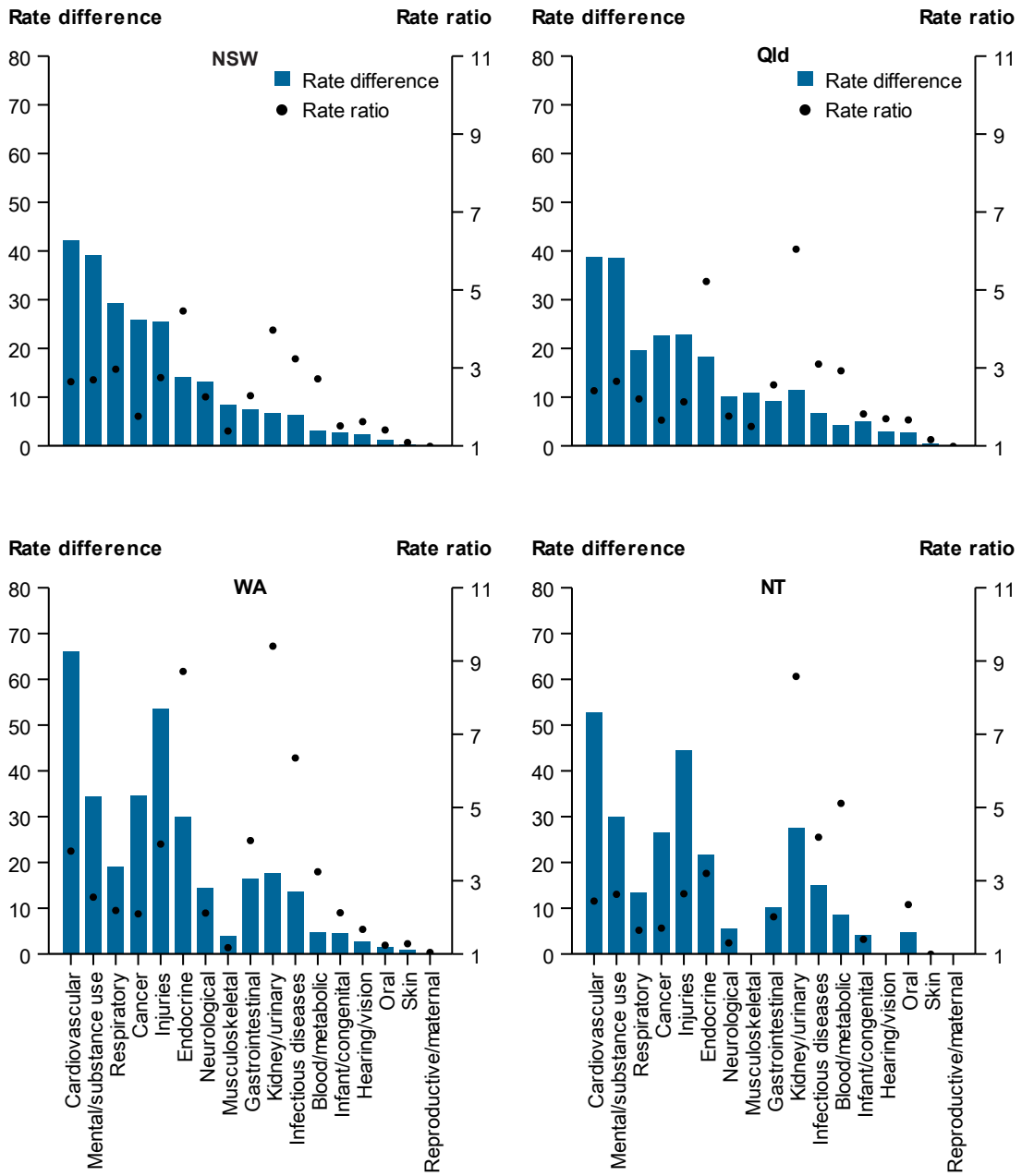
Source: This figure is based on data in a supplementary table available online—Table S12.1.8.

Figure 12.1.8: Percentage contribution (%) of leading causes of the gap in total burden between Indigenous and non-Indigenous Australians (based on DALY rate difference), by state/territory (NSW, Qld, WA and the NT), 2011

Figure 12.1.9 presents rate differences as well as rate ratios by disease group to provide, respectively, a picture of the diseases with the largest absolute differences in total burden, and the largest relative disparities:

- In New South Wales the Indigenous to non-Indigenous rate ratio was highest for endocrine disorders (4.5), while in Western Australia, Queensland and the Northern Territory the highest rate ratios were for kidney/urinary diseases (9.4, 6.0 and 8.6 respectively).

- The largest differences in rates between Indigenous and non-Indigenous Australians (as measured by age-standardised DALY rate differences) were for cardiovascular diseases in all 4 states and territories. The second largest rate differences were for mental & substance use disorders in New South Wales and Queensland. In Western Australia and the Northern Territory the second-largest rate differences were observed for injuries.



Note: No bar for rate difference on graph indicates that the rate difference is less than zero; rate ratios not shown on graph if ratio is less than 1.

Source: This figure is based on data in a supplementary table available online—Table S12.1.9.

Figure 12.1.9: DALY rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group and state/territory (NSW, Qld, WA and the NT), 2011

Data quality

Data quality for fatal burden is considered reasonably high for all 4 states and territories for which estimates are reported, being based on mortality data adjusted for Indigenous under-identification using state/territory-specific adjustment factors from the ABS's Census Data Enhancement Indigenous Mortality Study (2011–12). Indigenous deaths for the Northern Territory required the least adjustment and are considered of very high quality. Despite the adjustments made to reduce the bias in Indigenous YLL results, the adjustment factors themselves introduce a degree of uncertainty around the true level of mortality among Indigenous Australians.

A more important limitation is that Indigenous YLL estimates were not able to be reported for Victoria, South Australia, Tasmania and the Australian Capital Territory, due to the small number of Indigenous deaths reported for these jurisdictions each year, and individual mortality adjustment factors were not available from the ABS for these states and territories.

Data quality for non-fatal burden estimates for each of the states and territories is considered of lower quality than fatal estimates. This was because direct prevalence data at the state/territory level was not able to be used for most disease groups. Either this data were not available for the Indigenous population, or there were issues with variation in Indigenous data quality across the jurisdictions for most administrative data collections for which adjustments could not be made. As such, a proxy approach was used to disaggregate the national Indigenous non-fatal estimates based on state/territory proportions from either hospitalisation data (adjusted for under-identification) or the ABS AATSIHS. Indigenous YLD estimates derived from the AATSIHS are generally considered of higher quality than those derived from hospitalisation data. This is because, although adjusted for under-identification, the subnational proportions derived from hospitalisation data may not always reflect state/territory differences in underlying disease prevalence, due to variations in access to and use of hospital services across the jurisdictions. In this analysis, data from the AATSIHS were available to undertake state/territory distribution for 6 disease groups (respiratory diseases, mental & substance use disorders, endocrine disorders including diabetes, kidney & urinary diseases, and hearing & vision disorders). Distribution for 1 group (skin disorders) was undertaken according to the population distribution due to a lack of relevant data from other sources, while the remaining 10 disease groups were distributed using hospitalisation data.

12.2 Burden of disease by remoteness

This section presents Indigenous burden of disease estimates by remoteness for the 5 remoteness categories *Major cities, Inner regional, Outer regional, Remote* and *Very remote*. In 2011, most (57%) of Australia's Aboriginal and Torres Strait Islander population lived in *Major cities* and *Inner regional* areas. However, remote areas have higher proportions of Aboriginal and Torres Strait Islander people resident there.

The key aim of the analysis in this section 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. For example, Indigenous and non-Indigenous Australians living in more remote areas are often disadvantaged with regard to educational and employment opportunities, income and access to services. Health behaviours and risks may also differ by remoteness (AIHW 2014b).

Total burden

The overall pattern of disease burden among Indigenous Australians broadly followed population size, though with the total burden in *Inner regional* areas being somewhat lower than might be expected based on population (Table 12.2.1). *Remote* and *Very remote* areas accounted for a higher proportion of disease burden (11% and 16%, respectively) than population (8% and 14%, respectively).

Table 12.2.1: Number and proportion of population and total burden (DALY), by remoteness, Indigenous Australians, 2011

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total[(a)]
Indigenous population (no.)	233,146	147,683	146,129	51,275	91,648	**669,881**
Indigenous population %	34.8	22.0	21.8	7.7	13.7	**100.0**
DALY no.	56,512	34,037	40,491	19,284	29,418	**179,743**
DALY %	31.4	18.9	22.5	10.7	16.4	**100.0**
YLD no.	31,855	19,302	19,585	7,682	10,996	**89,420**
YLD %	35.6	21.6	21.9	8.6	12.3	**100.0**
YLL no.	24,657	14,735	20,907	11,602	18,423	**90,324**
YLL %	27.3	16.3	23.1	12.8	20.4	**100.0**

(a) Totals exclude records with unknown/missing remoteness classification.

Note: The numbers may not add to total for all columns due to rounding.

When examining age-standardised DALY rates, Remote areas had the highest rate of total burden experienced by the Indigenous population in 2011 (524 DALY per 1,000 people), followed by *Very remote* areas (440 DALY per 1,000 people). *Inner regional* areas had the lowest rate of total burden (358 DALY per 1,000) (Table 12.2.2):

- Rates of fatal burden experienced by the Indigenous population followed a similar pattern by remoteness, being highest in *Remote* and *Very remote* areas.
- There was less variation in Indigenous rates of non-fatal burden, which were highest in *Remote* areas (197 YLD per 1,000 people) and lowest in *Very remote* areas (160 YLD per 1,000).

The lower burden in *Very remote* areas compared with *Remote* areas may influenced by people in *Very remote* areas moving to larger population centres when they are in very poor health and require more intensive health care.

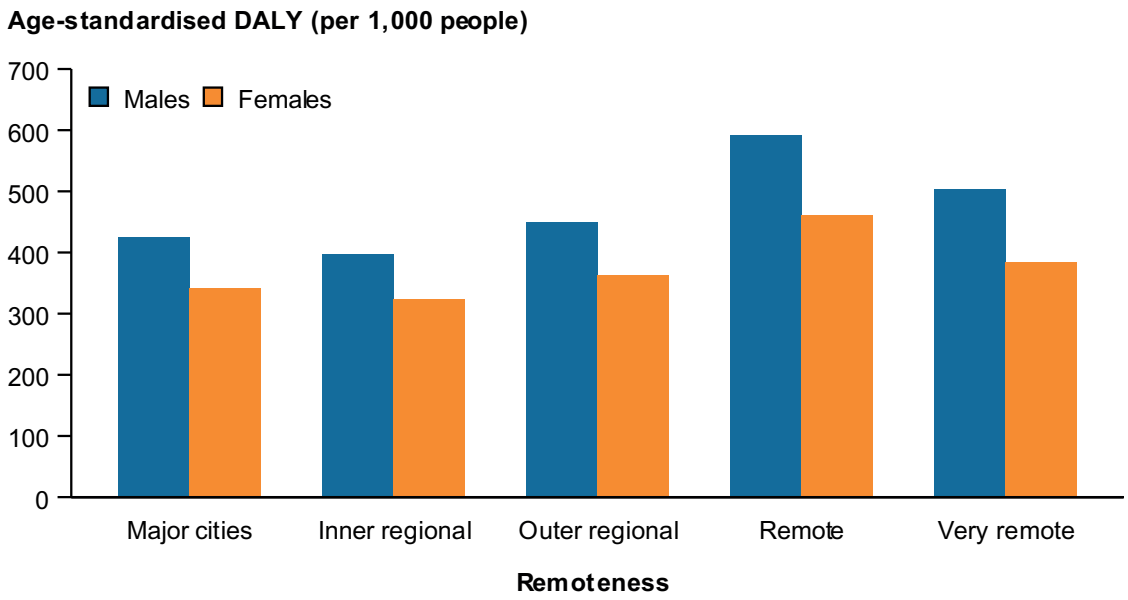
Table 12.2.2: DALY, YLD and YLL counts and age-standardised rates (per 1,000 people[a]), by remoteness, Indigenous Australians, 2011

	Total burden		Non-fatal burden		Fatal burden[b]	
	DALY	ASR	YLD	ASR	YLL	ASR
Major cities	56,512	379.4	31,855	191.4	24,657	188.0
Inner regional	34,037	357.9	19,302	186.1	14,735	171.8
Outer regional	40,491	404.2	19,585	179.3	20,907	224.9
Remote	19,284	523.7	7,682	196.8	11,602	326.8
Very remote	29,418	440.2	10,996	159.7	18,423	280.5

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

(b) Deaths used in the calculation of YLL estimates have been adjusted for Indigenous under-identification using AIHW adjustment factors (see Appendix Table B4).

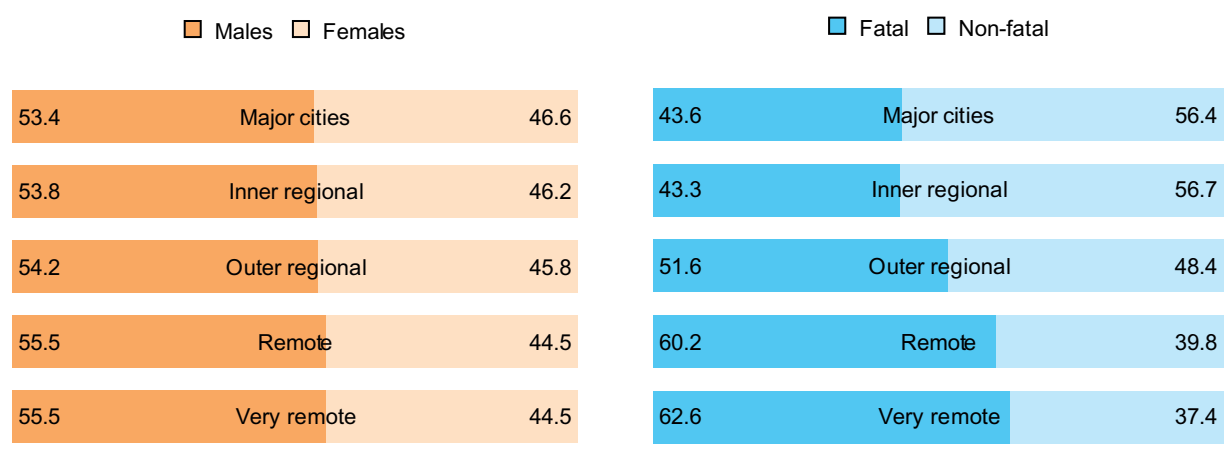
The same general pattern in DALY rates by remoteness was evident for Indigenous males and females (Figure 12.2.1).



Source: This figure is based on data in a supplementary table available online—Table S12.1.1.

Figure 12.2.1: Age-standardised DALY rates (per 1,000 people) for Indigenous Australians, by sex and remoteness, 2011

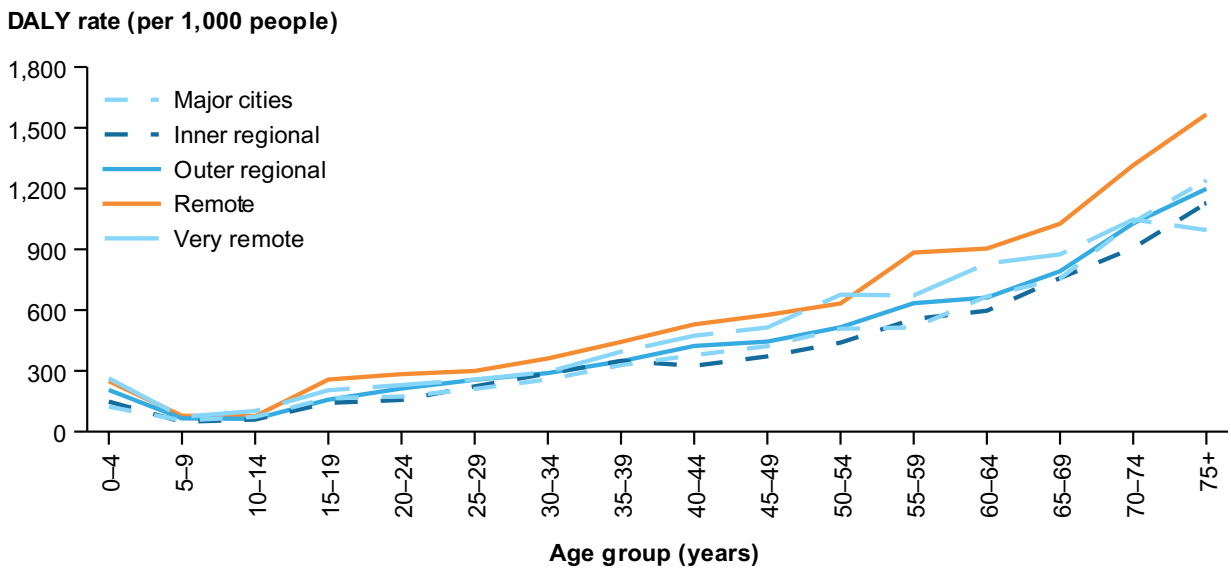
Proportions of total burden were slightly higher for males than for females across all remoteness areas (Figure 12.2.2.). Distributions by fatal and non-fatal burden show that fatal burden contributed to a larger proportion of total burden in *Remote* and *Very remote* areas than in the other remoteness areas.



Source: This figure is based on data in a supplementary table available online—Table S12.2.2.

Figure 12.2.2: Proportion of burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and remoteness, 2011

While Indigenous DALY rates increased with age in all remoteness areas of Australia, rates for Indigenous persons living in *Remote* areas were generally higher than for Indigenous persons living in the other remoteness areas from age 55 onwards (Figure 12.2.3).



Source: This figure is based on data in a supplementary table available online—Table S12.2.3.

Figure 12.2.3: Age specific DALY rates for Indigenous Australians, by age and remoteness, 2011

Total burden by disease group

In 2011, mental & substance use disorders, injuries and cardiovascular diseases were among the 3 biggest contributors to overall burden among Indigenous Australians in all 5 remoteness categories; however there were some differences in rankings and percentage contributions to overall burden (Table 12.2.3, Figure 12.2.4):

- Mental & substance use disorders was the leading contributor to overall burden in *Major Cities, Inner regional* and *Outer regional* areas, contributing 25%, 23% and 21% of DALY respectively.
- Injuries was the leading contributor to overall burden in *Remote* and *Very remote* areas contributing 19% of DALY.

Cancer was the fourth largest contributor to overall burden among Indigenous Australians in *Outer regional, Remote* and *Very remote* areas.

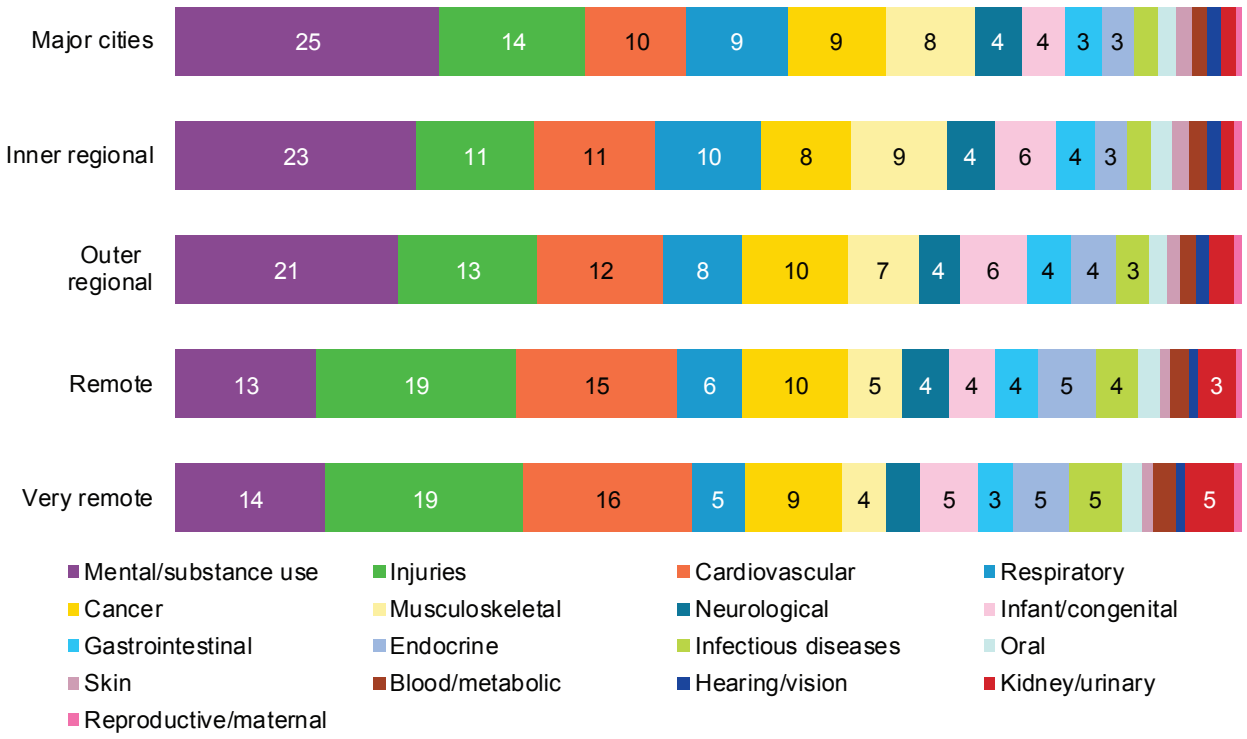
Other leading contributors to total burden in *Major cities* and *Inner regional* areas were respiratory diseases, cancer and musculoskeletal conditions. In *Outer regional* areas respiratory and musculoskeletal conditions ranked fifth and sixth respectively. In *Remote* areas respiratory and endocrine disorders (including diabetes) ranked fifth and sixth respectively. In *Very remote* areas infant & congenital conditions and respiratory diseases contributed 5.5% and 5.4% respectively of total DALY. Infant & congenital conditions did not appear in the top 6 contributors to total burden in the other regions.

Table 12.2.3: Age-standardised DALY rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Mental & substance use	64.7	58.5	62.8	51.5	46.5
Cardiovascular	53.7	56.2	64.7	91.8	80.9
Cancer	51.9	43.5	53.2	67.6	53.9
Injuries	39.3	32.2	42.1	78.3	63.0
Respiratory	39.3	40.4	35.5	38.7	27.6
Musculoskeletal	34.0	34.4	28.7	28.1	20.4
Neurological	24.4	21.2	21.7	31.5	17.7
Endocrine	14.8	13.8	22.2	33.4	30.0
Gastrointestinal	13.2	13.0	16.2	22.0	16.0
Kidney/urinary	7.7	6.4	13.1	22.6	28.9
Infectious diseases	7.5	6.0	10.3	17.6	17.1
Hearing/vision	6.7	6.8	6.4	5.8	5.0
Infant/congenital	6.7	8.1	10.2	10.7	11.1
Oral	5.8	6.9	5.6	9.4	7.6
Blood/metabolic	4.7	5.1	6.0	8.4	8.5
Skin	3.7	3.9	3.7	4.2	4.1
Reproductive/maternal	1.4	1.6	1.9	2.1	2.0
Total	**379.4**	**357.9**	**404.2**	**523.7**	**440.2**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
2. The numbers may not add to total for all columns due to rounding.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.2.4.

Figure 12.2.4: Causes of total burden (proportion of DALY %), by remoteness, Indigenous Australians, 2011

Non-fatal burden

There was some variation in Indigenous rates of non-fatal burden across remoteness area by disease group. The greatest differences were observed for:

- Mental & substance use disorders, where Indigenous age-standardised YLD rates were highest in *Major cities* (60 per 1,000 people) and lowest in *Very remote* areas (43 per 1,000).
- Injuries, where Indigenous YLD rates were highest in *Remote* areas (23 per 1,000) and lowest in *Inner regional* areas (10 per 1,000).
- Infectious diseases, where Indigenous YLD rates were also highest in *Remote* areas (8 per 1,000) lowest in *Major cities* and *Inner regional* areas (3 per 1,000) (Table 12.2.4).

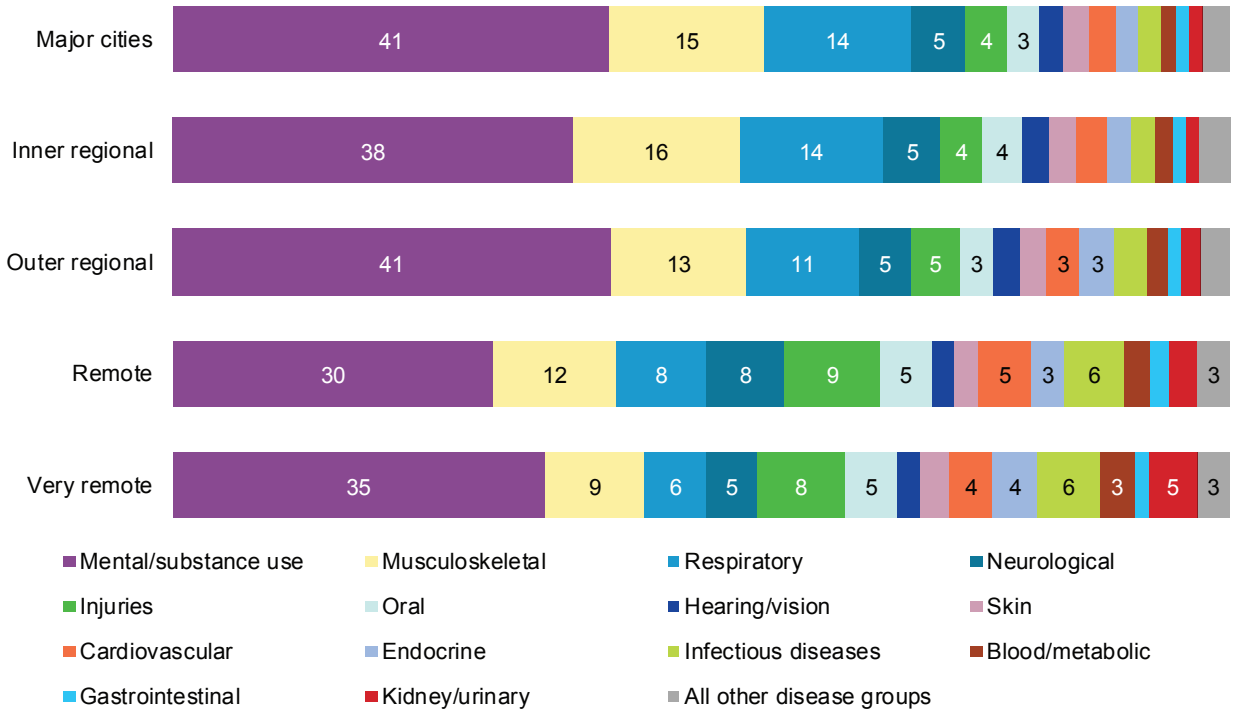
Mental & substance use disorders and musculoskeletal conditions were the top 2 contributors to non-fatal burden in all remoteness categories (Figure 12.2.5). Respiratory diseases and injuries ranked in the top 5 for all remoteness categories, but the proportions differed. For example, respiratory diseases contributed to almost 14% in *Major cities* and *Inner regional* areas, and 6% in *Very remote* areas.

Table 12.2.4: Age-standardised YLD rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Mental & substance use	59.5	54.3	58.9	45.3	42.5
Musculoskeletal	33.4	33.9	26.8	24.9	17.5
Respiratory	29.6	27.5	20.4	17.2	10.0
Neurological	14.9	14.6	13.0	20.3	10.8
Injuries	10.7	10.2	11.5	22.9	18.1
Cardiovascular	7.5	8.7	9.0	14.3	10.3
Hearing/vision	6.7	6.8	6.4	5.8	4.8
Oral	5.8	6.9	5.6	9.1	7.6
Endocrine	4.1	4.0	5.7	5.7	6.2
Kidney/urinary	3.5	2.8	4.5	7.0	10.8
Skin	3.3	3.3	3.3	3.2	3.3
Infectious diseases	3.1	3.2	4.1	8.3	7.2
Gastrointestinal	2.4	2.3	2.4	3.3	2.0
Blood/metabolic	2.1	2.5	3.0	4.2	4.4
Cancer	1.8	1.8	1.5	1.7	1.3
Infant/congenital	1.6	1.7	1.5	1.6	1.4
Reproductive/maternal	1.3	1.6	1.8	2.1	1.6
Total	**191.4**	**186.1**	**179.3**	**196.8**	**159.7**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
2. The numbers may not add to total for all columns due to rounding.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.2.5.

Figure 12.2.5: Leading causes of non-fatal burden (proportion of YLD %), by remoteness, Indigenous Australians, 2011

Fatal burden

For almost all disease groups, rates of fatal burden experienced by Indigenous Australians in 2011 were highest in *Remote* areas followed by *Very remote* areas (exceptions were for infant & congenital conditions, kidney & urinary diseases and infectious diseases, for which YLL rates were highest in Very remote areas). Large differences in fatal burden by remoteness were observed for cardiovascular disease, injuries, kidney & urinary diseases and endocrine disorders (Table 12.2.5):

- For cardiovascular diseases, Indigenous age-standardised YLL rates ranged from 46 per 1,000 in *Major cities* to 78 per 1,000 in *Remote* areas.
- For injuries, Indigenous YLL rates ranged from 22 per 1,000 in *Inner regional* areas to 55 per 1,000 in *Remote* areas.
- For kidney & urinary diseases, Indigenous YLL rates ranged from 3.5 per 1,000 in *Inner regional* areas to 18 per 1,000 in *Very remote* areas.
- For endocrine disorders (which includes diabetes), Indigenous YLL rates ranged from 10 per 1,000 in *Inner regional* to 28 per 1,000 in *Remote* areas.
- Injuries and cardiovascular diseases were the top 2 contributors to fatal burden in all remoteness categories except *Major cities*, where cancer was in second position; cancer ranked third across all the other categories (Figure 12.2.6).

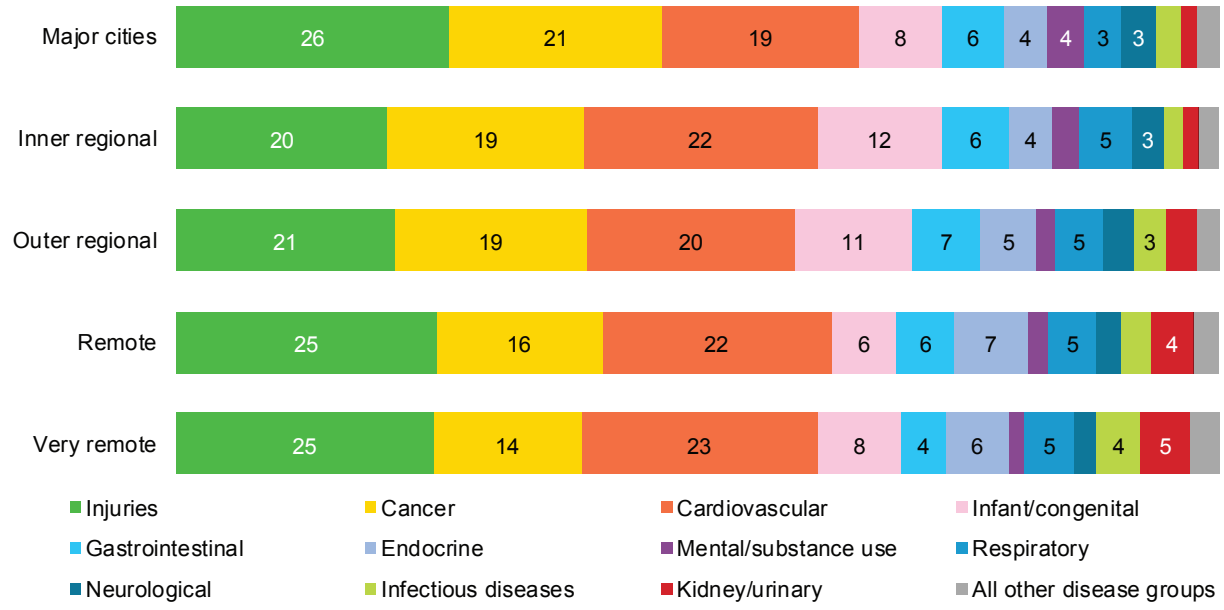
- Other leading contributors to fatal burden were infant & congenital conditions, gastrointestinal and endocrine disorders, which ranked in fourth to sixth across most remoteness categories.
- Respiratory diseases ranked sixth in *Inner regional* areas, but did not feature in the top 6 for any other areas.
- Kidney & urinary diseases ranked sixth in *Very remote* areas, but did not feature in the top 6 for any other areas.

Table 12.2.5: Age-standardised YLL rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2011

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Cancer	50.1	41.6	51.7	65.9	52.6
Cardiovascular	46.1	47.5	55.7	77.6	70.7
Injuries	28.6	22.0	30.6	55.4	44.8
Gastrointestinal	10.8	10.7	13.8	18.7	14.0
Endocrine	10.7	9.8	16.5	27.7	23.9
Respiratory	9.7	12.9	15.0	21.5	17.6
Neurological	9.5	6.6	8.8	11.2	7.0
Mental & substance use	5.2	4.2	3.8	6.2	4.0
Infant/congenital	5.0	6.3	8.7	9.1	9.7
Infectious diseases	4.3	2.8	6.2	9.2	9.9
Kidney/urinary	4.2	3.5	8.6	15.6	18.0
Blood/metabolic	2.6	2.7	3.0	4.2	4.1
Musculoskeletal	0.6	0.5	1.8	3.2	2.9
Skin	0.4	0.6	0.5	1.0	0.8
Reproductive/maternal	0.1	–	0.2	–	0.4
Hearing/vision	–	–	–	–	0.2
Oral	–	–	–	0.3	–
Total	**188.0**	**171.8**	**224.9**	**326.8**	**280.5**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
2. The numbers may not add to total for all columns due to rounding.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.2.6.

Figure 12.2.6: Leading causes of fatal burden (proportion of YLL %), by remoteness, Indigenous Australians, 2011

Gap in burden between Indigenous and non-Indigenous Australians

This section presents a comparison of estimates of burden between Indigenous and non-Indigenous Australians by remoteness area, and estimates of the gap between the 2 population groups, as measured by rate ratios and rate differences.

The greatest disparity in age-standardised rates of disease burden between Indigenous and non-Indigenous Australians was in Remote areas (rate ratio of 2.4 and rate difference of 306 per 1,000 people). *Major cities* had the second highest rate ratio (2.1), while *Very remote* areas had the second highest rate difference (212 per 1,000 people). *Inner regional* areas had the lowest DALY rate ratio and rate difference (Table 12.2.6):

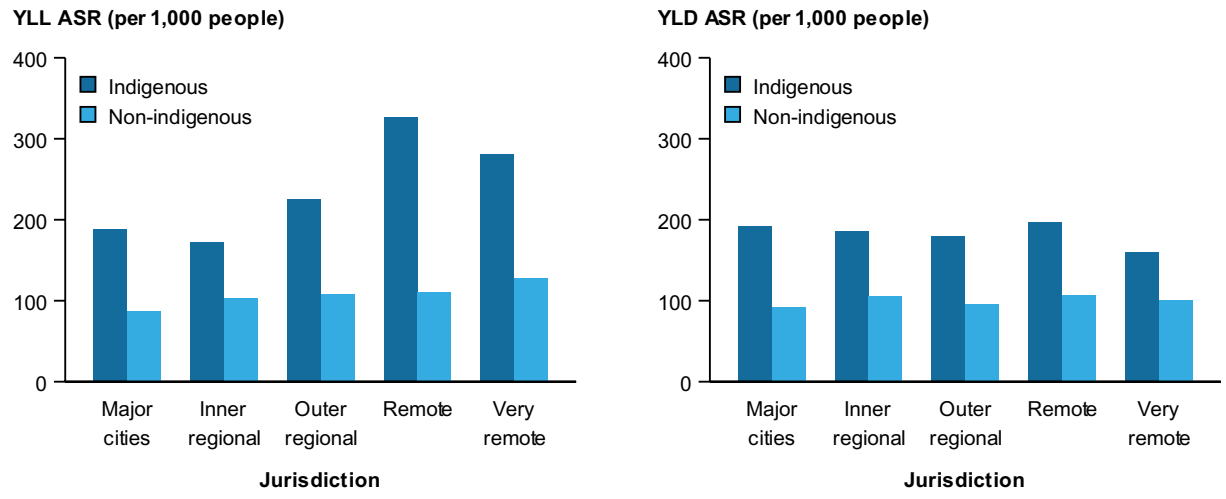
- For fatal burden, the greatest disparity in rates between Indigenous and non-Indigenous Australians was also observed in *Remote* areas. This was followed by *Very remote* areas (Figure 12.2.7).
- By comparison there was less variation across remoteness areas in the gap between Indigenous and non-Indigenous Australians in rates of non-fatal burden (Figure 12.2.7).

Table 12.2.6: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences by Indigenous status and remoteness, 2011

	Age-standardised DALY rate per 1,000		Health gap (DALY)	
	Indigenous	Non-Indigenous	Rate difference	Rate ratio
Major cities	379.4	179.8	199.7	2.1
Inner regional	357.9	208.5	149.4	1.7
Outer regional	404.2	202.9	201.3	2.0
Remote	523.7	217.4	306.3	2.4
Very remote	440.2	228.7	211.6	1.9

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Figure 12.2.8 shows the top 11 disease groups contributing to the gap in total burden between



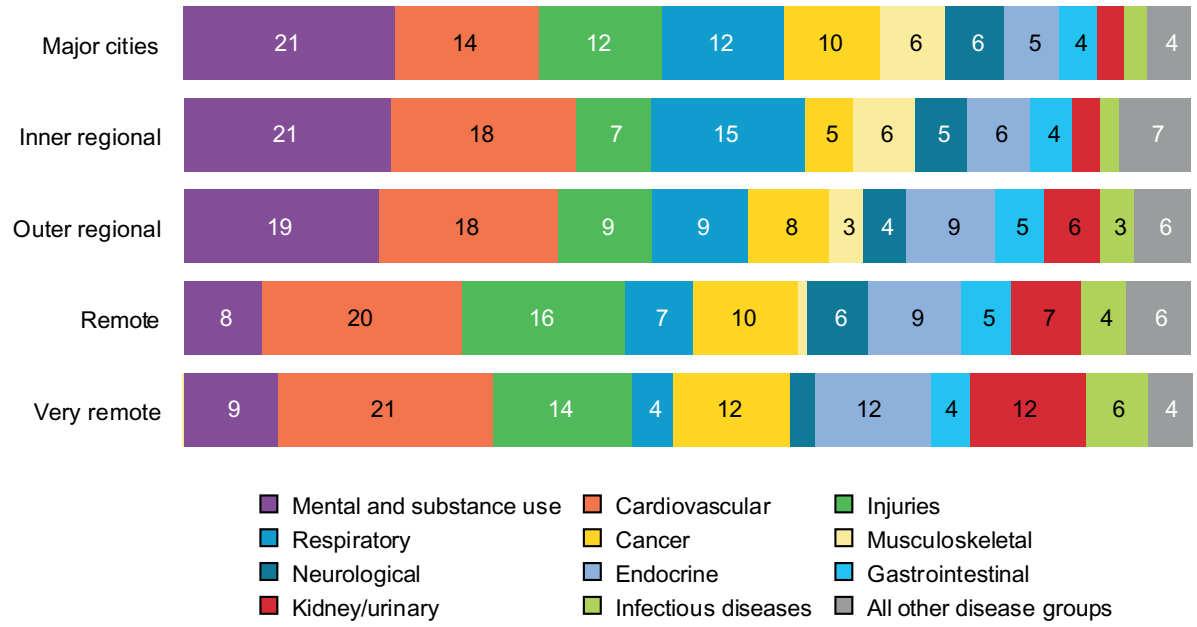
Source: This figure is based on data in a supplementary table available online—Table S12.2.7.

Figure 12.2.7: Age-standardised YLL and YLD rates, by Indigenous status and remoteness, 2011

Indigenous and non-Indigenous Australians in 2011 (as measured by age-standardised rate differences) in each of the 5 remoteness categories.

Mental & substance use disorders were the leading disease group contributing to the gap in total burden in *Major cities, Inner regional* and *Outer regional* areas. Mental & substance use disorders were responsible for around 20% of the gap across these 3 remoteness areas.

Cardiovascular diseases were the leading disease group contributing to the gap in total burden in *Remote* and *Very remote* areas, contributing around 20% of the gap in these 2 areas.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

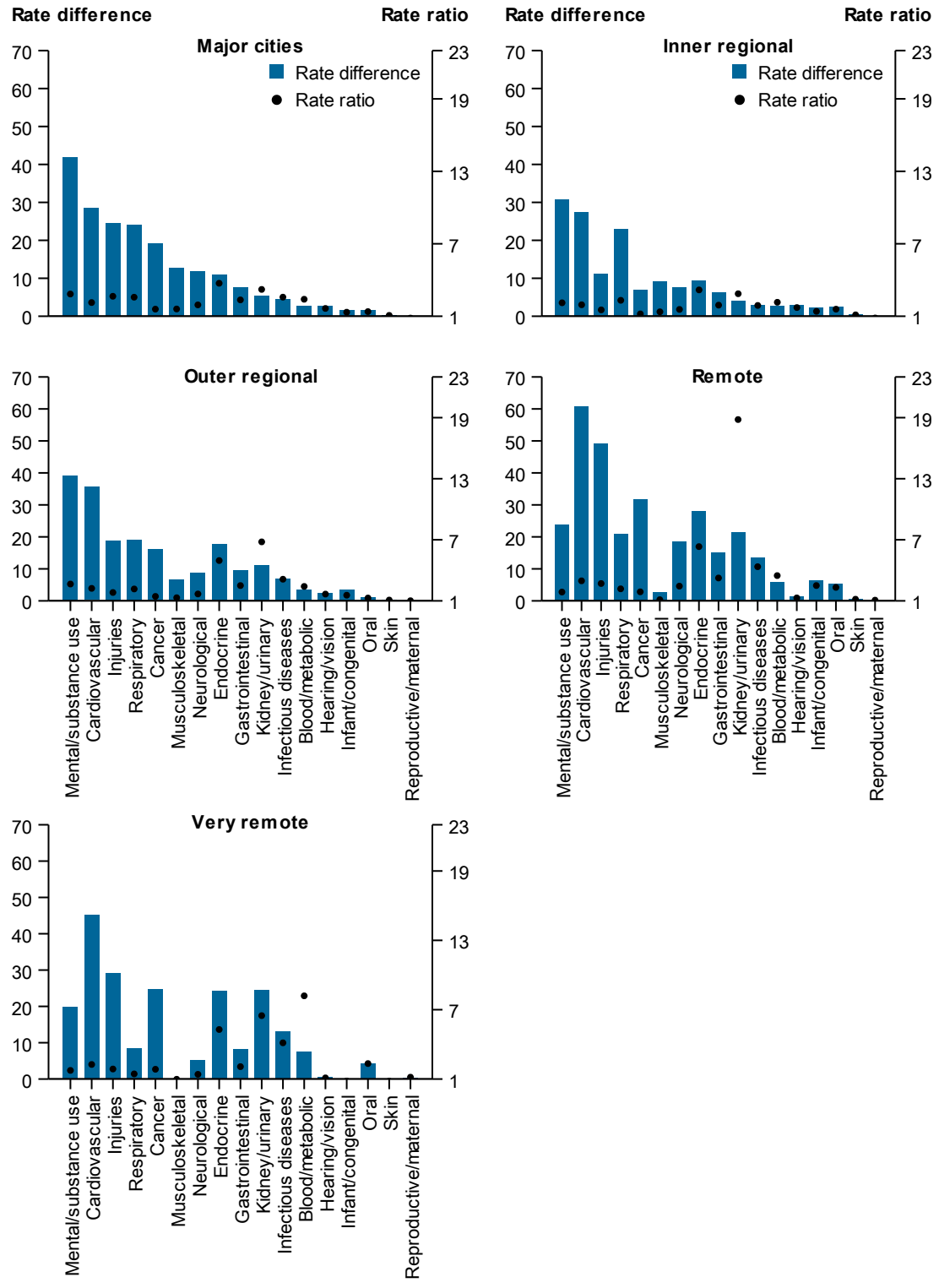
Source: This figure is based on data in a supplementary table available online—Table S12.2.8.

Figure 12.2.8: Percentage contribution (%) of leading causes of the gap in total burden between Indigenous and non-Indigenous Australians (based on DALY rate difference), by remoteness, 2011

Figure 12.2.9 presents rate differences as well as rate ratios by disease group to provide, respectively, a picture of the diseases with the largest absolute differences contributing to the gap in total burden, and the largest relative disparities in each remoteness category.

In *Major cities, Inner regional* and *Outer regional* areas mental & substance use disorders and cardiovascular diseases had the largest rate differences between Indigenous and non-Indigenous Australians. In *Major cities* and *Inner regional* areas, the largest rate ratios were observed for endocrine disorders (3.7 and 3.2 respectively). In *Outer regional* areas the largest rate ratio was observed kidney & urinary diseases (6.8).

In *Remote* and *Very remote* areas, cardiovascular diseases and injuries had the largest rate differences. In *Remote* areas the largest rate ratio was observed for kidney & urinary diseases (18.8, by far the largest relative difference across all disease groups and remoteness categories); and in *Very remote* areas the largest rate ratio was for blood & metabolic disorders (8.2).



Note: No bar for rate difference on graph indicates that the rate difference is less than zero; rate ratios not shown on graph if ratio is less than 1.

Source: This figure is based on data in a supplementary table available online—Table S12.2.9.

Figure 12.2.9: DALY rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group and remoteness, 2011

Data quality

Data quality for fatal burden is considered reasonably high for all remoteness categories, being based on mortality data adjusted for Indigenous under-identification using remoteness-specific adjustment factors from the AIHW's EMD project (2008–2010). Indigenous deaths in *Remote* and *Very remote* areas required the least adjustment and are considered of very high quality, while Indigenous deaths in *Major cities* required the greatest adjustment. AIHW adjustment factors were used due to limitations with the available ABS remoteness adjustment factors (only available for 2 remoteness categories of *Major cities/Inner regional* combined, and *Outer regional/Remote/Very remote* combined). It is important to note that YLL estimates by remoteness presented in this report are not comparable to YLL estimates presented in other sections which were adjusted using factors from the ABS CDE Indigenous Mortality Study.

Data quality for non-fatal burden estimates for each of the remoteness categories is considered of lower quality than fatal estimates. This was because direct prevalence data at the remoteness level was not able to be used for most disease groups. Either these data were not available for the Indigenous population, or there were issues with variation in Indigenous data quality across remoteness categories for which adjustments could not be made. As such hospitalisation data (adjusted for under-identification) or the ABS AATSIHS were used to disaggregate the national Indigenous YLD into remoteness categories. There are limitations with this approach, particularly for Remote and Very remote areas. This is because the remoteness proportions derived from hospitalisation data may in part reflect differences in access to hospital services rather than remoteness differences in underlying disease prevalence; and estimates from the AATSIHS are subject to issues with small sample size and numbers in Very remote areas for some disease groups. In this analysis, data from the AATSIHS were available to undertake distribution by remoteness area for 6 disease groups (respiratory diseases, mental & substance use disorders, endocrine disorders including diabetes, kidney & urinary diseases, and hearing & vision disorders). Distribution for 1 group (skin disorders) was undertaken according to the population distribution due to a lack of relevant data from other sources, while the remaining 10 disease groups were distributed using hospitalisation data.

12.3 Burden of disease by socioeconomic group

This section provides information on burden of disease for the Aboriginal and Torres Strait Islander population by level of socioeconomic disadvantage. An alternative method for examining the impact of socioeconomic position on burden of disease is to treat social determinants as risk factors—this approach was not feasible to undertake for the current study; however, it is considered an important area of work to progress in future burden of disease studies.

In this report, socioeconomic groups for Indigenous burden estimates are based on an Indigenous-specific index of socioeconomic disadvantage: IRSEO index, developed by Dr Nicholas Biddle of the Centre for Aboriginal Economic Policy Research. It reflects the level of socioeconomic disadvantage experienced by Indigenous Australians living in each Indigenous Area in Australia and is determined by factors such as household income, employment and education level (Biddle 2009; Biddle 2013). The analysis in this section divides the Indigenous population into 'quintiles' (fifths) of disadvantage, where the first quintile (Q1) represents the 20% of Indigenous Areas that have the lowest IRSEO index scores and the fifth quintile (Q5) the 20% of areas with the highest scores.

Measures of the gap (and non-Indigenous estimates by level of socioeconomic disadvantage) are not presented in this section as a comparable index for the non-Indigenous population is not available.

Crude rather than age-standardised rates have been used in this section as the socioeconomic indexes described here incorporate a population age-weighting which results in little difference in the age-profile of the populations assigned to each quintile of socioeconomic disadvantage under the indexes.

Total burden

Total disease burden (DALY) among Indigenous Australians varied across socioeconomic disadvantage quintiles (based on the IRSEO index) (Table 12.3.1). The quintile with the highest Indigenous population proportion (27%, quintile 3) also had the greatest proportion of burden (27%); however, there was no clear relationship between the distribution of Indigenous population and disease burden in the remaining quintiles.

Table 12.3.1: Number and proportion of population and total burden (DALY), by socioeconomic disadvantage quintile, Indigenous Australians, 2011

	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Total[(a)]
Indigenous population (no.)	87,007	102,016	177,572	174,726	128,525	**669,846**
Indigenous population %	13.0	15.2	26.5	26.1	19.2	**100.0**
DALY no.	39,396	38,326	48,750	32,283	24,008	**182,762**
DALY %	21.6	21.0	26.7	17.7	13.1	**100.0**
YLD no.	17,180	20,015	24,884	14,723	12,760	**89,562**
YLD %	19.2	22.3	27.8	16.4	14.2	**100.0**
YLL no.	22,216	18,311	23,866	17,560	11,248	**93,200**
YLL %	23.8	19.6	25.6	18.8	12.1	**100.0**

(a) Totals exclude records with unknown IRSEO index quintile.

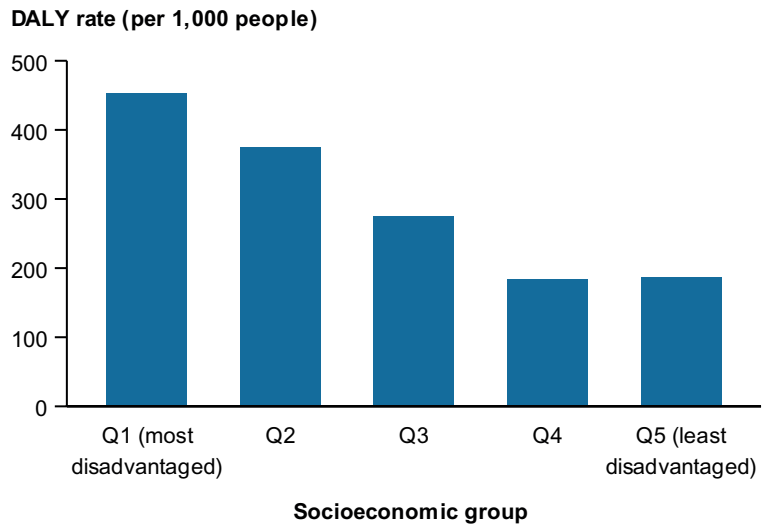
Note: The numbers may not add to total for all columns due to rounding.

Table 12.3.2 shows the number, proportion and rates of total, non-fatal and fatal burden experienced by Indigenous Australians in 2011 by socioeconomic disadvantage quintile (based on the IRSEO index). As the IRSEO index quintiles are based on the number of regions in Australia, rather than the number of individuals within each region, differences in the number of YLL, YLD and DALY in each quintile may reflect differences in the size of the population within each quintile.

Table 12.3.2: DALY, YLD and YLL counts, proportions and crude rates (per 1,000 people), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

	Total burden			Non-fatal burden			Fatal burden		
Socioeconomic disadvantage quintile	DALY	% of DALY	ASR	YLD	% of YLD	Rate per 1,000	YLL	% of YLL	Rate per 1,000
Q1 (most disadvantaged)	39,396	21.6	452.8	17,180	19.2	197.5	22,216	23.8	255.3
Q2	38,326	21.0	375.7	20,015	22.3	196.2	18,311	19.6	179.5
Q3	48,750	26.7	274.5	24,884	27.8	140.1	23,866	25.6	134.4
Q4	32,283	17.7	184.8	14,723	16.4	84.3	17,560	18.8	100.5
Q5 (least disadvantaged)	24,008	13.1	186.8	12,760	14.2	99.3	11,248	12.1	87.5

When examining DALY rates per 1,000 Indigenous population, a general trend of increasing rates with increasing level of socioeconomic disadvantage was observed (Figure 12.3.1). Indigenous Australians living in areas with the most socioeconomic disadvantage experienced the highest rate of DALY (453 per 1,000 people), more than twice the rate of burden in areas with the least socioeconomic disadvantage (187 per 1,000 people).

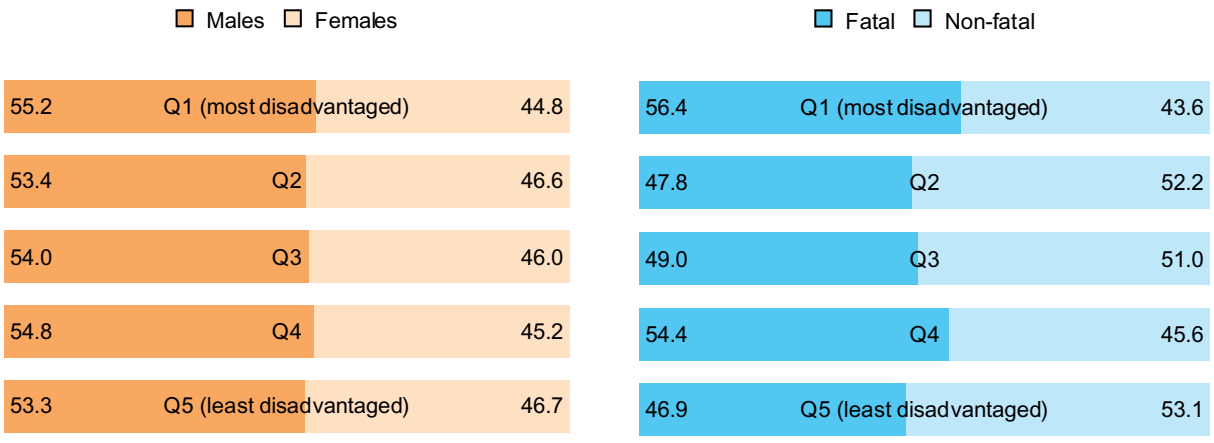


Note: Quintiles for the IRSEO index for the YLD component of total burden were derived using 2013 hospital episodes. This is because mapping to the IRSEO index requires the geographic category of SA2, which only became available in hospitals data in 2013.

Source: Table 12.3.2.

Figure 12.3.1: DALY rates (per 1,000 people) for Indigenous Australians, by socioeconomic disadvantage quintile (IRSEO index), 2011

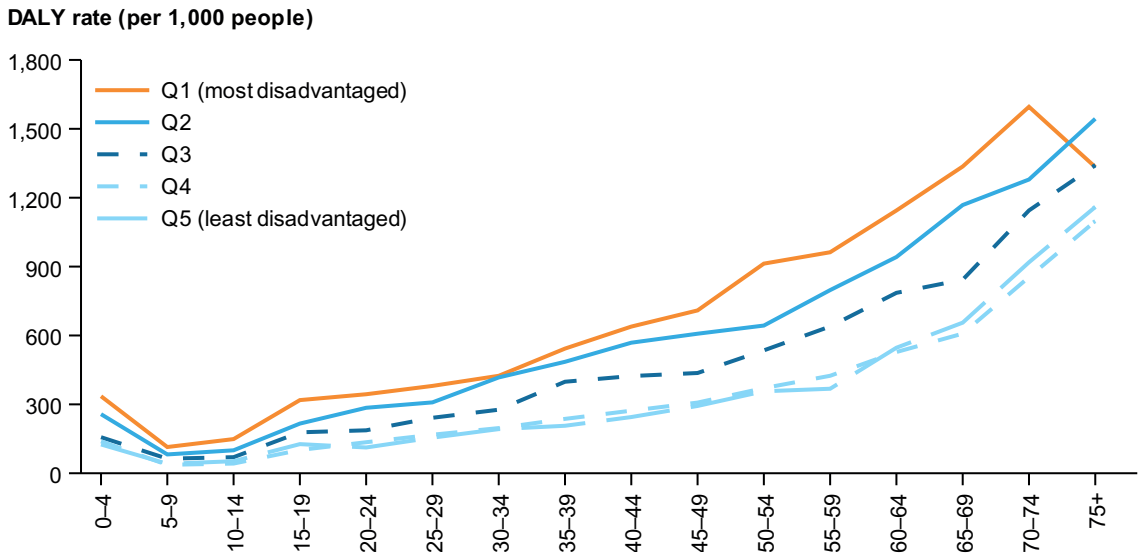
Proportions of total burden were slightly higher for males than for females across all 5 quintiles (Figure 12.3.2.). Distributions by fatal and non-fatal burden show no clear gradient across the quintiles.



Source: This figure is based on data in a supplementary table available online—Table S12.3.1.

Figure 12.3.2: Proportion of burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and socioeconomic disadvantage quintile (IRSEO index), 2011

Rates of DALY generally increased with age over the 5 socioeconomic disadvantage quintiles (Figure 12.3.3). Across most age groups, , Indigenous Australians living in the most disadvantaged areas experienced higher DALY rates compared to Indigenous Australians living elsewhere.



Source: This figure is based on data in a supplementary table available online—Table S12.3.2.

Figure 12.3.3: Age-specific DALY rates for Indigenous Australians, by age and socioeconomic disadvantage quintile (IRSEO index), 2011

Although it is not possible to provide a measure of the gap in this section, it is of interest to note that the burden for Indigenous Australians in the 2 least disadvantaged quintiles (185 and 187 DALY per 1,000) is similar to the burden for non-Indigenous Australians as a whole (185 per 1,000).

Total burden by disease group

Table 12.3.3 compares DALY rates by disease group for Indigenous Australians by socioeconomic disadvantage quintile in 2011.

A gradient of increasing burden with increasing socioeconomic disadvantage was observed in most disease groups. The greatest relative differences by socioeconomic group were for kidney & urinary diseases, cardiovascular diseases, mental & substance use and endocrine disorders (including diabetes), with the most disadvantaged quintile experiencing disease burden at more than 2.5 times the rate of the least disadvantaged quintile.

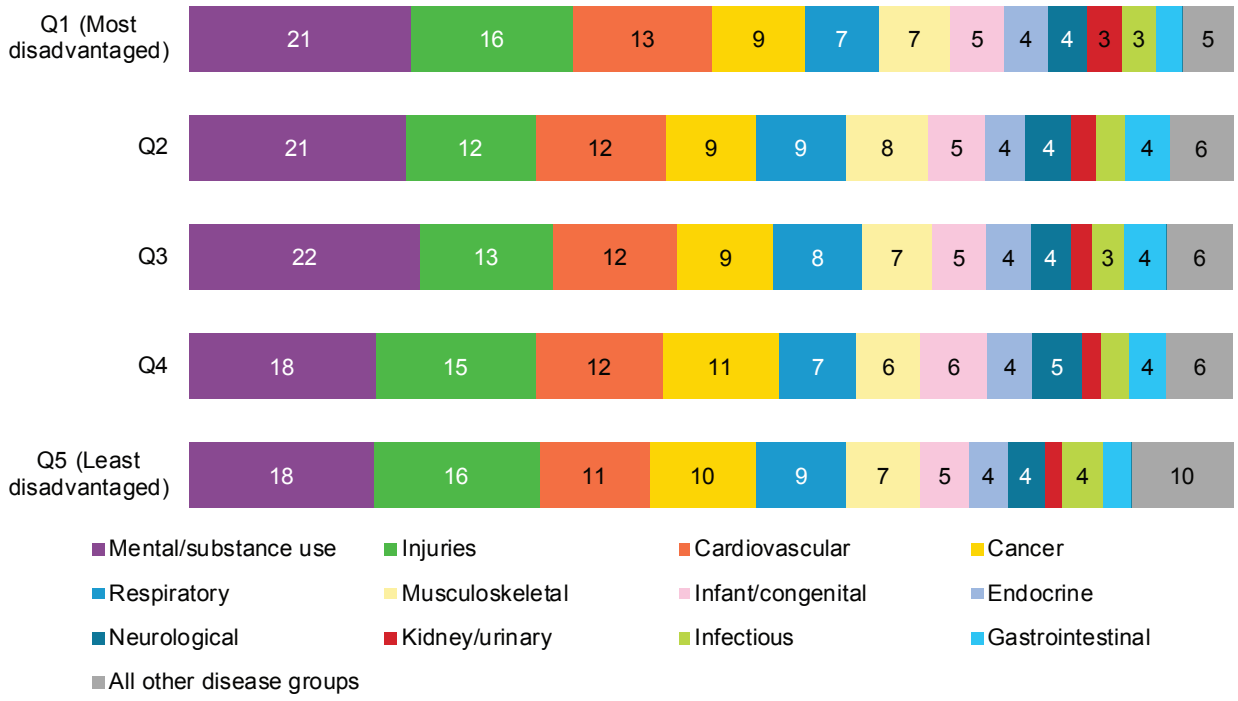
Table 12.3.3: Crude DALY rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Q1/Q5 ratio
Mental & substance use	96.1	77.9	60.8	32.9	33.0	2.9
Injuries	70.3	46.6	34.8	28.5	29.5	2.4
Cardiovascular	60.5	46.9	32.8	22.3	19.8	3.1
Cancer	39.9	32.3	25.2	20.6	19.0	2.1
Respiratory	32.2	32.2	23.2	13.8	16.2	2.0
Musculoskeletal	30.9	30.2	18.4	11.2	13.1	2.4
Infant/congenital	23.5	19.9	14.3	11.9	8.8	2.7
Endocrine	18.8	14.9	11.8	8.0	6.8	2.8
Neurological	17.0	16.7	10.4	8.6	6.6	2.6
Kidney/urinary	15.2	8.6	5.6	3.5	3.3	4.6
Infectious diseases	14.5	10.5	8.4	5.0	7.1	2.0
Gastrointestinal	11.8	15.9	11.1	6.6	5.2	2.3
Oral	6.4	6.4	4.9	3.4	4.4	1.5
Blood/metabolic	5.6	5.5	4.2	3.1	4.6	1.2
Skin	3.9	4.2	3.6	2.2	4.5	0.9
Hearing/vision	3.7	4.6	3.3	2.0	3.6	1.0
Reproductive/maternal	2.4	2.4	1.8	1.1	1.1	2.3
Total	**452.8**	**375.7**	**274.5**	**184.8**	**186.8**	**2.4**

Note: The numbers may not add to total for all columns due to rounding.

Figure 12.3.4 presents the leading disease groups contributing to total burden for Indigenous Australians for each of the 5 socioeconomic disadvantage quintiles.

Across each socioeconomic disadvantage quintile, the same disease groups make up the leading 5 contributors to the total disease burden—mental & substance use, injuries, cardiovascular diseases, cancer and respiratory diseases.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.3.3.

Figure 12.3.4: Leading causes of total burden (proportion of DALY %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

Non-fatal burden

The gradient observed in Indigenous rates of non-fatal burden across socioeconomic groupings by disease group was not as defined as for overall disease burden. The disease groups with the most pronounced gradient were:

- Mental & substance use disorders, where the YLD rate in the most disadvantaged quintile was 3 times that in the least disadvantaged quintile (92 compared with 30 YLD per 1,000).
- Neurological conditions, where the YLD rate was just over 3 times that in the most disadvantaged quintile (11 compared with 4 YLD per 1,000) (Table 12.3.4).

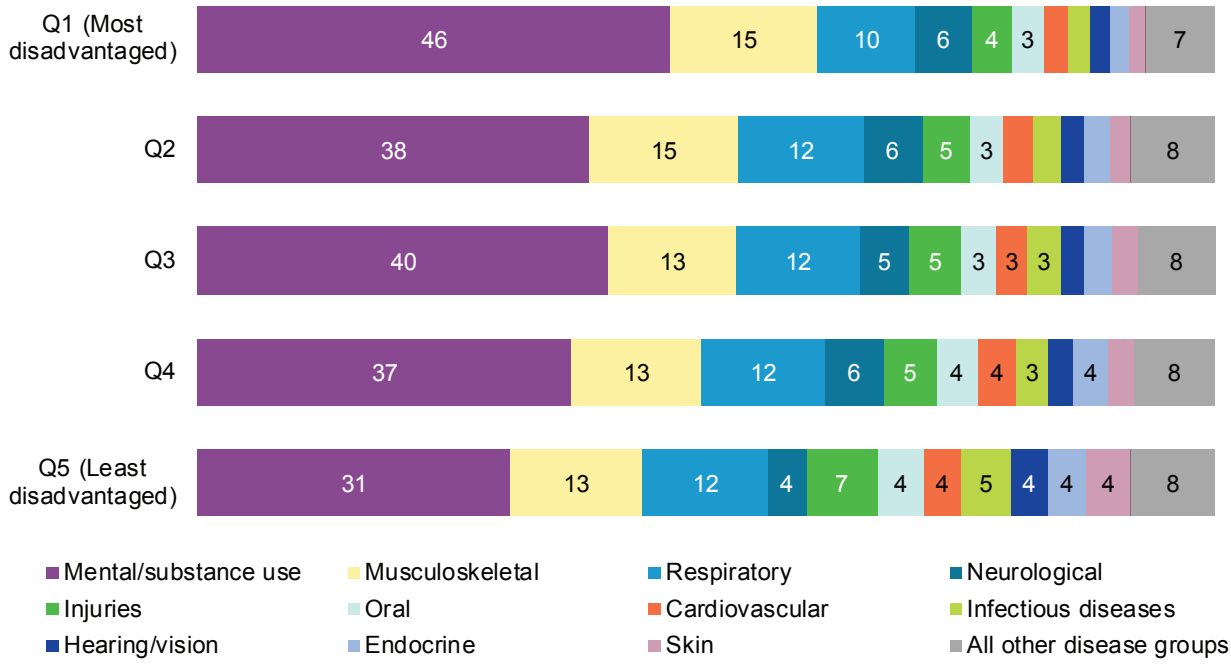
Table 12.3.4: Crude YLD rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Q1/Q5 ratio
Mental & substance use	91.5	75.3	56.5	30.9	30.4	3.0
Musculoskeletal	28.7	28.9	17.6	10.8	13.0	2.2
Respiratory	18.9	24.0	17.0	10.1	12.3	1.5
Neurological	11.2	11.4	7.0	5.0	3.7	3.1
Injuries	7.6	9.3	7.0	4.3	7.1	1.1
Oral	6.2	6.4	4.9	3.4	4.4	1.4
Cardiovascular	4.8	5.8	4.3	3.2	3.7	1.3
Infectious diseases	4.3	5.4	4.6	2.6	4.8	0.9
Hearing/vision	3.7	4.5	3.3	2.0	3.6	1.0
Endocrine	3.5	4.9	3.8	3.0	3.8	0.9
Skin	3.2	4.0	3.4	2.0	4.3	0.7
Kidney/urinary	3.1	3.8	2.5	1.4	2.0	1.6
Blood/metabolic	2.9	3.5	2.3	1.7	2.9	1.0
Gastrointestinal	2.4	2.9	1.9	1.2	1.2	2.1
Infant/congenital	2.1	2.6	1.7	1.0	0.8	2.6
Reproductive/maternal	1.9	2.4	1.7	1.0	1.1	1.8
Cancer	1.4	1.2	0.7	0.4	0.3	4.1
Total	**197.5**	**196.2**	**140.1**	**84.3**	**99.3**	**2.0**

Note: The numbers may not add to total for all columns due to rounding.

Figure 12.3.5 presents the leading disease groups contributing to non-fatal burden for Indigenous Australians for each of the 5 socioeconomic disadvantage quintiles:

- Mental & substance use disorders, musculoskeletal conditions and respiratory diseases were the top 3 ranked leading contributors to non-fatal burden in all socioeconomic disadvantage quintiles, although proportions differed for each disease.
- Neurological conditions and injuries ranked fourth or fifth in all 5 socioeconomic disadvantage quintiles, with the exception of the least disadvantaged quintile where infectious diseases ranked fifth and neurological conditions did not appear among the top 6 leading causes.
- Oral disorders ranked sixth across all socioeconomic disadvantage quintiles.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.3.4.

Figure 12.3.5: Leading causes of non-fatal burden (proportion of YLD %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

Fatal burden

In 2011, Indigenous Australians living in areas in the most disadvantaged quintile had a YLL rate almost 3 times that for those in the least disadvantaged quintile. A gradient of increasing burden with increasing socioeconomic disadvantage was observed in most disease groups. The largest variations were observed for injuries, cardiovascular disease and cancer—the 3 main causes of fatal burden (Table 12.3.5):

- For injuries, Indigenous YLL rates ranged from 63 per 1,000 in the most disadvantaged quintile to 22 per 1,000 in the least disadvantaged quintile, a rate ratio of almost 3.
- For cardiovascular disease, Indigenous YLL rates ranged from 56 per 1,000 in the most disadvantaged quintile to 16 per 1,000 in the least disadvantage quintile, a rate ratio of more than 3.
- For cancer, Indigenous YLL rates ranged from 39 per 1,000 in the most disadvantaged quintile to 19 per 1,000 in the least disadvantage quintile, a rate ratio of just over 2.

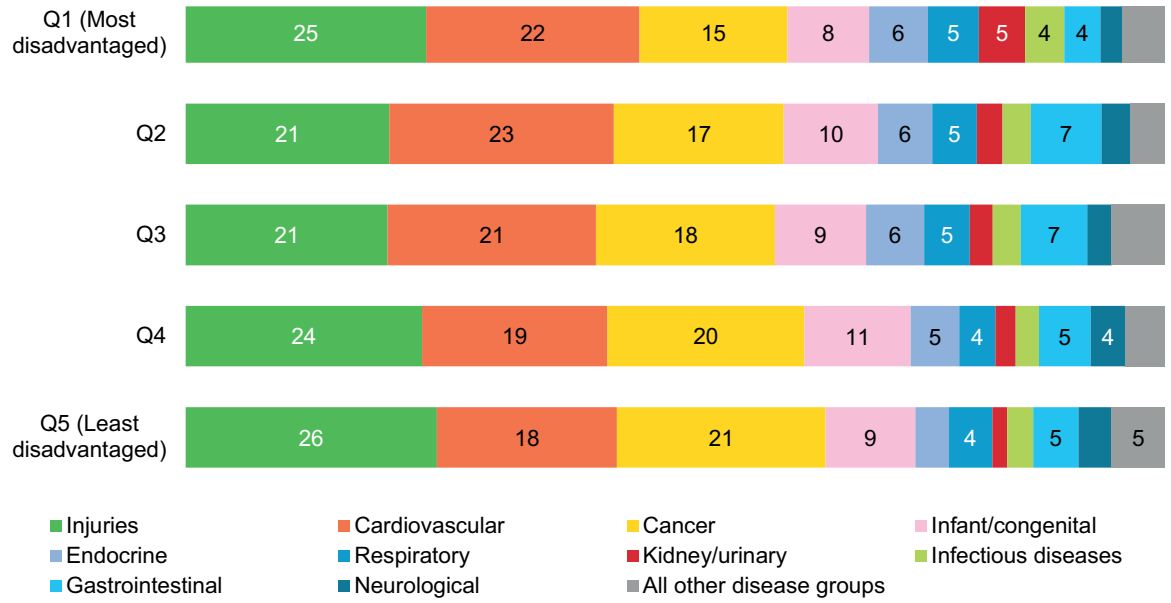
Table 12.3.5: Crude YLL rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Q1/Q5 ratio
Injuries	62.6	37.3	27.7	24.2	22.4	2.8
Cardiovascular	55.7	41.2	28.6	19.0	16.1	3.5
Cancer	38.6	31.1	24.5	20.2	18.6	2.1
Infant/congenital	21.3	17.2	12.5	10.9	8.0	2.7
Endocrine	15.3	10.0	8.0	5.0	3.0	5.1
Respiratory	13.3	8.1	6.3	3.7	3.9	3.4
Kidney/urinary	12.0	4.8	3.1	2.1	1.3	9.0
Infectious diseases	10.2	5.2	3.8	2.4	2.3	4.4
Gastrointestinal	9.4	12.9	9.1	5.3	4.0	2.3
Neurological	5.8	5.3	3.4	3.6	3.0	2.0
Mental & substance use	4.6	2.6	4.3	2.0	2.7	1.7
Blood/metabolic	2.7	2.1	1.8	1.4	1.7	1.6
Musculoskeletal	2.2	1.4	0.9	0.4	0.2	12.0
Skin	0.7	0.2	0.2	0.2	0.2	4.4
Reproductive/maternal	0.5	–	0.1	0.1	–	. .
Oral	0.2	–	–	–	–	. .
Hearing/vision	–	0.1	–	–	–	. .
Total	**255.3**	**179.5**	**134.4**	**100.5**	**87.5**	**2.9**

Note: The numbers may not add to total for all columns due to rounding.

Figure 12.3.6 presents the leading disease groups contributing to fatal burden for Indigenous Australians for each of the 5 socioeconomic disadvantage quintiles:

- Injuries, cardiovascular disease and cancer were in the top 3 ranked leading contributors to fatal burden in all socioeconomic disadvantage quintiles, although proportions differed for each disease.
- Infant & congenital conditions were ranked fourth across all socioeconomic disadvantage quintiles.
- Endocrine disorders (which include diabetes) were ranked fifth in the most disadvantaged areas, contributing 6% to the fatal burden in those areas.



Note: Per cent labels are not shown for disease groups contributing less than 3% of burden.

Source: This figure is based on data in a supplementary table available online—Table S12.3.5.

Figure 12.3.6: Leading causes of fatal burden (proportion of YLL %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2011

Data quality

For both Indigenous fatal and non-fatal burden estimates by socioeconomic disadvantage, an Indigenous-specific index (the IRSEO index) was used as this was considered to more accurately reflect levels of disadvantage in the Indigenous population than more traditional measures used in Australia, such as the SEIFA. However, a major limitation is that a comparable index for the non-Indigenous population is not available, and as such, estimates of the gap in burden by socioeconomic disadvantage quintile are not able to be reported.

Fatal burden estimates by level of socioeconomic disadvantage are considered of reasonable quality. Indigenous mortality adjustment factors are not available by level of socioeconomic disadvantage, and as such adjustment factors from the ABS CDE Indigenous Mortality Study at the national level (age-adjusted) were used to adjust Indigenous deaths for under-identification in each socioeconomic quintile. This assumes there are no differences in Indigenous identification between Indigenous persons living in each socioeconomic disadvantage quintile other than those resulting from age, which may not be the case. However, differences in identification by remoteness and geographical area are also likely to impact on these estimates, which should be kept in mind when interpreting Indigenous YLL estimates presented by socioeconomic disadvantage in this report.

Data quality for non-fatal burden estimates by level of socioeconomic disadvantage is considered of reasonably low quality and should be interpreted with caution. This is because SA2-level data are required in order to calculate the IRSEO index, and as such hospitalisation data were the only data collection assessed as suitable to use to disaggregate national Indigenous YLD estimates into quintiles of socioeconomic disadvantage. Hospitalisation data were used for subnational disaggregation for all disease groups, which may not always reflect socioeconomic differences in underlying disease prevalence due to differential access to and use of hospital services across levels of socioeconomic disadvantage.

13 Data gaps and opportunities

This chapter outlines some of the gaps in data availability and quality that have impacted on the methodological choices made to produce the burden of disease estimates in this study, as well as on the estimates themselves. This include issues relating to identification of Indigenous people in key data sources, the availability of detailed information about the prevalence of specific diseases and risk factors in the Indigenous population, and the differing quality and availability of relevant data across the states and territories.

The chapter also notes some of the opportunities for use of the results of this study, as well as highlighting areas where work could be undertaken that would improve, and increase the usefulness of, any future estimates of the burden of disease in Indigenous Australians.

13.1 Data gaps and limitations

Burden of disease estimates for the Aboriginal and Torres Strait Islander population produced as part of the ABDS 2011 are based on the best current knowledge, methods and available data, as suited to the Indigenous Australian context. In recent decades improvements have been made to both the quality and availability of data on the health of Indigenous Australians. However, there are some data gaps and limitations which need to be considered when interpreting the results of this report and in guiding further methodological research in this area.

An overarching limitation that impacts Indigenous burden of disease analysis is that the Indigenous population is very small relative to the non-Indigenous population, accounting for 3% of the total Australian population. Small numbers in either the population, deaths data or disease/risk factor prevalence data can affect the reliability of the estimates, particularly when data are compared across diseases, age groups or jurisdictions.

Fatal burden estimates

For Indigenous fatal burden estimates, although Australia has very good quality deaths data, not all deaths of Aboriginal and Torres Strait Islander people are identified as such when they are registered. While national data linkage studies have provided adjustment factors that were used to correct for under-identification of Indigenous status in death registrations for YLL estimates presented in this report, uncertainty still exists around the true level of mortality among Indigenous Australians. A long-term strategy to improve Indigenous mortality estimates is to improve the data at the collection phase so that fewer adjustments will be necessary for Indigenous mortality reporting in the future.

A second limitation relating to both national and Indigenous fatal burden estimates is that the current method used for estimating fatal burden in burden of disease studies uses death certificate information on the underlying cause of death only—information contained in the associated causes of death are not currently used to assign the fatal burden. The current method assigns the entire burden to 1 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. For example, CKD and mental disorders have causal pathways that are complex and interwoven with many other diseases, and are often listed as associated causes of death rather than as an underlying cause. This may mean that the total fatal burden of these diseases cannot be fully ascertained from burden of disease estimates alone and that the YLL estimates produced do not represent the life expectancy gap found in people with these disorders. Deaths due to end-stage kidney failure are also affected by access to dialysis treatment which varies geographically and is particularly critical for Indigenous Australians living in remote communities. Further development work may provide alternative methods for estimating fatal burden such as basing future YLL estimates on multiple causes of death data, or quantifying the indirect burden from particular diseases using the 'diseases-as-risks' approach.

Non-fatal burden estimates

For Indigenous estimates of non-fatal burden, where available, data on Indigenous prevalence were sourced directly from disease registers, health surveys or epidemiological studies, or indirectly from other sources such as hospitalisations and incidence data. For some administrative data sources, Indigenous Australians are under-identified to varying degrees across state and territory and remoteness areas. Where the extent of this under-identification is known, and adjustment factors are available (such as in the case of hospitalisations data), estimates can be adjusted to account for such under-identification. However, there are a number of key national data collections for which there has been no formal assessment of the level of Indigenous under-identification. Examples include cancer incidence data, ED data and notifiable diseases data.

Where no suitable data source on prevalence was available for a particular disease for the Indigenous population, indirect estimation methods were used to derive Indigenous prevalence estimates. This included the use of ratios of the differences between Indigenous and total population rates from secondary data sources such as hospital admissions. For some causes, the same disease prevalence as used for national estimates (that is, the total Australian population) was assumed due to lack of data to suggest otherwise. In addition, for some causes, the age or sex distribution from a secondary data source was needed in order to produce Indigenous prevalence estimates by age group and sex. These approaches result in varying levels of confidence about the accuracy of these estimates.

Key gaps in available data to accurately estimate the disease prevalence of major diseases in the Aboriginal and Torres Strait Islander population include:

- Mental & substance use disorders: this has good quality data to estimate the burden in the total Australian population available from national diagnostic surveys, however equivalent data for the Indigenous population is lacking. An Indigenous-specific survey of diagnosed prevalence of mental & substance use disorders rather than self-report is needed in order to fill this information gap.
- COPD: here, the clinical study providing Indigenous estimates of the prevalence of COPD is based on a small sample in Indigenous Australians in the Kimberly region and lacks sufficient information on breakdowns of COPD by age and sex.

- Oral disorders: for these, prevalence estimates for Indigenous adults and children are based on out-dated surveys with relatively small Indigenous samples (for example, 2004–06 National Survey of Adult Oral Health and the 2003–04 Child Dental Health Survey). Estimates for most oral disorders could be improved with updated national surveys with a larger Indigenous sample.
- Dementia: here, prevalence estimates are based on data from 2 small epidemiological studies of Indigenous Australians. A larger national study of dementia in the Indigenous population is needed.
- Hearing loss: estimates rely on self-reports of hearing loss and may be subject to under-reporting if people are unaware of the extent of their own hearing loss, particularly in mild cases. National data based on objective examinations of hearing loss in Indigenous populations is needed.

For severity distributions (which represent the proportion of people with a given disease by levels of severity) used in calculating Indigenous YLD estimates for relevant causes, the ABDS 2011 was able to use data on levels of severity in the Indigenous Australian population for a small number of diseases only. Where these data were not available, the severity distributions used for national estimates were applied. These national estimates in the ABDS used Australian data on severity levels where available, or severity distributions from the GBD study. While the global severity will be appropriate to apply to the Indigenous Australian population in some cases, estimates for some causes would be improved with Indigenous-specific data on disease severity levels in Australia.

The set of disability weights used in this study are sourced from the GBD 2013, which are based on surveys of populations across a number of countries (Salomon et al. 2015). However, to date, no specific validation of the disability weights in the Indigenous Australian context has been undertaken.

Risk factor estimates

For risk factor estimates, only those risk factors that had strong evidence of casual association between risk factor exposure and disease and had sufficient data on both exposure in the Indigenous population and disease-specific effect sizes were included in this study. A number of risk factors considered important for the Indigenous population (for example, childhood underweight and low birthweight) were not able to be included in the study as some data inputs required to estimate attributable burden were not available for, or not relevant to, the Indigenous population (for example, the relative risks for breastfeeding and childhood underweight available from the GBD 2010 were sourced from developing countries and related to infectious diseases only). The ABDS 2011 adopted relative risks used in the GBD 2010 except when they were considered inappropriate or not available (for example, 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). The ABDS is one of the few studies in Australia that have estimated relative risk for relevant diseases and risk factors in the Aboriginal and Torres Strait Islander population.

Key gaps in data available to estimate exposure to risk factors for Indigenous Australians include:

- Low bone mineral density: for which no standardised bone mineral density measurements at the femoral neck were available. National rates were applied to the Indigenous population, based on the fact that the same rates of osteoporosis were self-reported by the Indigenous and non-Indigenous population in the AATSIHS 2012–13 and the AHS 2011–12.

- Occupational exposures: Indigenous status was not available from data published by Safe Work Australia (Compendium of Workers' Compensation Statistics Australia 2010–11 and Work-related Traumatic Injury Fatalities, Australia 2010–11). Instead, an Indigenous to non-Indigenous hospitalisation rate ratio of all injuries with the ICD-10AM activity code U73 ('While working for income') was used.
- Alcohol: Self-reported alcohol consumption is regularly an underestimate of actual consumption (Rehm et al. 2010). Excise, import and sales figures are a better measure of the volume of alcohol sold nationally. Therefore, methods used in recent global studies (and described by Rehm et al. 2010) were used to adjust survey data to fit known sales data. However, as these data cannot be disaggregated by Indigenous status, self-reported consumption in the AATSIHS 2012–13 could only be adjusted by the same correction factors that are used nationally.

Social factors (such as income/poverty, education and employment) play an important role in determining the health of a population, often having a strong association with health outcomes and health behaviours. Further, their association with Indigenous health and with 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 disadvantage as a way of quantifying disparities in fatal and non-fatal burden across different social and economic groups. However, it was not feasible to include social determinants of health as risk factors in the ABDS 2011 due to the extensive body of work that would be required (such as developing appropriate definitions directly related to health and sourcing disease-specific relative risks). Estimating exposure to social determinants is further complicated by the fact that their impact can accumulate over the life course, and their effect may continue to be felt throughout a person's life and even across generations. However, the AIHW recognises that this is an important area of work to progress for future burden of disease studies.

For the majority of the risk factor analysis in this report, risk factors are analysed independently. Due to the complex pathways and interactions between risk factors, it is not valid to simply add the estimated impact of each risk factor. A combined risk factor analysis has been conducted for all risk factors included in the study following methods used in previous global burden of disease studies. However, these methods rest on the assumption that each risk factor is independent and does not take into account known features of 'real-world' epidemiology such as mediation between risk factors, correlations between exposures, or effect modification. Further developments in this area may be possible in the future.

Subnational estimates

A number of data quality issues and technical challenges impacted on what was feasible and valid to produce for Indigenous subnational estimates of burden of disease in the current study. This included issues such as differences in the quality of Indigenous data across states and territories and remoteness areas for key administrative data collections; a lack of suitable Indigenous identification adjustment factors at subnational levels for most of these collections (with the exception of mortality and hospitalisations); a limited number of data sources that included both an Indigenous status identifier and the required geographical variables for the 3 subnational levels of interest (state/territory, remoteness and socioeconomic groups); and small numbers for many causes when disaggregated at subnational levels.

To overcome these issues, Indigenous subnational estimates of fatal burden were based on mortality data adjusted for Indigenous under-identification using available adjustment factors; and a proxy approach was used to disaggregate Indigenous non-fatal estimates at subnational levels based on subnational proportions from either hospitalisation data (adjusted for under-identification) or ABS Indigenous health survey data. However, there are limitations with these approaches, the most important being that estimates for only 4 states and territories were considered adequate to report; and the subnational proportions derived from hospitalisation data may not always reflect subnational differences in underlying disease prevalence.

Estimates of changes since 2003

While 2003 and 2011 estimates presented in this report can be compared to each other to give a general indication of whether Indigenous disease burden has changed over time, it cannot be assumed that there is a straight line between these 2 points (additional data points are needed in order to accurately assess changes over time).

Specific to Indigenous estimates, changes in Indigenous identification over time, inconsistencies in identification in the numerator and denominators used for some 2003 and 2011 estimates, and inherent uncertainties in estimating the Aboriginal and Torres Strait Islander population (particularly for years further away from the Census year), impact on the ability to draw strong conclusions about changes over time from the results.

It is also important to note that the Indigenous population used for 2003 estimates in the current study (based on the 2011 Census) is different to the 2003 population used in the previous Indigenous burden of disease study (which used the projected 2003 Indigenous population based on the 2001 Census). As the ABS currently recasts the Indigenous population based on each Census, the 2003 and 2011 Indigenous population estimates used in this study may also not be comparable to the populations used in future Indigenous burden of disease studies. This has implications for developing a consistent time series, as Indigenous burden of disease rates will need to be recalculated for each reference year following the release of each Census estimated resident population.

13.2 Method developments and key decisions made

While some of the above limitations remain, various methodological decisions and developments were made by the AIHW, in consultation with the study's IRG, to address issues affecting Indigenous burden of disease estimates in the ABDS 2011.

For the fatal burden component, a number of methodological considerations specific to Indigenous estimates were examined. These included assessing the impact of using different standard life tables on resulting Indigenous YLL estimates; determining the most suitable approach for adjusting deaths for Indigenous under-identification in mortality data for both 2003 and 2011 estimates; assessing the number of years of mortality data to combine to produce robust YLL estimates to overcome small numbers; and determining suitable methods to redistribute Indigenous deaths data that are not appropriate for burden of disease analysis.

For the non-fatal component, methodological considerations included determining the most suitable adjustment factors for hospitalisation data for 2003 and 2011; how to account for unknown levels of Indigenous under-identification in cancer incidence data, ED data and notifiable diseases data; and determining the most appropriate indirect method to derive an Indigenous prevalence estimate for causes for which no direct data were available.

For risk factor estimates, methodological considerations included whether the same list of risk factors should be used for both Indigenous and national estimates; and the use of self-reported versus measured survey data on risk factor exposure.

For subnational estimates of Indigenous burden, key decisions were needed on an appropriate and feasible method to produce the subnational estimates in the light of numerous technical challenges and data issues; the level of analysis and reporting best supported by available data (for example, disease group versus specific diseases), subnational disaggregations (for example, which state and territories and remoteness categories); and the most appropriate measure of socioeconomic disadvantage for the Indigenous population.

Final overarching methodological considerations for Indigenous estimates were deciding on the best means of measuring the gap in burden between Indigenous and non-Indigenous Australians; and the choice of the Indigenous population denominator for 2003 estimates to ensure consistency in Indigenous identification levels with 2011 estimates produced.

In consultation with the IRG, a significant amount of work was undertaken to test the sensitivity of results to differing methodological choices. As a result, AIHW authors agreed to:

- adopt the GBD 2010 standard life table for calculating Indigenous YLL. While using this life table results in a greater YLL for Indigenous Australians than using life tables with a lower life expectancy (as used in previous burden of disease studies), sensitivity analyses shows no difference in the ranking of diseases in terms of both Indigenous YLL and the 'gap' in fatal burden (see 'Chapter 3 Context, assumptions and methodological choices' for more detail on the choice of standard life table).
- aggregate 3 years of mortality data, and combine age groups and disease groups where needed in order to overcome issues with small numbers and improve the reliability of the estimates.
- apply ABS mortality adjustment factors to both 2003 and 2011 Indigenous deaths to correct Indigenous under-identification in mortality data, with the exception of estimates by remoteness, for which AIHW adjustment factors were used due to limitations with the available ABS remoteness adjustment factors.
- apply the same methods as those used for the total Australian population to redistribute deaths not appropriate for the burden of disease analysis for Indigenous deaths. New methods developed 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.
- adjust hospitalisations data for Indigenous under-identification using adjustment factors by remoteness and state/territory from hospital data quality studies undertaken by the AIHW.
- where adjustment factors were not available (for example, cancer incidence and notifiable diseases data), limit analysis to only those jurisdictions considered to have adequate Indigenous data quality for both reference periods.
- assess available indirect methods to derive Indigenous prevalence for each relevant cause based on a set of guidelines and criteria developed by the AIHW in conjunction with expert advice.
- use the same risk factor list for both Indigenous and national estimates (for comparability) if possible.
- use measured data for Indigenous risk factor estimates where this is considered to be more accurate than self-reported estimates (for example, body mass index).
- use a proxy approach for deriving Indigenous and non-Indigenous subnational estimates based on subnational proportions from either mortality, hospitalisations or health survey data.

- report Indigenous subnational estimates at the disease group level only (due to small numbers at the specific disease level).
- report remoteness area results for all 5 remoteness categories (*Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote*) and state/territory results for New South Wales, Queensland, Western Australia and the Northern Territory only (as YLL estimates for the other jurisdictions were not able to be reported due to small numbers of Indigenous deaths, and lack of suitable Indigenous mortality adjustment factors for these states and territories).
- use the IRSEO index to examine variation in Indigenous burden of disease by level of socioeconomic disadvantage.
- use direct age-standardisation to calculate rates for comparing the Indigenous and non-Indigenous populations.
- use rate differences as the primary measure of the gap in burden, and rate ratios as a secondary measure where appropriate.
- use 2003 and 2011 Indigenous population estimates based on the 2011 Census for rate calculations, which provides consistency in Indigenous identification levels between the 2 denominators.

Uncertainty bounds have not been included in this study for a number of reasons. Advice from the EAG 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 required 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 subnational estimates). It was not practical to incorporate all imperfections and uncertainties into a single measure, such as an uncertainty interval. Instead, key information on the quality of estimates has been provided (see 'Appendix B: Methods overview'), covering all aspects affecting quality, so that users of ABDS 2011 can make judgments about the estimates' usefulness or otherwise for particular purposes.

Given the study's aim to be transparent in the data sources, assumptions and methods used to calculate estimates with the ability to replicate the results; detailed methods information is provided in Appendix B, and in an accompanying technical methods report for the ABDS 2011.

13.3 Opportunities to further use and improve the estimates

There are a number of opportunities to further use and explore the vast quantity of data which underpin the estimates presented in this report, or to examine them at a deeper level, including many potential policy-relevant analyses that could be undertaken using the results from ABDS 2011.

There is further opportunity to explore the estimates for Indigenous 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), detail across age/sex/subnational groups, or to help answer specific research questions (for example, burden in the last year of life for cancer). Similarly, the estimates could contribute to health impact assessment of new policies before decision making (for example estimated impact of reducing Indigenous smoking rates on a particular level of disease burden).

One of the key areas in which the ABDS 2011 estimates could be further used is in guiding resource allocation, aligning budgets to health priorities and disease burden. The estimates could also be combined with disease expenditure data. Further, estimates could be used in cost-effectiveness analysis, where the change in DALY can be used to assess the corresponding change in expenditure.

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) and of particular risk factors (for example, nutrition, intimate partner violence). With appropriate data, further work could be undertaken to explore disease burden at local levels (for example, by Primary Health Networks or Indigenous Area). Further work could also provide alternative groupings of diseases within and across disease groups (for example, vascular diseases, septicaemia) or with diseases as risks factors (for example, diabetes and CKD). Some of this work is being undertaken for national estimates as separate projects, but was out-of-scope of this current study.

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 show change in estimates over time to examine historical trends and future projections.

Likewise, there are opportunities to improve Indigenous 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, and within the Indigenous Australian context. Part of this process was the identification of a number of data gaps, particularly in the prevalence of diseases (for example diseases treated in primary health care) and for some risk factors, and for Indigenous-specific severity distributions. There are also various areas where refining our current methods would be beneficial (for example, validating comorbidity adjustment, uncertainty estimation, incorporating multiple causes of death into YLL calculations). There is also potential for work to explore Australian and Indigenous-specific disability weights, based on more extensive data collections within Australia.

There may be potential to include social determinants of health (such as income/poverty, education and employment) as risk factors in future burden of disease studies by building on the work of other countries. For example, Scotland's National Health Service has undertaken some exploratory work to estimate the impact of social determinants on the burden of disease using linked health survey and hospital and mortality data. One option could be for Australia to use the relative risks produced from this work if they are made available and are considered generalisable to the Australian and Indigenous Australian populations. A more useful and effective strategy however would be for the linkage of Indigenous health survey data with administrative data in Australia. This would provide an invaluable resource not only for future burden of disease studies but for other research work looking at the impact of social determinants of health on mortality and morbidity outcomes.

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's work on Indigenous burden of disease will make a useful contribution to the body of knowledge and international expertise in this area.

Appendix A: Social determinants of health

The broader social, environmental, economic and cultural conditions in which people live have increasingly been recognised as important determinants of health and health inequalities (WHO 2013). Social determinants of health, such as income, poverty, education employment and housing infrastructure, play an important role in population health, often having a strong association with health outcomes and health behaviours.

A conceptual framework outlining how the social and economic determinants of health impact on the health and wellbeing of Indigenous Australians and result in health inequities was developed by Osborne, Baum and Brown (2013) (Figure 1). The framework presents the historical context of colonisation (and related issues such as dispossession and removal from land and separation from family and community) as the overarching driver of the social, economic and health inequities experienced by Indigenous Australians. The social and economic determinants are represented as upstream factors that both influence and are influenced by midstream factors such as health behaviours and psychosocial factors. These in turn impact on downstream factors such as physiological systems and biological reactions, and ultimately health outcomes. It is noted, however, that the relationship between the social determinants and health is complex and multi-directional and it is therefore not possible to specify direct causal relationships. As a result, while the importance of social determinants in recognised in this report, at present these factors cannot be adequately described within the Burden of Disease framework.

Social and economic determinants are also reflected in the different patterns of health and health inequities for Indigenous Australians depending upon their age, life stage, gender and location (Osborne et al. 2013). Health issues in adolescence and early adulthood, such as mental health and wellbeing and suicide, sexual and reproductive health for example, are different to those in adulthood, where chronic diseases such as cancers, diabetes and heart disease, are more prominent. Indigenous women experience motherhood earlier on average than non-Indigenous women and these experiences of child birth and caring responsibilities have different implications for their health (Osborne et al. 2013). Social determinants are important predictors of poor circumstances during pregnancy (such as maternal stress, nutrient deficiencies, inadequate antenatal care and maternal alcohol and tobacco use), which in turn cause babies to be born underweight. The impact of low birthweight on chronic disease and mortality persists into adulthood (Wadsworth & Butterworth 2003; Hoy & Nicol 2010). Another important factor is location, due to the higher levels of poverty and disadvantage and the poorer health outcomes in remote areas where Indigenous Australians are more likely to live (AIHW 2014a). The experience of the social determinants will therefore differ depending on whether Indigenous Australians live in remote, rural or urban areas, as well as on family and cultural backgrounds (Osborne et al. 2013).

The relationship between various social and economic factors and Indigenous health at the population level, and the health gap between Indigenous and non-Indigenous Australians is well documented (AIHW 2014a, 2015c, 2015d; Anderson, Baum & Bentley 2007; Booth & Carroll 2005). There are clear associations between social factors such as housing, education, income and employment with health measures such as risk factor levels and self-assessed health. Looking at education as an example, the proportions of the Indigenous population who smoke, or who assess their health as fair or poor, decrease as levels of schooling completed increase (AIHW 2015a).

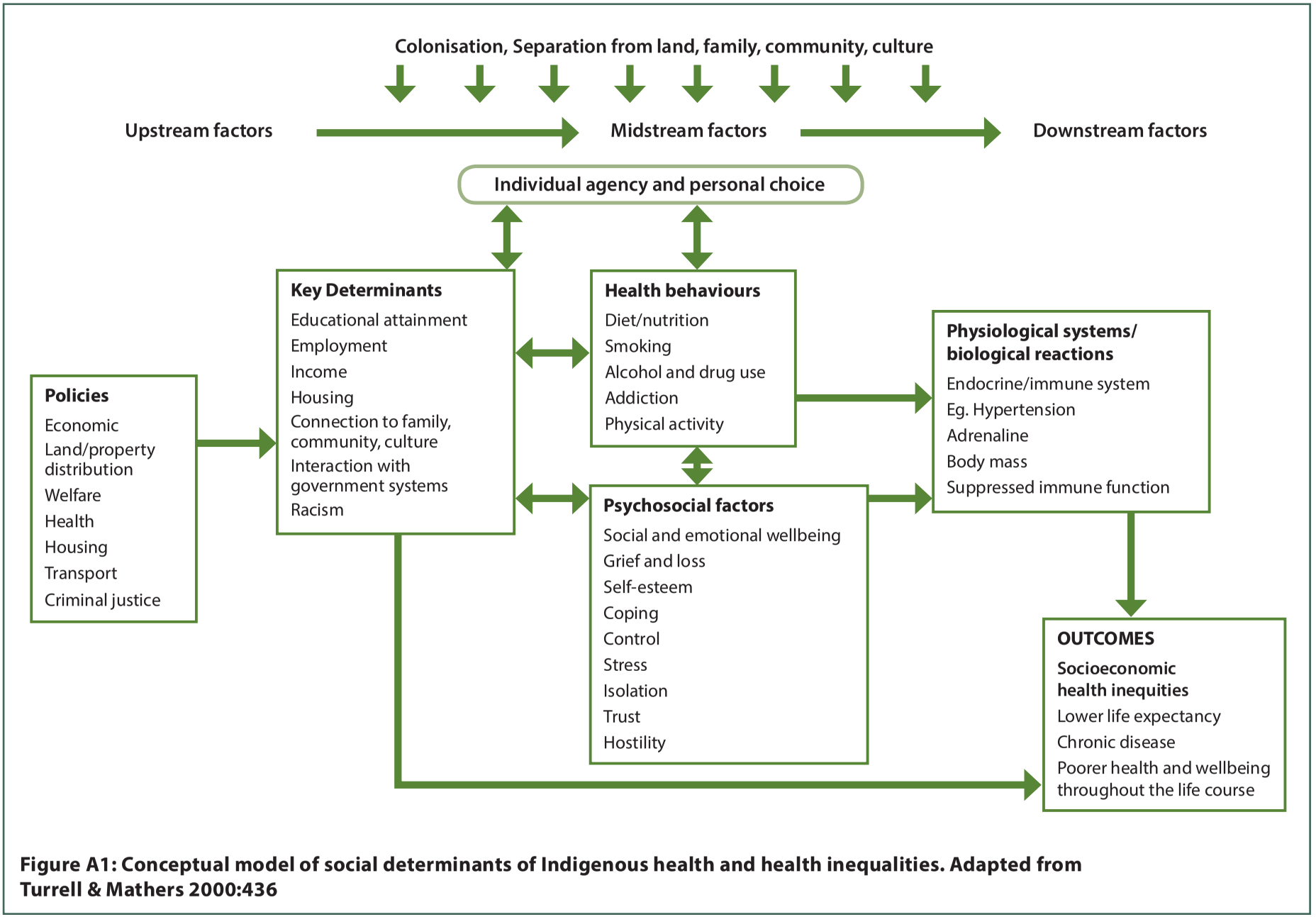


Figure A1: Conceptual model of social determinants of Indigenous health and health inequalities. Adapted from Turrell & Mathers 2000:436

Quantifying the impact of social determinants

The complex interrelationship between the various determinants of health and their differing impacts over time makes it difficult to quantify the relative contribution of social determinants to the health gap between Indigenous and non-Indigenous Australians. But several Australian studies have developed ranges of estimates of this relative contribution with fairly similar results:

- Booth and Carroll (2005) analysed the contribution of social determinants to the poorer health of Indigenous Australians, measured in terms of self-assessed health status. They concluded that between one-third and one-half of the health gap was due to social determinants.
- DSI Consulting Pty Ltd and Benham (2009) found that up to one-third of the difference in life expectancy could be attributed to differences in income, school education, employment status and overcrowded housing.
- Zhao and others (2013) looked at both social determinants and health behaviours and found that socioeconomic disadvantage explained between 42% and 53% of the gap in life expectancy.
- The AIHW explored the relative contribution of social determinants and behavioural risk factors on the health gap using data from the 2004–05 National Aboriginal and Torres Strait Islander Health Survey (AIHW 2014b). The health gap was a composite measure of self-assessed health, the number of health conditions and emotional distress. Social determinants included household income, highest level of school, and employment status. Social determinants were estimated to be responsible for nearly one-third (31%) of the health gap. Interactions between the social determinants and behaviours risk factors were estimated to explain an additional 15% of the health gap.

Social determinants and the disease burden

Some studies have also attempted to estimate the impact of social determinants on the disease burden. For example, the GBD 2013 study looked at how much of the change in HALE/DALY between 1990 and 2013 could be explained by a composite of 'socio-demographic status' (which included income per year, schooling past age 15, fertility rate and age). Globally, this score explained over 50% of the changes in lower respiratory infections, diarrhoea, musculoskeletal disorders, maternal disorders, 20–50% of HIV/AIDS, mental & substance use disorders, transport injuries; and less than 10% of cardiovascular disease, chronic respiratory diseases and diabetes.

The Burden of Disease and Injury in the Northern Territory 1999–2003 study included socioeconomic status as a risk factor, which was attributed to 27% of variation in the disease burden. SEIFA was applied at the Statistical Local Area (SLA) level to mortality (YLL), but not morbidity (YLD) estimates as they are not SLA-specific. It was assumed that the association between risk factor exposure and morbidity was consistent with the association observed for mortality. Linear regression was used to measure the correlation between SEIFA indices and YLL. The determinant coefficient (R2) was used as an estimate of the proportion of the total burden of disease attributable to socioeconomic status. However, this is not a causal inference.

In the ABDS, burden of disease estimates were disaggregated by a measure of socioeconomic disadvantage as a way of quantifying disparities in fatal and non-fatal burden across different social and economic groups. While it was not feasible to include social determinants of health as risk factors in the current study due to the resources needed to undertake the large and complex body of work that would be required (such as developing appropriate definitions directly related to health and sourcing disease-specific relative risks), the AIHW recognises this is an important area of work to progress for future burden of disease studies.

Appendix B: Methods overview

This appendix summarises the methodological approach of the ABDS 2011, including general burden of disease methods, and methods used specifically to produce estimates for the Aboriginal and Torres Strait Islander population. A more detailed methodological description is provided in a separate technical report *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016b).

B.1 General burden of disease methods

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 to estimate the overall burden of disease (DALY) for a specified period of time (reference year). This burden can then be attributed to risk factors selected for inclusion in that part of the analysis. The methods for estimating each of these components of analysis are described in the following section.

B.1.1 Disease and injury (condition) list

The disease and injury list details the specific diseases and causes of injury for which estimates were made. An Australian disease and injury list was developed specifically for this study to reflect the Australian context. It is a hierarchical classification which comprises 2 levels. The highest level contains 17 disease groups under which 200 diseases and injuries are classified. The condition list used for the ABDS is included in Appendix Table B1. Definitions for each disease by ICD-10 for mortality or ICD-10-AM (where relevant) for morbidity are available in additional online tables.

B.1.2 Fatal burden (YLL)

Fatal burden measures the impact of dying prematurely, and is measured in terms of **Years of life lost (YLL)**. YLL is calculated by summing the number of deaths at each single year of age, multiplied by remaining life expectancy according to a reference life table.

Years of life lost = number of deaths in the reference year x remaining life expectancy at the age of death (according to the reference life table)

Reference life table

The Australian Burden of Disease Study 2011 uses the reference life table developed in the GBD 2010 study (see Murray et al. 2012b). This life table was derived rigorously using the lowest age-specific mortality rates experienced in any country. The result is a hypothetical life table, rather than one that is actually experienced in any single country. The reference life table estimates a life expectancy at birth to be age 86.0 for both males and females. The reference life table used in this study is included in Appendix Table B2.

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 come from the AIHW's National Mortality Database. In this study, Indigenous deaths have been adjusted for under-identification in mortality data (see Section B.3 for further information).

Redistribution of unspecified deaths

There are a number of ICD codes which are not considered appropriate or valid causes of death for a burden of disease study. Some examples include causes of death that are considered as implausible as the underlying cause such as hypertension; intermediate causes that have a precipitating cause such as septicaemia; immediate causes that occur in the final stages of dying such cardiac arrest; or causes that are ill-defined or unspecified.

Despite its overall high quality, the Australian deaths dataset includes some records with these codes. A list of the ICD-10 codes used to identify deaths for redistribution in the ABDS is included in the accompanying technical methods report for the study.

A total of 636 Indigenous deaths (8.3%) were identified for redistribution in 2011. These deaths were reassigned to a more appropriate cause in the disease and injury list using 1 of 3 redistribution methods:

1. **direct evidence**: using results from data linkage studies or other sources
2. **indirect multiple causes of death method**: using the pattern of the underlying causes of death where the cause identified for redistribution was mentioned as an associated cause of death
3. **proportional redistribution to specified target causes(s)**: reassigning deaths across a range of target causes selected according to the existing distribution of the underlying cause of death within that disease group, expert advice or the GBD redistribution algorithms.

Of the Indigenous deaths redistributed, 85% were redistributed using empirical evidence (direct evidence, indirect multiple causes of death or a mix of both) and 15% were redistributed using proportional redistribution.

B.1.3 Non-fatal burden (YLD)

Non-fatal burden is a measure of healthy life lost due to ill health, expressed as **Years lived with disability (YLD)**. In this study a prevalence-based approach to calculating YLD has been used in which the YLD measures the proportion of healthy life lost due to disease in the reference year of the study compared to full health. This is calculated by estimating the amount of time spent with a condition multiplied by a **disability weight**.

Years lived with disability = disease prevalence x disability weight

Disability weights are a valuation of health loss between 0 (no health loss) and 1 (equivalent to death) that reflect 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. This approach to measuring YLD does not include an estimate of past or future health loss, and differs from previous Australian and Indigenous burden of disease studies which used an incidence-based approach in calculating YLD.

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 Indigenous Australian population; and to be timely, accurate, reliable and credible. Where possible, national data sources containing information on the Indigenous Australian population were used. This included data from administrative data sources (for example, disease registers, hospitalisations), surveys and epidemiological studies. Where such data for a particular disease or sequela was not available for the Indigenous population, indirect methods were used to derive Indigenous prevalence and morbidity estimates (see Section B.3 for further information).

All potential data sources (whether published or unpublished) were assessed for comparability, relevance and representativeness, currency, accuracy, validation, credibility and accessibility/timeliness. These criteria were incorporated into a quality indicator for each estimate. 'Appendix C: How reliable are the estimates?' provides a summary of the quality framework used to assess Indigenous non-fatal estimates in this study.

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. Each model depicts the major sources of health loss (sequelae) caused by different severity levels and stages of disease, then maps these to 1 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 1 particular disease.

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). Disability weights were derived using a survey instrument that allowed respondents in the general public to make pairwise comparisons between 2 health states. Respondents were surveyed in 2 ways: household surveys (face-to-face interviews in Bangladesh, Indonesia, Peru and Tanzania, and telephone interviews in the United States of America), and an open-access web-based survey. At least 500 of the web-based survey participants were based in Australia (Salomon et al. 2012). The result is a set of weights which is claimed to reflect consistent results across different cultural environments (Salomon 2010; Salomon et al. 2012).

A final disability weight for each sequela is calculated from the sum of the disability weights for each health state, weighted by the severity distribution observed in the population.

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.

Comorbidity bias adjustment

Comorbidity occurs when a person experiences several diseases or injuries simultaneously.

This might arise by coincidence, as when someone experiences both asthma and dental caries. Or it might reflect systematic influences, as when a single risk factor (say, an environmental pollutant or physical inactivity) gives rise to several health conditions; or when multiple conditions are associated genetically; or when 1 condition gives rise to another condition.

Comorbidity poses a challenge for burden of disease analysis. Simply summing YLD estimates (derived from the prevalences and disability weights for single conditions) without adjustment can lead to overestimation of the overall non-fatal burden—this is the problem of 'comorbidity bias'.

The ABDS has not compiled data on the pattern of actual comorbidity within the Indigenous population. Instead, it has adjusted for comorbidity bias by modelling comorbidity prevalences and associated health losses, using a procedure similar to that adopted in other recent burden of disease studies. The remainder of this section outlines the procedure; for more details of the methodology see AIHW 2016b.

Comorbidity bias in burden of disease studies

We might envisage an ideal data environment for bringing comorbidity into burden of disease estimation would comprise:

- a full suite of unit records for every person in the population, showing what combination of (comorbid) conditions s/he experienced in the reference period and
- a full suite of disability weights (measures of the health losses) associated with every observed combination of comorbid conditions.

Ideally, we would then estimate aggregate YLD by summing all the health losses implied by the observed pattern of comorbidity.

For presentation purposes, it is convenient to show YLD estimates for individual conditions, and this requires us to ascribe the YLD for a given comorbid combination back to its component conditions. A procedure commonly used in recent burden of disease studies is as follows:

- distribute the disability weight for a comorbid combination fractionally across its component conditions—typically, re-scaling each component weight using the ratio of the comorbid weight to the sum of the component weights
- cumulate all such component-wise fractions across the population, to arrive at a 'comorbidity-adjusted' weight for each individual condition
- for each condition, multiply the condition's prevalence by its comorbidity-adjusted weight, to arrive its comorbidity-adjusted YLD.

An ambition of any such adjustment procedure is to ensure that the sum across all such comorbidity-adjusted YLD estimates is equal to the ideal aggregate YLD a described here. But, in practice, this can be achieved only approximately. Consider how YLD estimates are typically worked up:

- The YLD for a given health condition is obtained through multiplying its prevalence by its (unadjusted, original) disability weight. Aggregate YLD is the sum of YLD estimates across all health conditions.

The available data are less than ideal:

- **Prevalences** are derived from a wide variety of data sources and models. Many of the data sources recognise only 1 health condition of interest—so the prevalence estimates available to a burden of disease study typically count cases, not people, and count single conditions, not combinations of conditions. We certainly do not have data on the pattern of all comorbid combinations.
- A variety of approaches has been adopted for estimating **disability weights**, but a common feature of almost all approaches is that the suite of disability weights refers to single health conditions, not to combinations of conditions.

Moreover, it is implausible to assume that disability weights are simply additive:

- Consider the case of Jane Doe who experiences metastatic cancer (DW = 0.484), migraine headache (DW = 0.433) and severe epilepsy (DW = 0.657). If we trace though a case-counting approach to estimating prevalences and computing YLD estimates (that is, ignoring comorbidity), Jane would contribute 1.574 person-years to aggregate YLD. But a person-counting approach would impose a ceiling of 1 person-year's worth of health loss on any individual's contribution.

In the absence of comprehensive datasets, adjustment for comorbidity bias has relied on *modelling* both the prevalences and the disability weights for comorbid conditions. The modelled data are then used, as outlined here, to compute a re-scaled (comorbidity-adjusted) disability weight each for condition–and it is from the adjusted weights (but the original prevalences) that comorbidity-adjusted YLD estimates are derived.

Comorbidity bias adjustment in this study

This strategy as outlined has been adopted for this study. The key idea underpinning the adjustment procedure was to simulate a population exhibiting comorbidities and their associated health losses (disability weights) that mimics the ideal dataset envisaged earlier.

- As to *prevalences*, this study has assumed independent ('multiplicative') comorbidity—that is, the probability of experiencing such-and-such a combination of conditions is simply the product of the probabilities of experiencing each of the constituent conditions. In reality, of course, the pattern of comorbidities is likely to be more complex, but there is evidence that this assumption provides an approximation that is acceptable for the purposes of burden of disease estimation.
- As to *disability weights*, this study has assumed a multiplicative relationship between the health loss suffered by a person who experiences such-and-such a combinations of sequelae and the losses associated with the constituent sequelae. The combined disability weight for a comorbid combination of conditions is equal to:

1 minus {the product of {1 minus the DW for each constituent sequela}}.

Note that, in particular, this assumption puts a ceiling of 1 on the disability weight that can arise from any combination of conditions.

Assumptions of these kinds have been used for the Global Burden of Disease and other recent burden of disease studies.

Assembling the simulated population entailed the following steps:

- The available data on single-condition prevalences (and the independence assumption) were used to simulate a population that exhibits all possible combinations of 1, 2, 3 or 4 comorbid conditions selected from the ABDS 2011 list of sequelae. The frequency of a given combination within the simulated population depends upon the probabilities (taken as the pre-capita prevalences) of individual conditions. In reality, of course, a person may experience 5 or more conditions, but the approximation error from capping the number of conditions in the synthetic population at 4 may be expected to be negligible.
- The available data on single-condition disability weights (and the multiplicative assumption) was used to attach a disability weight to each combination of comorbid conditions, and thence to each member of the simulated population.

Because disease prevalences are known to vary by age and sex (and in order to support a disaggregated presentation of the results), the procedure was undertaken at the level of the age–sex cohort. Comorbidity bias adjustment was undertaken separately for the Indigenous and non-Indigenous populations, and for each of the reference years: 2003 and 2011.

The adjusted YLD estimates that result from applying adjusted weights that have been derived from such a simulation are expected to be a reasonable approximation to the ideal aggregate YLD (and comorbidity-adjusted YLD estimates for individual conditions) envisaged earlier. The closeness of approximation depends on the how reasonable are the assumptions underlying the models. Validation studies by GBD and other investigators suggest that the approximations appear reasonable at aggregate level.

B.1.4 Total burden of disease

Non-fatal and fatal burden are combined in a summary measure called **disability-adjusted life years (DALY**). One DALY is 1 year of 'healthy life' lost due to illness and/or death in the reference year of the study. The DALY for each condition is calculated by summing the YLL and YLD for that condition. The total burden of disease is calculated by summing DALY across all conditions.

Disability-adjusted life years = YLD + YLL

B.1.5 Risk factors

This section describes the method used to quantify the impact of risk factors in the ABDS 2011.

Risk factor list

There are 29 risk factors included in the ABDS 2011 for the Indigenous component of the study (see Appendix Table B3 for a list). The same risk factor list was used for ABDS estimates for the total Australian population with 2 exceptions: unimproved sanitation, which was included for Indigenous estimates only, and high sun exposure, which was included for total population estimates only.

Risk–outcome pairs

Risk–outcome pairs associates a condition in the cause list with known risk factors for that condition (for example, high cholesterol is a risk factor for CHD and stroke). A large-scale investigation of all possible risk–outcome pairs was conducted as part of GBD 2010. For those risk factors selected for inclusion in this study, the ABDS 2011 has adopted the available relevant risk–outcome pairs used in GBD 2010 (US Burden of Disease Collaborators 2013).

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, risk factor exposure definitions used in GBD 2010 were adopted.

Estimates of Indigenous population distributions of risk factor exposure by age and sex have been based on a variety of sources. The 2012–13 AATSIHS was the primary data source for most risk factor exposure estimates. This was complemented by administrative datasets such as the exposure type recorded on disease notifications to the NNDSS (unsafe sex and injecting drug use), state and territory air quality monitoring data (air pollution), and the National Homicide Monitoring Program (intimate partner violence).

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).

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). 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.

Theoretical-minimum-risk exposure distribution

The estimated contribution of a risk factor to disease burden was calculated by comparing the observed risk factor distribution to an alternative, hypothetical distribution (the counterfactual). This scenario could be an increase or decrease in levels of exposure or changes in behaviour compared to what is currently observed in the population. In the ABDS 2011, as in previous Australian burden of disease studies, a **theoretical-minimum-risk exposure distribution** (TMRED) scenario was adopted, based on the 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.

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:

$$PAF = \frac{\sum_c P_c\,(RR_c - 1)}{\sum_c P_c\,(RR_c - 1) + 1} \times 100$$

where

c = an index for category, P = prevalence and RR = relative risk.

Combined risk factor analysis

To combine risk factors, the following formula was used:

$$PAF = 1 - \prod(1 - PAF_r)$$

where

PAF is the population attributable fraction of burden attributable a disease from all risk factors.

PAF_r is the population attributable fraction for risk factor 'r' and linked disease

the product $\prod$ 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%.

B.2 Overarching methodologies /choices

B.2.1 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 years from a particular data source, techniques were used to adjust the counts or rates to the reference year.

B.2.2 Age groups

Analysis was undertaken using as fine a disaggregation as the data supported, and supplied in 5-year age groups to 85+. Where data could not be obtained directly by the 5-year age groups listed, modelling was used to derive the required age groups suitable for analysis. Age groups used for reporting vary for different aspects of the study based on the measure being reported and the size of numbers (see Section B.3 for more detail).

B.2.3 Geography

Analysis by geographical areas was carried out for selected state and territories, remoteness and socioeconomic group based on area of usual residence. See Section B.3 for further information on Indigenous subnational estimates presented in this report.

B.2.4 Reference populations

Aboriginal and Torres Strait Islander population estimates as at 30 June 2011 (based on the 2011 Census) were used to calculate Indigenous rates presented in this report. See Section B.3 for information on population denominator issues to consider when interpreting changes in Indigenous estimates over time.

Non-Indigenous population estimates were calculated by subtracting the Aboriginal and Torres Strait Islander population estimates from the total Australian population estimates for the same years.

For the calculation of Indigenous rates of burden by remoteness, experimental Indigenous population estimates calculated by the AIHW were used (for 5 remoteness categories, by 5-year age group and sex, as at 30 June 2009, 2010 and 2011). These estimates were calculated based on the ABS's 2011 Census ERP for the Aboriginal and Torres Strait Islander population. The ABS has released the 2011 ERP for the Indigenous population for only 3 remoteness categories (*Major cities*, *Inner/Outer regional* combined, and *Remote/ Very remote* combined)—therefore these data could not be used to calculate Indigenous rates for the 5 remoteness categories individually.

For the calculation of Indigenous burden rates by socioeconomic disadvantage, the 2011 Aboriginal and Torres Strait Islander Estimated Resident Population (ERP) at the Statistical Area 2 (SA2) level was used.

The Australian 2001 standard population (published 20 June 2013) is used for all age-standardisation as per AIHW and ABS standards.

B.3 Indigenous specific methods/data quality issues

B.3.1 Dealing with small numbers

An important consideration for Indigenous burden of disease is the robustness and reliability of estimates produced, and the level of disaggregation that the data will support given the small size of the Indigenous population and consequently the relatively small number of Indigenous deaths each year compared with the very much larger non-Indigenous population. To ensure validity of the results, the AIHW has aggregated several years of mortality data, age groups, and disease groups in producing Indigenous YLL estimates. Similarly, due to the small number of Indigenous prevalent cases of some diseases, a number of age groups and/or years were aggregated to produce Indigenous YLD estimates for some diseases. In some cases the level of disaggregation used to report Indigenous estimates is broader than that reported for the total Australian population. This is discussed further in the following section.

Combining years of deaths data

The number of deaths due to any particular cause varies from year to year. These fluctuations are more noticeable for causes that are less common and in Indigenous deaths that are often small in number. To reduce the impact of random fluctuations, 3 years of deaths data were summed, then divided by 3, to produce average annual YLL estimates.

This provides greater stability in Indigenous estimates of YLL and rates for:

- causes of death that are rare
- causes that occur episodically
- reporting at disaggregated levels (for example, by the level of cause group, and for subnational estimates).

Mortality and YLL estimates presented in this report are based on deaths that occurred from 2009 to 2011.

Reporting age groups

The standard reporting age groups used for reporting Indigenous YLL estimates at the disease group level in this report are: less than 1; 1–14; 15–24; 25–34; 35–44; 45–54; 55–64; 65–74; and 75 and over. These age groups are slightly different to those reported for the total Australian population (where the 1–14 group is split into 1–4 and 5–14, and the highest age group is 85 and over) in order to minimise the number of small cells. However, where numbers support the use of more detailed age groups (such as figures presenting total YLL rather than YLL by disease group), Indigenous YLL estimates are reported using the same age groups as reported for the total Australian population.

Reporting disease groups and specific diseases

Of the 17 disease groups included in the ABDS 2011 disease and injury list, for YLL estimates only the top 14 disease groups, and the top 20 specific diseases are presented separately in most figures and tables due to small numbers of Indigenous deaths. For YLD and DALY estimates, all 17 disease groups are presented and the top 20 specific diseases.

B.3.2 Adjusting for Indigenous under-identification in deaths data

Every year, a number of deaths of Aboriginal and Torres Strait Islander people are not identified as such when they are registered (ABS 2013d). This may arise from the non-reporting of a deceased person's Indigenous status on the death registration form, or from incorrect identification of a deceased person's Indigenous status (recording a person as non-Indigenous when they are Indigenous, and vice versa). The degree of under-identification can vary by age, state/territory, remoteness and over time. This under-identification means the number of deaths recorded as Aboriginal and Torres Strait Islander is an underestimate of the true levels of mortality in that population.

Since the last Indigenous Australian burden of disease study, the AIHW and ABS have made advances in the assessment of under-identification in mortality data using data linkage methods. The ABS's Census Data Enhancement Indigenous Mortality Study (2011–12) linked Census records with death registration records (ABS 2013c). The AIHW's EMD project (2008–2010) linked registered deaths with Indigenous death records from administrative data sources including residential aged care data, hospital data and perinatal data (AIHW 2012). Both of these studies produced mortality correction factors that can be used to adjust for Indigenous under-identification in Australian mortality data. The AIHW study produced adjustment factors for all 8 states and territories and 5 remoteness categories; the ABS study produced state/territory adjustment factors for New South Wales, Queensland, Western Australia and the Northern Territory individually, and a combined adjustment factor for the other 4 jurisdictions (Victoria, South Australia, Tasmania and the Australian Capital Territory). The ABS determined that there were too few deaths in the linked dataset to calculate reliable adjustment factors for 5 remoteness categories, or alternative grouped remoteness categories, therefore remoteness adjustment factors from the ABS study are only available for 2 combined categories: *Major cities/Inner regional* combined, and *Outer regional/Remote/Very remote* combined.

In this study, mortality adjustment factors from the ABS's Census Data Enhancement Indigenous Mortality Study (2011–12) have been used to adjust Indigenous deaths for under-identification in mortality data, with the exception of estimates by remoteness, for which adjustment factors from the AIHW's EMD project (2008–2010) were used.

The ABS national and state/territory adjustment factors were chosen as they take into account under-identification in both mortality data and population data, and therefore, in theory, provide consistency in the numerator and denominator used in Indigenous YLL calculations. The ABS adjustment factors are also the official estimates of Indigenous mortality coverage in Australia. Furthermore, sensitivity analyses undertaken by the AIHW looking at the impact of using the different adjustment factors available (ABS compared to AIHW) on the resulting Indigenous YLL estimates and measures of the gap showed that at the national level, the age patterns and disease rankings remained consistent using either set of adjustment factors (see AIHW 2015c for more detail).

AIHW remoteness adjustment factors have been used to calculate YLL estimates by remoteness due to a number of limitations with the ABS remoteness adjustment factors. The ABS combined adjustment factors for *Major cities/Inner regional* and *Outer regional/Remote/Very remote* are not considered useful to policymakers for examining mortality disparities by remoteness, given the wide variation between the 5 remoteness categories, and because the chosen groupings of remoteness (in particular, the combining of *Outer regional* with *Remote* and *Very remote*) mask any mortality disparities by remoteness—they do not follow the typical categories of non-remote and remote.

It is important to note that YLL estimates by remoteness presented in this report are not comparable to YLL estimates presented in other sections. This is because the former have been adjusted using factors from the AIHW EMD study, while the latter were adjusted using factors from the ABS CDE Indigenous Mortality Study. Total numbers of adjusted deaths and YLL should be sourced from tables for national results which are based on the ABS adjustment factors.

The same national age-specific mortality adjustment factors were applied in the calculation of both 2003 and 2011 Indigenous YLL estimates. This was assessed as the most suitable approach for producing 2003 estimates following a series of sensitivity analyses undertaken by the AIHW. This approach assumes no change in Indigenous identification in recording of Indigenous deaths between 2003 and 2011 which is consistent with results from the AIHW's EMD Linkage study.

The mortality adjustment factors used in this study can be found in Appendix Table B4.

B.3.3 Adjusting for Indigenous under-identification in hospitals data

Hospitalisations of Indigenous persons are also under-identified to varying degrees across state and territory and remoteness areas. Some jurisdictions also have slightly different approaches to the collection and recording of Indigenous status information in their hospital collections. The incompleteness of Indigenous identification means that hospital separations recorded as Aboriginal and Torres Strait Islander is an underestimate of hospitalisations of Indigenous Australians.

In this study, hospitalisation data used in the calculation of Indigenous YLD estimates were adjusted for Indigenous under-identification using adjustment factors from hospital data quality studies undertaken by the AIHW. For 2011 estimates, adjustment factors from the 2011–12 *Indigenous identification in hospital separations data quality study* (AIHW 2013b) were applied. For 2003 estimates, adjustment factors from the 2007-08 *Indigenous identification in hospital separations data quality study* (AIHW 2010) were applied. It should be noted that the studies from which these adjustment factors were derived did not examine under-identification by diagnoses or casemix, and that under-identification may vary across disease groups.

The hospital adjustment factors used in this study can be found in Appendix tables B5 and B6.

B.3.4 Measuring the gap between Indigenous and non-Indigenous Australians

There is strong interest in measuring the 'health gap' between Indigenous and non-Indigenous Australians for the ABDS, given the gap in the life expectancy between these 2 populations.

As the Indigenous population has a younger age profile than the non-Indigenous population, burden of disease rates have been age-standardised to adjust for differences in age structure between the 2 populations. The gap in disease burden (referred to as the 'health gap') has been measured using direct age-standardisation, which applies the age-specific rates of the Indigenous and non-Indigenous populations to the current Australian standard population (the Australian ERP as at 30 June 2001). The direct method has been used as it enables multiple comparisons (for example, cause by sex) and can be used for comparisons over time. A limitation of the direct method is that less reliable estimates can be produced when the method is applied to a small number of deaths—this should be kept in mind when interpreting gap results for less common causes.

For reporting of the health gap between the Indigenous and non-Indigenous populations, rate differences, as well as rate ratios are presented. Rate differences provide a measure of the absolute gap (or difference) between 2 populations, while rate ratios are a measure of the relative gap (or difference) between 2 population groups. Both measures are considered useful when examining health inequalities because they provide different information—rate differences tell us which leading causes of the gap should be targeted in order to reduce the overall mortality gap, whereas rate ratios tell us which causes have the greatest relative disparities between the Indigenous and non-Indigenous populations.

B.3.5 Indirect methods for deriving Indigenous morbidity estimates

Prevalence estimates for the Indigenous population, by age and sex, are required for each disease and injury included in the ABDS 2011 in order to calculate Indigenous burden of disease estimates. Prevalence estimates can be taken directly from disease registers, health surveys or epidemiological studies, or indirectly from other sources, such as incidence data. However, for some causes, there is no data source that can provide a reliable prevalence estimate for the Indigenous population.

In such cases, indirect methods are required to derive prevalence estimates for the Indigenous population. Such methods include:

- apply Indigenous: non-Indigenous hospitalisation rate ratios to the total population prevalence
- apply Indigenous: non-Indigenous rate ratios from other relevant data sources (for example, mortality data, health surveys, health services data, epidemiological studies) to the total population prevalence
- source data from international literature on disease prevalence in other indigenous populations (for example, apply Maori: non Maori prevalence rate ratios or assume Maori prevalence rates)
- use the total population prevalence estimate for the Indigenous population estimate (assumes the same prevalence for the cause in both population groups).

Potential indirect methods were assessed based on a set of guidelines and criteria developed by the AIHW which covered 8 dimensions relating to the data source used in the indirect method (for example, comparability, relevance and representativeness, currency, accuracy, coverage, statistical uncertainty, measurement error and credibility). This assessment was used in conjunction with expert advice to determine the most appropriate indirect method to derive an Indigenous prevalence estimate for each cause.

There were 41 diseases across 8 disease groups where indirect methods were used to derive Indigenous prevalence for either the whole or part of the disease. Of these, 13 (32%) used hospitalisation rate ratios, 29 (71%) used rate ratios from other data sources, and 2 (5%) used Maori prevalence rates. A list of these diseases and sequela and the indirect methods used can be found in Appendix Table B7. Mental and substance use disorders represented the large majority (85%) of the Indigenous YLD produced based on indirect methods (and accounted for 9 of the diseases).

A further 11 diseases used national prevalence rates to derive Indigenous prevalence for the whole disease, representing 5% of total Indigenous YLD in 2011; and an additional 11 diseases used national ratios to derive Indigenous prevalence for particular sequelae (applied to Indigenous hospitalisations or cancer incidence rates) (Appendix Table B8).

It should be noted that adjustments made based on linked hospital data were drawn from a single jurisdiction and may not apply equally to all hospitalisation data.

B.3.6 Indigenous subnational estimates

Indigenous subnational estimates are reported for selected state and territories (New South Wales, Queensland, Western Australia and the Northern Territory), remoteness categories and socioeconomic quintile at the disease group level only. Estimates were calculated at the disease group level only (not at the detailed cause level) due to small numbers:

- State and territory-level estimates are not presented for Victoria, South Australia, Tasmania and the Australian Capital Territory, due to a number of issues relating to the calculation of Indigenous YLL estimates (which are also used in the calculation of DALY estimates). This includes the small number of Indigenous deaths reported for these jurisdictions each year, individual mortality adjustment factors are not available from the ABS for these states and territories, and the use of a combined adjustment factor produced by the ABS for these 4 states and territories results in implausible Indigenous YLL estimates.
- Estimates for all 5 categories of remoteness are reported (*Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote*.
- The 2011 IRSEO index is used to examine variation in the burden of disease for the Indigenous population by level of socioeconomic disadvantage (Biddle 2013). The index incorporates 9 variables from the 2011 Census of Population and Housing that measure employment, occupation, education, income and housing. The IRSEO index was originally calculated at the Indigenous Area level and has been converted to Statistical Area Level 2 (SA2) using a population-weighted concordance. The IRSEO index is considered to be more suitable for use for the Indigenous population than traditional measures of socioeconomic disadvantage used in Australia such as SEIFA. SEIFA scores for each geographical unit are calculated based on the socioeconomic characteristics of the entire population and thus they may not accurately reflect levels of socioeconomic disadvantage in the Indigenous population.

Indigenous subnational estimates of YLL were calculated directly from mortality data adjusted for Indigenous under-identification using state/territory and remoteness specific adjustment factors.

For Indigenous YLD estimates, a proxy approach was used to disaggregate national YLD into subnational categories. This involved applying the subnational distribution pattern for a particular disease group from either hospitalisation data (adjusted for under-identification) or health survey data (the 2012–13 AATSIHS) to disaggregate the national-level Indigenous YLD estimates for each disease group. Hospitalisation data were used for 10 disease groups and health survey data were used for 6 disease groups for state/territory and remoteness estimates. The subnational Indigenous population structure was used for 1 disease group (skin disorders). For estimates by socioeconomic quintile, hospitalisation data were used for all disease groups as SA2-level data were available from this data collection which was required to calculate the IRSEO index. The purpose of hospital administrative data is not estimation of prevalence/incidence of disease and these estimates should be treated with caution.

The data source used for each disease group to disaggregate Indigenous YLD into subnational categories can be found in Appendix Table B9; and the subnational proportions used to disaggregate Indigenous YLD estimates for each disease group can be found in Appendix tables B10–B12.

Indigenous DALY estimates were then calculated by summing the YLL and YLD estimates for each disease group and subnational category.

The same approach as outlined here was used to produce subnational estimates for the non-Indigenous population, with the 2011–12 AHS used as the data source to determine proportional splits in place of the 2012–13 AATSIHS. It should be noted that the sum of the Indigenous and non-Indigenous YLD and DALY estimates for each subnational category will not always equal the subnational estimate published for the total Australian population in the AIHW's report *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016a). This is because different methods and/or data sources may have been used to calculate these estimates.

B.3.7 Assessment of changes over time and population denominator issues

The population denominators used to calculate rates for 2003 and 2011 Indigenous burden of disease estimates are the ABS Aboriginal and Torres Strait Islander population estimates as at 30 June 2003 and 30 June 2011 based on the 2011 Census (ABS 2014b). This population series inherently applies the Indigenous identification level in 2011 to earlier years in the series, including for 2003, in the backcast methods used. The backcasting method also assumes that Aboriginal and Torres Strait Islander life expectancy at birth increased by 0.3 years per year for males and 0.15 years per year for females between 2006 and 2011. It increased by 0.2 years per year for males and 0.15 years per year females between 1996 and 2006.

Using this backcast population for 2003 estimates provides consistency between the denominators used for 2003 and 2011 Indigenous burden of disease estimates, which is very important for assessing rate changes over time.

Indigenous YLL estimates for 2003 and 2011 will be consistent in terms of Indigenous identification in both the numerator and denominator (as adjustment factors used take into account under-identification in both mortality and population data based on the 2011 Census). However, it is important to note that some Indigenous YLD rates which have not had any adjustments made for under-identification may be affected by numerator/denominator inconsistencies (as disease occurrence in 2003 and 2011 may not always follow the same identification as population measurements in 2011). This should be kept in mind when interpreting any changes over time in Indigenous burden of disease estimates reported.

B.3.8 Estimating the impact of chronic diseases

Chronic diseases are the leading causes of illness, disability and death in Australia, in both Indigenous and non-Indigenous people. For the purposes of this report, the group 'all chronic diseases' was defined which includes cardiovascular diseases, mental & substance use disorders, cancer, diabetes, CKD, CLD, hearing loss, vision loss and selected musculoskeletal, neurological, respiratory and congenital conditions. A complete list of the specific diseases and disease groups included in the group 'all chronic diseases' is in Appendix Table B13.

Note that this 'all chronic diseases' group is different to that used for the national component of the ABDS 2011, and to the grouping commonly used in other AIHW reports. The 'all chronic diseases' group defined for this report contains a range of conditions which for a range of reasons are not included in general AIHW reporting on chronic diseases, such as CLD, hearing and vision loss, certain neurological conditions (for example, multiple sclerosis) and some congenital conditions (for example, Down syndrome). Appendix Table B13 notes which conditions are not included in the definition of chronic disease used in the national component of the ABDS 2011.

Table B1: Disease and injury list used in the ABDS factors, 2011

Infectious diseases

Barmah Forest virus
Campylobacteriosis
Chlamydia
Dengue
Diphtheria
Gonorrhoea
HIV/AIDS
Haemophilus influenza 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 & asphyxia
Brain malformations
Cardiovascular defects
Cerebral palsy
Cleft lip and/or palate
Down syndrome
Gastrointestinal malformations
Neonatal infections
Neural tube defects
Other chromosomal abnormalities
Other congenital conditions
Other disorders of infancy
Pre-term birth & low birthweight complications
Sudden infant death syndrome
Urogenital malformations

Cancers 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

Cancers and other neoplasms (continued)

Melanoma of the skin
Mesothelioma
Mouth & pharyngeal cancer
Myeloma
Non-Hodgkin lymphoma
Non-melanoma skin cancer
Oesophageal cancer
Other benign, insitu 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 disease
Pneumoconiosis
Sarcoidosis
Upper respiratory conditions

Gastrointestinal disorders

Abdominal wall hernia
Appendicitis
Chronic liver disease
Diverticulitis
Functional gastrointestinal disorders (FGID)
Gallbladder and bile duct disease
Gastro Oesophageal Reflux Disease (GORD)
Gastroduodenal disorders
Inflammatory bowel disease (IBD)
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

continued

Table B1: (continued): Disease and injury list used in the ABDS factors, 2011

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 conditions

Chronic kidney disease
Enlarged prostate
Kidney stones
Other kidney and urinary diseases

Reproductive and maternal conditions

Early pregnancy loss
Endometriosis
Genital prolapse
Gestational diabetes

Reproductive and maternal conditions (continued)

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 disorders (continued)

Skin infections (incl. 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

External causes of Injury (continued)

Suicide & 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 B2: Standard life table: life expectancy (years) at age of death for all persons

Age at death	Life expectancy	Age at death	Life expectancy	Age at death	Life expectancy	Age at death	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 B3: Risk factor list used for Indigenous estimates in the ABDS 2011

Risk factor/cluster	Component
Air pollution	Particulate matter (2.5µg/m3)
Unimproved sanitation	
Alcohol use	Daily intake
	Binge drinking
Childhood sexual abuse	
Dietary risk factors	Diet low in fibre
	Diet low in fruit
	Diet low in milk
	Diet low in nuts and seeds
	Diet high in processed meats
	Diet high in red meat
	Diet high in saturated fat
	Diet high in sodium
	Diet high in sugar sweetened beverages
	Diet low in seafood omega 3 fatty acids
	Diet low in vegetables
	Diet low in whole grains
Drug use	Illicit drug use: cocaine
	Illicit drug use: opioids
	Illicit drug use: amphetamines
	Illicit drug use: injecting drug use
High blood pressure	
High body mass	
High blood plasma glucose	
High total cholesterol	
Intimate partner violence	
Iron deficiency	
Low bone mineral density	
Occupational risks	Injuries
	Occupation
	Industry
Physical inactivity	
Tobacco smoking	Smoking
	Smoking: second hand
Unsafe sex	

Table B4: Mortality adjustment factors used for Indigenous national and subnational YLL estimates

	ABS CDE study adjustment factor	AIHW EMD study adjustment factor
2003 and 2011 Indigenous national and 2011 Indigenous socioeconomic group estimates		
0–14	1.21	..
15–59	1.12	..
60 and over	1.29	..
2011 Indigenous state/territory estimates		
New South Wales	1.42	..
Queensland	1.24	..
Western Australia	1.14	..
Northern Territory	0.96	..
2011 Indigenous remoteness estimates		
Major cities	..	1.25
Inner regional	..	1.22
Outer regional	..	1.12
Remote	..	1.04
Very remote	..	1.02

Source: ABS 2013c; AIHW 2012.

Table B5: Hospitalisation adjustment factors used for 2011 Indigenous YLD estimates (from AIHW 2011-12 Indigenous identification in hospital separations data quality study)

State/territory	Remoteness category	Correction factor
NSW	Major cities	1.37
	Inner regional	1.09
	Outer regional	1.08
	Remote and Very remote	1.02
Victoria	Major cities	1.41
	Inner regional	1.06
	Outer regional	1.09
Queensland	Major cities	1.17
	Inner regional	1.12
	Outer regional	1.04
	Remote and Very remote	0.97
WA	Major cities	0.99
	Inner regional	1.02
	Outer regional	1.00
	Remote	1.07
	Very remote	1.00
SA	Major cities	1.16
	Inner regional and Outer regional	1.03
	Remote and Very remote	1.00
Tasmania	Inner regional	1.37
ACT	Major cities	1.69
NT	Outer regional	1.03
	Remote	0.99
	Very remote	1.00
Total		**1.09**

Table B6: Hospitalisation adjustment factors used for 2003 Indigenous YLD estimates (from AIHW 2007–08 Indigenous identification in hospital separations data quality study)

Remoteness area	Correction factor
Major cities	1.25
Inner regional	1.11
Outer regional	1.06
Remote and Very remote	1.03
Total	**1.12**

Source: AIHW 2010.

Table B7: Diseases for which Indigenous prevalence estimates for 2011 were derived using indirect methods

Disease[a]	Data source and indirect method
Mental and substance use disorders	
Depressive disorders	Major depressive disorder: Age and sex-specific rate ratios (Indigenous: national) based on Qld linked mental health care data
	Dysthymia: sex specific rate ratios (Indigenous: national) based on Qld linked mental health care data
Anxiety disorders	Age and sex specific rate ratios (Indigenous: national) based on Qld linked mental health care data
Bipolar affective disorder	Age and sex specific rate ratios (Indigenous: national) based on Qld linked mental health care data
Alcohol use disorders	Asymptomatic/Very mild/mild: Age and sex-specific hospitalisation rate ratios (Indigenous: national)
	Moderate/Severe: Age and sex specific rate ratios (Indigenous: national) based on Qld linked mental health care data
Drug use disorders	Cannabis dependence: Age and sex- specific rate ratios (Indigenous: national) based on Qld linked mental health care data
	Amphetamine dependence and opioid dependence: Sex-specific rate ratios (Indigenous: national) based on Qld linked mental health care data
	Cocaine dependence: sex-specific rate ratios (Indigenous: non- Indigenous) from national drug strategy survey data
	Other drug dependence: sex-specific hospitalisation rate ratios (Indigenous: national)
Schizophrenia	Age and sex specific rate ratios (Indigenous: national) based on Qld linked mental health care data
Attention deficit hyperactivity disorder	Average of age-specific rate ratios (Indigenous: non- Indigenous) based on LSIC and Qld linked mental health care data
Conduct disorder	Average of age-specific rate ratios (Indigenous: non- Indigenous) based on LSIC and Qld linked mental health care data
Intellectual disability	Age-specific rate ratios (Indigenous: non- Indigenous) from WA Intellectual Disability Exploring Answers (IDEA) database
Cancer & other neoplasms	
Non-melanoma skin cancer[b]	Diagnosis and primary therapy of simple NMSC: Applied Indigenous: national ratio of complex NMSC
Ductal carcinoma in situ[b]	Mastectomy due to DCIS: applied ratio of Indigenous: national diagnosed breast cancer <2 cm to national DCIS incidence
Cardiovascular diseases	
Peripheral vascular disease	New Zealand Maori rates were applied to the Indigenous population.
Atrial fibrillation and flutter	Overall AF was obtained by applying the New Zealand Maori rates to the Indigenous population.
Infectious diseases	
Syphilis	Age and sex-specific hospital separation and notification rate ratios (Indigenous: national)
Other sexually transmitted infections[b]	Genital herpes: Rate ratio of Indigenous to national herpes simplex virus II sero-prevalence
Hepatitis B (acute)	Age- and sex-specific notification rate ratios (Indigenous: national)
Hepatitis C (acute)	Age- and sex-specific notification rate ratios (Indigenous: national)
Upper respiratory tract infections	Age- and sex-specific hospital separation rate ratios (Indigenous: national)
Otitis media	Age- and sex-specific rate ratios (Indigenous: national) of self-reported diseases of the ear and mastoid process (AHS 2011-13)
Lower respiratory tract infections	Age- and sex-specific hospital separation rate ratios (Indigenous: national)

continued

Table B7 (continued): Diseases for which Indigenous prevalence estimates for 2011 were derived using indirect methods

Disease[(a)]	Data source and indirect method
Infectious diseases (continued)	
Influenza	Age- and sex-specific hospital separation rate ratios (Indigenous: national)
Varicella-zoster	Age- and sex-specific chickenpox and shingles notification rate ratios (Indigenous: national)
Campylobacteriosis	Age- and sex-specific hospital separation rate ratios (Indigenous: national)
Salmonellosis	Age- and sex-specific hospital separation rate ratios (Indigenous: national)
Rotavirus	Age- and sex-specific hospital separation rate ratios (Indigenous: national)
Reproductive & maternal	
Early pregnancy loss	Indigenous: national age specific rate ratios from hospital separations for medical abortions applied to national rate of Medicare data, in addition to adjusted hospitalisations data.
Genital prolapse	Indigenous: national rate ratios from hospital separations for genital prolapse applied to national rate.
Infant and congenital conditions	
Pre-term birth & low birthweight complications	Age-specific rate ratios (Indigenous: non-Indigenous) from WA IDEA database
Birth trauma & asphyxia	Age-specific rate ratios (Indigenous: non-Indigenous) from WA IDEA database
Cerebral palsy	Sex-specific rate ratios (Indigenous: non-Indigenous) from the Australian Cerebral Palsy Register (ACPR), age distribution obtained from national estimates
Neural tube defects	Applied Indigenous birth prevalence rate obtained from WA Register of Developmental Anomalies (WARDA) to national estimates
Cardiovascular defects	Applied Indigenous birth prevalence rate obtained from WARDA to national estimates
Cleft lip and/or palate	Applied Indigenous birth prevalence rate obtained from WARDA to national estimates
Gastrointestinal malformations	Applied Indigenous birth prevalence rate obtained from WARDA to national estimates
Urogenital malformations	Applied Indigenous birth prevalence rate obtained from WARDA to national estimates
Down syndrome	Age-specific rate ratios (Indigenous: non-Indigenous) from WA IDEA database
Brain malformations	Age-specific rate ratios (Indigenous: non-Indigenous) from WA IDEA database
Oral disorders	
Dental caries and pulpitis	Indigenous: national rate ratios from National Survey of Adult Oral Health 2004–06 (age ≥15) and Child Dental Health Survey 2009 (age <15) were applied to national age and sex distributions.
Periodontal disease	Indigenous: national rate ratios from National Survey of Adult Oral Health 2004–06 and Child Dental Health Survey 2009 were applied to national age and sex distributions.
Skin disorders	
Ulcers	Other chronic skin ulcers: used hospital rate ratio to determine prevalence start point, then applied national pattern of prevalence by age. Pressure ulcers (skin): applied hospital rate ratios to total population prevalence by age and sex.

(a) Excludes residual ('other') diseases within each disease group which also used indirect methods such as hospitalisation rate ratios in many instances (6 in total).

(b) Applicable to listed sequelae only.

Table B8: Diseases for which national rates or ratios were assumed to derive Indigenous prevalence estimates for 2011

Disease	Data source and indirect method
Cancer & other neoplasms	
Breast cancer[(a)]	Mastectomy due to breast cancer: national incidence: hazard ratio applied for males only.
Prostate cancer[(a)]	Impotence/incontinence due to prostate cancer: national rates of treatments and outcomes for prostate cancer applied to the Indigenous 10-year prevalence of prostate cancer.
Laryngeal cancer[(a)]	Laryngectomy due to laryngeal cancer: national sex-specific laryngectomy incidence hazard rates applied to the Indigenous 10-year prevalence.
Bowel cancer[(a)]	Stoma due to bowel cancer: due to the small number of cases and hospitalisations, the stoma incidence hazard for Indigenous cases was assumed to be the same as national population.
Bladder cancer[(a)]	Stoma/urinary incontinence due to bladder cancer: insufficient data to produce Indigenous-specific rates for the various urinary diversions, so national rates were assumed. The proportion of people experiencing incontinence due to various diversion types was assumed to be the same for the Indigenous population as the national.
Brain and central nervous system cancer[(a)]	Brain injury due to brain cancer: National rates assumed.
Ductal carcinoma in situ[(a)]	Mastectomy due to DCIS: applied ratio of Indigenous: national diagnosed breast cancer <2 cm to national DCIS incidence.
Benign and uncertain brain tumours[(a)]	Brain injury due to benign and uncertain brain tumours: national rates assumed.
Infectious diseases	
Other sexually transmitted infections[(a)]	Genital warts: Assumed no difference in the prevalence rate of Indigenous genital warts (based on analysis of BEACH, NHMD and the results of 2 epidemiological studies of HPV).
Mental & substance use disorders	
Eating disorders	Assume same prevalence rate as national
Autism spectrum disorders	Assume same prevalence rate as national
Gastrointestinal disorders	
Gastroduodenal disorders	Assume same prevalence rate and inflation factor as national
Inflammatory bowel disease	Assume same prevalence rate as national
Gastro Oesophageal Reflux Disease	Assume same prevalence rate as national
Functional gastrointestinal disorders	Assume same prevalence rate as national
Neurological conditions	
Parkinson disease	National prevalence rates and severity distribution were applied to the Indigenous population.
Multiple sclerosis	The national prevalence: separation ratio was applied to the count of Indigenous MS hospital separations. The severity distribution used for Indigenous is the same one used for national estimates.
Guillain-Barré Syndrome	The national persons: separation ratio was applied to the count of Indigenous GBS hospital separations.
Skin disorders	
Acne	Assume same prevalence rate as national
Dermatitis and eczema	Assume same prevalence rate as national
Reproductive & maternal	
Endometriosis	Assume same prevalence as total Australian population for endometriosis. Adjusted hospital separations used for severe endometriosis and subtracted from total endometriosis estimates to inform mild estimates.
Infertility	Assume same prevalence rate as national (including all sequelae of the infertility envelope).

(a) Applicable to listed sequelae only.

Table B9: Data source used for subnational distribution of Indigenous non-fatal burden estimates

	State/territory	Remoteness	Socioeconomic quintile
Infectious diseases	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Infant/congenital	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Cancer	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Cardiovascular	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Respiratory	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Gastrointestinal	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Neurological	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Mental & substance use	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Endocrine	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Kidney/urinary	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Reproductive/maternal	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Musculoskeletal	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Hearing/vision	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Skin	Population distribution	Population distribution	Adjusted hospitalisations
Oral	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Blood/metabolic	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Injuries	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations

Table B10: Subnational proportions used for distribution of non-fatal burden estimates by state/territory, by Indigenous status

	Indigenous				Non-Indigenous			
	NSW	Qld	WA	NT	NSW	Qld	WA	NT
Infectious diseases	23.2	25.3	17.0	21.4	29.7	21.7	9.7	0.6
Infant/congenital	31.4	27.2	11.6	10.0	32.6	18.5	10.8	0.6
Cancer	30.5	27.6	11.7	7.5	27.5	23.1	10.6	0.4
Cardiovascular	26.8	27.6	15.0	12.1	30.5	20.3	9.6	0.6
Respiratory	38.5	24.9	11.7	4.7	30.7	19.9	10.9	0.7
Gastrointestinal	30.0	24.8	14.5	10.1	30.9	20.5	9.7	0.6
Neurological	29.9	27.6	13.8	8.7	25.0	22.4	10.6	0.4
Mental/substance use	32.3	28.6	12.8	8.3	31.7	19.5	10.0	0.6
Endocrine	35.4	20.9	19.0	12.0	36.4	22.9	9.8	1.1
Kidney/urinary	25.8	27.2	17.1	20.1	34.7	20.2	10.9	0.7
Reproductive/maternal	27.8	29.7	13.5	12.4	30.3	21.3	10.6	1.0
Musculoskeletal	33.4	28.2	10.9	6.3	33.4	19.4	10.5	0.6
Hearing/vision	32.3	28.6	12.8	8.3	33.4	19.8	10.0	0.7
Skin	31.1	28.2	13.2	10.3	32.3	19.8	10.5	0.7
Oral	22.4	27.4	14.0	13.1	25.3	18.8	13.8	0.4
Blood/metabolic	20.8	25.5	14.4	22.5	23.8	21.0	11.9	0.4
Injuries	24.1	24.7	19.4	16.7	30.1	20.4	10.5	0.8

Note: Proportions for respiratory disease, endocrine disorders, kidney & urinary diseases, musculoskeletal conditions, mental & substance use disorders and hearing & vision disorders calculated from the AATSIHS 2012–13 (Indigenous) and AHS 2011–12 (non-Indigenous). Proportions for skin disorders based on the Indigenous and non-Indigenous population distributions. All other disease group proportions calculated from the NHMD.

Table B11: Subnational proportions used for distribution of non-fatal burden by remoteness, by Indigenous status

	Indigenous					Non-Indigenous				
	Major cities	Inner regional	Outer regional	Remote	Very remote	Major cities	Inner regional	Outer regional	Remote	Very remote
Infectious diseases	24.3	16.2	20.9	15.4	23.2	66.3	21.3	10.2	1.5	0.7
Infant/ congenital	35.2	23.8	20.4	7.9	12.7	71.4	19.1	8.0	1.1	0.4
Cancer	35.7	23.7	20.0	9.0	11.5	67.6	22.1	8.9	1.1	0.3
Cardiovascular	27.1	20.4	22.6	13.6	16.3	64.9	23.5	10.0	1.2	0.4
Respiratory	42.5	25.4	19.8	6.2	6.1	69.4	20.3	8.7	1.2	0.4
Gastrointestinal	33.7	20.7	22.0	11.4	12.2	68.1	21.6	8.9	1.1	0.4
Neurological	34.6	21.7	20.4	12.2	11.1	68.2	21.3	9.1	1.1	0.4
Mental/ substance use	37.7	21.0	23.2	6.7	11.1	70.0	19.8	8.1	1.5	0.6
Endocrine	28.8	17.4	25.6	9.8	18.4	67.7	22.0	8.8	1.1	0.4
Kidney/urinary	23.2	12.2	20.8	12.2	31.4	74.0	19.7	5.4	0.7	0.2
Reproductive/ maternal	29.9	20.6	23.7	10.7	15.2	71.2	17.9	8.9	1.4	0.5
Musculoskeletal	38.3	24.9	20.8	7.3	8.6	67.4	21.8	9.0	1.4	0.4
Hearing/vision	35.2	23.1	22.7	7.9	11.2	69.6	20.1	8.8	1.2	0.4
Skin	34.8	22.0	21.8	7.7	13.7	71.3	18.3	8.7	1.2	0.5
Oral	29.9	22.6	19.3	11.6	16.6	69.4	19.7	9.4	1.1	0.3
Blood/ metabolic	25.1	18.9	23.2	11.7	21.2	68.7	20.9	9.0	1.1	0.3
Injuries	27.5	16.9	20.0	15.2	20.4	66.1	21.6	10.1	1.6	0.6

Note: Proportions for respiratory disease, endocrine disorders, kidney & urinary diseases, musculoskeletal conditions, mental & substance use disorders and hearing & vision disorders calculated from the AATSIHS 2012–13 (Indigenous) and AHS 2011–12 (non-Indigenous). Proportions for skin disorders based on the Indigenous and non-Indigenous population distributions. All other disease group proportions calculated from the NHMD.

Table B12: Subnational proportions used for distribution of non-fatal burden by socioeconomic quintile, Indigenous Australians

	Indigenous (IRSEO Index)				
	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)
Infectious diseases	13.3	19.6	28.9	16.1	22.1
Infant/congenital	17.9	25.7	29.3	16.8	10.3
Cancer	25.0	25.5	25.1	15.4	9.0
Cardiovascular	14.9	21.0	27.0	20.2	17.0
Respiratory	15.7	23.5	28.8	16.9	15.1
Gastrointestinal	17.3	24.4	28.1	17.9	12.3
Neurological	20.6	24.6	26.3	18.5	10.0
Mental/substance use	22.8	22.0	28.7	15.4	11.2
Endocrine	12.3	20.1	27.2	21.0	19.5
Kidney/urinary	17.0	24.3	27.3	15.6	15.9
Reproductive/maternal	16.3	23.8	29.3	17.1	13.6
Musculoskeletal	20.6	24.3	25.8	15.6	13.7
Hearing/vision	14.8	21.1	26.6	16.3	21.1
Skin	12.5	18.3	27.8	16.2	25.2
Oral	16.8	20.3	26.9	18.5	17.6
Blood/metabolic	14.8	20.9	24.6	17.7	22.0
Injuries	14.7	21.0	27.6	16.6	20.1

Note: All proportions calculated from the NHMD.

Table B13: Diseases included in the group 'all chronic diseases' in the Indigenous component of the ABDS 2011

Disease groups
all cancer
all cardiovascular diseases
all mental & substance use disorders
Individual diseases
asthma
back pain & problems
cerebral palsy*
chronic kidney disease*
chronic liver disease*
chronic obstructive pulmonary disease (COPD)
cystic fibrosis*
dementia*
dermatitis and eczema*
diabetes
Down syndrome*
endometriosis*
epilepsy*
haemophilia*
hearing loss*
infertility*
inflammatory bowel disease (IBD)*
motor neurone disease*
multiple sclerosis*
neural tube defects*
osteoarthritis
Parkinson disease*
polycystic ovarian syndrome*
psoriasis*
rheumatoid arthritis
vision loss*

* Not included in the definition of 'chronic diseases' used in the national component of the ABDS 2011.

Appendix C: 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 reference life table, disability weights and relative risks) were reviewed and assessed as appropriate by the study's EAG and IRG 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 EAG and IRG.
- All models and inputs used in YLL and YLD estimates were reviewed by disease-specific experts and other experts to ensure their appropriateness for Australian and Indigenous populations. Methods for particular risk factors were also reviewed by experts.
- A Quality Index was produced to assist the user in interpreting the reliability of estimates within this framework.

ABDS 2011 Indigenous-specific 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 2-dimensional *quality index* based on:

- the relevance and quality of the source data
- 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 2 dimensions, weighted for the contribution to the overall disease-level estimate or risk-factor-level estimate.

The Indigenous-specific Quality Index is an extension of the ABDS Quality Index which was developed for assessment of national estimates from the ABDS to incorporate Indigenous-specific criteria to address data quality issues relevant to Indigenous estimates.

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 with little data transformation required. For Indigenous estimates, the data source is highly specific to the Indigenous population and there are no known under-identification issues, or if there are, appropriate adjustment factors are available. The estimates can be considered to be highly indicative of the health loss experienced by the Indigenous population due to these diseases or risk factors.

- C–D: moderately relevant/accurate: estimate is derived from reasonably comprehensive and relevant data with only moderate transformations required, including taking into account known trends in the underlying data (such as over time or age distributions). For Indigenous estimates, there may be some gaps (for example, Indigenous under-identification) that require a secondary data source to fill. These estimates can be considered to be moderately indicative of the health loss incurred from 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. For Indigenous estimates, this may involve using indirect estimates obtained from a proxy data source to fill in considerable gaps. These estimates are to be considered as possibly indicative of the health loss experienced by the Indigenous population, and should be used with some caution.

More detailed information on the ABDS Quality Index, the Indigenous-specific Quality Index and the criteria and methods used, is provided in a separate technical report *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016b).

Fatal burden estimates

Using the Indigenous-specific Quality Index, all mortality data (adjusted for Indigenous under-identification), 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 injury-related deaths are classified by the external cause; subsequent mapping is required to estimate fatal burden by nature.

Fatal estimates account for around 53% of the total DALY experienced by Indigenous Australians.

Non-fatal burden estimates

YLD estimates, which also account for around 47% of the total DALY experienced by Indigenous Australians, 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.

Relevance and quality of data sources

Over half (57%) of diseases (accounting for 42% of Indigenous 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 Indigenous population. This includes most cancer, cardiovascular, gastrointestinal, kidney & urinary, musculoskeletal, neurological, blood & metabolic and injuries estimates; and some infectious diseases, respiratory, hearing & vision and reproductive & maternal burden.

A further 13% (accounting for 5% Indigenous 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 Indigenous 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, cardiovascular defects, gastroduodenal disorders and GORD, and some of the remaining infectious and oral diseases.

Only 5.7% of causes (6.8% of Indigenous 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 reliability to the Australian context; or indirectly from secondary data sources. Examples of these causes include conduct disorder, autism spectrum disorders, dermatitis & eczema, eating disorders, attention deficit hyperactivity disorder and genital prolapse.

Methods of transformation to overcome data shortcomings

Nearly half (46%) of diseases estimated (accounting for 31% of Indigenous YLD) could be derived with no transformation required or using accepted adjustment factors (for example, for Indigenous under-identification) (Appendix Table C1). A further 30% (accounting for 49% of Indigenous YLD) were derived from data where there were known issues with Indigenous under-identification; but no evidence of a difference between the Indigenous and the national population. Around 18% of diseases (accounting for 12% of Indigenous YLD) relied on deriving prevalence based on other epidemiological measures, or indirect methods from other (related) data sources. Only 6.3% of diseases (6.9% of Indigenous YLD) relied on indirect modelling methods or inferences of distribution from other (unrelated) data sources or expert advice.

Table C1: 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	19.3	6.4	13.6	2.5
B	37.5	35.9	32.4	28.9
C	12.5	4.9	30.1	49.4
D	25.0	45.9	17.6	12.4
E	5.7	6.8	6.3	6.9

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 83% of risk factors—this accounts for 83% of the attributable DALY.

For 83% of risk factors (accounting for 88% of attributable DALY), exposure was able to be derived with no transformation required or using known trends and applying appropriate Indigenous under-identification adjustment factors (Appendix Table C2).

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 C2: 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	75.9	61.3	6.9	12.3
B	6.9	21.8	75.9	75.7
C	3.4	11.4	10.3	7.2
D	13.8	5.5	6.9	4.8
E	–	–	–	–

Older age groups

Care should also be taken when comparing disease-level information in age groups over 75. Data for this population is often limited, leading to greater variability.

Appendix D: Additional tables

Gap in health outcomes

Health gap by disease group

Table D1: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, males, 2011

Disease group	DALY per 1,000[(a)]		Rate ratio	Rate difference	Contribution to total rate difference (%)
	Indigenous	Non-Indigenous			
Cardiovascular	87.7	33.5	2.6	54.2	19.7
Injuries	70.5	24.3	2.9	46.2	16.8
Mental & substance use	64.9	24.7	2.6	40.1	14.6
Cancer	66.1	40.3	1.6	25.8	9.4
Respiratory	38.0	16.2	2.4	21.9	8.0
Endocrine	22.8	5.0	4.5	17.8	6.5
Gastrointestinal	19.0	6.7	2.8	12.3	4.5
Neurological	23.6	11.5	2.1	12.1	4.4
Kidney/urinary	14.8	2.7	5.4	12.1	4.4
Infectious diseases	12.7	3.4	3.8	9.3	3.4
Musculoskeletal	28.4	20.2	1.4	8.2	3.0
Infant/congenital	11.4	5.8	2.0	5.6	2.0
Blood/metabolic	5.7	1.8	3.2	3.9	1.4
Oral	7.2	4.4	1.6	2.7	1.0
Hearing/vision	6.8	4.5	1.5	2.3	0.8
Skin	3.9	3.3	1.2	0.5	0.2
Reproductive/ maternal	0.3	0.4	0.9	–	–
All diseases	**483.7**	**208.6**	**2.3**	**275.0**	**100.0**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Table D2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, females, 2011

Disease group	DALY per 1,000[(a)]		Rate ratio	Rate difference	Contribution to total rate difference (%)
	Indigenous	Non-Indigenous			
Cardiovascular	58.1	18.4	3.2	39.7	18.2
Mental & substance use	51.1	22.5	2.3	28.5	13.1
Respiratory	40.6	15.3	2.6	25.3	11.6
Injuries	30.9	9.0	3.4	21.9	10.0
Cancer	49.7	28.5	1.7	21.3	9.7
Endocrine	21.2	3.2	6.7	18.0	8.2
Kidney/urinary	15.0	1.8	8.5	13.3	6.1
Neurological	24.1	12.9	1.9	11.2	5.1
Musculoskeletal	32.7	23.6	1.4	9.1	4.2
Gastrointestinal	14.1	5.0	2.8	9.1	4.2
Infectious diseases	10.2	2.5	4.1	7.7	3.5
Blood/metabolic	6.8	2.3	2.9	4.4	2.0
Infant/congenital	8.4	4.6	1.8	3.8	1.7
Hearing/vision	6.1	3.4	1.8	2.7	1.2
Oral	5.9	3.9	1.5	2.0	0.9
Skin	3.9	3.5	1.1	0.4	0.2
Reproductive/ maternal	3.0	3.1	1.0	–	–
All diseases	**381.8**	**163.3**	**2.3**	**218.5**	**100.0**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Change between 2003 and 2011

Changes in the overall health gap

Table D3: Age-standardised DALY, YLL and YLD rates (per 1,000 people) for Indigenous and non-Indigenous Australians, rate ratios and rate differences, by sex, 2003 and 2011

	Indigenous age-standardised rate	Non-Indigenous age-standardised rate	ASR rate ratio	ASR rate difference
Males				
Total burden (DALY)				
2003	516.3	236.6	2.2	279.7
2011	483.7	208.6	2.3	275.0
Non-fatal burden (YLD)				
2003	181.6	99.9	1.8	81.7
2011	190.3	95.0	2.0	95.3
Fatal burden (YLL)				
2003	334.7	136.7	2.4	198.0
2011	293.4	113.7	2.6	179.7
Females				
Total burden (DALY)				
2003	398.3	178.2	2.2	220.2
2011	381.8	163.3	2.3	218.5
Non-fatal burden (YLD)				
2003	172.1	96.5	1.8	75.6
2011	178.3	93.0	1.9	85.2
Fatal burden (YLL)				
2003	226.2	81.7	2.8	144.5
2011	203.5	70.2	2.9	133.3

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Table D4: Gap measures of total burden (age-standardised DALY rates, rate ratios and rate differences per 1,000 people) by disease group and sex, 2003 and 2011

	Indigenous DALY		Non-Indigenous DALY		Rate ratio		Rate difference	
	2003	2011	2003	2011	2003	2011	2003	2011
Males								
Cardiovascular	109.0	87.7	45.6	33.5	2.4	2.6	63.4	54.2
Injuries	68.3	70.5	26.8	24.3	2.5	2.9	41.5	46.2
Mental & substance use	65.3	64.9	24.8	24.7	2.6	2.6	40.5	40.1
Cancer	62.5	66.1	45.2	40.3	1.4	1.6	17.3	25.8
Respiratory	41.8	38.0	18.5	16.2	2.3	2.4	23.3	21.9
Endocrine	25.2	22.8	5.2	5.0	4.9	4.5	20.1	17.8
Gastrointestinal	22.7	19.0	7.3	6.7	3.1	2.8	15.4	12.3
Neurological	24.2	23.6	9.8	11.5	2.5	2.1	14.5	12.1
Kidney/urinary	15.0	14.8	2.7	2.7	5.6	5.4	12.3	12.1
Infectious diseases	18.2	12.7	4.8	3.4	3.8	3.8	13.4	9.3
Musculoskeletal	28.5	28.4	24.6	20.2	1.2	1.4	3.9	8.2
Infant/congenital	13.2	11.4	6.8	5.8	1.9	2.0	6.4	5.6
Blood/metabolic	4.3	5.7	2.1	1.8	2.0	3.2	2.2	3.9
Oral	7.2	7.2	4.4	4.4	1.6	1.6	2.8	2.7
Hearing/vision	6.8	6.8	4.4	4.5	1.6	1.5	2.4	2.3
Skin	3.7	3.9	3.3	3.3	1.1	1.2	0.5	0.5
Reproductive/maternal	0.3	0.3	0.4	0.4	1.0	0.9	–	–
Females								
Cardiovascular	74.0	58.1	25.7	18.4	2.9	3.2	48.3	39.7
Mental & substance use	48.0	51.1	22.4	22.5	2.1	2.3	25.6	28.5
Respiratory	39.0	40.6	15.6	15.3	2.5	2.6	23.4	25.3
Injuries	28.1	30.9	9.3	9.0	3.0	3.4	18.8	21.9
Cancer	46.8	49.7	32.0	28.5	1.5	1.7	14.8	21.3
Endocrine	24.2	21.2	3.0	3.2	8.1	6.7	21.2	18.0
Kidney/urinary	14.2	15.0	1.8	1.8	8.0	8.5	12.4	13.3
Neurological	23.3	24.1	11.2	12.9	2.1	1.9	12.1	11.2
Musculoskeletal	34.4	32.7	27.5	23.6	1.2	1.4	6.8	9.1
Gastrointestinal	15.1	14.1	5.2	5.0	2.9	2.8	9.9	9.1
Infectious diseases	14.7	10.2	3.3	2.5	4.5	4.1	11.5	7.7
Blood/metabolic	6.8	6.8	2.3	2.3	3.0	2.9	4.5	4.4
Infant/congenital	10.1	8.4	5.1	4.6	2.0	1.8	5.0	3.8
Hearing/vision	6.1	6.1	3.4	3.4	1.8	1.8	2.7	2.7
Oral	6.0	5.9	3.9	3.9	1.5	1.5	2.0	2.0
Skin	4.7	3.9	3.4	3.5	1.4	1.1	1.3	0.4
Reproductive/maternal	3.0	3.0	3.1	3.1	1.0	1.0	–0.1	–

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Table D5: Gap measures of non-fatal burden (age-standardised YLD rates, rate ratios and rate differences per 1,000 people) by disease group and sex, 2003 and 2011

	Indigenous DALY		Non-Indigenous DALY		Rate ratio		Rate difference	
	2003	2011	2003	2011	2003	2011	2003	2011
Males								
Mental & substance use	59.0	60.4	23.7	23.7	2.5	2.5	35.3	36.7
Injuries	11.7	19.2	4.9	5.2	2.4	3.7	6.7	14.0
Respiratory	20.3	20.5	11.9	10.8	1.7	1.9	8.4	9.7
Neurological	13.6	14.0	4.9	5.5	2.8	2.6	8.7	8.5
Musculoskeletal	27.1	27.0	24.1	19.7	1.1	1.4	3.0	7.4
Kidney/urinary	6.4	5.5	0.8	1.0	8.2	5.3	5.6	4.4
Cardiovascular	9.6	9.9	8.0	6.9	1.2	1.4	1.6	3.0
Infectious diseases	4.6	3.9	1.2	1.2	3.7	3.4	3.4	2.8
Oral	7.1	7.1	4.4	4.4	1.6	1.6	2.7	2.7
Hearing/vision	6.8	6.8	4.4	4.5	1.6	1.5	2.4	2.3
Endocrine	3.6	4.2	2.0	2.4	1.8	1.7	1.6	1.8
Blood/metabolic	2.0	2.1	0.5	0.4	4.1	4.9	1.5	1.7
Infant/congenital	2.1	2.1	1.0	1.0	2.1	2.0	1.1	1.0
Skin	3.2	3.2	3.1	3.1	1.1	1.0	0.2	0.1
Reproductive/maternal	0.3	0.3	0.3	0.3	1.0	1.0	–	–
Gastrointestinal	2.6	2.3	2.4	2.4	1.1	1.0	0.2	−0.1
Cancer	1.7	1.8	2.3	2.4	0.7	0.8	−0.6	−0.6
Females								
Mental & substance use	45.9	49.1	21.9	22.1	2.1	2.2	24.0	27.0
Respiratory	23.7	25.7	11.7	11.8	2.0	2.2	12.1	14.0
Musculoskeletal	31.3	30.8	26.8	22.9	1.2	1.3	4.5	7.9
Neurological	16.9	14.8	7.2	7.7	2.4	1.9	9.7	7.1
Injuries	4.9	7.7	1.7	1.9	2.8	4.0	3.1	5.8
Cardiovascular	9.5	8.5	4.9	4.0	2.0	2.1	4.7	4.5
Kidney/urinary	3.1	4.5	0.4	0.5	7.1	9.1	2.7	4.0
Endocrine	4.8	5.4	1.2	1.5	3.9	3.5	3.5	3.9
Infectious diseases	5.4	4.7	1.1	1.0	4.9	4.5	4.3	3.7
Hearing/vision	6.1	6.1	3.4	3.4	1.8	1.8	2.7	2.7
Blood/metabolic	3.5	3.6	1.2	1.1	2.9	3.2	2.2	2.5
Oral	6.0	5.9	3.9	3.9	1.5	1.5	2.0	2.0
Infant/congenital	1.4	1.1	0.6	0.6	2.1	1.8	0.7	0.5
Skin	3.6	3.4	3.2	3.4	1.1	1.0	0.3	–
Gastrointestinal	2.3	2.4	2.5	2.5	0.9	1.0	−0.2	–
Reproductive/maternal	2.5	2.8	3.0	3.0	0.8	0.9	−0.5	−0.2
Cancer	1.5	1.6	1.8	1.8	0.9	0.9	−0.2	−0.2

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Table D6: Gap measures of fatal burden (age-standardised YLL rates, rate ratios and rate differences per 1,000 people) by disease group and sex, 2003 and 2011

	Indigenous DALY		Non-Indigenous DALY		Rate ratio		Rate difference	
	2003	2011	2003	2011	2003	2011	2003	2011
Males								
Cardiovascular	99.5	77.8	37.7	26.7	2.6	2.9	61.8	51.2
Injuries	56.7	51.3	21.9	19.1	2.6	2.7	34.8	32.2
Cancer	60.8	64.3	42.9	37.8	1.4	1.7	17.9	26.4
Endocrine	21.7	18.6	3.2	2.6	6.8	7.2	18.5	16.0
Gastrointestinal	20.1	16.7	4.9	4.3	4.1	3.9	15.2	12.4
Respiratory	21.5	17.5	6.6	5.4	3.3	3.3	14.9	12.1
Kidney/urinary	8.6	9.3	1.9	1.7	4.5	5.5	6.7	7.6
Infectious diseases	13.6	8.8	3.5	2.2	3.8	4.0	10.0	6.6
Infant/congenital	11.1	9.3	5.8	4.8	1.9	2.0	5.3	4.6
Neurological	10.6	9.7	4.9	6.0	2.2	1.6	5.8	3.7
Mental/substance use	6.3	4.4	1.1	1.0	5.8	4.4	5.2	3.4
Blood/metabolic	2.3	3.6	1.6	1.4	1.4	2.7	0.7	2.3
Musculoskeletal	1.4	1.3	0.6	0.5	2.6	2.6	0.9	0.8
Skin	0.5	0.7	0.2	0.2	2.5	3.1	0.3	0.4
Oral	0.1	0.1	–	–	34.9	4.8	0.1	0.1
Hearing/vision	–	–	–	–	..	..	–	–
Reproductive/maternal	–	–	–	–	..	..	–	–
Females								
Cardiovascular	64.4	49.6	20.8	14.4	3.1	3.4	43.6	35.2
Cancer	45.2	48.2	30.2	26.6	1.5	1.8	15.0	21.5
Injuries	23.2	23.2	7.6	7.1	3.1	3.3	15.7	16.1
Endocrine	19.4	15.8	1.8	1.6	10.9	9.7	17.6	14.2
Respiratory	15.3	14.9	3.9	3.6	3.9	4.2	11.4	11.3
Kidney/urinary	11.1	10.5	1.3	1.3	8.3	8.3	9.7	9.3
Gastrointestinal	12.8	11.6	2.7	2.5	4.7	4.6	10.1	9.1
Infectious diseases	9.3	5.5	2.2	1.4	4.3	3.9	7.2	4.1
Neurological	6.5	9.3	4.1	5.2	1.6	1.8	2.4	4.1
Infant/congenital	8.7	7.3	4.5	3.9	1.9	1.8	4.2	3.3
Blood/metabolic	3.4	3.1	1.1	1.2	3.1	2.7	2.3	2.0
Mental/substance use	2.1	2.0	0.5	0.5	4.3	4.3	1.6	1.5
Musculoskeletal	3.1	1.8	0.8	0.7	3.9	2.7	2.3	1.2
Skin	1.1	0.5	0.2	0.2	7.0	2.8	1.0	0.3
Reproductive/maternal	0.5	0.3	0.1	0.1	7.4	3.0	0.5	0.2
Hearing/vision	–	–	–	–	..	..	–	–
Oral	–	–	–	–	..	..	–	–

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Changes in the risk factors contributing to the gap

Table D7: Age-standardised Indigenous and non–Indigenous DALY rates (per 1,000 people) attributed to selected risk factors, 2003 and 2011

	2003		2011	
Risk factor	**Indigenous**	**Non-Indigenous**	**Indigenous**	**Non-Indigenous**
Tobacco use	74.9	19.3	72.5	15.6
High body mass	44.8	9.4	44.1	9.5
Alcohol use	31.2	10.4	29.1	9.4
Physical inactivity	36.8	10.6	28.8	8.8
High blood pressure	37.0	13.4	28.5	8.6
Diet low in fruit	16.7	4.6	13.5	3.4
Drug use	12.8	3.0	13.3	3.2
High cholesterol	19.6	7.2	12.4	4.2
Diet low in vegetables	12.1	3.2	9.6	2.4
Intimate partner violence	3.8	0.9	4.7	0.9
Occupational exposures & hazards	4.3	2.6	4.6	2.5
Unsafe sex	2.9	0.9	2.9	0.8
Iron deficiency	1.8	0.6	1.8	0.5
Low bone mineral density	0.7	0.4	0.7	0.2

Note: Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Results by disease group

Mental and substance use disorders

Table D8: Number and age-standardised rates (per 1,000 people) of total burden for mental & substance use disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Alcohol use disorders	8,037	58,005	13.5	2.7	5.0	10.8
Anxiety disorders	8,455	132,516	13.5	6.2	2.2	7.4
Depressive disorders	6,970	120,689	11.7	5.6	2.1	6.1
Schizophrenia	2,721	31,610	4.8	1.5	3.3	3.3
Drug use disorders (excluding alcohol)	2,141	29,810	3.5	1.4	2.5	2.1
Intellectual disability	1,366	12,836	2.1	0.6	3.4	1.5
Bipolar affective disorder	1,839	36,471	3.0	1.7	1.7	1.3
Conduct disorder	1,633	8,232	1.5	0.4	3.4	1.0
Attention deficit hyperactivity disorder	700	6,468	0.8	0.3	2.5	0.5
Eating disorders	741	22,971	1.1	1.1	1.0	–
Autism spectrum disorders[b]	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
Other mental & substance use disorders	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
Total mental & substance use	**36,223**	**506,331**	**57.8**	**23.6**	**2.4**	**34.1**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

(b) Note: Autism spectrum disorders not reported due to data quality issues.

Note: The numbers may not add to total for all columns due to rounding.

Injuries

Table D9: Number and age-standardised rates (per 1,000 people) of total burden for injuries (external), by Indigenous status and cause, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Suicide & self-inflicted injuries	8,513	104,957	12.5	4.8	2.6	7.6
Falls	2,365	56,750	8.1	2.4	3.4	5.7
RTI - motor vehicle occupants	4,741	44,760	7.1	2.1	3.4	5.0
Homicide & violence	3,378	22,679	5.5	1.1	5.2	4.4
Poisoning	3,102	48,304	5.6	2.3	2.5	3.3
Other unintentional injuries	2,105	28,566	3.4	1.3	2.6	2.1
Other RTI	1,364	11,552	2.4	0.5	4.5	1.9
Fire, burns & scalds	639	7,130	1.2	0.3	3.6	0.8
Drowning	979	9,744	1.3	0.5	2.8	0.8
Other land transport injuries	864	12,411	1.4	0.6	2.4	0.8
RTI - motorcyclists	484	12,193	0.8	0.6	1.5	0.3
All other external causes of injury	256	6,618	0.8	0.3	3.0	0.6
Total injuries	**28,790**	**365,664**	**49.9**	**16.6**	**3.0**	**33.3**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Cardiovascular diseases

Table D10: Number and age-standardised rates (per 1,000 people) of total burden for cardiovascular diseases, by Indigenous status and disease, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Coronary heart disease	13,716	332,934	41.3	13.4	3.1	27.9
Stroke	3,299	133,472	12.1	5.4	2.3	6.7
Rheumatic heart disease	1,204	10,335	2.8	0.4	6.6	2.3
Cardiomyopathy	1,238	21,867	2.7	0.9	2.9	1.8
All other cardiovascular diseases	4,314	134,824	13.0	5.5	2.4	7.5
Total cardiovascular	**23,771**	**633,432**	**71.8**	**25.6**	**2.8**	**46.2**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Cancer and other neoplasms

Table D11: Number and age-standardised rates (per 1,000 people) of total burden for leading 10 cancers, by Indigenous status and cause, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Lung cancer	4,258	150,632	14.7	6.2	2.4	8.5
Liver cancer	1,246	28,129	4.0	1.2	3.4	2.8
Mouth & pharyngeal cancer	1,126	16,490	3.2	0.7	4.8	2.6
Unknown primary	816	34,769	2.9	1.4	2.0	1.5
Oesophageal cancer	850	22,923	2.4	0.9	2.5	1.4
Pancreatic cancer	802	43,626	2.8	1.8	1.5	1.0
Cervical cancer	496	6,059	1.2	0.3	4.6	1.0
Bowel cancer	1,353	91,068	4.5	3.8	1.2	0.7
Breast cancer	1,173	69,502	3.5	2.9	1.2	0.6
Leukaemia	624	30,006	1.7	1.3	1.3	0.4
Total 10 cancers	*12,744*	*493,205*	*40.9*	*20.4*	*2.0*	*20.5*
All other cancers	5,103	322,198	16.1	13.5	1.2	2.7
Total (including all cancers)	**17,847**	**815,403**	**57.0**	**33.9**	**1.7**	**23.1**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Respiratory diseases

Table D12: Number and age-standardised rates (per 1,000 people) of total burden for respiratory diseases, by Indigenous status and disease, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
COPD	5,755	154,591	21.5	6.4	3.4	15.1
Asthma	6,130	101,183	10.8	4.7	2.3	6.2
Upper respiratory conditions	1,950	73,724	3.3	3.4	1.0	–
All other respiratory diseases	1,250	30,403	3.6	1.3	2.9	2.3
Total respiratory	**15,085**	**359,901**	**39.2**	**15.7**	**2.5**	**23.5**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Musculoskeletal conditions

Table D13: Number and age-standardised rates (per 1,000 people) of total burden for musculoskeletal conditions, by Indigenous status and condition, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Other musculoskeletal	6,985	176,962	16.4	7.6	2.2	8.8
Rheumatoid arthritis	1,677	81,812	4.8	3.5	1.4	1.3
Gout	260	3,996	0.8	0.2	4.8	0.6
Osteoarthritis	1,261	84,545	3.6	3.5	1.0	0.1
Back pain & problems	2,521	161,267	5.0	7.1	0.7	–2.1
Total musculoskeletal	**12,704**	**508,582**	**30.6**	**21.9**	**1.4**	**8.7**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Infant and congenital conditions

Table D14: Number and age-standardised rates (per 1,000 people) of total burden for infant & congenital conditions, by Indigenous status and condition, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Pre-term birth & LBW complications	3,068	22,162	2.5	1.1	2.4	1.5
SIDS	1,723	7,472	1.4	0.4	3.8	1.0
Other disorders of infancy	1,276	9,256	1.0	0.4	2.3	0.6
Cerebral palsy	615	8,577	0.8	0.4	1.9	0.4
Cardiovascular defects	758	11,492	0.9	0.5	1.6	0.3
Birth trauma & asphyxia	1,349	17,635	1.2	0.8	1.4	0.3
Other congenital conditions	524	9,713	0.5	0.5	1.0	–
All other infant & congenital	1,457	22,873	1.7	1.1	1.5	0.6
Total infant & congenital	**10,770**	**109,181**	**9.9**	**5.2**	**1.9**	**4.7**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Endocrine disorders

Table D15: Number and age-standardised rates (per 1,000 people) of total burden for endocrine disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Diabetes	7,725	93,928	21.7	3.9	5.6	17.8
Other endocrine disorders	138	4,305	0.2	0.2	1.3	–
Total endocrine	**7,863**	**98,234**	**21.9**	**4.1**	**5.4**	**17.9**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Neurological conditions

Table D16: Number and age-standardised rates (per 1,000 people) of total burden for neurological conditions, by Indigenous status and condition, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Dementia	2,182	149,126	12.8	5.7	2.3	7.1
Epilepsy	2,683	42,050	5.3	1.9	2.8	3.3
Migraine	892	26,993	1.5	1.2	1.2	0.3
Parkinson disease	200	25,892	1.1	1.1	1.1	0.1
All other neurological conditions	1,629	54,761	3.3	2.4	1.4	1.0
Total neurological	**7,587**	**298,822**	**24.0**	**12.3**	**2.0**	**11.8**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Gastrointestinal disorders

Table D17: Number and age-standardised rates (per 1,000 people) of total burden for gastrointestinal disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Chronic liver disease	4,174	43,431	9.4	1.9	5.1	7.5
Pancreatitis	490	3,478	1.1	0.1	7.6	0.9
Inflammatory bowel disease (IBD)	522	19,681	1.0	0.9	1.2	0.1
All other GI disorders	1,710	69,650	4.9	2.9	1.7	2.0
Total gastrointestinal	**6,896**	**136,240**	**16.4**	**5.8**	**2.8**	**10.6**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Infectious diseases

Table D18: Number and age-standardised rates (per 1,000 people) of total burden for infectious diseases, by Indigenous status and disease, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Lower respiratory infections	1,961	27,603	4.8	1.1	4.3	3.7
Gastrointestinal infections	1,472	11,222	1.6	0.5	3.1	1.1
Pneumococcal disease	274	934	0.4	<0.05	10.3	0.4
HIV/AIDS	241	4,832	0.5	0.2	2.1	0.2
Influenza	193	2,295	0.3	0.1	3.3	0.2
Tuberculosis	136	1,216	0.3	0.1	5.0	0.2
Upper respiratory infections	155	2,605	0.2	0.1	2.0	0.1
Meningococcal disease	129	596	0.1	<0.05	4.4	0.1
Otitis media	115	427	0.1	<0.05	5.5	0.1
Trachoma	64	0	0.3	–	. .	0.3
All other infectious diseases	1,330	15,435	2.5	0.7	3.8	1.9
Total infectious diseases	**6,069**	**67,166**	**11.3**	**2.9**	**3.9**	**8.4**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Kidney and urinary diseases

Table D19: Number and age-standardised rates (per 1,000 people) of total burden for kidney & urinary diseases, by Indigenous status and disease, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Chronic kidney disease	3,696	38,878	11.5	1.6	7.3	9.9
Enlarged prostate	38	2,635	0.2	0.1	1.4	–
Kidney stones	4	431	<0.05	<0.05	0.6	–
Other kidney & urinary diseases	950	12,713	3.2	0.5	6.4	2.7
Total kidney & urinary	**4,687**	**54,656**	**14.9**	**2.2**	**6.8**	**12.7**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Oral disorders

Table D20: Number and age-standardised rates (per 1,000 people) of total burden for oral disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Dental caries	2,206	34,550	3.4	1.6	2.1	1.8
Severe tooth loss	477	34,797	1.8	1.4	1.2	0.3
Periodontal disease	561	25,609	1.3	1.1	1.2	0.2
Other oral disorders	6	730	<0.05	<0.05	0.3	–
Total oral disorders	**3,250**	**95,686**	**6.5**	**4.2**	**1.6**	**2.3**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Blood and metabolic disorders

Table D21: Number and age-standardised rates (per 1,000 people) of total burden for blood & metabolic disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Iron-deficiency anaemia	867	10,610	1.8	0.5	3.7	1.3
Protein-energy deficiency	803	6,314	1.1	0.2	4.4	0.8
Cystic Fibrosis	88	1,767	0.1	0.1	1.4	–
Haemophilia	2	151	<0.05	<0.05	0.4	–
Haemolytic anaemias	7	899	<0.05	<0.05	0.3	–
Other blood & metabolic disorders	1,236	27,750	3.2	1.2	2.7	2.0
Total blood & metabolic	**3,002**	**47,491**	**6.2**	**2.1**	**3.0**	**4.2**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Skin disorders

Table D22: Number and age-standardised rates (per 1,000 people) of total burden for skin disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Ulcers	189	5,850	0.6	0.2	2.5	0.4
Skin infections(incl. Cellulitis)	163	3,645	0.4	0.1	2.9	0.3
Acne	720	14,711	0.7	0.7	1.0	–
Dermatitis & eczema	912	30,904	1.4	1.4	1.0	–
Psoriasis	248	13,781	0.5	0.6	0.7	–0.2
Other skin disorders	150	5,677	0.3	0.3	1.0	–
Total skin disorders	**2,383**	**74,568**	**3.9**	**3.4**	**1.1**	**0.5**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Hearing and vision disorders

Table D23: Number and age-standardised rates (per 1,000 people) of total burden for hearing & vision disorders, by Indigenous status and disorder, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Vision loss	412	17,409	2.2	0.7	3.3	1.6
Hearing loss	1,353	65,153	3.1	2.7	1.1	0.4
Other vision disorders	45	2,810	0.1	0.1	0.6	–
Other hearing & vestibular disorders	378	9,494	0.9	0.4	2.3	0.5
Total hearing & vision disorders	**2,188**	**94,867**	**6.4**	**3.9**	**1.6**	**2.4**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

Reproductive and maternal conditions

Table D24: Number and age-standardised rates (per 1,000 people) of total burden for reproductive & maternal conditions, by Indigenous status and condition, 2011

	DALY		Rate (per 1,000 people)[a]			
	Indig.	Non-Indig.	Indig.	Non-Indig.	Rate ratio	Rate difference
Polycystic ovarian syndrome	634	13,566	0.9	0.6	1.3	0.2
Endometriosis	72	300	0.1	<0.05	8.0	0.1
Maternal haemorrhage	60	355	0.1	<0.05	4.3	0.1
Genital prolapse	137	18,126	0.3	0.8	0.4	–0.4
All other reproductive & maternal conditions	209	5,629	0.3	0.3	1.2	0.1
Total reproductive & maternal	**1,112**	**37,976**	**1.7**	**1.7**	**1.0**	**–**

(a) Rates are directly age-standardised to the 2001 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Note: The numbers may not add to total for all columns due to rounding.

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 and Kidney Unit	AIHW
Cardiovascular Disease EAG: 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 EAG: Jonathan Shaw (Chair), Stephen Colagiuri, Maria Craig, Wendy Davis, Mark Harris, Greg Johnson, Glynis Ross and Sophia Zoungas	AIHW advisory group
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

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
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
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 EAG: Tim Mathew (Chair), Alan Cass, Steven Chadban, Jeremy Chapman, Joan Cunningham, Bettina Douglas, Wendy Hoy, Stephen McDonald and David Parker	AIHW advisory group

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
Mental and substance use disorders	
AIHW Mental Health and Palliative Care Unit	AIHW
Kimina Anderson	Indigenous Forensic Mental Health Service, Queensland Health
Peter Azzopardi	South Australian Health, Medical Research Institute
Ms Jenny Bourke	Telethon Kids Institute
Assoc. Prof. Alan Clough	James Cook University
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
Prof. Ernest Hunter	Regional Psychiatrist, Queensland Health
Assoc. Prof. Helen Leonard	Telethon Kids Institute
Prof. John McGrath	University of Queensland
Prof. George Patton	Royal Children's Hospital Melbourne
Lucy Stanley	Queensland Health
Prof. Harvey Whiteford	University of Queensland
Daniel Williamson	Queensland Health
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
Matthew Montgomery	ABS
Prof. Tania Winzenberg	University of Tasmania
Neurological conditions	
Disability and Ageing Unit	AIHW
Prof. Kaarin Anstey	Dementia Collaborative Research Centre, Early Diagnosis and Prevention Australian National University
Prof. George Mellick	Griffith University
Prof. Matthew Kiernan	University of Sydney
Prof. Andrew Palmer	University of Tasmania

continued

Table E1 (continued): List of disease-specific contributors

Expert (group or person)	Organisation
Oral disorders	
Assoc. Prof. David Brennan	Australian Research Centre for Population Oral Health, University of Adelaide
Adjunct Assoc. Prof. Ratilal Lalloo	Australian Research Centre for Population Oral Health, University of Adelaide
Dr Liana Luzzi	Australian Research Centre for Population Oral Health, University of Adelaide
Prof. Marco Peres	Australian Research Centre for Population Oral Health, University of Adelaide
Dr John Rogers	Victorian Department of Health
Reproductive and maternal conditions	
Assoc. Prof. Georgina Chambers	National Perinatal Epidemiology and Statistics Unit, University of New South Wales
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
Mr Paul Atyeo	ABS
Ms Janis Baines	Food Standards Australia and New Zealand
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

age weighting: A method sometimes used to adjust the relative 'value' of years lived at different ages—for example, to value a year lived by a young adult more highly than a year lived at older ages. If applied, age weighting results in some age groups having an increased influence on the estimates of disease burden relative to other age groups.

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 2 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 reduced to its **theoretical minimum risk exposure distribution**.

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.

chronic: Persistent and long-lasting.

comorbidity: A health problem/disease that exists at the same times as (an)other health problem(s).

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.

counterfactual: An alternative risk factor exposure distribution chosen for comparison with the observed distribution, to estimate the alterable contribution of that risk factor to the burden of disease. The most commonly used counterfactual in burden of disease studies is the **theoretical minimum risk exposure distribution**.

disability-adjusted life years (DALY): A year of healthy life lost, either through premature death or living with disability due to illness or injury.

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).

discounting: A method sometimes used to adjust the relative 'value' of years lived (or lost) in the future. It is based on the assumption that a year lived in the future is of less 'value' than a year lived now. Discounting for future benefits is standard practice in some economic analyses.

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.

effect modification: A change in the observed magnitude or direction of an association between a risk exposure and an outcome when a third variable (such as age or sex) is included in the analysis.

effect size: A statistical measure of the strength of the relationship between 2 variables (in this context, between a risk exposure and a disease outcome), expressed, for example, as a relative risk or odds ratio.

envelope: The total prevalence of a condition present in the population that constrains the combined prevalence of different sequelae.

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 that causes 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 **years of life lost**, and also referred to as 'life lost'.

health state: Reflects a combination of signs and symptoms that result health loss, and are not necessarily unique to 1 particular disease. A health state might also be a severity level of a **sequela** (typically mild, moderate and severe levels are distinguished). For example, the health state 'mild heart failure' is used for sequelae of coronary heart disease, hypertensive heart disease, congenital heart disease and several other conditions. Each health state is associated with a **disability weight**.

hospitalisation: An episode of hospital care that starts with the formal admission process and ends with the formal separation process (synonymous with admission and separation).

incidence: Refers to the occurrence of a disease or event. The incidence rate is the number of new cases occurring during a specified time period.

International Classification of Diseases (ICD): The World Health Organization's internationally accepted classification of diseases and related health conditions. The 10th revision, Australian modification (ICD-10-AM) is currently in use in Australian hospitals for admitted patients.

linked disease: A disease or injury for which there is evidence that a risk factor increases its likelihood.

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 3 categories of non-admitted patient: emergency department patient, outpatient, and other non-admitted patient (treated by hospital employees off the hospital site, including through 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 **years lived with disability**.

population attributable fraction (PAF): For a particular risk factor and causally linked disease or injury, the percentage reduction in burden for a population that would occur if exposure to the risk factor was avoided or reduced to its theoretical minimum.

premature death: Deaths that occur at a younger age than a selected cut-off.

prevalence: Refers to the existence of a disease or event, whether or not it is newly occurring; the prevalence rate is the number of cases existing at a point in time (point prevalence) or over a specified time period (period prevalence).

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 1 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.

redistribution: A method in a burden of disease study for reassigning deaths with an underlying cause of death that is not in the study's disease list. Typically, the deaths reassigned include: those with a case that is implausible as an underlying cause of death; those that relate to an intermediate cause in the chain of events leading to death; or those for which there is insufficient detail to ascertain a specific cause of death.

reference life table: A table that shows, for each age, the number of remaining years a person could potentially live, to measure the **years of life lost** from dying at that age.

relative risk: The risk of an event relative to exposure, calculated as the ratio of the probability of the even occurring in the exposed group to the probability of it occurring in the non-exposed group.

risk factor: Any factor that causes or increases the likelihood of a health disorder or other unwanted condition or event.

risk exposure distribution: The measure of the spread or distribution of exposure to the risk factor in the population that have encountered, experienced, or have the risk factor.

risk–outcome pair: Associates a condition in the cause list with a known risk factor for that condition.

sequelae: Health consequences of diseases and injuries, such as heart failure due to coronary heart disease. Each sequelae may be mapped to 1 or more **health states**.

theoretical minimum risk exposure distribution (TMRED): The risk factor exposure distribution that will lead to the lowest conceivable disease burden.

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

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

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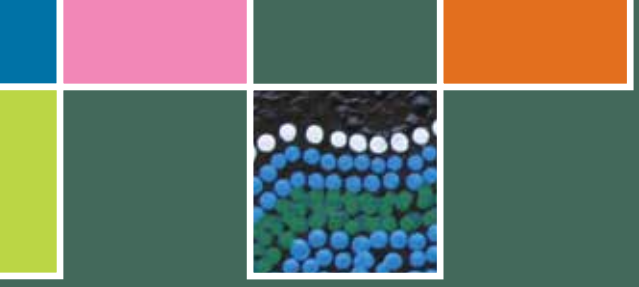

This report provides estimates of the non-fatal and fatal burden of disease for the Aboriginal and Torres Strait Islander population as well as estimates of the gap in disease burden between Indigenous and non-Indigenous Australians. The disease groups causing the most burden among Indigenous Australians in 2011 were mental and substance use disorders, injuries, cardiovascular diseases, cancer and respiratory diseases. Indigenous Australians experienced a burden of disease that was 2.3 times the rate of non-Indigenous Australians. Over one third of the overall disease burden experienced by Indigenous Australians could be prevented by removing exposure to risk factors such as tobacco and alcohol use, high body mass, physical inactivity and high blood pressure.