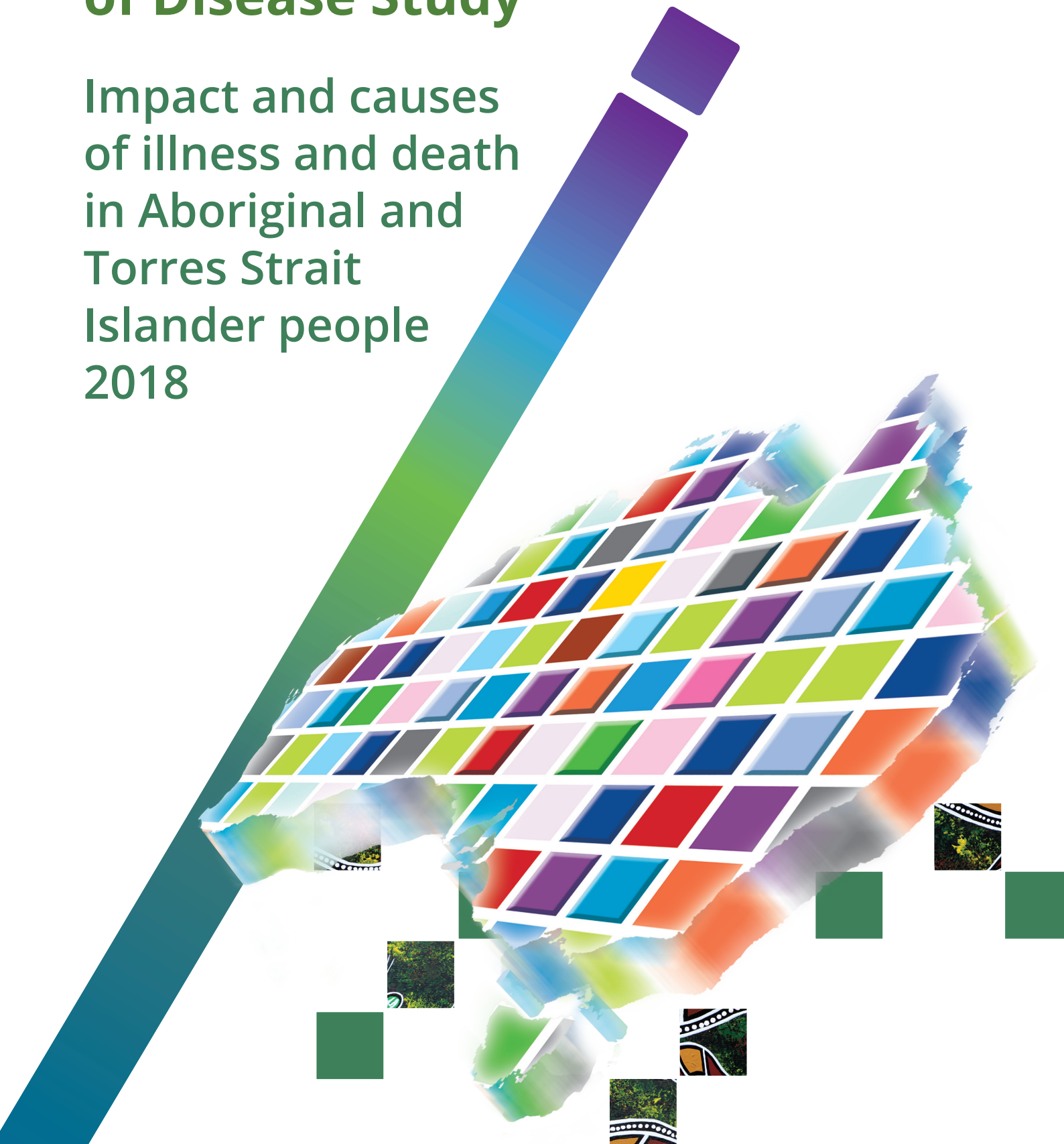
Australian Government
Australian Institute of Health and Welfare

AIHW

Australian Burden of Disease Study

Impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018



AIHW

Australian Burden of Disease Study

Impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018

The AIHW is an independent statutory Australian Government agency producing authoritative and accessible information and statistics to inform and support better policy and service delivery decisions, leading to better health and wellbeing for all Australians.

© Australian Institute of Health and Welfare 2022

This product, excluding the AIHW logo, Commonwealth Coat of Arms and any material owned by a third party or protected by a trademark, has been released under a Creative Commons BY 3.0 (CC BY 3.0) licence. Excluded material owned by third parties may include, for example, design and layout, images obtained under licence from third parties and signatures. We have made all reasonable efforts to identify and label material owned by third parties.

You may distribute, remix and build upon this work. However, you must attribute the AIHW as the copyright holder of the work in compliance with our attribution policy available at www.aihw.gov.au/copyright/. The full terms and conditions of this licence are available at http://creativecommons.org/licenses/by/3.0/au/.

This publication is part of the Australian Institute of Health and Welfare's Australian Burden of Disease Study series. A complete list of the Institute's publications is available from the Institute's website www.aihw.gov.au.

ISSN 2204-4108 (Online)
ISSN 2006-4508 (Print)
ISBN 978-1-76054-951-0 (Online)
ISBN 978-1-76054-952-7 (Print)
DOI 10.25816/xd60-4366

Suggested citation

Australian Institute of Health and Welfare 2022. Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2018. Australian Burden of Disease Study series no. 26. Cat. no. BOD 32. Canberra: AIHW.

Australian Institute of Health and Welfare

Board Chair	Chief Executive Officer
Mrs Louise Markus	Mr Rob Heferen

Any enquiries relating to copyright or comments on this publication should be directed to:

Australian Institute of Health and Welfare
GPO Box 570
Canberra ACT 2601

Tel: (02) 6244 1000
Email: info@aihw.gov.au

Please note that there is the potential for minor revisions of data in this report. Please check the online version at www.aihw.gov.au for any amendment.

Contents

Summary iv
1 Introduction 1
2 Total burden of disease 19
3 Non-fatal burden of disease 41
4 Fatal burden of disease 59
5 Contribution of risk factors to burden. 79
6 Gap in health outcomes. 94
7 Changes over time. 106
8 Health-adjusted life expectancy. 134
9 Overview of results by disease group 144
10 Variation across geographic and population groups 201
11 Data gaps and opportunities 243
Appendix A: Methods overview 256
Appendix B: How reliable are the estimates? 294
Appendix C: Understanding and using burden of disease estimates 298
Appendix D: Additional tables and figures. 305
Acknowledgments 333
Abbreviations 334
Symbols 336
Glossary 337
List of tables 345
List of figures 350
List of boxes 359
Related publications 360

Summary

Every year in Australia, many years of healthy life are lost because of injury, illness or premature deaths in the population. This loss of healthy life is called the 'burden of disease' in epidemiological literature.

Burden of disease analysis combines the impact of living with poor health (the non-fatal burden of disease) with dying prematurely (fatal burden). Fatal and non-fatal burden combined is referred to as total burden. Burden of disease is recognised as the best method to measure the impact of different diseases or injuries in a population.

This report presents the results of the Indigenous component of the Australian Burden of Disease Study 2018. It provides estimates of the total, non-fatal and fatal burden of disease and injury for the Aboriginal and Torres Strait Islander population for 2018 using the DALY (disability-adjusted life years) measure. One disability adjusted life year (or 1 DALY) represents 1 year of healthy life lost, either through premature death ('years of life lost' or YLL) or from living with an illness or injury ('years lived with disability' or YLD). YLD are weighted to account for the severity of disease.

DALY estimates are presented for 219 diseases (which are grouped into 17 disease groups, see Table 1.2), as well as estimates of the burden attributable to 39 individual risk factors, such as tobacco use and physical inactivity. Estimates of the gap in disease burden between Indigenous and non-Indigenous Australians are also presented. Interactive data are available online.

In 2018, Indigenous Australians lost 240,000 years of healthy life (total burden, DALY) due to:

Living with illness or injury (non-fatal)
53% of total burden

Dying prematurely (fatal)
47% of total burden

Chronic diseases and injuries cause most of the burden of disease

The 5 disease groups causing the most burden in 2018 were mental & substance use disorders, injuries, cardiovascular diseases, cancer & other neoplasms and musculoskeletal conditions; together, these accounted for almost two-thirds (63%) of the total burden among Indigenous Australians.

Summary of total burden and 5 leading disease groups, Indigenous Australians, 2018

	Mental/ substance use	Injuries	Cardiovascular	Cancer	Musculoskeletal	Total (all diseases)
Number of DALY	54,263	29,769	24,612	23,742	19,168	239,942
% of total DALY	23	12	10	10	8	100
% of DALY that was fatal	2	89	86	94	4	47
Change between 2003 and 2018[(a)]	↑ 12.1	— –1.0	↓ –40.4	↓ –4.0	↓ –8.1	↓ –67.8

(a) Calculated as 2018 age-standardised rate minus 2003 age-standardised rate.

Substantial drop in fatal burden

Overall, the health of Indigenous Australians has improved over the 15-year period from 2003 to 2018. After adjusting for population growth and ageing, there was a 15% decline in total burden—this decrease was driven by a 27% decline in fatal burden. Over the same period there was no substantial change in non-fatal burden.

Decreases over time for most disease groups

Between 2003 and 2018, the rate of total burden (after adjusting for age and population changes) fell for over half of the 17 disease groups included in this study. The most notable declines were for cardiovascular diseases, endocrine disorders (including diabetes), musculoskeletal conditions and infectious diseases (decreases of 40, 13, 8.1 and 5.8 DALY per 1,000 people, respectively). The most notable increase was for mental & substance use disorders (increase of 12 DALY per 1,000 people).

More burden for males

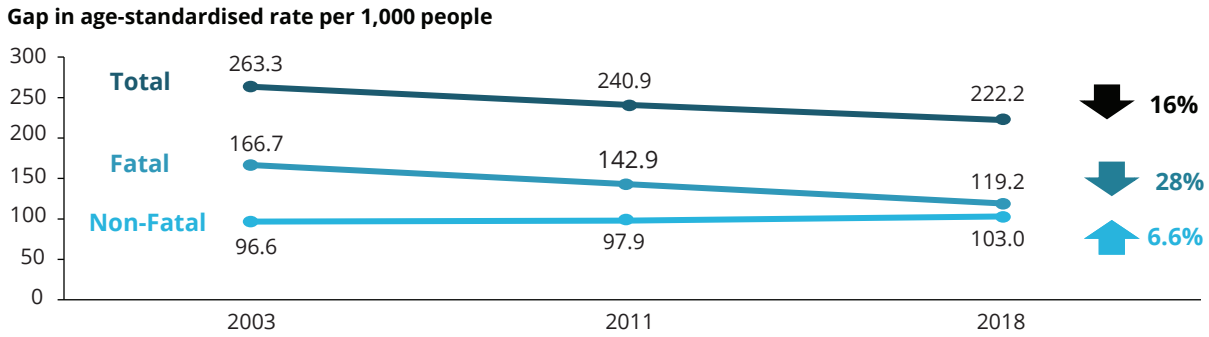
Indigenous males experienced more health loss than Indigenous females overall and for most age groups, accounting for 54% of the total burden compared with 46% for females. In 2018, Indigenous males suffered 1.4 times the rate of fatal burden (238 YLL per 1,000 males) experienced by females (167 YLL per 1,000 females). Indigenous males experienced a higher proportion (52%) of their total burden due to dying early while Indigenous females experienced more of their burden from living with disease (58%).

Four disease groups contributed to over half of the gap in total disease burden

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 in 2018. Four disease groups accounted for over half (54%) of the gap in total disease burden between Indigenous and non-Indigenous Australians (based on age-standardised DALY rate differences); mental & substance use disorders (20%), cardiovascular diseases (14%), injuries (10%) and respiratory diseases (10%).

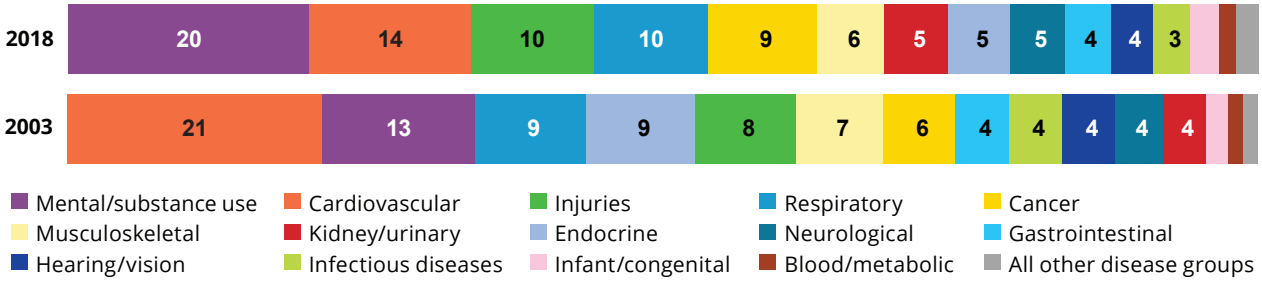
Gap in burden has narrowed

After removing differences in population size and age structure, the absolute gap in burden between Indigenous and non-Indigenous Australians decreased between 2003 and 2018 (DALY rate differences of 263 and 222 per 1,000 people), although the relative gap remained stable (rate ratio of 2.3 in each year). The decrease in the absolute gap was largely driven by a narrowing of the gap for fatal burden, which decreased by 28% between 2003 and 2018. The gap in non-fatal burden increased slightly during this period, by 6.6%.



Disease groups contributing to the gap

Mental & substance use disorders and cardiovascular diseases were the 2 leading disease groups contributing to the gap in total burden (as measured by DALY rate difference) in 2003 and 2018, although their rankings and the amount they contributed to the gap shifted between years. Mental & substance use disorders and cancers caused more of the gap in 2018 than they did in 2003, whereas cardiovascular diseases and endocrine disorders (including diabetes) caused less of the gap.



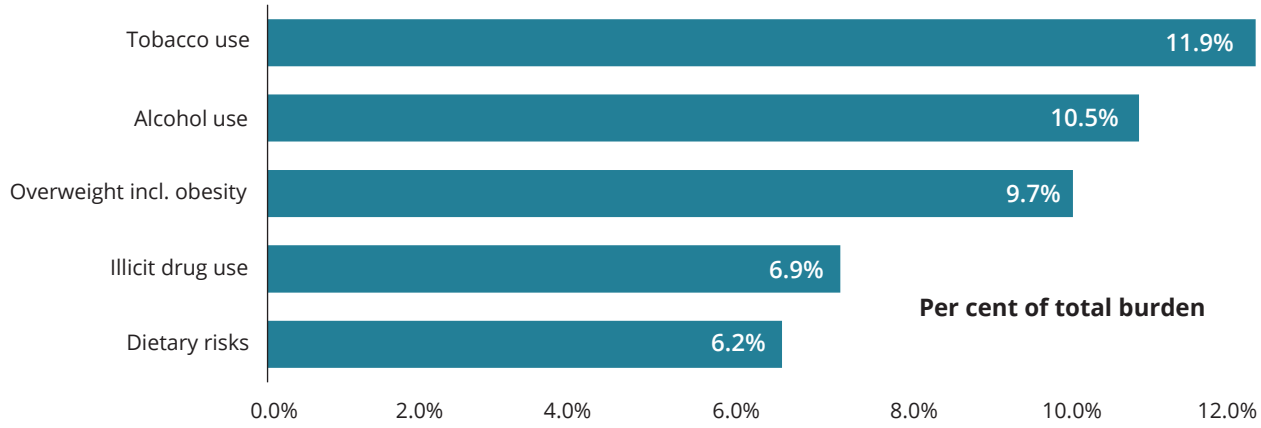
Disease burden is not shared equally across Australia

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). The gap between Indigenous and non-Indigenous Australians was largest in Western Australia, where Indigenous Australians experienced total burden at 2.7 times the rate of non-Indigenous Australians.

Large inequalities were also evident across remoteness areas, with Very remote and 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.

Almost half of disease burden is potentially preventable

In 2018, 49% of the burden of disease in Indigenous Australians could potentially have been prevented by avoiding exposure to the modifiable risk factors examined in this study. The risk factors contributing to the most burden were:



Most of life is spent in good health

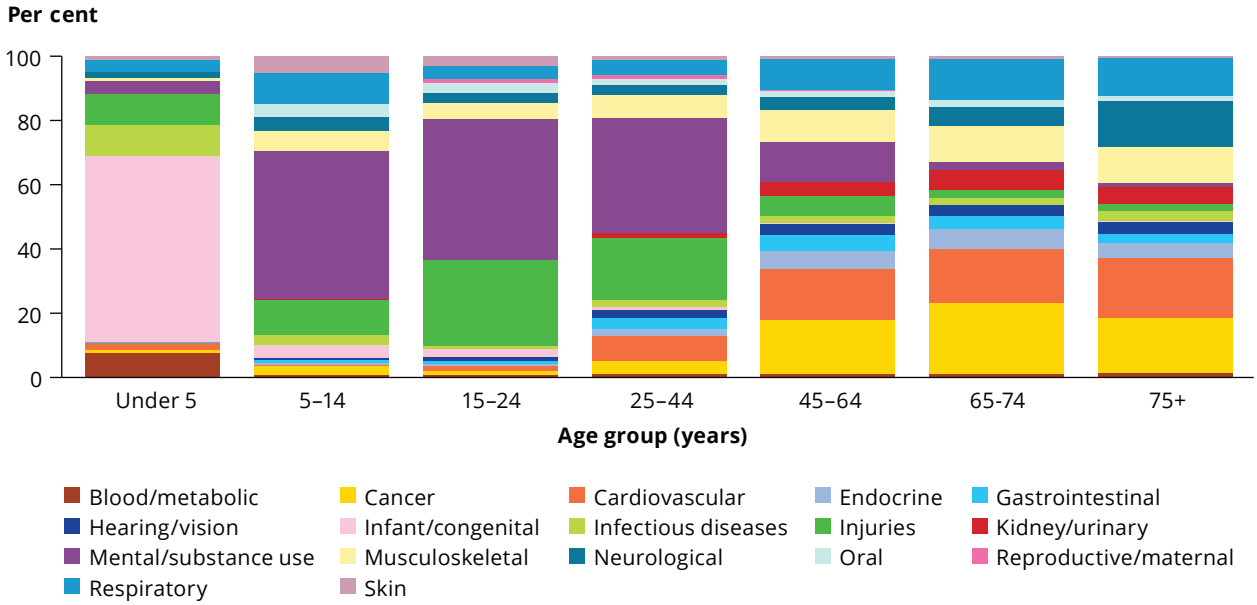
Indigenous Australians are, on average, spending most of their lives in full health (meaning no disease or injury; also referred to as health-adjusted life expectancy (HALE)). Indigenous males and females born in 2018 could expect to live around 80% of their lives in full health—56.0 years of the 70.0 years of average life expectancy for males, and 58.8 years of the 74.4 years of average life expectancy for females.

In 2018, the gap in HALE at birth between Indigenous and non-Indigenous Australians was 15.5 years for males and 14.7 years for females.

Main contributors to burden change over the life course

Indigenous Australians experienced major health loss from different types of disease groups and individual diseases throughout the life course.

In infancy and young childhood, infant & congenital conditions were the predominant cause of burden. Mental & substance use disorders and injuries (including suicide) were the main causes of burden for late childhood, adolescence and adulthood (to age 44). Cardiovascular diseases and cancer started to emerge as major causes of burden from around age 45, and continued to contribute substantially to disease burden in older Indigenous Australians. Respiratory diseases affected all age groups, and musculoskeletal conditions affected all age groups from age 5.



The leading cause of burden was coronary heart disease

When considering individual diseases, the 5 diseases with the highest burden among Indigenous Australians in 2018 were coronary heart disease (contributing 5.8% of total burden), anxiety disorders (5.3%), suicide & self-inflicted injuries (4.6%), alcohol use disorders (4.4%) and depressive disorders (4.3%).

Coronary heart disease showed the largest reduction in total burden over time—from 55 to 29 DALY per 1,000 people between 2003 and 2018. Declines in total burden (based on age-standardised DALY rates) were also seen for type 2 diabetes, stroke, rheumatoid arthritis, hearing loss and chronic obstructive pulmonary disease (COPD).

1

Introduction

For Aboriginal and Torres Strait Islander people, good health is more than the absence of disease or illness; it is a holistic concept that includes physical, social, emotional, cultural, spiritual and ecological wellbeing, for both the individual and the community. Although the health of Indigenous Australians has improved in a number of areas over the past 2 decades (for example, cardiovascular disease deaths and infant health), there are still areas where outcomes have not improved, or have worsened (such as psychological distress, cancer and suicide rates) (AIHW 2020). It is difficult, however, to get an overarching view of the issues that affect Indigenous health, when the impacts of the various diseases and conditions vary so widely.

This report presents results from the Aboriginal and Torres Strait Islander component of the Australian Burden of Disease Study (ABDS) 2018. A separate report presents results for the whole Australian population. The current reference year for the ABDS is 2018 as 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.

Burden of disease analysis measures the impact of fatal and non-fatal burden; that is, both deaths and living with poor health. More than merely counting deaths or disease prevalence, it also takes into account age at death and severity of disease.

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 both health policy and programs and service delivery. This is especially important for the Aboriginal and Torres Strait Islander population because it is known to have unacceptably high levels of mortality, illness and injury (AIHW 2020). Burden of disease studies allow deaths and living with illness to be compared and reported in a consistent manner. Estimates produced from a burden of disease study are the best summary measures of a population's health.

The ABDS 2018 uses burden of disease analysis to measure the impact of 219 separate diseases and injuries on the health of the Australian and the Aboriginal and Torres Strait Islander populations. This report provides a detailed picture of the burden of disease for the Aboriginal and Torres Strait Islander population in 2018, including comparisons with 2011 and 2003. It includes estimates of total, fatal and non-fatal burden for the total Aboriginal and Torres Strait Islander population, as well as for selected states and territories, remoteness areas and socioeconomic groups. It also includes estimates of the gap in disease burden between Indigenous and non-Indigenous Australians, as well as estimates of the contribution to disease burden made by selected risk factors. A summary report presenting key findings for the Indigenous population is also available (AIHW 2021b).

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 2018* (AIHW 2021a). Detailed methods are provided in a web-based report *Australian Burden of Disease Study 2018: methods and supplementary material* (AIHW 2021c). All reports, along with interactive data visualisations for both the Australian and Indigenous Australian populations, are available on the AIHW website at aihw.gov.au.

Note that for ease of reading, the terms 'Indigenous Australians' and 'Indigenous population' are used interchangeably throughout this report to refer to the Aboriginal and Torres Strait Islander population.

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

The health loss that the DALY measures represents the difference between the current health status of the population and the ideal situation where everyone lives 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 way of collating the best available data on causes of health loss to produce comparable and concise information. The ability to use data from a range of sources to construct an internally consistent measure for all diseases is a key strength of a burden of disease study. The major benefit is that the impact of a disease that may cause death can be compared with one that may not be fatal but may cause great suffering in a large number of people. Similar comparisons and rankings across different diseases or injuries cannot be produced by using separate studies conducted on a disease-by-disease basis, which may use different survey methods and/or disparate data sources.

When DALY are used to measure the burden of disease in a population in a time interval, they can be calculated using an incidence, prevalence, or 'hybrid' perspective. Each method produces a different result. In ABDS 2018, a hybrid perspective for calculating DALY has been used, consistent with recent global studies as well as with ABDS 2015 and 2011. This calculates YLL from an incidence perspective and YLD from a prevalence perspective—hence 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.

Box 1.1: Key burden of disease terms

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

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

Disability-adjusted life years (DALY): A measure (in years) of healthy life lost, either through premature death, defined as dying before the ideal life span (YLL) or, equivalently, through living with ill health due to illness or injury (YLD). Often also called 'health loss'.

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

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

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

Health-adjusted life expectancy (HALE): The number of healthy years a person of a particular age can expect to live.

Health loss: The total number of healthy years lost from living with disease/injury (YLD) and the total number of years lost from dying early from disease/injury (YLL). It is often used synonymously with DALY.

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

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

Life expectancy: The number of years a person of a particular age can expect to live.

Non-fatal burden: The burden from living with ill-health as measured by years lived with disability. It is often used synonymously with YLD.

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

(continued)

Box 1.1 (continued): Key burden of disease terms

Reference life table: A table that corresponds to the maximum life expectancy for an individual in good health.

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

Sequela: Consequence of diseases; often used in the plural, sequelae. For example, heart failure due to coronary heart disease, or vision loss due to cataracts.

Theoretical minimum risk exposure distribution (TMRED): The distribution of exposure to a risk factor that would lead to the lowest conceivable disease burden. The TMRED is defined for each risk factor as the theoretical minimum exposure for which there is no increased risk of disease.

Years lived with disability (YLD): The number of years of life spent in a state of less than full health, weighted to account for disease severity. YLD represent non fatal burden.

Years of life lost (YLL): The number of years of life lost due to premature death, defined as dying before the ideal life span (see Table A2 in Appendix A). YLL represent fatal burden.

(Refer to the Glossary for a full list of definitions).

1.2 How can burden of disease studies be used?

Monitoring of population health

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

Health policy and health service planning

Burden of disease studies provide valuable information to inform health policy making and health service planning. By comparing all diseases together, these studies can highlight which diseases and risk factors cause the most burden, which are increasing or decreasing, and which are causing the greatest health inequalities and gaps. They can also indicate the diseases most likely to have an impact on the health system and services in terms of, for example, doctor and allied health professional visits, hospital admissions and dental care.

As well, estimates of the burden attributable to various risk factors (such as smoking, physical inactivity, high blood pressure) can show how much of the disease burden could be averted if a population's exposure to the risk had been modified to the lowest level—for example, if smoking were eliminated or if sodium intake were reduced to a minimum level. This information can then be used to develop and target prevention policies.

1.3 What can't burden of disease studies tell us?

Burden of disease analysis quantifies the size of health problems in terms of deaths and ill-health. It does not measure the social or economic impacts of diseases, or the direct impact on the health system. While it can provide some indication of areas of health workforce demand, it needs to be used together with other information to determine where there are gaps. Burden of disease analysis does not enumerate all the causes of each disease (especially social determinants), and does not map the causal relationship between different diseases (except in a small number of cases through risk factor analysis).

Since burden of disease analysis quantifies only the size of a health problem, it should not be used on its own for resource allocation, as it does not show what interventions will work or which are most cost effective. However, as outlined earlier, burden of disease analysis can help highlight areas with potential for cost-effective interventions.

1.4 How is burden of disease measured?

Burden of disease quantifies the gap between a population's actual health and an ideal level of health in a 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, or DALY, where 1 DALY represents 1 year of 'healthy' life lost to illness or death. The more DALY associated with a disease or injury, the greater the burden.

Years of life lost (YLL) measure the years lost between the age at which a person dies and an ideal life span. In this study, the ideal remaining life expectancy varies at each age, but starts as a life expectancy at birth of 86.0 years for both men and women (see Appendix Table A2 for the full life expectancy table). This ideal life span is based on the lowest observed death rates at each age group from multiple countries (Murray and Ezzati et al. 2012), and is not equal to the current Indigenous or non-Indigenous Australian life expectancy (which is 71.6 and 75.6 years for Indigenous men and women, and 80.2 and 83.4 years for non-Indigenous men and women, respectively) (ABS 2018c). Total YLL is influenced by both the total number of deaths and the ages at which those deaths occur.

Years lived with disability (YLD) measure the number of healthy years of life lost due to living with disease at the population level. This is calculated by estimating the proportion of a year spent with a condition, multiplied by a disability weight indicating the severity of the condition and its effects (see Box 1.2). Total YLD is 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.

Note that in burden of disease analysis, the term 'disability' refers to any experience of less than perfect health. It is not the same as disability that is usually measured in health surveys, which generally define disability as a limitation, restriction or impairment lasting at least 6 months and which restricts everyday activities.

Box 1.2: Disability weights

Disability weights attempt to capture the severity of the effects of a disease or injury on a scale from 0 (perfect health) to 1 (equivalent to death). They aim to quantify societal preferences for different health states. The weights do not represent the lived experience of any health state or imply any societal value of the person in a particular health state. Rather, they quantify societal preference for health states in relation to the 'ideal' of good health.

Disability weights are based on various international surveys of people in the general community. Respondents were given descriptions of individuals with different health states and asked to specify which person was more healthy (Salomon et al. 2015).

For example, *Cancer: metastatic* has a disability weight of 0.451, while *Severe tooth loss* has a weight of 0.067. A total of 235 health states are specified and used in the calculation of YLD (Salomon et al. 2015).

Constructed in this way, the DALY is a summary measure of the overall population health for the year being reported (see Box 1.3 for an example). That is, 1 DALY represents 1 lost year of 'healthy life' and is equal to YLL plus YLD. The DALY measure enables comparison of individual diseases, population groups and points in time.

Box 1.3: Example of calculating disability-adjusted life years

Burden of disease analyses estimate health loss from living with or dying from disease and injury in a single year—measured as DALY.

Joe, aged 65, has angina (a chronic heart condition that causes temporary chest pain on exertion). Joe suffers health loss from living with angina; in burden of disease analyses, this impact is measured using a 'disability weight'. Angina has a disability weight of 0.2 and, as it is a chronic condition, it would affect Joe for the entirety of that year (0.2 x 1 year = 0.2 YLD). However, if Joe then has a heart attack in the same year, they would also experience short-term health loss (for about a month) with a disability weight of 0.5 (0.5 x 1/12 = 0.04). This gives Joe a total of 0.24 YLD health loss due to coronary heart disease (that is, angina or heart attack).

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

Joe's total DALY will therefore be 0.24 YLD plus 23 YLL, making 23.24 DALY.

Measuring the contribution of risk factors

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 possible level (known as the theoretical minimum risk exposure distribution, or TMRED).

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

1.5 A history of burden of disease analysis

The first global burden of disease study—for the year 1990—developed the DALY measure and quantified the global disease burden (and attribution to risk factors) from over 100 individual diseases and injuries (Murray & Lopez 1996). Since then, more global and country studies have been undertaken and methods further developed.

Before the ABDS 2018, in Australia, 4 major national burden of disease studies were conducted (AIHW 2016b, 2019a; Begg et al. 2007; Mathers et al. 1999), as well as 2 studies for Indigenous Australians (AIHW 2016a; Vos et al. 2007). Some states and territories have also completed burden of disease work. Table 1.1 provides a summary of global and national Australian studies.

The Global Burden of Disease Study (GBD), conducted by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington in the United States of America with other partners, was first published in December 2012 (Murray and Vos et al. 2012). It used substantially revised methods from those of earlier studies to generate DALY for 2010, and revised estimates for 1990 and 2005 (see AIHW 2014a for further detail on method changes). Following this GBD study, the World Health Organization (WHO) applied GBD methods (with some modifications) to produce global burden of disease estimates for 2000–2012 (WHO 2014), then for 2015 and 2016 (WHO 2017, 2018). The IHME has since updated its estimates for the reference years 2013, 2015, 2016, 2017 and 2019, along with revised estimates for 2010 and earlier years (respectively, Murray et al. 2015; GBD 2015 DALYs and HALE Collaborators 2016, GBD 2016 DALYs and HALE Collaborators 2017, GBD 2017 DALYs and HALE Collaborators 2018, GBD 2019 Diseases and Injuries Collaborators 2020). The most recent Australian burden of disease study included estimates for 2015 with revised estimates for 2011 and 2003 (AIHW 2019a).

The ABDS uses Australian data sources and adapts the methods of global studies to quantify burden of disease. Although the global studies estimate disease burden in Australia, they are designed to provide internationally comparable results, and the methods and assumptions used may not always align with Australian health data and contexts. The global studies also do not estimate the burden that Indigenous Australians or subnational population groups experience. Further information and international comparisons are presented in Chapter 9 of *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* (AIHW 2021a).

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

Study	Reference year	Reference
Global study: Harvard School of Public Health in collaboration with The World Bank and the World Health Organization (WHO)	1990	Murray & Lopez 1996
First Australian study: Australian Institute of Health and Welfare (AIHW)	1996	Mathers et al. 1999
Global study: The World Bank	2000–2002	Lopez et al. 2006
Second Australian study: AIHW and The University of Queensland	2003	Begg et al. 2007
First Indigenous Australian study: The University of Queensland	2003	Vos et al. 2007
Global study: WHO	2004 with projections to 2030	WHO 2009
Global study: Institute for Health Metrics and Evaluation (IHME)	2010	Murray and Vos et al. 2012
Global study: WHO	2011	WHO 2014
Global study: IHME	2013	Murray et al. 2015
Third Australian study: AIHW	2011	AIHW 2016b
Second Indigenous Australian study: AIHW	2011	AIHW 2016a
Global studies: WHO	2015; 2016	WHO 2017; WHO 2018
Global study: IHME (annual updates from reference year of 2015 onwards)	2015; 2016; 2017; 2019	GBD 2015 DALYs and HALE Collaborators 2016; GBD 2016 DALYs and HALE Collaborators 2017; GBD 2017 DALYs and HALE Collaborators 2018; GBD 2019 Diseases and Injuries Collaborators 2020
Fourth Australian study: AIHW	2015	AIHW 2019a

1.6 Overview of the ABDS 2018

The ABDS 2018 incorporates estimates for both the Australian population as a whole and the Indigenous Australian population, and was undertaken to build on the AIHW's previous burden of disease studies and current disease monitoring work. It updates burden of disease estimates, using the infrastructure developed as part of the ABDS 2011 and further refined through ABDS 2015, and includes several improvements since the previous Aboriginal and Torres Strait Islander study (AIHW 2016a). The ABDS 2018 Aboriginal and Torres Strait Islander study provides burden of disease estimates best matched to the Australian context for the Indigenous Australian population (including subnational estimates where possible) for 2018. It also provides estimates for 2011 and 2003, revised using the same methods as for 2018, to enable direct comparisons.

The methods used to produce estimates for the Indigenous Australian population (described later in this chapter and in 'Appendix A: Methods overview') were consistent with those used for the Australian population as a whole.

The chosen reference period (2018) reflects the data availability from key data sources (such as the National Aboriginal and Torres Strait Islander Health Survey, deaths data, hospital admissions data and various disease registers) at the time analyses began.

The ABDS 2018 includes 219 diseases and injuries (see Table A1), grouped into 17 broad disease groups (see Table 1.2), with a total of 745 sequelae. National estimates for Indigenous Australians were produced for 3 reference years (2003, 2011 and 2018), and subnational estimates for 2 years (2011 and 2018). There were 39 risk factor components or exposures that are combined into 19 individual risk factors for reporting (see Table A3). In total, more than half a million individual estimates were created for the Indigenous population.

Table 1.2: ABDS 2018 Disease groups

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

Data sources

Data to develop the ABDS 2018 Indigenous estimates were obtained from many different sources. Deaths data for the fatal burden were sourced from the National Mortality Database. Data for the non fatal burden came from a variety of sources: national data sets with complete coverage (such as the National Hospital Morbidity Database and the Australian Cancer Database), national surveys (such as the National Aboriginal and Torres Strait Islander Health Survey 2018–19), linked hospitals and deaths data, and a number of epidemiological studies.

Where possible and appropriate, other inputs for the ABDS 2018 were obtained from the GBD studies. The standard life table for fatal burden, and health states and disability weights for the non-fatal burden were obtained from GBD 2013. Relative risks and the TMRED for the risk factor attribution were obtained from GBD 2017 and the AIHW's review of the literature.

Population estimates underpinning all estimates were sourced from *Estimates and projections, Aboriginal and Torres Strait Islander Australians, 2006 to 2031* (ABS 2019b) and *Australian Demographic Statistics* (ABS 2019a).

Details of the various data sources, including standard inputs, are in 'Appendix A: Methods overview' and in *Australian Burden of Disease Study 2018: methods and supplementary material* (AIHW 2021c).

Additional tables/information to accompany this report, as well as data visualisations showing burden of disease estimates, are provided on the AIHW website at http://www.aihw.gov.au/burden-of-disease/.

What's new in the ABDS 2018 and in this report?

This detailed report contains a new chapter on health-adjusted life expectancy (HALE) (Chapter 8) and presents key changes in estimates over the 3 reference years for Indigenous Australians (Chapter 7). Box 1.4 provides a brief overview of the main developments since the last Indigenous burden of disease study (ABDS 2011).

What about the burden due to COVID-19?

As this study (ABDS 2018) aims to provide estimates of disease burden for the 2018 reference year, estimates of the burden due to COVID-19 are not included. However, as part of a separate project, AIHW has calculated estimates of the fatal and non-fatal burden due to COVID-19 in Australia for 2020 using Australian deaths and notifications data. These estimates were published in a synthesis report on COVID-19 in Australia (AIHW 2021d). The report used the best available data at the time of analysis and largely drew on methods and development work internationally. Estimates were reported at the national level only, and by broad age group and sex.

For future ABDS, COVID-19 will be added to the ABDS cause list for reporting from 2020 onwards in order to monitor the direct fatal and non-fatal impacts of the disease. As data on COVID-19 and methods for estimating burden are continuously improving over time, this work would be updated to incorporate improvements in data (for example, use of linked data) and to reflect the latest understanding of the disease and any further improvements to methods. Estimates could also be extended to be produced for Indigenous Australians and at subnational levels (state/territory, remoteness and socioeconomic group).

Box 1.4: Key developments since the 2011 Aboriginal and Torres Strait Islander burden of disease study

1. An expanded list of diseases, which includes the disaggregation of:
   - diabetes into type 1 and type 2 diabetes
   - leukaemia into 5 sub-types
   - mouth and pharyngeal cancer into lip and oral cavity cancer, nasopharyngeal cancer and other oral cavity and pharynx cancers
   - vision loss into 5 conditions—refractive errors, cataract and other lens disorders, glaucoma, age-related macular degeneration and other vision disorders
   - varicella-zoster into varicella (chickenpox) and herpes-zoster (shingles)
   - other land transport accidents into road traffic injury—pedestrians, road traffic injury—pedal cyclists, and other land transport accidents
   - pneumoconiosis into silicosis, asbestosis and other pneumoconiosis.

   together with new diseases previously reported in residual groupings:
   - urinary tract infections
   - mumps
   - interstitial nephritis
   - scabies.
2. New conceptual models for some diseases in line with changes to the disease list or new evidence.
3. New data sources for many diseases.
4. Reporting of sub-categories of risk factor estimates including:
   - overweight (including obesity), reported separately, as well as combined
   - illicit drug use by type
   - tobacco use by exposure method (active or passive)
   - high blood plasma glucose by intermediate hyperglycaemia and diabetes.
5. Impaired kidney function (including 2 subcategories for disease stage) and low birthweight/short gestation as new risk factors.
6. Child abuse risk factor, expanded from just sexual abuse to include physical, emotional abuse and neglect.
7. Intimate partner violence risk factor, expanded from physical and sexual abuse to include emotional abuse.
8. Revised risk factor calculations and an increased number of linked diseases for selected risk factors due to increased evidence.
9. Estimation of HALE (see Chapter 8).

(continued)

Box 1.4 (continued): Key developments since the 2011 Aboriginal and Torres Strait Islander burden of disease study

Estimates for 2003 and 2011 have been recalculated, where methods were updated, to enable comparison with 2018 estimates (see Chapter 7). Historical estimates have also been recalculated to account for revised Indigenous population estimates published following the 2016 Census (ABS 2019b). The published estimates from previous Australian studies are not directly comparable with those for the ABDS 2018 due to these method changes. Further information can be found in Appendix A.

Methodological choices specific to Indigenous estimates

Underlying the burden of disease estimates presented in this report are a number of methodological choices, assumptions and inputs. These choices are each associated with underlying assumptions and can affect the burden of disease estimates produced, including the relative burden assigned to different diseases and risk factors.

Additional factors needed to be 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 were consistent with those used to produce national estimates. For example, the same reference life table, disability weights and disease list were used. However, it was not always possible to adopt completely consistent methods due to differences in data availability, data quality and population size and characteristics.

This section discusses some of the methodological issues and choices specific to Indigenous burden of disease estimates. A summary of general methods for calculating burden of disease estimates, as well as further discussion on all the topics below can be found in 'Appendix A: Methods overview' with additional information in the accompanying technical methods report for the study (AIHW 2021c).

The Aboriginal and Torres Strait Islander population

In 2016, there were an estimated 798,400 Aboriginal and Torres Strait Islander people in Australia, accounting for 3.3% of the total population (ABS 2018b).

Most Indigenous Australians live in non-remote areas (81% in 2016) rather than remote areas (19%). By comparison, 99% of non-Indigenous Australians lived in non-remote areas and 1% in remote areas in 2016. However, of all people living in remote areas, the proportion who are Indigenous is relatively high. In 2016, 30% of people living in remote areas were Indigenous. Almost one-third (30%) of people living in the Northern Territory were Indigenous compared with 6% 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 2016, the median age of the Indigenous population was 20.3 compared with 37.8 for the non-Indigenous population. The Indigenous population living in remote areas tends to have a younger age structure than those living in non-remote areas.

The number of Indigenous people formally counted in the Census has increased considerably over the last few decades, with large increases of 21% between 2006 and 2011, and 18% between 2011 and 2016 (ABS 2018a). Population growth (that is, more births than deaths) can explain the majority of these increases (70% of the increase between 2006 and 2011; 79% of the increase between 2011 and 2016). However, the remaining proportion 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 2011 and 2016 occurred among those living in non-remote areas, in New South Wales and in children aged less than 15 (ABS 2018a).

To account for differences in population age structure and size, 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 2018, 2011 and 2003 estimates. However, changes in the propensity to identify as Indigenous may affect the comparability of data about Indigenous Australians 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.

Choice of population denominator

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 Indigenous burden of disease estimates.

The AIHW examined the impact of using 2 different Indigenous population denominators in rate calculations for Indigenous burden of disease estimates: the backcast and projected estimates based on the most recent Census, and a cohort-interpolated population based on individual Census years. The backcast approach applies the Indigenous identification level in 2016 to all earlier years, while the interpolation approach applies the identification level at the closest Census point to each year. Although the interpolation approach would seem appropriate in terms of matching identification levels at the time of data collection, it was agreed in consultation with the study reference group to use the backcast population series based on the 2016 Census, as this provides a consistent population denominator time series (which is important for assessing changes in rates over time) as well as consistency with the previous ABDS 2011 method and all other AIHW and national Closing the Gap reporting.

Data quality and availability

While in recent decades major improvements have been made to the quality and availability of information about Indigenous Australians, existing data are subject to a number of limitations. These include: under-identification of Indigenous Australians in administrative data sets; 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, various methods have been used to adjust for these issues in this study. These are discussed in this section.

Indigenous under-identification

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

Mortality data

Every year, a number of deaths of Aboriginal and Torres Strait Islander people are not identified as such when registered (ABS 2018c). This might arise from the non-reporting of a deceased person's Indigenous status on the death registration form (for example, the question is never asked, or the answer is not known), 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 net effect is an under-identification of Aboriginal and Torres Strait Islander people in the deaths data. Previous analysis by the AIHW suggests that up to 15% of Indigenous deaths may not be recorded as Indigenous in official mortality records (AIHW 2019c).

Adjustment factors to account for Indigenous under-identification in death registration records have been produced from national and state/territory data linkage studies. These studies include the ABS Census Data Enhancement (CDE) Study (ABS 2013; 2018c) and the AIHW Enhanced Mortality Database (EMD) study (AIHW 2012; 2017f).

Based on the results from a series of sensitivity analyses on the impact of using the different mortality adjustment factors and discussion with the study reference group, the approach taken for the 2018 reference year was to use adjustment factors from the ABS 2016 CDE Study to adjust Indigenous deaths for YLL estimates and gap measures. The ABS adjustment factors 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.

The adjustment factors used for the 2003 and 2011 reference years in the ABDS 2018 were the same as those used in the ABDS 2011, that is, factors from the ABS 2011 CDE Study (ABS 2013) for the national, state/territory and socioeconomic levels, and factors from the AIHW EMD study (AIHW 2012, 2017f) for remoteness levels.

Hospitalisations data

Hospitalisations of Indigenous Australians 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 are an underestimate of hospitalisations of Indigenous Australians.

In the ABDS 2018, 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 2018 and 2011 estimates, adjustment factors from the 2011–12 Indigenous identification in hospital separations data quality study (AIHW 2013a) were applied. For 2003 estimates, adjustment factors from the 2007–08 Indigenous identification in hospital separations data quality study (AIHW 2010) were applied.

Indirect methods

Where no data were available to provide a reliable Indigenous prevalence estimate, indirect methods were needed to derive prevalence estimates. Such methods included applying rate ratios from proxy data sources (for example, hospitalisations) to the total population prevalence.

Potential indirect methods were assessed against a set of guidelines developed by the AIHW, which covered 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 disease.

Methods for Indigenous subnational estimates

In determining methods for producing Indigenous burden of disease estimates at subnational levels, several factors were considered. These included:

- the availability of Indigenous data at the geographical levels of interest (state/territory, remoteness and socioeconomic groups)
- the 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
- the most appropriate measure of socioeconomic disadvantage for the Indigenous population.

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

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.

More information on the methods and data sources used to calculate Indigenous subnational burden of disease estimates is in 'Appendix A: Methods overview' and in *Australian Burden of Disease Study 2018: methods and supplementary material* (AIHW 2021c).

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 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 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 very small number of events—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 to reduce the overall mortality gap, whereas rate ratios tell us which causes have the greatest relative disparities in death rates 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 should not be added together to estimate burden in the total population, because differences in data sources and adjustments made to account for under-identification mean that there will be slight differences from the estimates made for all Australians. Refer to the AIHW report *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* (AIHW 2021a) for burden of disease estimates for the total Australian population.

Box 1.5: 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 (DALY), non-fatal (YLD) and fatal (YLL) 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.

(continued)

Box 1.5 (continued): Different types of estimates presented in this report

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 2018).

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 (such as between 2003 and 2018 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 A: 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, fatal (YLL), non-fatal (YLD) and total burden (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 & 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 2018.

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 2018 the burden was estimated for 219 diseases.

2

Total burden of disease

Key results

- In 2018, Indigenous Australians lost 239,942 years of healthy life due to premature death or living with disease or injury, or 289 DALY for every 1,000 people.
- Indigenous Australians suffered more burden from living with illness (53% of total burden) than burden from premature death (47% of total burden).
- Overall, Indigenous males experienced more burden (54% of total burden) than Indigenous females (46%). Dying from disease and injury accounted for more burden in males, while living with illness accounted for more burden in females.
- The rate of burden (number of DALY per 1,000 people) increased with age from early childhood, with older Indigenous Australians experiencing a substantial proportion of the total burden despite making up a small proportion of the population.
- The main contributors to burden in 2018 were mental & substance use disorders (23% of DALY), injuries (12%), cardiovascular diseases (10%), cancer (9.9%) and musculoskeletal conditions (8.0%).
- In children aged under 5, infant & congenital conditions caused most of the burden.
- Mental & substance use disorders and injuries were the main causes of burden among Indigenous Australians aged 5–45.
- Cancer and cardiovascular diseases and were the main contributors to disease burden in Indigenous Australians aged 45 and over.
- Neurological conditions (such as dementia) also contributed substantially to burden in Indigenous Australians aged 75 and over.
- In 2018, the 5 conditions causing the most burden among Indigenous Australians were coronary heart disease (5.8% of the total), anxiety disorders (5.3%), suicide & self-inflicted injuries (4.6%), alcohol use disorders (4.4%) and depressive disorders (4.3%).

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, due to both 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.

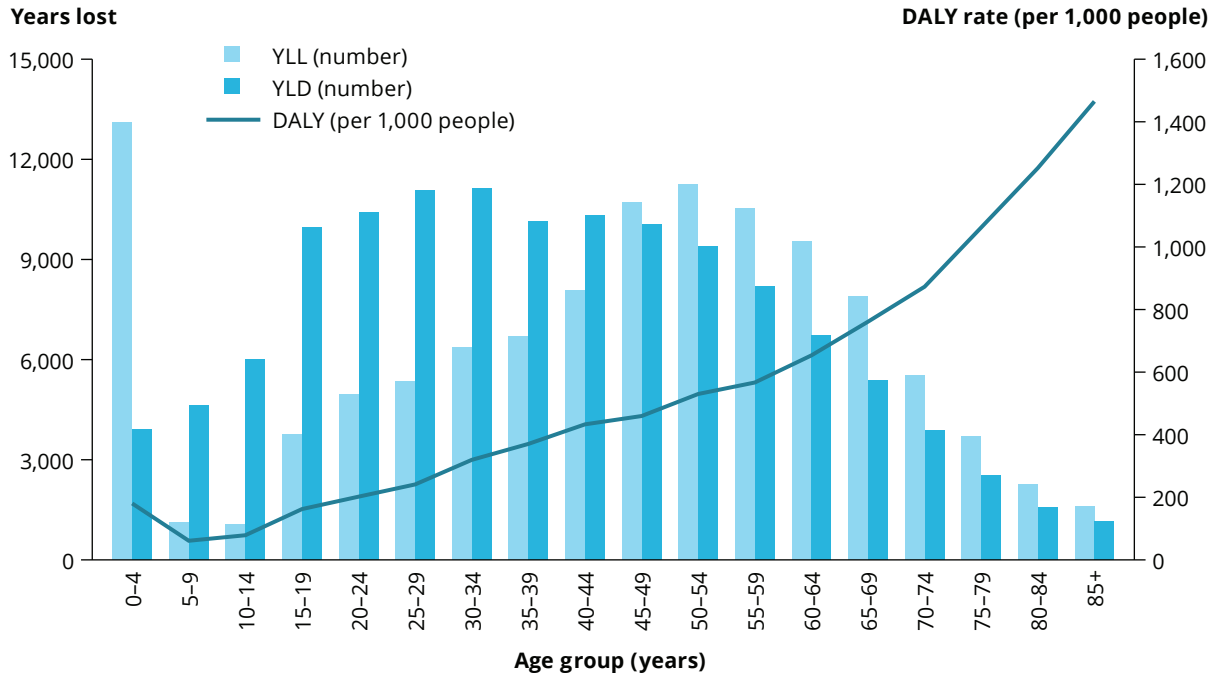
This chapter presents estimates of total burden (DALY) for the Aboriginal and Torres Strait Islander population in 2018. Comparisons to estimates for the non-Indigenous population, including estimates of the gap in total burden between Indigenous and non-Indigenous Australians, are presented in 'Chapter 6 Gap in health outcomes'. Estimates of burden at the subnational level (by state and territory, remoteness and socioeconomic status) are presented in 'Chapter 10 Variation across geographic and population groups'.

2.1 Total burden experienced in 2018

In 2018, Indigenous Australians lost 239,942 years due to premature death or living with disease or injury, which equates to around 289 DALY for every 1,000 Indigenous Australians. This burden was split between 113,445 years of life lost due to premature death (YLL) and 126,496 disability-weighted years lived with disease or injury (YLD) (47% fatal, 53% non-fatal burden), which affected Aboriginal and Torres Strait Islander people differently across the life course.

Among infants and young children aged 0–4 there were substantially more YLL than YLD, with each death in this age group contributing up to 86 YLL. Most (83%) of the burden among Indigenous children aged 5–14 resulted from living with illness (YLD), as did around two-thirds of the burden among people aged 15–44. For Indigenous Australians aged 45 and over, more than half of the total burden was due to premature death (YLL) (Figure 2.1).

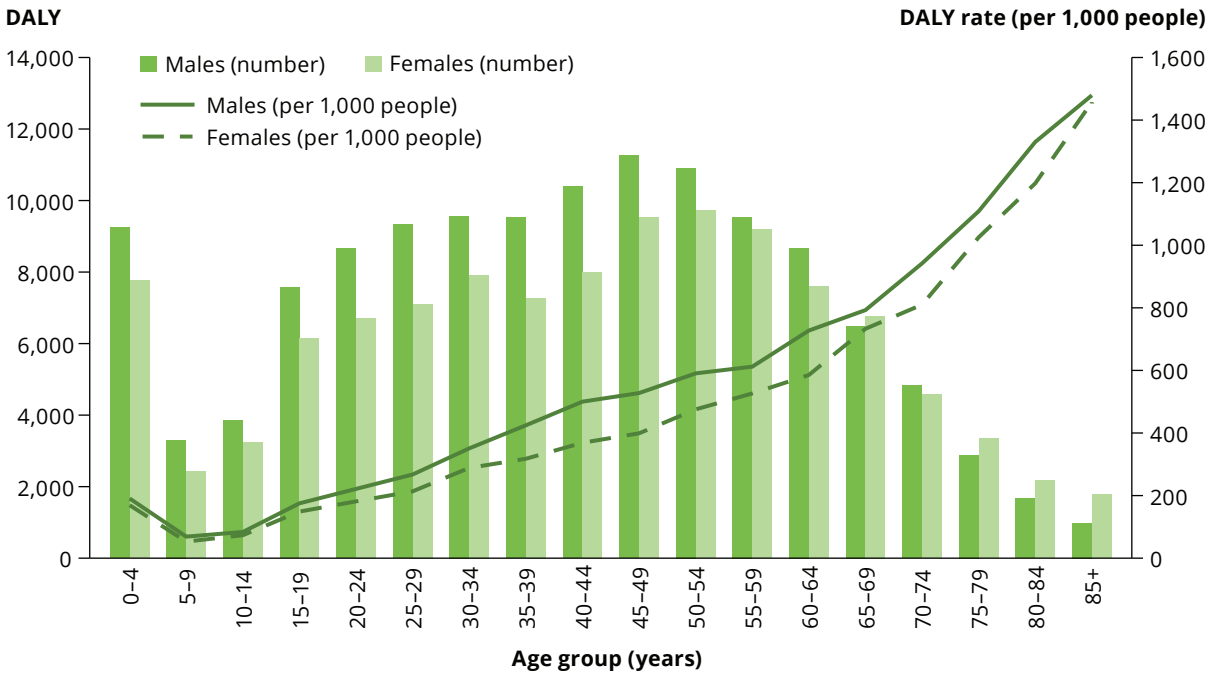
Figure 2.1: Fatal (YLL) and non-fatal (YLD) composition of the total burden (DALY) for Indigenous Australians, by age group, 2018



Source: This figure is based on data in a supplementary table available online—Table S2.1.

Indigenous males experienced 128,700 DALY compared to 111,242 DALY for Indigenous females, accounting for 54% of the total burden compared with 46% for females. Indigenous males experienced more burden than females across all age groups as reflected in the higher DALY rates (Figure 2.2). Higher DALY counts for Indigenous females aged 65 and over were driven by the greater number of Indigenous women still alive in these age groups compared to Indigenous men.

Figure 2.2: Number and rates of total burden (DALY), by age group and sex, Indigenous Australians, 2018



Source: This figure is based on data in a supplementary table available online—Table S2.2.

2.2 Which disease groups cause the most burden?

The total burden (DALY) caused by disease groups is described in this section. For information relating to the reporting of disease groups and individual diseases in the ABDS 2018, refer to Box 2.1.

- Among Indigenous Australians, the largest disease group contributors to total burden in 2018 were mental & substance use disorders (23% of total burden), followed by injuries (12%), cardiovascular diseases (10%), cancer (9.9%) and musculoskeletal conditions (8.0%) (Figure 2.3).
- Mental & substance use disorders was the greatest contributor to total burden for both Indigenous males and females, accounting for 23% and 22% of burden, respectively (Figure 2.3, Table 2.1). The leading causes of mental & substance use total burden were anxiety disorders (23% of total mental & substance use burden), alcohol use disorders (19%) and depressive disorders (19%).

- Injuries were responsible for a higher proportion of the burden in Indigenous males (16%) than in Indigenous females (8.3%) and ranked second for males and sixth for females. The leading causes of injuries burden were suicide & self-inflicted injuries (37% of total injuries burden), poisoning (such as the toxic effects of medicinal or other substances) (17%), road traffic injuries (motor vehicle occupants) (12%) and homicide & violence (10%).

More detail about the individual diseases that contribute to the burden in each disease group is presented in 'Chapter 9 Overview of results by disease group'.

Box 2.1: How are diseases and disease groups assigned in the Australian Burden of Disease Study 2018?

The ABDS 2018 estimated the years of healthy life lost due to living with illness (YLD) and the years of life lost due to dying from illness (YLL) for 219 separate diseases and injuries, which were grouped into 17 disease groups (16 disease groups, 1 injury group reported by external cause and nature of injury).

Disease

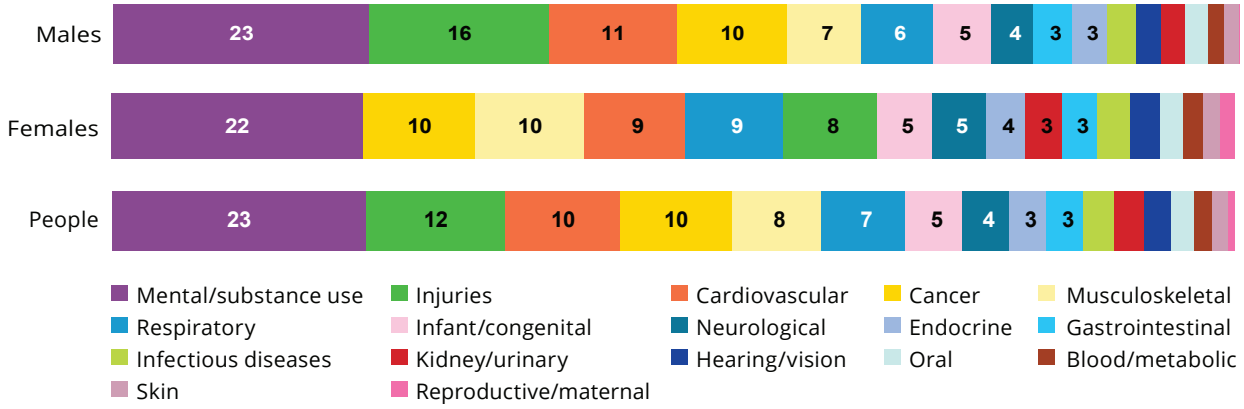
Disease is a term that describes a health problem. The ABDS 2018 disease list was developed to reflect the needs of health reporting and monitoring in Australia; it listed mutually exclusive diseases and injuries (defined according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, or ICD-10) that collectively reflected the total disease burden in Australia.

Disease group

A disease group consists of a number of related diseases/conditions. Each of the 219 diseases was assigned to a disease group, based on the chapter structure of ICD-10 codes (WHO 2016). For injuries, the conditions were grouped by both external cause (presented in this chapter) and nature of injury (see Appendix D). Conditions that could not be individually specified for analysis were grouped into the residual ('other') category of each disease group.

For example, musculoskeletal conditions is a disease group that includes back pain & problems, osteoarthritis, rheumatoid arthritis and gout. A number of conditions (such as fibromyalgia, tendonitis) were grouped into the residual category—'other musculoskeletal conditions'—and are collectively analysed and reported in the study.

Figure 2.3: Proportion (%) of total burden (DALY), by disease group and sex, Indigenous Australians, 2018



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

Table 2.1: Total burden (DALY, DALY %, DALY age-standardised rates (ASRs)), by disease group and sex, Indigenous Australians, 2018

	Males				Females			
Rank	Disease group	DALY	Proportion (%)	ASR	Disease group	DALY	Proportion (%)	ASR
1	Mental/ substance use	29,277	22.7	75.8	Mental/ substance use	24,986	22.5	63.6
2	Injuries	20,490	15.9	53.4	Cancer	11,103	10.0	43.8
3	Cardiovascular	14,662	11.4	62.1	Musculoskeletal	10,791	9.7	39.2
4	Cancer	12,639	9.8	57.8	Cardiovascular	9,950	8.9	41.8
5	Musculoskeletal	8,377	6.5	32.9	Respiratory	9,699	8.7	35.0
6	Respiratory	8,221	6.4	33.6	Injuries	9,279	8.3	24.4
7	Infant/congenital	6,692	5.2	10.6	Infant/congenital	5,471	4.9	8.8
8	Neurological	4,774	3.7	23.6	Neurological	5,282	4.7	23.1
9	Gastrointestinal	4,449	3.5	16.4	Endocrine	3,936	3.5	15.2
10	Endocrine	4,030	3.1	17.4	Kidney/urinary	3,623	3.3	15.1
11	Infectious diseases	3,270	2.5	10.6	Gastrointestinal	3,514	3.2	12.5
12	Hearing/vision	2,865	2.2	12.0	Infectious diseases	3,227	2.9	9.9
13	Kidney/urinary	2,775	2.2	12.8	Hearing/vision	2,968	2.7	11.1
14	Oral	2,631	2.0	8.5	Oral	2,322	2.1	7.3
15	Blood/metabolic	1,832	1.4	5.3	Blood/metabolic	1,957	1.8	5.6
16	Skin	1,651	1.3	4.3	Skin	1,732	1.6	4.4
17	Reproductive/ maternal	66	0.1	0.2	Reproductive/ maternal	1,401	1.3	3.6
	Total	**128,700**	**100.0**	**437.4**	**Total**	**111,242**	**100.0**	**364.4**

Notes

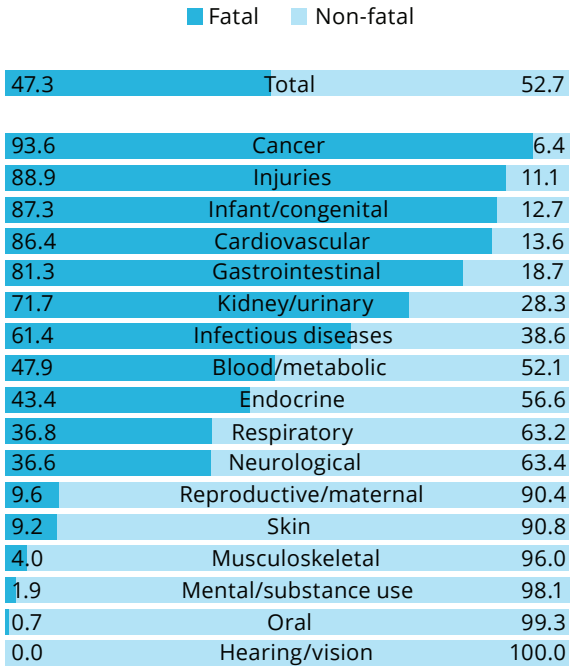
1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed as DALY per 1,000 people (DALY ASR).
2. Numbers and percentages shown for disease groups may not add up to the total due to rounding.

How does the contribution of fatal and non-fatal burden differ across disease groups?

The contribution to total burden due to dying prematurely (fatal burden; YLL) and living with illness (non-fatal burden; YLD) differed greatly for each disease group (Figure 2.4).

Among the 5 highest burden disease groups, the total burden from cancer, injuries and cardiovascular diseases was predominantly fatal (YLL contributing 94%, 89% and 86% of the disease group burden, respectively), while the burden from mental & substance use disorders and musculoskeletal conditions was predominantly non-fatal (YLD contributing 98% and 96% of the disease group burden, 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.

Figure 2.4: Fatal (YLL) and non-fatal (YLD) proportion of total burden, by disease group, Indigenous Australians, 2018



Source: This figure is based on data in a supplementary table available online—Table S2.3.

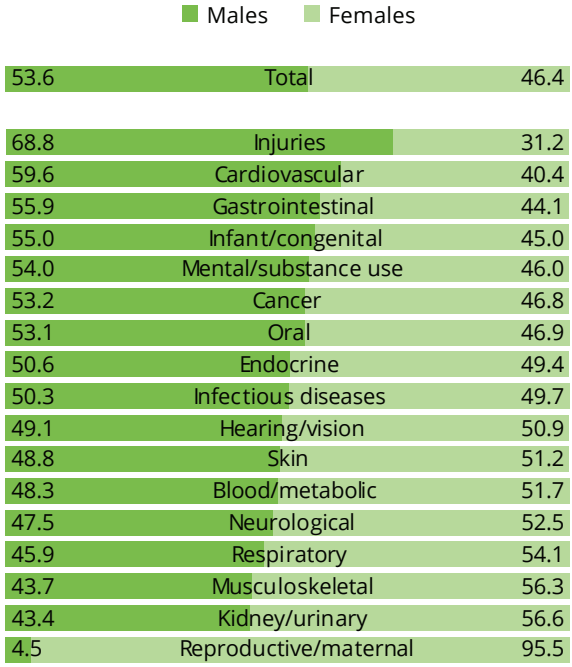
How does burden differ between males and females?

Indigenous males accounted for slightly more than half (54%) of the total burden in 2018 (Figure 2.5). Indigenous males experienced a higher proportion (52%) of their total burden due to dying early from disease and injury while Indigenous females experienced more of their burden from living with disease (58%).

The distribution of overall burden between the sexes varied by disease group (Figure 2.5). Indigenous males experienced over two-thirds (69%) of the burden from injuries and a greater share of the burden from cardiovascular diseases (60%), gastrointestinal disorders (56%), infant & congenital conditions (55%) and mental & substance use disorders (54%). Indigenous females experienced a greater share of the burden from kidney & urinary diseases (57%), musculoskeletal conditions (56%) and respiratory diseases (54%).

The disease group reproductive & maternal conditions consists of predominantly female-related conditions (for example, polycystic ovarian syndrome, endometriosis, and pregnancy-related disorders), with 96% of the burden due to this disease group occurring in Indigenous females.

Figure 2.5: Proportion of total burden (DALY) by sex, by disease group for Indigenous Australians, 2018



Source: This figure is based on data in a supplementary table available online—Table S2.4.

Indigenous males and females experienced different rates of burden (reported as age-standardised rates, or ASRs; see Box 2.2 for more information) for each disease group. After adjusting for differences in the population age structure, Indigenous males experienced 20% more burden than Indigenous females (rate ratio of 1.2); however, there were clear differences in burden by disease group (Table 2.2).

Box 2.2: Age-standardised rates (ASRs)

The ABDS 2018 compares the rate of disease burden between different population groups and different time periods using ASRs. ASRs seek to allow like-for-like comparisons.

Firstly, the ASR expresses the burden in terms of the number of years lost per 1,000 people (the 'rate' part) to remove differences in burden that are just due to the different sizes of the 2 populations.

Secondly, it adjusts for differences in the age structure between the 2 populations. The burden of both living with illness and dying from disease is influenced by age. Different population groups have a different composition of age groups.

Using ASRs ensures the rate of each comparison group is based on a standard population with consistent age structure (to remove differences in burden due to differences in age composition) and allows for accurate comparison of disease burden between 2 groups.

Indigenous males had 2.2 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, of 29 and 20 DALY per 1,000, respectively (Table 2.2).

Indigenous females experienced higher rates of burden than Indigenous males for reproductive & maternal conditions (rate ratio of 0.1), kidney & urinary diseases (0.8), musculoskeletal conditions (0.8) and blood & metabolic disorders (0.9).

Table 2.2: Comparison of DALY rate ratios and rate differences of age-standardised rates (ASRs): Indigenous males: Indigenous females, Australia, 2018

	DALY ASR			
Disease group	Males	Females	Rate difference	Rate ratio
Injuries	53.4	24.4	29.0	2.2
Cardiovascular	62.1	41.8	20.3	1.5
Cancer	57.8	43.8	14.0	1.3
Mental/substance use	75.8	63.6	12.2	1.2
Gastrointestinal	16.4	12.5	3.9	1.3
Endocrine	17.4	15.2	2.2	1.1
Infant/congenital	10.6	8.8	1.8	1.2
Oral	8.5	7.3	1.2	1.2
Hearing/vision	12.0	11.1	0.8	1.1
Infectious diseases	10.6	9.9	0.7	1.1
Neurological	23.6	23.1	0.5	1.0
Skin	4.3	4.4	–0.1	1.0
Blood/metabolic	5.3	5.6	–0.3	0.9
Respiratory	33.6	35.0	–1.4	1.0
Kidney/urinary	12.8	15.1	–2.3	0.8
Reproductive/maternal	0.2	3.6	–3.3	0.1
Musculoskeletal	32.9	39.2	–6.3	0.8
Total	**437.4**	**364.4**	**73.0**	**1.2**

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. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. Numbers may not add to totals for all columns due to rounding.

2.3 Which diseases and injuries cause the most burden?

Of the 219 individual diseases analysed, the leading 20 diseases and injuries together accounted for 57% of the burden that Indigenous Australians experienced in 2018 (60% for males and 56% for females). Rankings for diseases that caused the largest amount of burden in males and females are shown in Table 2.3. Coronary heart disease (CHD), anxiety disorders and depressive disorders were ranked in the top 5 diseases for both sexes; however, the proportion of burden that each contributed was different.

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

Table 2.3: Leading 20 causes of total burden (DALY) for Indigenous Australians, by sex, 2018

Rank	Males	DALY	% of total	Females	DALY	% of total	People	DALY	% of total
1	Coronary heart disease	9,073	7.0	Anxiety disorders	7,489	6.7	Coronary heart disease	13,992	5.8
2	Suicide & self-inflicted injuries	8,111	6.3	Depressive disorders	6,137	5.5	Anxiety disorders	12,674	5.3
3	Alcohol use disorders	7,933	6.2	Coronary heart disease	4,920	4.4	Suicide & self-inflicted injuries	10,930	4.6
4	Anxiety disorders	5,185	4.0	Asthma	4,736	4.3	Alcohol use disorders	10,568	4.4
5	Depressive disorders	4,095	3.2	COPD	4,111	3.7	Depressive disorders	10,231	4.3
6	COPD	4,068	3.2	Back pain & problems	3,719	3.3	COPD	8,179	3.4
7	Type 2 diabetes	3,415	2.7	Type 2 diabetes	3,539	3.2	Asthma	7,975	3.3
8	Lung cancer	3,283	2.6	Chronic kidney disease	3,501	3.1	Type 2 diabetes	6,954	2.9
9	Asthma	3,239	2.5	Suicide & self-inflicted injuries	2,819	2.5	Back pain & problems	6,953	2.9
10	Back pain & problems	3,234	2.5	Alcohol use disorders	2,635	2.4	Chronic kidney disease	6,067	2.5
11	Poisoning	3,179	2.5	Lung cancer	2,584	2.3	Lung cancer	5,867	2.4
12	Drug use disorders (excluding alcohol)	2,992	2.3	Hearing loss	2,363	2.1	Poisoning	5,091	2.1
13	Chronic liver disease	2,937	2.3	Drug use disorders (excluding alcohol)	2,006	1.8	Drug use disorders (excluding alcohol)	4,999	2.1
14	Schizophrenia	2,716	2.1	Poisoning	1,912	1.7	Hearing loss	4,714	2.0
15	Chronic kidney disease	2,566	2.0	Dementia	1,845	1.7	Chronic liver disease	4,683	2.0
16	RTI - motor vehicle occupants	2,544	2.0	Rheumatoid arthritis	1,821	1.6	Schizophrenia	3,870	1.6
17	Hearing loss	2,351	1.8	Chronic liver disease	1,746	1.6	RTI - motor vehicle occupants	3,642	1.5
18	Pre-term birth & LBW complications	2,035	1.6	Osteoarthritis	1,625	1.5	Pre-term birth & LBW complications	3,367	1.4
19	Epilepsy	1,826	1.4	Breast cancer	1,499	1.3	Dementia	3,297	1.4
20	Homicide & violence	1,799	1.4	Stroke	1,498	1.3	Stroke	3,149	1.3

(continued)

Table 2.3 (continued): Leading 20 causes of total burden (DALY) for Indigenous Australians, by sex, 2018

Rank	Males	DALY	% of total	Females	DALY	% of total	People	DALY	% of total
	Leading 20 diseases	76,579	59.5	Leading 20 diseases	62,508	56.2	Leading 20 diseases	137,202	57.2
	All other diseases	*52,121*	*40.5*	*All other diseases*	*48,734*	*43.8*	*All other diseases*	*102,739*	*42.8*
	Total	**128,700**	**100.0**	**Total**	**111,242**	**100.0**	**Total**	**239,942**	**100.0**

Colour legend: % of total burden. ≥ 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

COPD chronic obstructive pulmonary disease; LBW low birthweight; RTI road traffic injuries.

Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'. Numbers may not add to totals for all columns due to rounding.

2.4 How does disease burden change across the life course?

Indigenous Australians experienced major health loss from different types of disease groups and individual diseases throughout the life course.

Figures 2.6 and 2.7 show the amount (Figure 2.6) and relative proportion (Figure 2.7) of total burden (DALY) contributed by each disease group across the life course for Indigenous males and females in 2018.

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 contributors to disease burden in older Indigenous Australians.

Respiratory diseases affected all age groups, accounting for between 3% and 13% of total burden in Indigenous males and females across age groups.

Musculoskeletal conditions (back pain & problems) affected all age groups from age 5, accounting for between 4% and 12% of total burden in Indigenous Australians across age groups.

Figure 2.6: Total burden (number of DALY), by disease group and age group, Indigenous males and females, 2018

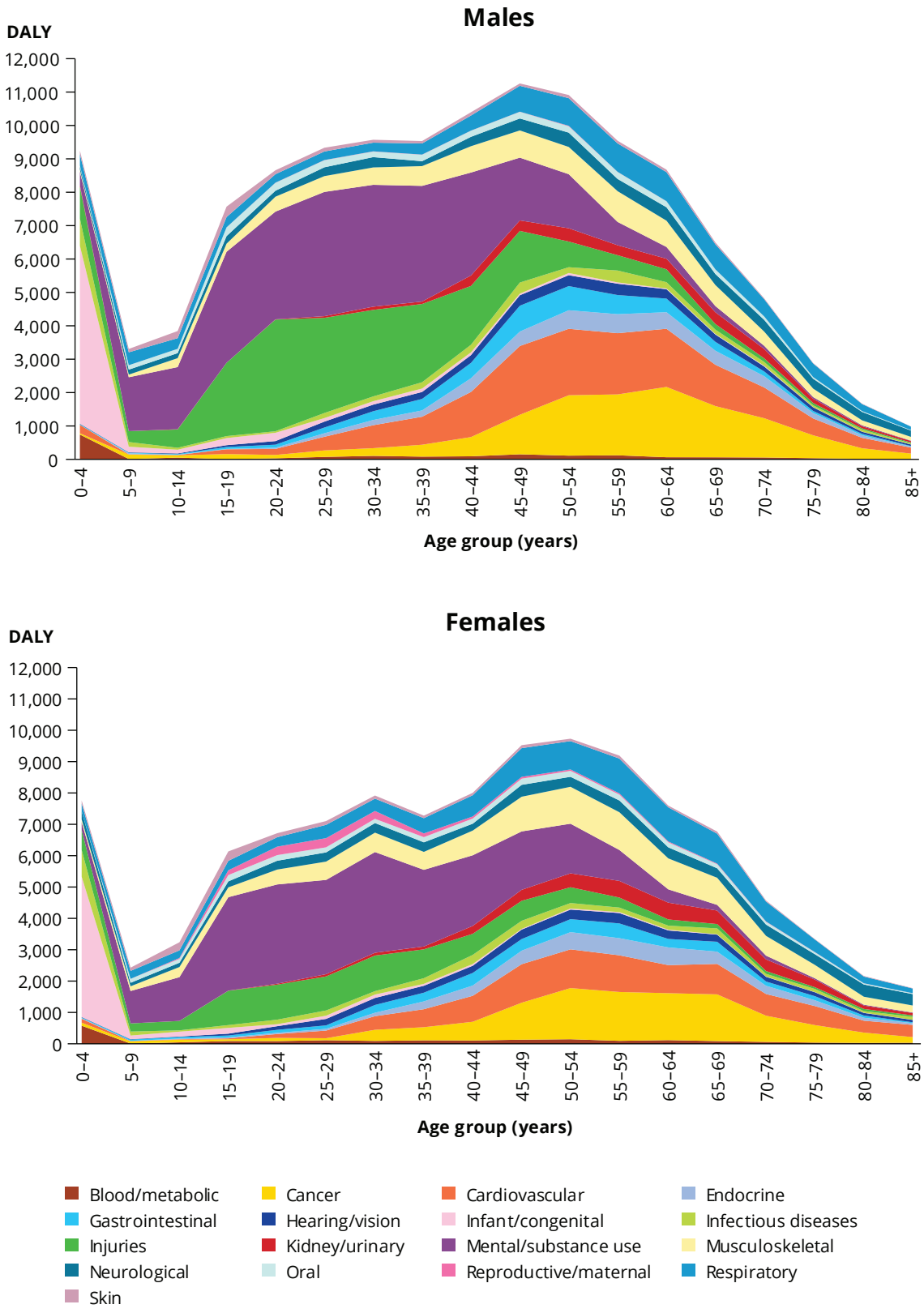
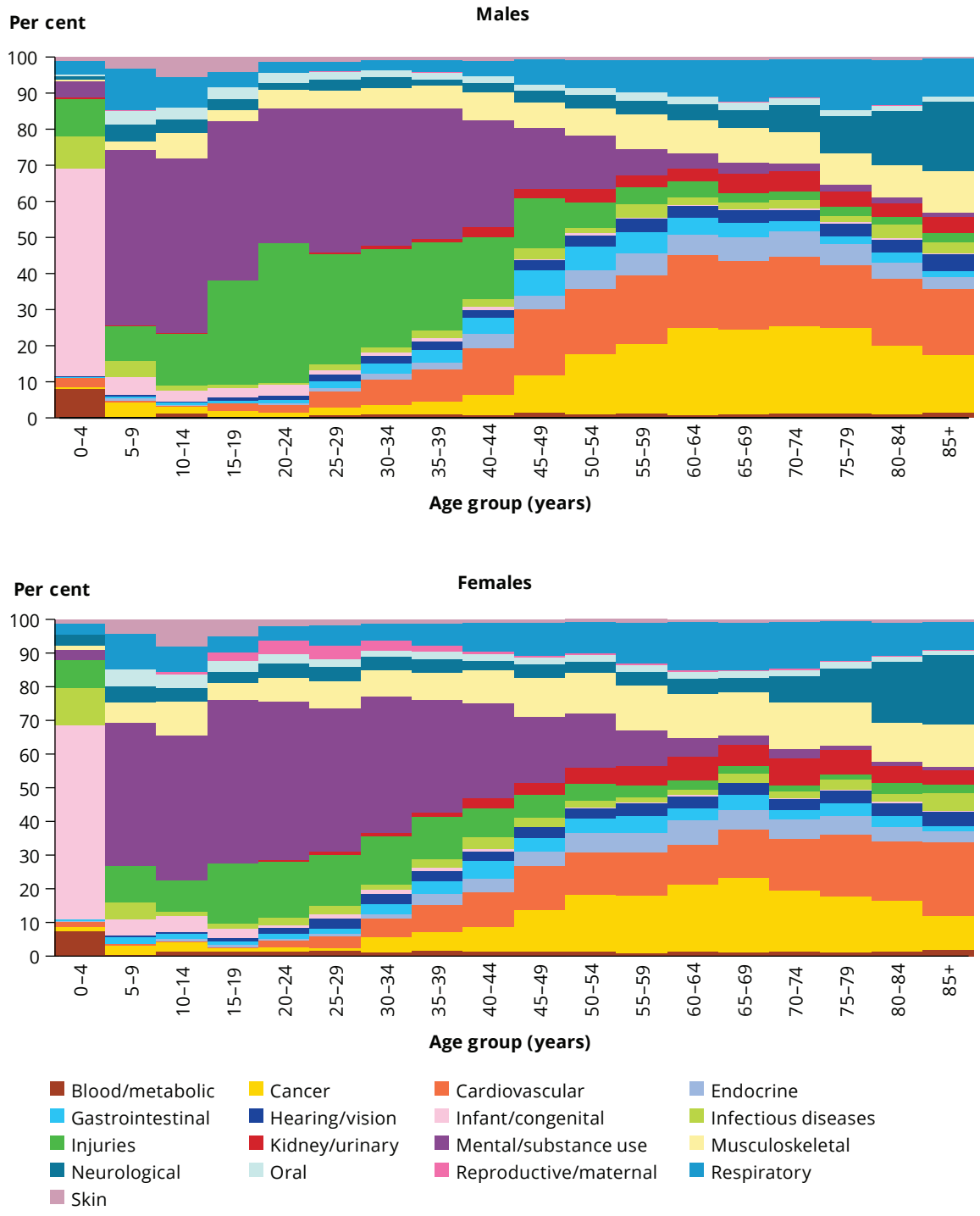


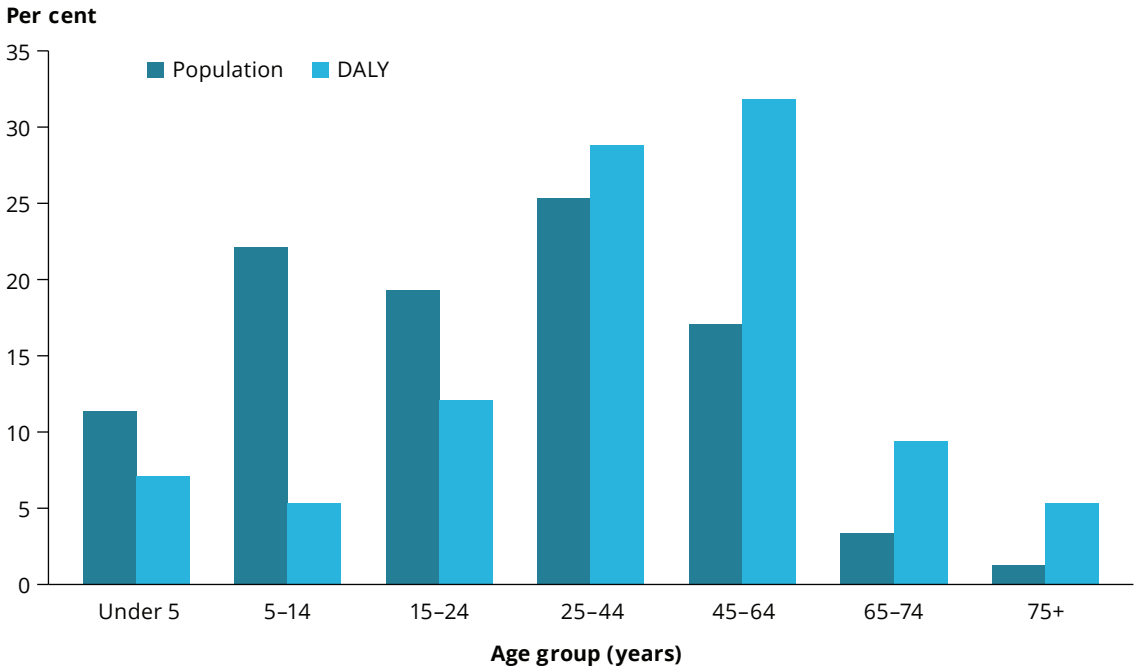
Figure 2.7: Relative proportion of total burden (DALY), by disease group and age group, Indigenous males and females, 2018



Leading causes of total burden at different stages of life

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. As the amount of burden varies greatly by age, the same leading causes may have very large differences in burden across age groups (for example, asthma in infants versus in children). Conversely, causes that are not ranked among the leading 10 causes for some age groups may still be high-burden diseases. The burden in 7 broad age groups is described in this section, drawing on results shown in figures 2.8, 2.9, 2.10 and 2.11.

Figure 2.8: Proportion of Indigenous population and total burden (DALY), by age group, Indigenous Australians, 2018



Source: This figure is based on data in a supplementary table available online—Table S2.5.

Infants and young children (aged under 5)

- Infants and children aged under 5 comprised 11% of the Indigenous population, and accounted for 7% of the total burden of Indigenous Australians in 2018.
- Infant & congenital conditions accounted for a large portion of the burden in this age group, mostly due to pre-term/low birthweight complications (17% of the total), birth trauma & asphyxia (8.8%) and SIDS (sudden infant death syndrome; 5.3%).
- Protein-energy deficiency (a type of malnutrition) was also a major contributor of burden in this age group, accounting for 6.4% of the overall burden.

Children (aged 5–14)

- Children aged 5–14 comprised 22% of the total Indigenous population, but accounted for only 5% of the total burden of disease.
- Anxiety disorders (accounting for 13% of the total burden), asthma (8.7%), depressive disorders (6.3%) and conduct disorder (14%) were the main causes of health loss for Indigenous children aged 5–14. Estimates for conduct disorder 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 young adults (aged 15–24)

- Adolescents and young adults aged 15–24 made up about 19% of the Indigenous population and accounted for 12% of the total burden.
- Mental & substance use disorders and injuries were the main contributors to the burden in this age group.
- Suicide & self-inflicted injuries (20% of the total burden), alcohol use disorders (12%), anxiety disorders (5.2%) and motor vehicle traffic accidents (4.9%) were the leading causes of the burden in Indigenous males aged 15–24.
- Anxiety disorders (13% of the total burden), suicide & self-inflicted injuries (11%), depressive disorders (9.8%) and alcohol use disorders (6.8%) were the leading causes of the burden in Indigenous females aged 15–24.

Adults (aged 25–44)

- Adults aged 25–44 made up 25% of the total Indigenous population and contributed 29% to the total burden.
- For Indigenous males aged 25–44, alcohol use disorders were the leading contributor to total burden (12%), followed by suicide & self-inflicted injuries (10%) and anxiety disorders (5.7%).
- Anxiety disorders (11% of the total) and depressive disorders (9.1%) were the 2 leading contributors to the burden among Indigenous females aged 25–44, followed by asthma (4.9%).

Adults (aged 45–64)

- Adults aged 45–64 made up 17% of the Indigenous population and contributed 32% of total burden.
- For Indigenous males aged 45–64, CHD, COPD and lung cancer were the leading diseases contributing to the burden, together accounting for almost one-quarter (24%) of the burden for Indigenous males in this age group. Chronic liver disease (CLD) and type 2 diabetes were also leading contributors to the burden in this age group.
- For Indigenous females aged 45–64, CHD, COPD and type 2 diabetes were the leading diseases contributing to the total burden (together accounting for 18% of the burden in this age group). Chronic kidney disease and anxiety disorders were also leading contributors to the burden for Indigenous females in this age group.

Adults (aged 65–74)

- Adults aged 65–74 made up only 3.4% of the Indigenous population in 2018, but accounted for 9.4% of the burden.
- CHD, COPD, lung cancer, chronic kidney disease and type 2 diabetes were the major contributors to the burden for both Indigenous males and females in this age group.

Older people (aged 75 and over)

- Adults aged 75 and over comprised only 1.3% of the Indigenous population, but accounted for 5.3% of the total burden.
- Dementia, COPD and CHD were the major contributors to the burden in both Indigenous males and females aged 75 and over, together accounting for 30% and 29% of the burden, respectively.
- Lung cancer and type 2 diabetes were also leading contributors of burden for Indigenous males in this age group.
- For Indigenous females, chronic kidney diseases and rheumatoid arthritis rounded out the top 5 leading causes of burden in this age group.

Figure 2.9: Leading causes of total burden (DALY; proportion of total %) for Indigenous males, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,784; 19%)	Conduct disorder (1,127; 16%)	Suicide/self-inflicted injuries (3,200; 20%)	Alcohol use disorders (4,656; 12%)	Coronary heart disease (5,270; 13%)	Coronary heart disease (1,322; 12%)	Dementia (611; 11%)
2nd	Birth trauma/ asphyxia (635; 6.9%)	Anxiety disorders (899; 13%)	Alcohol use disorders (1,996; 12%)	Suicide/self-inflicted injuries (4,022; 10%)	COPD (2,211; 5.5%)	COPD (1,026; 9.1%)	COPD (570; 10%)
3rd	Protein-energy deficiency (557; 6.0%)	Asthma (662; 9.3%)	Anxiety disorders (851; 5.2%)	Anxiety disorders (2,209; 5.7%)	Lung cancer (2,038; 5.0%)	Lung cancer (760; 6.7%)	Coronary heart disease (510; 9.2%)
4th	SIDS (475; 5.1%)	ADHD (366; 5.1%)	RTI/motor vehicle occupant (802; 4.9%)	Poisoning (2,102; 5.4%)	Chronic liver disease (1,923; 4.8%)	Type 2 diabetes (678; 6.0%)	Lung cancer (260; 4.7%)
5th	Other unintentional injuries (405; 4.4%)	Depressive disorders (344; 4.8%)	Depressive disorders (794; 4.9%)	Depressive disorders (2,078; 5.4%)	Type 2 diabetes (1,844; 4.6%)	Chronic kidney disease (571; 5.0%)	Type 2 diabetes (252; 4.5%)
6th	Cardiovascular defects (403; 4.4%)	Autism spectrum disorders (309; 4.3%)	Drug use disorders (794; 4.9%)	Coronary heart disease (1,915; 4.9%)	Back pain and problems (1,316; 3.3%)	Dementia (498; 4.4%)	Stroke (228; 4.1%)
7th	Neonatal infections (320; 3.5%)	Dental caries (258; 3.6%)	Schizophrenia (609; 3.8%)	Schizophrenia (1,634; 4.2%)	Chronic kidney disease (1,242; 3.1%)	Stroke (301; 2.7%)	Rheumatoid arthritis (220; 4.0%)
8th	Asthma (297; 3.2%)	RTI/motor vehicle occupant (225; 3.1%)	Asthma (507; 3.1%)	Drug use disorders (1,599; 4.1%)	Alcohol use disorders (1,158; 2.9%)	Rheumatoid arthritis (286; 2.5%)	Prostate cancer (213; 3.8%)
9th	LRI incl influenza & pneumonia (287; 3.1%)	Epilepsy (210; 2.9%)	Dental caries (389; 2.4%)	Back pain and problems (1,117; 2.9%)	Hearing loss (1,078; 2.7%)	Hearing loss (285; 2.5%)	Chronic kidney disease (191; 3.5%)
10th	Other gastro-intestinal inf. (213; 2.3%)	Intellectual disability (177; 2.5%)	Homicide/ violence (353; 2.2%)	RTI/motor vehicle occupant (1,026; 2.6%)	Anxiety disorders (1,072; 2.7%)	Back pain and problems (265; 2.3%)	Hearing loss (136; 2.5%)
	Top 10 (5,376; 58%)	Top 10 (4,576; 64%)	Top 10 (10,294; 63%)	Top 10 (22,358; 58%)	Top 10 (19,153; 47%)	Top 10 (5,993; 53%)	Top 10 (3,191; 58%)

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Note: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions.

Figure 2.10: Leading causes of total burden (DALY; proportion of total %) for Indigenous females, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,179; 15%)	Anxiety disorders (738; 13%)	Anxiety disorders (1,612; 13%)	Anxiety disorders (3,342; 11%)	Coronary heart disease (2,574; 7.1%)	COPD (1,097; 9.7%)	Dementia (971; 13%)
2nd	Birth trauma/ asphyxia (869; 11%)	Conduct disorder (684; 12%)	Suicide/self-inflicted injuries (1,381; 11%)	Depressive disorders (2,757; 9.1%)	COPD (2,150; 6.0%)	Coronary heart disease (919; 8.1%)	Coronary heart disease (603; 8.3%)
3rd	Protein-energy deficiency (533; 6.9%)	Depressive disorders (458; 8.1%)	Depressive disorders (1,265; 9.8%)	Asthma (1,483; 4.9%)	Type 2 diabetes (1,933; 5.4%)	Chronic kidney disease (783; 6.9%)	COPD (546; 7.5%)
4th	Cardiovascular defects (436; 5.6%)	Asthma (458; 8.1%)	Alcohol use disorders (879; 6.8%)	Back pain and problems (1,298; 4.3%)	Chronic kidney disease (1,785; 5.0%)	Lung cancer (722; 6.4%)	Chronic kidney disease (407; 5.6%)
5th	SIDS (434; 5.6%)	Back pain and problems (323; 5.7%)	Drug use disorders (605; 4.7%)	Alcohol use disorders (1,118; 3.7%)	Anxiety disorders (1,654; 4.6%)	Type 2 diabetes (631; 5.6%)	Rheumatoid arthritis (402; 5.5%)
6th	Other unintentional injuries (244; 3.2%)	Dental caries (247; 4.4%)	Asthma (545; 4.2%)	Drug use disorders (1,103; 3.6%)	Lung cancer (1,581; 4.4%)	Dementia (541; 4.8%)	Stroke (378; 5.2%)
7th	LRI incl influenza & pneumonia (224; 2.9%)	Epilepsy (184; 3.2%)	Bipolar affective disorder (481; 3.7%)	Suicide/self-inflicted injuries (1,020; 3.4%)	Asthma (1,555; 4.3%)	Rheumatoid arthritis (439; 3.9%)	Type 2 diabetes (319; 4.4%)
8th	Neonatal infections (211; 2.7%)	Acne (161; 2.8%)	Back pain and problems (479; 3.7%)	Poisoning (1,011; 3.3%)	Depressive disorders (1,488; 4.1%)	Asthma (373; 3.3%)	Lung cancer (194; 2.7%)
9th	Asthma (206; 2.7%)	ADHD (153; 2.7%)	Eating disorders (443; 3.4%)	Coronary heart disease (797; 2.6%)	Back pain and problems (1,304; 3.6%)	Osteoarthritis (355; 3.1%)	Hearing loss (177; 2.4%)
10th	Other gastro-intestinal inf. (193; 2.5%)	Suicide/self-inflicted injuries (142; 2.5%)	Dental caries (329; 2.6%)	Hearing loss (760; 2.5%)	Hearing loss (987; 2.7%)	Hearing loss (297; 2.6%)	Atrial fibrillation (150; 2.1%)
	Top 10 (4,530; 58%)	Top 10 (3,548; 63%)	Top 10 (8,020; 62%)	Top 10 (14,687; 48%)	Top 10 (17,011; 47%)	Top 10 (6,158; 54%)	Top 10 (4,146; 57%)

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Note: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions. No deaths from suicide & self-inflicted injuries were recorded in people aged less than 9 years.

Figure 2.11: Leading causes of total burden (DALY; proportion of total %) for Indigenous Australians, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (2,963; 17%)	Conduct disorder (1,811; 14%)	Suicide/self-inflicted injuries (4,581; 16%)	Alcohol use disorders (5,774; 8.4%)	Coronary heart disease (7,845; 10%)	Coronary heart disease (2,241; 9.9%)	Dementia (1,582; 12%)
2nd	Birth trauma/ asphyxia (1,504; 8.8%)	Anxiety disorders (1,638; 13%)	Alcohol use disorders (2,875; 9.9%)	Anxiety disorders (5,551; 8.0%)	COPD (4,361; 5.7%)	COPD (2,124; 9.4%)	COPD (1,116; 8.7%)
3rd	Protein-energy deficiency (1,090; 6.4%)	Asthma (1,120; 8.7%)	Anxiety disorders (2,463; 8.5%)	Suicide/self-inflicted injuries (5,042; 7.3%)	Type 2 diabetes (3,777; 4.9%)	Lung cancer (1,482; 6.5%)	Coronary heart disease (1,112; 8.7%)
4th	SIDS (909; 5.3%)	Depressive disorders (802; 6.3%)	Depressive disorders (2,059; 7.1%)	Depressive disorders (4,835; 7.0%)	Lung cancer (3,619; 4.7%)	Chronic kidney disease (1,355; 6.0%)	Rheumatoid arthritis (622; 4.9%)
5th	Cardiovascular defects (839; 4.9%)	ADHD (518; 4.0%)	Drug use disorders (1,399; 4.8%)	Poisoning (3,113; 4.5%)	Chronic kidney disease (3,027; 4.0%)	Type 2 diabetes (1,309; 5.8%)	Stroke (606; 4.7%)
6th	Other unintentional injuries (650; 3.8%)	Dental caries (505; 3.9%)	RTI/motor vehicle occupant (1,087; 3.7%)	Coronary heart disease (2,712; 3.9%)	Chronic liver disease (2,837; 3.7%)	Dementia (1,040; 4.6%)	Chronic kidney disease (598; 4.7%)
7th	Neonatal infections (531; 3.1%)	Back pain and problems (470; 3.7%)	Asthma (1,052; 3.6%)	Drug use disorders (2,701; 3.9%)	Anxiety disorders (2,726; 3.6%)	Rheumatoid arthritis (725; 3.2%)	Type 2 diabetes (571; 4.5%)
8th	LRI incl influenza & pneumonia (511; 3.0%)	Epilepsy (394; 3.1%)	Schizophrenia (838; 2.9%)	Back pain and problems (2,415; 3.5%)	Back pain and problems (2,620; 3.4%)	Hearing loss (582; 2.6%)	Lung cancer (455; 3.5%)
9th	Asthma (503; 3.0%)	Autism spectrum disorders (385; 3.0%)	Bipolar affective disorder (784; 2.7%)	Asthma (2,294; 3.3%)	Asthma (2,312; 3.0%)	Stroke (560; 2.5%)	Hearing loss (313; 2.4%)
10th	Other gastro-intestinal inf. (406; 2.4%)	RTI/motor vehicle occupant (315; 2.5%)	Back pain and problems (781; 2.7%)	Schizophrenia (2,241; 3.2%)	Depressive disorders (2,282; 3.0%)	Asthma (529; 2.3%)	Bowel cancer (269; 2.1%)
	Top 10 (9,906; 58%)	Top 10 (7,958; 62%)	Top 10 (17,919; 62%)	Top 10 (36,678; 53%)	Top 10 (35,407; 46%)	Top 10 (11,946; 53%)	Top 10 (7,243; 57%)

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Note: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions.

3

Non-fatal burden of disease

Key results

- In 2018, Indigenous Australians lost 126,496 years of healthy life due to living with the impacts of disease and injury (non-fatal burden).
- The overall rate of non-fatal burden among Indigenous Australians in 2018 was 152 YLD per 1,000 people. This was 12% higher than the rate of fatal burden (137 YLL per 1,000 people).
- Indigenous males and females experienced similar rates of non-fatal burden throughout the life course, which was lowest in infants and children and generally increased with age.
- The main disease groups causing non-fatal burden in Indigenous Australians were mental & substance use disorders (42%), musculoskeletal conditions (15%) and respiratory diseases (9.0%).
- In children aged under 5, the main causes of non-fatal burden were blood & metabolic disorders, infectious diseases, mental & substance use disorders (mainly developmental and behavioural disorders) and respiratory diseases, together accounting for over three-quarters of non-fatal burden in this age group.
- From ages 5 to 54, mental & substance use disorders dominated, accounting for one-third to two-thirds of the total non-fatal burden across the age groups.
- Individual chronic diseases, including musculoskeletal conditions, chronic obstructive pulmonary disease (COPD), dementia, hearing loss and type 2 diabetes, contributed increasingly to non-fatal burden in the older age groups.

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.

In this report, the 'non-fatal' burden of living with illness is measured as the years lived with disability (YLD; see Box 3.1), where 1 YLD is 1 year of healthy life lost due to living with the impacts of disease or injury (weighted to account for disease severity).

This chapter presents estimates of non-fatal burden (YLD) for the Aboriginal and Torres Strait Islander population in 2018. Comparisons with the non-Indigenous population, including estimates of the gap in non-fatal burden, are in 'Chapter 6 Gap in health outcomes'. Estimates of non-fatal burden at the subnational level (by state and territory, remoteness and socioeconomic status) are presented in 'Chapter 10 Variation across geographic and population groups'.

3.1 Non-fatal burden experienced in 2018

In 2018, Indigenous Australians lost 126,496 years of healthy life due to the impact of living with disease and injury. This accounted for just over one-half (53%) of the total burden experienced by Indigenous Australians and is equivalent to 152 YLD per 1,000 people.

Indigenous females experienced slightly more non-fatal health loss than Indigenous males, with females accounting for just over half of the total YLD (64,081 YLD, 51% for females and 62,415 YLD, 49% for males). While the rates of non-fatal burden were similar between males and females at younger ages and in the elderly (age 80 and over), Indigenous males experienced a higher rate of non-fatal burden in the age group 35–44, and females experienced a higher rate of non-fatal burden from ages 55–79 (Figure 3.1).

Box 3.1: How is years lived with disability calculated?

The calculation of YLD can be complex, but in simple terms it incorporates:

- the number of people with the disease and the consequences of the disease (the consequences are referred to as 'sequelae') during the reference year
- the duration of the disease sequelae (duration is expressed as a fraction of a year)
- the severity of the ill health associated with the disease sequelae (referred to as the 'disability weight').

The YLD experienced by the Australian population is calculated for each disease in the ABDS 2018, for each of the reference years. The number of people with the disease sequelae is multiplied by the duration of the sequelae to obtain point prevalence. The point prevalence is then multiplied by the disability weight to obtain the YLD.

For example, stroke has 2 sequelae: acute stroke (initial consequence) and chronic stroke (long-term consequence). The YLD for each sequela is estimated as follows: number of people suffering from acute (or chronic) stroke in a reference year x duration (out of 1 year) x disability weight (scale of 0–1). The total number of healthy years lost from living with stroke is obtained by adding the YLD for acute and chronic stroke.

For more detailed information on estimating YLD, see 'Appendix A: Methods overview'.

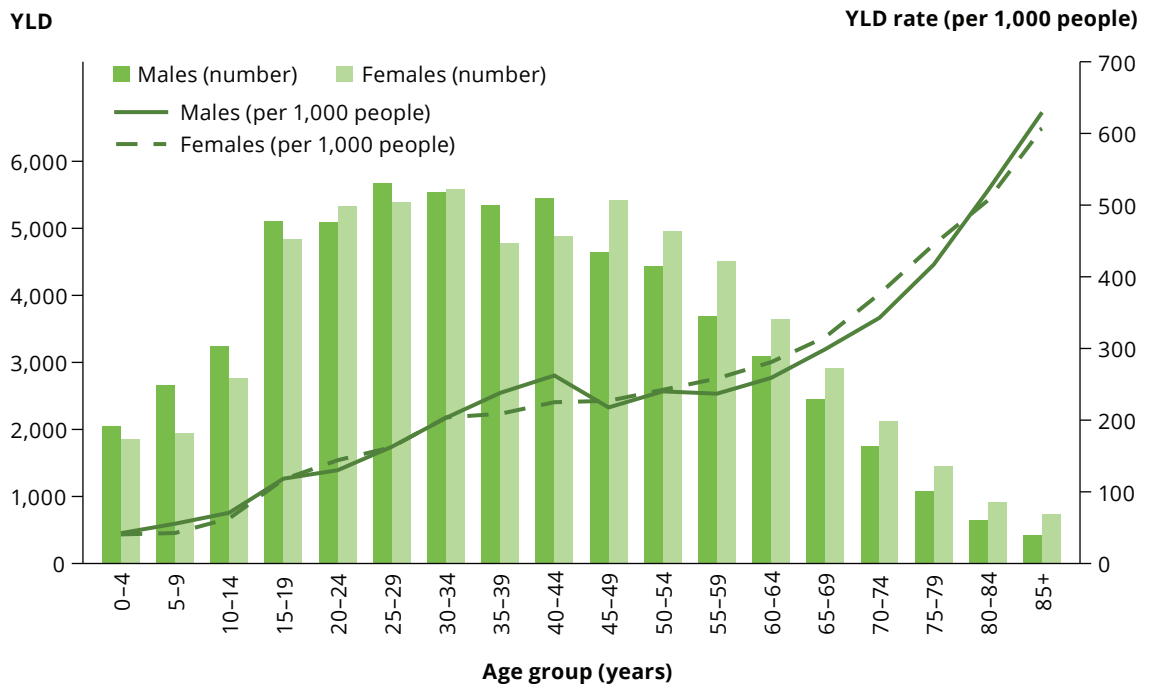
3.2 How does non-fatal burden vary by age?

The non-fatal health loss experienced by Indigenous Australians in 2018 varied by age, both in absolute number and rate of YLD. The total number of YLD experienced by Indigenous infants and young children was low, but increased rapidly until early adulthood.

In absolute terms (number of YLD), the majority of non-fatal burden was experienced by Indigenous males and females aged between 15 and 49 years.

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

Figure 3.1: Number and rate of years lived with disability (YLD), by age group and sex, Indigenous Australians, 2018



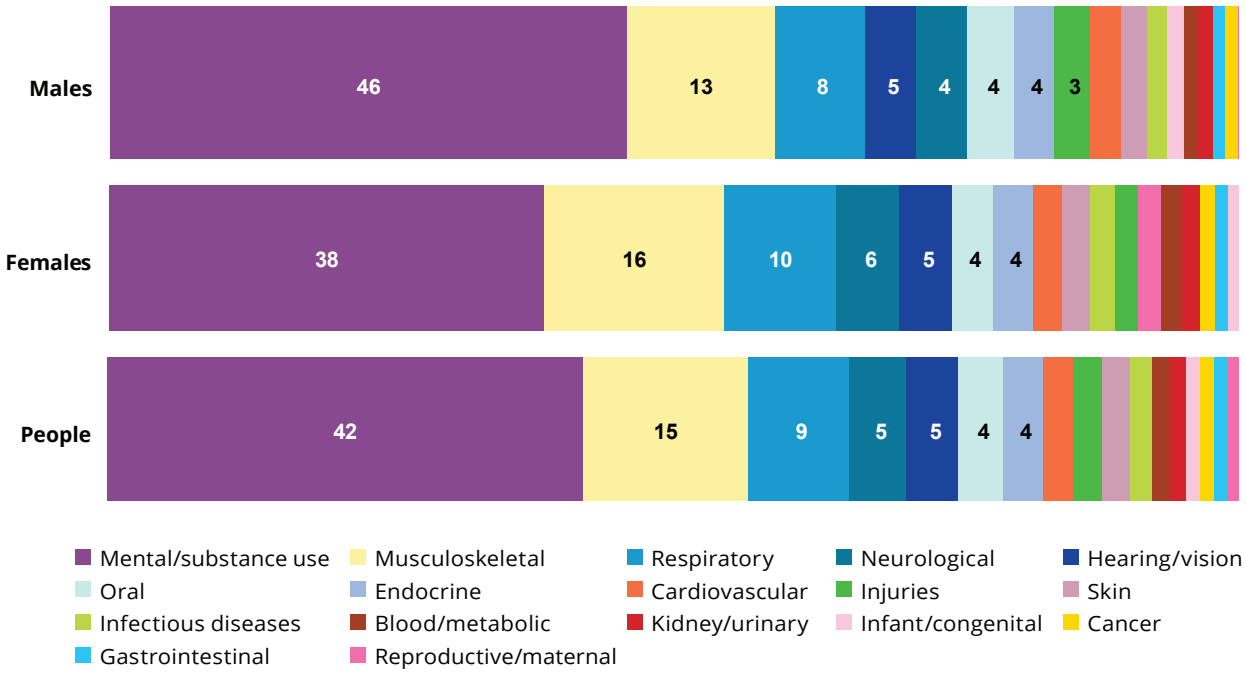
Source: This figure is based on data in a supplementary table available online—Table S3.1.

3.3 Which disease groups cause the most non-fatal burden?

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

- Three disease groups accounted for two-thirds (66%) of the non-fatal burden experienced by Indigenous Australians in 2018: mental & substance use disorders (42%), musculoskeletal conditions (15%) and respiratory diseases (9.0%) (Figure 3.2).
- Mental & substance use disorders were responsible for a higher proportion of the non-fatal burden in Indigenous males (46%) than in Indigenous females (38%) (Table 3.1). The leading causes of mental & substance use non-fatal burden were anxiety disorders (24% of mental & substance use non-fatal burden), depressive disorders (19%) and alcohol use disorders (19%).
- Musculoskeletal conditions were responsible for a slightly higher proportion of the non-fatal burden in Indigenous females (16%) than in Indigenous males (13%) (Table 3.1). The leading specific causes of musculoskeletal non-fatal burden were back pain & problems (38% of musculoskeletal non-fatal burden), rheumatoid arthritis (16%) and osteoarthritis (14%).
- Other disease groups that contributed substantially to the non-fatal burden included neurological conditions (5%) and hearing & vision disorders (5%).

Figure 3.2: Proportion of non-fatal burden (YLD) by disease groups and sex, Indigenous Australians, 2018



Note: Percentage labels are not shown for disease groups contributing less than 3% of burden.
Source: Table 3.1.

Table 3.1: Non-fatal burden (YLD, YLD %, YLD age-standardised rates (ASRs)), by disease group and sex, Indigenous Australians, 2018

	Males				Females			
Rank	Disease group	YLD	Proportion (%)	ASR	Disease group	YLD	Proportion (%)	ASR
1	Mental/ substance use	28,571	45.8	73.1	Mental/ substance use	24,667	38.5	62.5
2	Musculoskeletal	8,182	13.1	32.0	Musculoskeletal	10,221	15.9	37.2
3	Respiratory	4,957	7.9	17.3	Respiratory	6,375	9.9	20.7
4	Hearing/vision	2,865	4.6	12.0	Neurological	3,575	5.6	14.3
5	Neurological	2,804	4.5	13.0	Hearing/vision	2,968	4.6	11.1
6	Oral	2,598	4.2	8.4	Oral	2,319	3.6	7.3
7	Endocrine	2,223	3.6	8.9	Endocrine	2,284	3.6	8.3
8	Injuries	1,959	3.1	5.3	Cardiovascular	1,635	2.6	7.1
9	Cardiovascular	1,710	2.7	8.3	Skin	1,590	2.5	3.8
10	Skin	1,480	2.4	3.5	Infectious diseases	1,426	2.2	3.9
11	Infectious diseases	1,085	1.7	2.9	Injuries	1,338	2.1	4.0
12	Infant/congenital	966	1.5	2.4	Reproductive/ maternal	1,271	2.0	3.2
13	Blood/metabolic	788	1.3	1.8	Blood/metabolic	1,186	1.9	3.0
14	Kidney/urinary	778	1.2	3.8	Kidney/urinary	1,031	1.6	4.2
15	Gastrointestinal	716	1.1	2.2	Cancer	837	1.3	3.6
16	Cancer	680	1.1	3.9	Gastrointestinal	774	1.2	2.4
17	Reproductive/ maternal	55	0.1	0.2	Infant/congenital	584	0.9	1.4
	Total	**62,415**	**100.0**	**199.0**	**Total**	**64,081**	**100.0**	**197.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed as YLD per 1,000 people (YLD ASR).
2. Numbers and percentages shown for disease groups may not add up to the total due to rounding.

How does non-fatal burden differ between males and females?

Age-standardised rates (ASRs) 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 and females experienced similar amounts of non-fatal burden overall (rate ratio 1.0; rate difference 1.1), however, there were some large differences in YLD rates by disease group (Table 3.2):

- Indigenous males had 1.7 times the non-fatal burden due to infant & congenital conditions and 1.3 times the non-fatal burden due to injuries compared with Indigenous females.

- Indigenous males experienced less non-fatal burden due to blood & metabolic disorders than Indigenous females (rate ratio of 0.6).
- The disease group 'reproductive & maternal conditions' includes a number of highly sex-specific diseases for which most of the burden is experienced by females.

Table 3.2: Comparison of YLD rate ratios and rate differences of age-standardised rates (ASRs): Indigenous males: Indigenous females, Australia, 2018

	YLD ASR			
Disease group	Males	Females	Rate difference	Rate ratio
Mental/substance use	73.1	62.5	10.6	1.2
Injuries	5.3	4.0	1.3	1.3
Cardiovascular	8.3	7.1	1.1	1.2
Oral	8.4	7.3	1.1	1.2
Infant/congenital	2.4	1.4	0.9	1.7
Hearing/vision	12.0	11.1	0.8	1.1
Endocrine	8.9	8.3	0.6	1.1
Cancer	3.9	3.6	0.3	1.1
Gastrointestinal	2.2	2.4	–0.1	0.9
Skin	3.5	3.8	–0.2	0.9
Kidney/urinary	3.8	4.2	–0.5	0.9
Infectious diseases	2.9	3.9	–0.9	0.8
Blood/metabolic	1.8	3.0	–1.1	0.6
Neurological	13.0	14.3	–1.3	0.9
Reproductive/maternal	0.2	3.2	–3.1	0.1
Respiratory	17.3	20.7	–3.4	0.8
Musculoskeletal	32.0	37.2	–5.1	0.9
Total	**199.0**	**197.9**	**1.1**	**1.0**

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. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. Numbers may not add to totals for all columns due to rounding.

3.4 Which individual diseases cause the most non-fatal burden?

The leading 20 diseases for Indigenous males and females in terms of non-fatal burden are presented in Table 3.3. Together these diseases accounted for over two-thirds of the non-fatal disease burden. The list was predominantly characterised by chronic diseases and mental & substance use disorders.

Anxiety disorders, alcohol use disorders, depressive disorders, asthma, and back pain & problems were among the 5 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 with Indigenous females (3.8%), and anxiety disorders contributed a higher proportion of YLD for Indigenous females (12% compared with 8.3% for Indigenous males).

Other major differences between Indigenous males and females were:

- the contributions due to schizophrenia (4.3% of YLD for males; 1.8% for females), autism spectrum disorders (males 1.7%; females 0.4%) and drug use disorders (males 4.5%; females 3.0%) were considerably greater for males than for females
- the contributions due to osteoarthritis (females 2.5%; males 1.4%), migraine (females 1.7%; males 0.9%) and chronic kidney disease (females 1.6%; males 1.0%) were considerably greater for females than for males.

Table 3.3: Leading 20 causes of non-fatal burden (YLD) for Indigenous Australians, by sex, 2018

Rank	Males	YLD	% of total	Females	YLD	% of total	People	YLD	% of total
1	Alcohol use disorders	7,449	11.9	Anxiety disorders	7,489	11.7	Anxiety disorders	12,674	10.0
2	Anxiety disorders	5,185	8.3	Depressive disorders	6,126	9.6	Depressive disorders	10,220	8.1
3	Depressive disorders	4,094	6.6	Asthma	4,239	6.6	Alcohol use disorders	9,914	7.8
4	Back pain & problems	3,216	5.2	Back pain & problems	3,707	5.8	Asthma	7,170	5.7
5	Asthma	2,932	4.7	Alcohol use disorders	2,465	3.8	Back pain & problems	6,923	5.5
6	Drug use disorders (excluding alcohol)	2,834	4.5	Hearing loss	2,363	3.7	Drug use disorders (excluding alcohol)	4,758	3.8
7	Schizophrenia	2,664	4.3	Type 2 diabetes	2,080	3.2	Hearing loss	4,714	3.7
8	Hearing loss	2,351	3.8	Drug use disorders (excluding alcohol)	1,924	3.0	Type 2 diabetes	3,956	3.1
9	Type 2 diabetes	1,875	3.0	Rheumatoid arthritis	1,772	2.8	Schizophrenia	3,789	3.0
10	COPD	1,694	2.7	COPD	1,758	2.7	COPD	3,452	2.7
11	Dental caries	1,641	2.6	Osteoarthritis	1,614	2.5	Dental caries	3,111	2.5
12	Conduct disorder	1,554	2.5	Dental caries	1,470	2.3	Rheumatoid arthritis	2,939	2.3
13	Intellectual disability	1,207	1.9	Bipolar affective disorder	1,457	2.3	Bipolar affective disorder	2,490	2.0
14	Rheumatoid arthritis	1,167	1.9	Dementia	1,127	1.8	Conduct disorder	2,490	2.0
15	Epilepsy	1,114	1.8	Schizophrenia	1,125	1.8	Osteoarthritis	2,490	2.0
16	Autism spectrum disorders	1,086	1.7	Migraine	1,094	1.7	Dementia	2,049	1.6
17	Bipolar affective disorder	1,034	1.7	Eating disorders	1,087	1.7	Epilepsy	2,041	1.6
18	Dementia	922	1.5	Chronic kidney disease	1,005	1.6	Intellectual disability	1,844	1.5
19	Osteoarthritis	876	1.4	Conduct disorder	936	1.5	Migraine	1,678	1.3
20	Coronary heart disease	804	1.3	Epilepsy	927	1.4	Chronic kidney disease	1,651	1.3

(continued)

Table 3.3 (continued): Leading 20 causes of non-fatal burden (YLD) for Indigenous Australians, by sex, 2018

Leading 20 diseases	45,699	73.2	Leading 20 diseases	45,766	71.4	Leading 20 diseases	90,356	71.4
All other diseases	*16,716*	*26.8*	*All other diseases*	*18,316*	*28.6*	*All other diseases*	*36,141*	*28.6*
Total	**62,415**	**100.0**	**Total**	**64,081**	**100.0**	**Total**	**126,496**	**100.0**

Colour legend: % of total non-fatal burden. ≥ 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

COPD chronic obstructive pulmonary disease; LBW low birthweight; LRI lower respiratory infections; RTI road traffic injuries.

Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'. Numbers may not add to totals for all columns due to rounding.

How does non-fatal disease burden vary across the life course?

This section outlines the main disease groups and individual diseases that caused the most non-fatal burden for Indigenous Australians in different age groups.

Figures 3.3 and 3.4 show the amount (Figure 3.3) and relative proportion (Figure 3.4) of non-fatal burden (YLD) contributed by each disease group across the life course for Indigenous males and females in 2018.

The disease groups making the greatest contribution to non-fatal burden varied across the life course. In Indigenous children aged under 5, blood & metabolic disorders (including protein-energy deficiency), infectious diseases, mental & substance use disorders (mainly behavioural and developmental disorders) and respiratory diseases were responsible for over three-quarters (76%) of the non-fatal burden.

From ages 5 to 54, non-fatal burden was dominated by mental & substance use disorders, which accounted for between one-third to two-thirds (32%–63%) of the burden in these age groups.

The burden of musculoskeletal conditions also gradually increased from childhood onwards, accounting for a quarter (25%) of the non-fatal burden experienced by Indigenous Australians aged 55–84. From 65 years onward, musculoskeletal conditions, cardiovascular diseases, neurological conditions and hearing & vision disorders together accounted for between one-half and two-thirds (50%–67%) of the non-fatal burden experienced by Indigenous Australians.

Figure 3.3: Number of non-fatal burden (YLD), by disease group and age group, Indigenous males and females, 2018

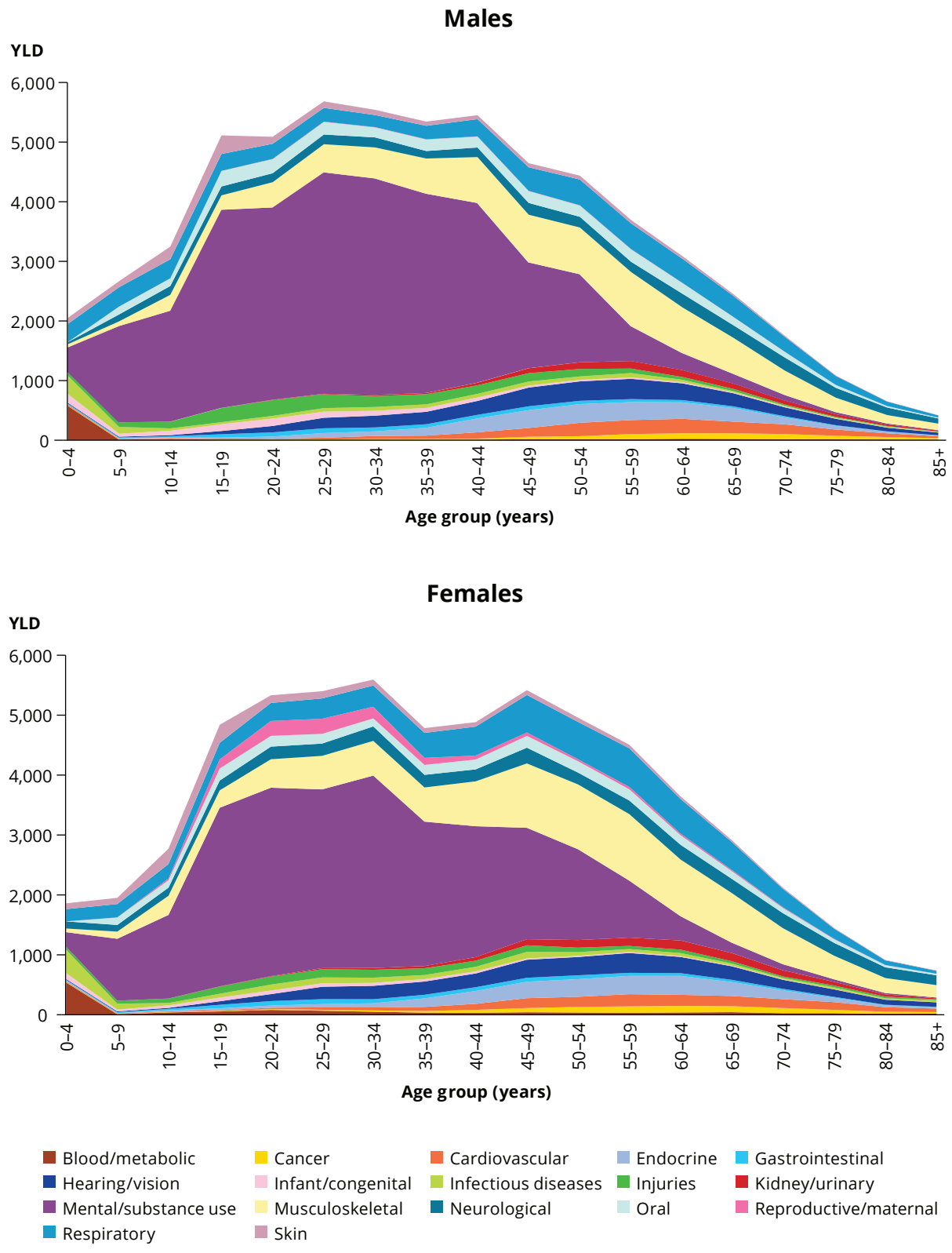
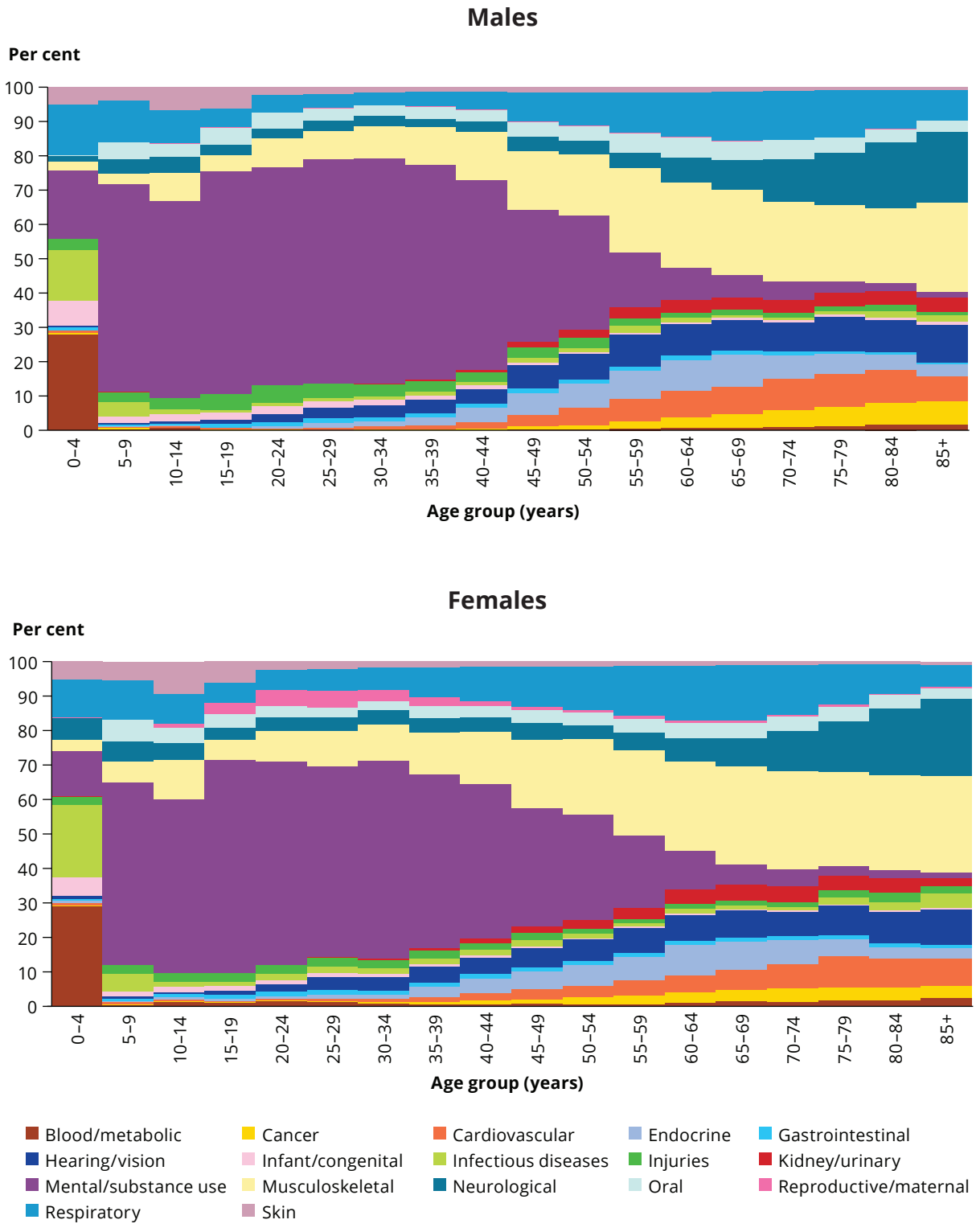


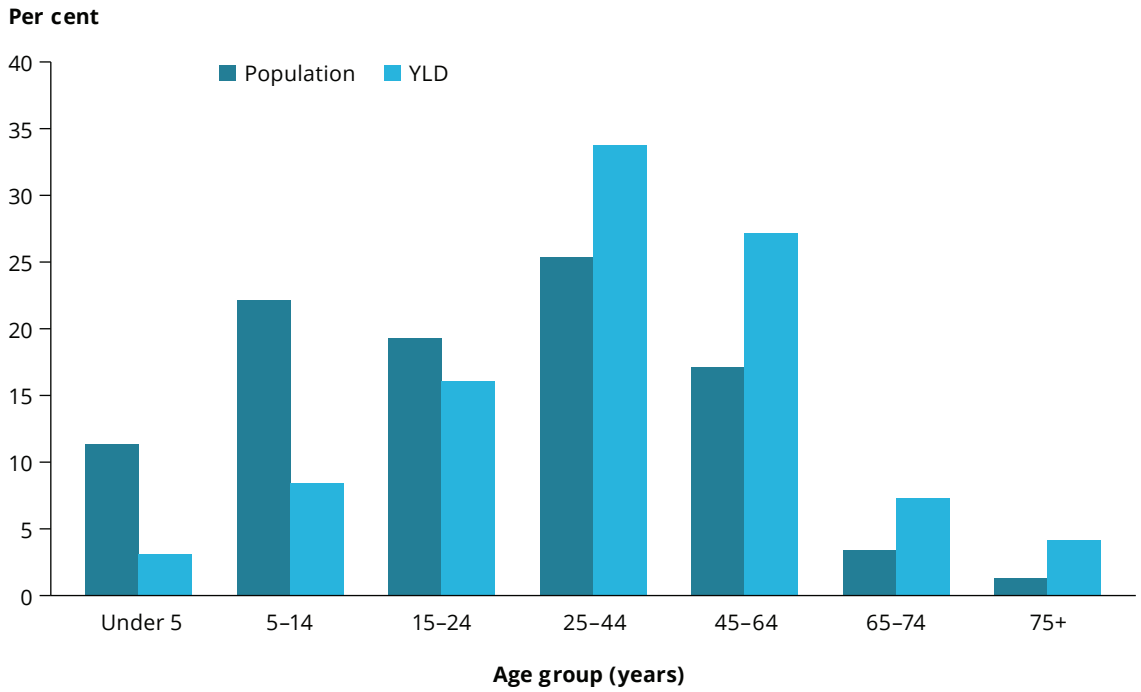
Figure 3.4: Relative proportion of non-fatal burden (YLD), by disease group and age group, Indigenous males and females, 2018



Leading causes of non-fatal burden at various life stages

The overall non-fatal burden was not evenly distributed over the different stages of life. As the amount of non-fatal burden varies greatly by age, the same leading causes may have very large differences in non-fatal burden across age groups. Conversely, causes that are not ranked among the top 10 for some age groups may still be high-burden diseases. The non-fatal burden in 7 broad age groups is described in this section, drawing on results shown in figures 3.5, 3.6, 3.7 and 3.8.

Figure 3.5: Proportion of Indigenous population and non-fatal burden (YLD), by age group, Indigenous Australians, 2018



Source: This figure is based on data in a supplementary table available online—Table S3.2.

Infants and young children (aged under 5)

Children under 5 contributed 3,911 YLD (3.1% of the total non-fatal burden), with protein-energy deficiency (a type of malnutrition), asthma and 'other gastrointestinal infections' together accounting for around half of these (51% for Indigenous males and 49% for Indigenous females).

Children (aged 5–14)

Children aged 5–14 contributed 10,638 YLD (8.4%). Conduct disorder (a behavioural disorder involving aggression and antisocial behaviour) was the main cause of non-fatal burden for Indigenous males in this age group, contributing 19% of the total (although Indigenous estimates for conduct disorder should be interpreted with caution as they are based on indirect modelling methods that are less reliable than for some other causes). Anxiety disorders were the main cause of non-fatal burden for Indigenous females in this age group, contributing 16% of the total. Asthma and depressive disorders also caused substantial non-fatal burden in this age group for both boys and girls.

Adolescents and young adults (aged 15–24)

People aged 15–24 contributed 20,373 YLD (16%), with the same 4 diseases among the top 4 contributors in both males and females. For males, alcohol use disorders were the main cause of burden, contributing 20% to the total, followed by anxiety disorders (8.3%), depressive disorders (7.8%) and drug use disorders (7.8%). For females, the main cause of burden was anxiety disorders, contributing 16% to the total, followed by depressive disorders (12%), alcohol use disorders (8.4%) and drug use disorders (6.0%). Asthma contributed around 5% in both sexes.

Adults (aged 25–44)

People aged 25–44 contributed 42,680 YLD (34%), with the top contributors very similar to those in adolescents and younger adults. For males, alcohol use disorders (21%) and anxiety disorders (10%) were the main causes of burden, followed by depressive disorders (9.4%) and schizophrenia (7.2%). For females, the largest contributors were anxiety disorders (16%) and depressive disorders (13%), followed by back pain & problems (6.3%) and asthma (6.2%). Hearing loss also appeared among the top 10 contributors in both sexes.

Adults (aged 45–64)

People aged 45–64 contributed 34,393 YLD (27%) to the total. For males, back pain & problems (8.3%) and type 2 diabetes (6.9%) were the greatest contributors, followed by hearing loss (6.8%) and anxiety disorders (6.8%). For females, anxiety disorders (8.9%) and depressive disorders (8.0%) were again the top contributors, followed by asthma (7.5%) and back pain & problems (7.0%).

Adults (aged 65–74)

This age group contributed 9,241 YLD (7.3%) to the total, and is the first age group in which mental & substance use disorders no longer appear in the top 10 contributors to non-fatal burden. COPD contributed most for both sexes, accounting for 10% in males and 8.2% in females. For males, dementia (8.5%), type 2 diabetes (7.5%), and hearing loss (6.8%) were the next greatest contributors. For females, rheumatoid arthritis (8.1%) came in second, followed by dementia (8.0%) and type 2 diabetes (7.4%). Osteoarthritis, asthma and coronary heart disease also featured in the top 10 for both sexes.

Older people (aged 75 and over)

For older Indigenous Australians (aged 75 and over) dementia was the leading cause of non-fatal burden, accounting for 16% of YLD in both males and females. Rheumatoid arthritis, COPD, hearing loss, and type 2 diabetes rounded out the top 5 contributors in both sexes. Overall, this age group contributed 5,260 YLD (4.2% of the total).

Figure 3.6: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous males, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Protein-energy deficiency (557; 27%)	Conduct disorder (1,127; 19%)	Alcohol use disorders (1,996; 20%)	Alcohol use disorders (4,528; 21%)	Back pain and problems (1,315; 8.3%)	COPD (438; 10%)	Dementia (338; 16%)
2nd	Asthma (292; 14%)	Anxiety disorders (899; 15%)	Anxiety disorders (851; 8.3%)	Anxiety disorders (2,209; 10%)	Type 2 diabetes (1,092; 6.9%)	Dementia (357; 8.5%)	Rheumatoid arthritis (220; 10%)
3rd	Other gastro-intestinal inf. (202; 9.9%)	Asthma (600; 10%)	Depressive disorders (794; 7.8%)	Depressive disorders (2,078; 9.4%)	Hearing loss (1,078; 6.8%)	Type 2 diabetes (316; 7.5%)	COPD (197; 9.1%)
4th	Conduct disorder (114; 5.6%)	ADHD (366; 6.2%)	Drug use disorders (793; 7.8%)	Schizophrenia (1,585; 7.2%)	Anxiety disorders (1,072; 6.8%)	Hearing loss (285; 6.8%)	Hearing loss (136; 6.3%)
5th	Anxiety disorders (98; 4.8%)	Depressive disorders (344; 5.8%)	Schizophrenia (609; 6.0%)	Drug use disorders (1,559; 7.1%)	COPD (909; 5.7%)	Rheumatoid arthritis (280; 6.7%)	Type 2 diabetes (99; 4.6%)
6th	Intellectual disability (89; 4.3%)	Autism spectrum disorders (309; 5.2%)	Asthma (482; 4.7%)	Back pain and problems (1,117; 5.1%)	Alcohol use disorders (850; 5.4%)	Back pain and problems (248; 5.9%)	Back pain and problems (80; 3.7%)
7th	Dermatitis and eczema (60; 2.9%)	Dental caries (258; 4.4%)	Dental caries (389; 3.8%)	Hearing loss (725; 3.3%)	Depressive disorders (794; 5.0%)	Osteoarthritis (167; 4.0%)	Coronary heart disease (75; 3.5%)
8th	LRI incl influenza & pneumonia (53; 2.6%)	Epilepsy (208; 3.5%)	Conduct disorder (312; 3.1%)	Asthma (702; 3.2%)	Asthma (667; 4.2%)	Coronary heart disease (159; 3.8%)	Atrial fibrillation (66; 3.1%)
9th	Autism spectrum disorders (44; 2.1%)	Intellectual disability (177; 3.0%)	Bipolar affective disorder (303; 3.0%)	Bipolar affective disorder (600; 2.7%)	Rheumatoid arthritis (528; 3.3%)	Asthma (144; 3.4%)	Chronic kidney disease (60; 2.8%)
10th	ADHD (39; 1.9%)	Back pain and problems (147; 2.5%)	Back pain and problems (302; 3.0%)	Dental caries (527; 2.4%)	Coronary heart disease (454; 2.9%)	Atrial fibrillation (129; 3.1%)	Refractive errors (51; 2.4%)
	Top 10 (1,548; 75%)	Top 10 (4,435; 75%)	Top 10 (6,832; 67%)	Top 10 (15,630; 71%)	Top 10 (8,760; 55%)	Top 10 (2,522; 60%)	Top 10 (1,320; 61%)

ADHD attention deficit hyperactivity disorder; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease. See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Estimates for anxiety disorders, depressive disorders and conduct disorder in children under 5 relate to children aged 4 years only. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions.

Figure 3.7: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous females, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Protein-energy deficiency (533; 29%)	Anxiety disorders (738; 16%)	Anxiety disorders (1,612; 16%)	Anxiety disorders (3,342; 16%)	Anxiety disorders (1,654; 8.9%)	COPD (411; 8.2%)	Dementia (494; 16%)
2nd	Other gastro-intestinal inf. (193; 10%)	Conduct disorder (684; 14%)	Depressive disorders (1,265; 12%)	Depressive disorders (2,756; 13%)	Depressive disorders (1,488; 8.0%)	Rheumatoid arthritis (409; 8.1%)	Rheumatoid arthritis (386; 12%)
3rd	Asthma (192; 10%)	Depressive disorders (458; 9.7%)	Alcohol use disorders (857; 8.4%)	Back pain and problems (1,298; 6.3%)	Asthma (1,383; 7.5%)	Dementia (401; 8.0%)	Hearing loss (177; 5.7%)
4th	Anxiety disorders (70; 3.8%)	Asthma (427; 9.0%)	Drug use disorders (605; 6.0%)	Asthma (1,280; 6.2%)	Back pain and problems (1,293; 7.0%)	Type 2 diabetes (375; 7.4%)	COPD (173; 5.6%)
5th	Conduct disorder (70; 3.7%)	Back pain and problems (323; 6.8%)	Asthma (520; 5.1%)	Alcohol use disorders (1,080; 5.2%)	Type 2 diabetes (1,121; 6.1%)	Osteoarthritis (355; 7.0%)	Type 2 diabetes (126; 4.1%)
6th	Dermatitis and eczema (57; 3.1%)	Dental caries (247; 5.2%)	Bipolar affective disorder (481; 4.7%)	Drug use disorders (1,045; 5.1%)	Hearing loss (987; 5.3%)	Asthma (335; 6.7%)	Osteoarthritis (114; 3.7%)
7th	LRI incl influenza & pneumonia (50; 2.7%)	Epilepsy (184; 3.9%)	Back pain and problems (479; 4.7%)	Hearing loss (760; 3.7%)	COPD (981; 5.3%)	Hearing loss (297; 5.9%)	Chronic kidney disease (112; 3.6%)
8th	Intellectual disability (44; 2.4%)	Acne (161; 3.4%)	Eating disorders (443; 4.4%)	Bipolar affective disorder (759; 3.7%)	Osteoarthritis (888; 4.8%)	Chronic kidney disease (236; 4.7%)	Asthma (102; 3.3%)
9th	Back pain and problems (27; 1.5%)	ADHD (153; 3.2%)	Dental caries (329; 3.2%)	Schizophrenia (591; 2.9%)	Rheumatoid arthritis (761; 4.1%)	Back pain and problems (200; 4.0%)	Coronary heart disease (91; 2.9%)
10th	Epilepsy (26; 1.4%)	Dermatitis and eczema (111; 2.4%)	Polycystic ovarian syndrome (257; 2.5%)	Eating disorders (537; 2.6%)	Chronic kidney disease (504; 2.7%)	Coronary heart disease (134; 2.7%)	Back pain and problems (87; 2.8%)
	Top 10 (1,263; 68%)	Top 10 (3,486; 74%)	Top 10 (6,849; 67%)	Top 10 (13,447; 65%)	Top 10 (11,058; 60%)	Top 10 (3,154; 63%)	Top 10 (1,863; 60%)

ADHD attention deficit hyperactivity disorder; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease. See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Estimates for anxiety disorders, depressive disorders and conduct disorder in children under 5 relate to children aged 4 years only. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions.

Figure 3.8: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous Australians, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Protein-energy deficiency (1,090; 28%)	Conduct disorder (1,811; 17%)	Alcohol use disorders (2,853; 14%)	Alcohol use disorders (5,608; 13%)	Anxiety disorders (2,726; 7.9%)	COPD (849; 9.2%)	Dementia (832; 16%)
2nd	Asthma (484; 12%)	Anxiety disorders (1,638; 15%)	Anxiety disorders (2,463; 12%)	Anxiety disorders (5,551; 13%)	Back pain and problems (2,608; 7.6%)	Dementia (759; 8.2%)	Rheumatoid arthritis (606; 12%)
3rd	Other gastro-intestinal inf. (395; 10%)	Asthma (1,027; 9.7%)	Depressive disorders (2,059; 10%)	Depressive disorders (4,835; 11%)	Depressive disorders (2,282; 6.6%)	Type 2 diabetes (691; 7.5%)	COPD (370; 7.0%)
4th	Conduct disorder (184; 4.7%)	Depressive disorders (802; 7.5%)	Drug use disorders (1,398; 6.9%)	Drug use disorders (2,604; 6.1%)	Type 2 diabetes (2,213; 6.4%)	Rheumatoid arthritis (688; 7.5%)	Hearing loss (313; 5.9%)
5th	Anxiety disorders (168; 4.3%)	ADHD (518; 4.9%)	Asthma (1,002; 4.9%)	Back pain and problems (2,414; 5.7%)	Hearing loss (2,065; 6.0%)	Hearing loss (582; 6.3%)	Type 2 diabetes (225; 4.3%)
6th	Intellectual disability (134; 3.4%)	Dental caries (505; 4.7%)	Schizophrenia (838; 4.1%)	Schizophrenia (2,176; 5.1%)	Asthma (2,049; 6.0%)	Osteoarthritis (523; 5.7%)	Chronic kidney disease (172; 3.3%)
7th	Dermatitis and eczema (117; 3.0%)	Back pain and problems (470; 4.4%)	Bipolar affective disorder (784; 3.8%)	Asthma (1,981; 4.6%)	COPD (1,890; 5.5%)	Asthma (479; 5.2%)	Back pain and problems (167; 3.2%)
8th	LRI incl influenza & pneumonia (104; 2.6%)	Epilepsy (392; 3.7%)	Back pain and problems (781; 3.8%)	Hearing loss (1,485; 3.5%)	Alcohol use disorders (1,353; 3.9%)	Back pain and problems (448; 4.8%)	Coronary heart disease (166; 3.1%)
9th	Epilepsy (58; 1.5%)	Autism spectrum disorders (385; 3.6%)	Dental caries (718; 3.5%)	Bipolar affective disorder (1,360; 3.2%)	Osteoarthritis (1,304; 3.8%)	Chronic kidney disease (346; 3.7%)	Osteoarthritis (163; 3.1%)
10th	ADHD (57; 1.5%)	Acne (279; 2.6%)	Eating disorders (565; 2.8%)	Dental caries (1,001; 2.3%)	Rheumatoid arthritis (1,289; 3.7%)	Coronary heart disease (293; 3.2%)	Atrial fibrillation (149; 2.8%)
	Top 10 (2,789; 71%)	Top 10 (7,828; 74%)	Top 10 (13,462; 66%)	Top 10 (29,014; 68%)	Top 10 (19,779; 58%)	Top 10 (5,658; 61%)	Top 10 (3,163; 60%)

ADHD attention deficit hyperactivity disorder; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease. See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Estimates for anxiety disorders, depressive disorders and conduct disorder in children under 5 relate to children aged 4 years only. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions.

4

Fatal burden of disease

Key results

- In 2018, Indigenous Australians lost 113,445 years of life due to premature death (fatal burden), equivalent to 137 YLL per 1,000 people.
- These lost years of life were the result of 3,619 deaths, 59% of which occurred in people aged less than 65.
- The YLL rates were similar for males and females in the age groups 1–14 and 85 and over, but at all other ages the YLL rate in Indigenous males was greater than that in Indigenous females.
- The main disease groups causing fatal burden in Indigenous Australians were injuries (23% of the total), cancer (20%) and cardiovascular diseases (19%).
- Injuries contributed 43% of fatal burden among Indigenous children and adolescents (aged 1–14) and 73% of the fatal burden among Indigenous young adults (aged 15–24).
- Just over one-half of the fatal burden in young adults (aged 15–24) and almost one-fifth of the fatal burden in people aged 25–44 was due to suicide & self-inflicted injuries.
- For Indigenous Australians aged 45 and over, chronic diseases became the main contributors to fatal burden, with cancer and cardiovascular diseases contributing 30% and 25%, respectively.
- The main individual contributors to fatal burden among Indigenous Australians aged 45 and over were coronary heart disease (16% of YLL), lung cancer (8.7%), chronic obstructive pulmonary disease (COPD; 7.1%) and chronic kidney disease (5.5%).

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. In this study, the burden of deaths due to diseases and injuries at all ages in the Aboriginal and Torres Strait Islander population is quantified.

Fatal burden is expressed as years of life lost (YLL), and is a measure of years lost due to dying prematurely (that is, before the expected life span) (see Box 4.1). YLL are calculated by summing, across age groups, the number of deaths multiplied by the remaining life expectancy for each of those deaths according to a standard life table. The ABDS 2018 uses the aspirational life table used in the GBD 2010 and 2013 studies (see Murray and Ezzati et al. 2012), which was the same life table used in ABDS 2011. It is different to the actual life table for the Indigenous population (the GBD table was derived from global mortality data), and the same life table has been used for both Indigenous and non-Indigenous Australians. Further details on the calculation of Indigenous YLL estimates can be found in 'Appendix A: Methods overview'.

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 A: 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 presented in 'Chapter 6 Gap in health outcomes'.

Box 4.1: How to interpret the years of life lost

Fatal burden is a measure of the years of life lost in the population due to dying from disease or injury, where 1 YLL is 1 year of life lost. The YLL associated with each death is based on 2 factors: the age at which death occurs and the life expectancy (according to an aspirational life table), which is the number of remaining years that a person would, on average, expect to live from that age. This life table is shown in Appendix Table A2.

At a population level, the total years of life lost for a disease is the sum of the number of deaths from the disease at each age multiplied by the remaining life expectancy for each person who died. Diseases that usually cause deaths at younger ages (for example, birth trauma & asphyxia and cardiovascular defects) have a much higher average YLL per death than diseases that tend to cause deaths at older ages (for example, stroke and chronic kidney disease).

Therefore, a similar amount of fatal burden can result from a small number of deaths occurring at young ages or a large number of deaths occurring at older ages. See Appendix Figure D7 for a comparison of diseases with the highest and lowest average YLL per death.

4.1 Fatal burden experienced in 2018

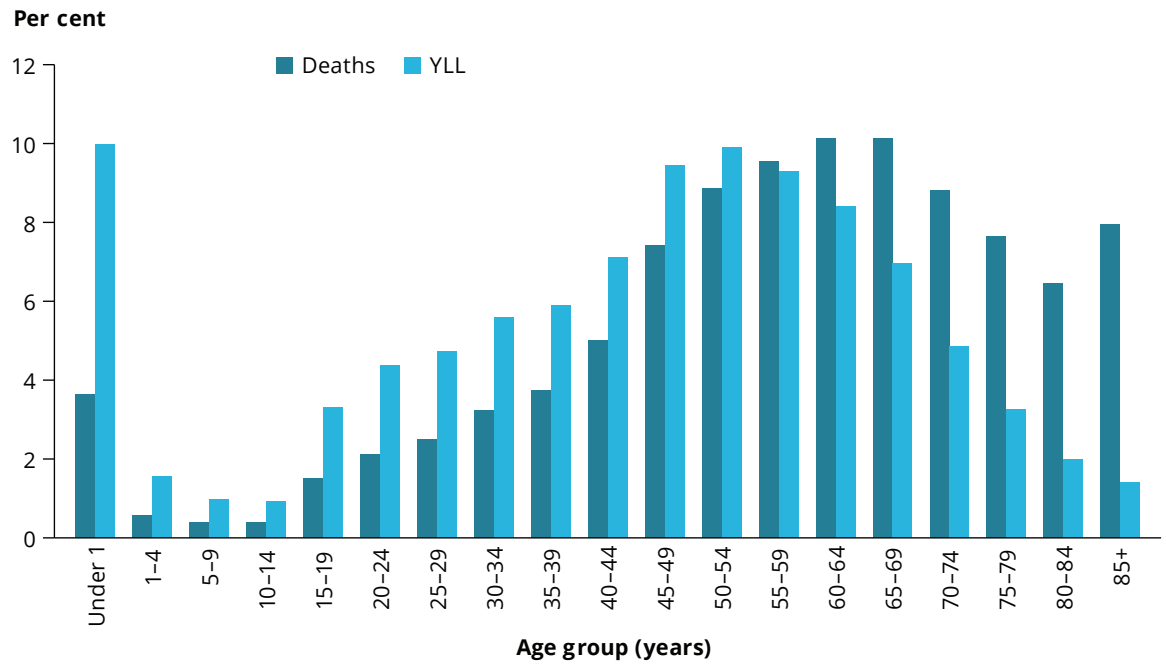
In 2018, Indigenous Australians lost 113,445 years of life due to early death. This was based on an estimated 3,619 deaths in that year. The fatal burden comprised 47% of the total burden of disease and injury for Indigenous Australians in 2018.

Over time fatal burden has declined substantially for Indigenous Australians, with a 27% reduction in the rate of fatal burden between 2003 and 2018 (from 275 to 201 YLL per 1,000 people, after adjusting for age). This decline resulted from lower fatal burden in most of the disease groups. For detailed information on changes in fatal burden over time, see 'Chapter 7 Changes over time'.

4.2 How does fatal burden vary by age and sex?

Both the number of deaths and the life expectancy (in this context, the remaining years a person of a specified age could have, on average, expected to live, based on the aspirational life table) influence the fatal burden. Figure 4.1 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.

Figure 4.1: Proportion of fatal burden (YLL) and deaths for Indigenous Australians, by age group, 2018



Source: Appendix Table D1.

The majority (59%) of Indigenous deaths in 2018 occurred before age 65. This is in stark contrast to the non-Indigenous population, where only 17% of deaths occurred before this age.

Deaths among infants (those aged under 1) represented 3.6% of all deaths but contributed 10% of the total fatal burden (Figure 4.1). As infants have the highest aspirational life expectancy, each death is associated with a large number of years of life lost. Young people (aged 1–14) had very few deaths; even with a high life expectancy for their age, they contributed the lowest amount of fatal burden compared to all other age groups under 85.

After infancy, a considerable component of the fatal burden in the Indigenous population is experienced in older adults (ages 50–74), reflecting the high number of deaths occurring in these age groups.

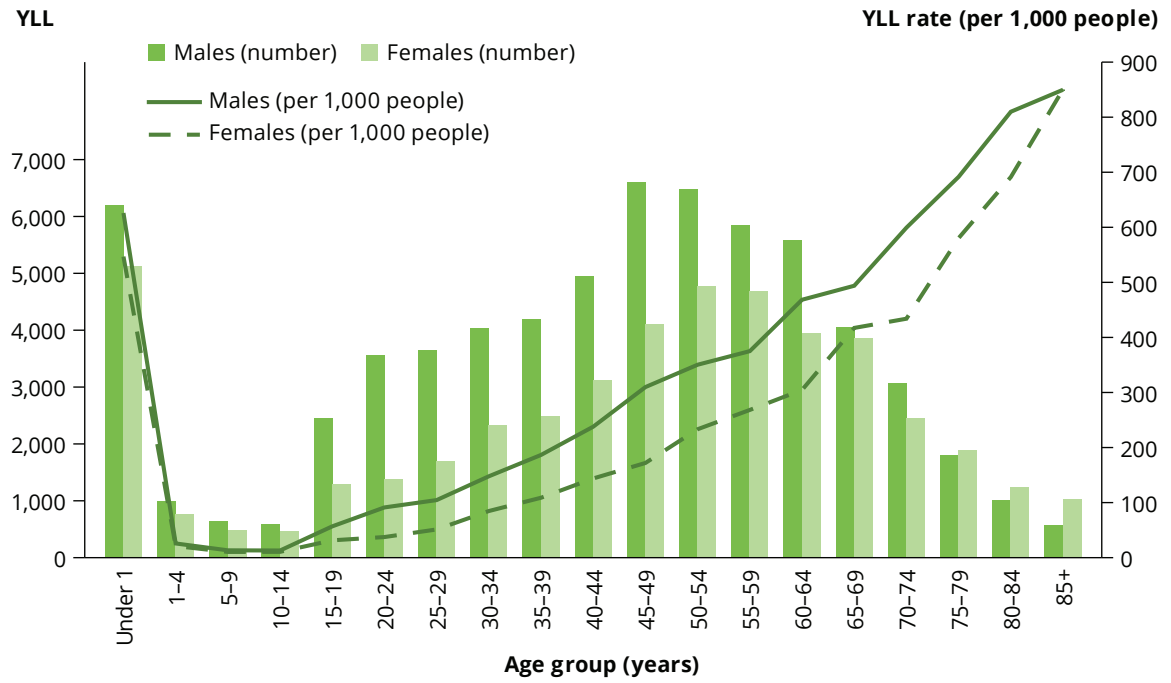
This pattern is quite different to that observed in the total Australian population, in which there is a general increase in the number of YLL with increasing age (up to around age 74) (AIHW 2021a). Despite the potential years of life remaining at an older age being less than at a younger age, the observed increase in YLL reflects the much higher proportion of deaths occurring at older ages in the non-Indigenous population.

Overall, these different patterns in YLL by age group reflect observed differences in actual 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 4.1). After taking into account differences in population age structure between the sexes, fatal burden for Indigenous males was 1.4 times that for Indigenous females (238 compared with 166 YLL per 1,000) (Table 4.2).

Figure 4.2 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 and 85 and over, where the rates were similar.

Figure 4.2: Numbers and rates of fatal burden (YLL, YLL per 1,000 people) for Indigenous Australians, by age group and sex, 2018



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

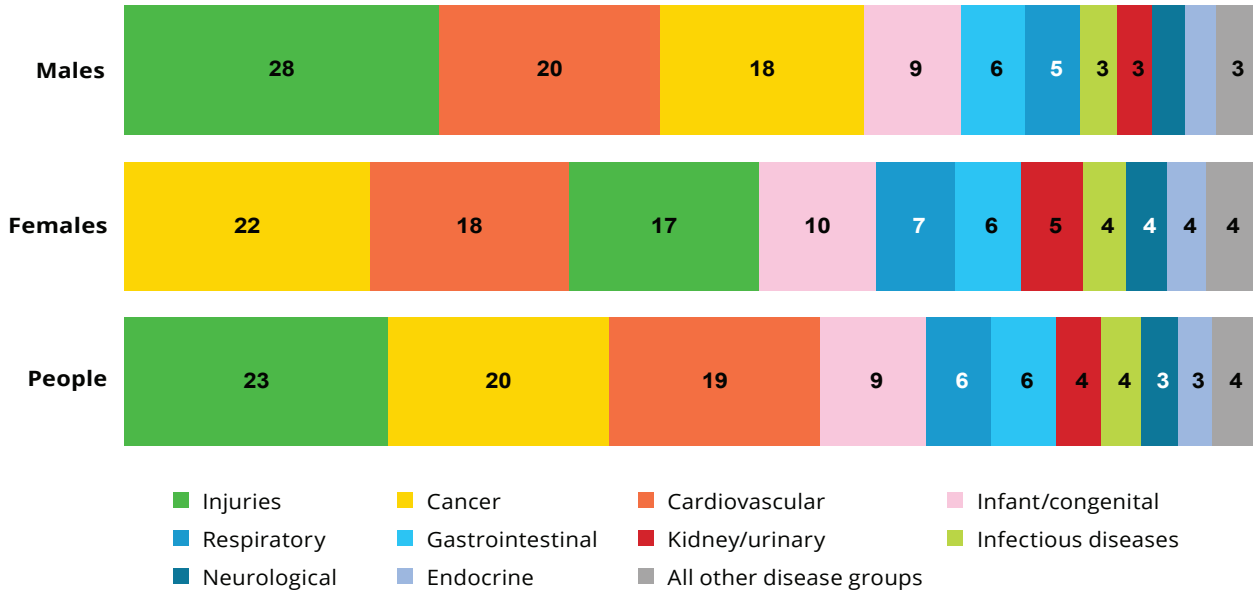
4.3 Which disease groups resulted in the most years of life lost?

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 over two-thirds of YLL that Indigenous Australians experienced in 2018: injuries (23%), cancer (20%), cardiovascular diseases (19%) and infant & congenital conditions (9%) (Figure 4.3).
- Injuries were responsible for a higher proportion of the fatal burden in Indigenous males (28%) than in Indigenous females (17%). The leading causes of injuries fatal burden were suicide & self-inflicted injuries (41% of injuries fatal burden), poisoning (such as the toxic effects of medicinal or other substances) (19%), road traffic injuries (motor vehicle occupants) (13%) and homicide & violence (7.8%).
- Cancer & other neoplasms was the greatest contributor to fatal burden for Indigenous females and ranked third for Indigenous males, accounting for 22% and 18% of YLL, respectively. The leading causes of cancers fatal burden were lung cancer (26% of cancer fatal burden), bowel cancer (7.7%), liver cancer (7.3%), pancreatic cancer (6.8%) and breast cancer (5.7%).
- Other disease groups that contributed substantially to the fatal burden included respiratory diseases (6%) and gastrointestinal disorders (6%).

- Kidney & urinary diseases accounted for 4% of the fatal burden in Indigenous Australians (3% in males and 5% in 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 global and Australian burden of disease methodology). The indirect impacts of diseases such as kidney disease, which are often reported as associated causes of death, are not included here. These can be estimated in some cases by considering the disease as a risk factor, as has been done for impaired kidney function and high blood plasma glucose (see Chapter 5 for more details).

Figure 4.3: Percentage contribution (%) of the top 10 leading causes of fatal burden (YLL) in Indigenous Australians, by disease group and sex, 2018



Notes
1. 'All other disease groups' includes mental & substance use disorders, reproductive & maternal conditions, skin disorders, oral disorders, musculoskeletal conditions and blood & metabolic disorders. Hearing & vision disorders are excluded as they did not cause any fatal burden.
2. Numbers may not add to 100% due to rounding.

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

Table 4.1 shows that while there may be fewer deaths from some disease groups, they can contribute proportionally higher YLL. Where YLL is comparatively high in relation to the number of deaths, the disease group typically caused deaths at younger ages.

For example, injuries were responsible for 18% of Indigenous male deaths and 10% of Indigenous female deaths, but contributed 28% and 17% of YLL, respectively.

Table 4.1: Comparison of deaths and fatal burden (YLL, YLL%, YLL ASR), by disease group and sex, Indigenous Australians, 2018

	Males						Females					
Rank	Disease group	Deaths (number)	Deaths (%)	YLL (number)	YLL (%)	ASR (YLL)	Disease group	Deaths (number)	Deaths (%)	YLL (number)	YLL (%)	ASR (YLL)
1	Injuries	364	18.4	18,531	28.0	48.1	Cancer	407	24.8	10,266	21.8	40.3
2	Cardiovascular	451	22.8	12,952	19.5	53.8	Cardiovascular	355	21.6	8,315	17.6	34.6
3	Cancer	472	23.9	11,959	18.0	53.9	Injuries	164	10.0	7,941	16.8	20.4
4	Infant/congenital	70	3.5	5,726	8.6	8.2	Infant/congenital	60	3.6	4,887	10.4	7.4
5	Gastrointestinal	116	5.9	3,733	5.6	14.2	Respiratory	151	9.2	3,324	7.0	14.3
6	Respiratory	139	7.0	3,264	4.9	16.3	Gastrointestinal	95	5.8	2,740	5.8	10.1
7	Infectious diseases	65	3.3	2,185	3.3	7.7	Kidney/urinary	112	6.8	2,592	5.5	10.9
8	Kidney/urinary	76	3.8	1,997	3.0	9.0	Infectious diseases	60	3.7	1,801	3.8	6.1
9	Neurological	88	4.4	1,970	3.0	10.6	Neurological	103	6.3	1,707	3.6	8.8
10	Endocrine	72	3.7	1,807	2.7	8.4	Endocrine	69	4.2	1,652	3.5	6.8
11	Blood/metabolic	28	1.4	1,044	1.6	3.5	Blood/metabolic	24	1.5	772	1.6	2.6
12	Mental	22	1.1	706	1.1	2.7	Musculoskeletal	21	1.3	570	1.2	2.1
13	Musculoskeletal	8	0.4	195	0.3	0.9	Mental	10	0.6	319	0.7	1.1
14	Skin	7	0.3	171	0.3	0.8	Skin	7	0.4	142	0.3	0.6
	All other disease groups	1	0.1	45	0.1	n.a.	All other disease groups	3	0.2	132	0.3	n.a.
	Total	**1,978**	**100.0**	**66,285**	**100.0**	**238.4**	**Total**	**1,641**	**100.0**	**47,160**	**100.0**	**166.5**

Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed as YLL per 1,000 people (YLL ASR).
2. Numbers and percentages may not add to column totals due to rounding.
3. Rankings are based on the number of YLL.
4. 'All other disease groups' includes reproductive & maternal conditions and oral disorders. Hearing & vision disorders are excluded as they did not cause any fatal burden.

How does fatal burden differ between males and females?

Differences in fatal burden between Indigenous males and females were evaluated using age-standardised rates, which take into account differences in population age structures. Indigenous males had more than twice the rate of fatal burden due to mental & substance use disorders and injuries as Indigenous females (rate ratios of 2.5 and 2.4), and almost 60% more fatal burden due to cardiovascular diseases (rate ratio of 1.6). Indigenous females had higher age-standardised rates of fatal burden due to kidney & urinary diseases and musculoskeletal conditions than Indigenous males (rate ratios of 0.8 and 0.4) (Table 4.2).

Table 4.2: Comparison of YLL age-standardised rates, rate differences and rate ratios, Indigenous males: Indigenous females, Australia, 2018

	YLL ASR			
Disease group	Males	Females	Rate difference	Rate ratio
Injuries	48.1	20.4	27.7	2.4
Cardiovascular	53.8	34.6	19.2	1.6
Cancer	53.9	40.3	13.7	1.3
Gastrointestinal	14.2	10.1	4.0	1.4
Respiratory	16.3	14.3	2.1	1.1
Neurological	10.6	8.8	1.8	1.2
Infectious diseases	7.7	6.1	1.6	1.3
Endocrine	8.4	6.8	1.6	1.2
Mental/substance use	2.7	1.1	1.6	2.5
Blood/metabolic	3.5	2.6	0.8	1.3
Infant/congenital	8.2	7.4	0.8	1.1
Skin	0.8	0.6	0.1	1.2
Oral	0.1	—	—	. .
Hearing/vision	—	—	—	. .
Reproductive/maternal	—	0.3	–0.3	0.1
Musculoskeletal	0.9	2.1	–1.1	0.4
Kidney/urinary	9.0	10.9	–1.9	0.8
All diseases	**238.4**	**166.5**	**71.9**	**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. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. Numbers may not add to totals for all columns due to rounding.

4.4 Which individual diseases resulted in the most years of life lost?

Of the 219 diseases in the ABDS 2018, 5 diseases resulted in just over one-third of the fatal burden among Indigenous Australians: coronary heart disease (CHD), suicide & self-inflicted injuries, lung cancer, poisoning and chronic obstructive pulmonary disease (COPD).

The leading 20 diseases were responsible for around two-thirds of the fatal burden for Indigenous males and females (Table 4.3). The leading diseases were largely chronic diseases.

The top 3 leading causes for life lost for both Indigenous males and females were CHD (13% of YLL for Indigenous males, 9% for Indigenous females); suicide & self-inflicted injuries (12% for males, 6% for females) and lung cancer (5% for both males and females).

Table 4.3: Leading 20 causes of fatal burden (YLL) for Indigenous Australians, by sex, 2018

Rank	Males	YLL	% of total	Females	YLL	% of total	People	YLL	% of total
1	Coronary heart disease	8,269	12.5	Coronary heart disease	4,250	9.0	Coronary heart disease	12,519	11.0
2	Suicide & self-inflicted injuries	8,078	12.2	Suicide & self-inflicted injuries	2,790	5.9	Suicide & self-inflicted injuries	10,868	9.6
3	Lung cancer	3,231	4.9	Lung cancer	2,540	5.4	Lung cancer	5,771	5.1
4	Poisoning	3,166	4.8	Chronic kidney disease	2,497	5.3	Poisoning	5,074	4.5
5	Chronic liver disease	2,929	4.4	COPD	2,353	5.0	COPD	4,727	4.2
6	RTI - motor vehicle occupants	2,401	3.6	Poisoning	1,908	4.0	Chronic liver disease	4,668	4.1
7	COPD	2,374	3.6	Chronic liver disease	1,739	3.7	Chronic kidney disease	4,416	3.9
8	Chronic kidney disease	1,919	2.9	Type 2 diabetes	1,459	3.1	RTI - motor vehicle occupants	3,399	3.0
9	Pre-term birth & LBW complications	1,772	2.7	Stroke	1,292	2.7	Type 2 diabetes	2,999	2.6
10	Type 2 diabetes	1,540	2.3	Breast cancer	1,232	2.6	Pre-term birth & LBW complications	2,938	2.6
11	Stroke	1,496	2.3	Pre-term birth & LBW complications	1,165	2.5	Stroke	2,788	2.5
12	Homicide & violence	1,322	2.0	LRI incl. influenza and pneumonia	1,004	2.1	LRI incl. influenza and pneumonia	2,162	1.9
13	LRI incl. influenza and pneumonia	1,158	1.7	RTI - motor vehicle occupants	998	2.1	Homicide & violence	2,073	1.8
14	Liver cancer	1,054	1.6	Birth trauma and asphyxia	868	1.8	Bowel cancer	1,709	1.5
15	Other unintentional injuries	1,031	1.6	Bowel cancer	789	1.7	Liver cancer	1,628	1.4
16	Cardiomyopathy	1,030	1.6	Homicide & violence	751	1.6	Other unintentional injuries	1,517	1.3
17	Bowel cancer	920	1.4	Pancreatic cancer	740	1.6	Pancreatic cancer	1,509	1.3
18	Pancreatic cancer	769	1.2	Dementia	718	1.5	Birth trauma and asphyxia	1,505	1.3
19	Oesophageal cancer	721	1.1	Rheumatic heart disease	617	1.3	Cardiomyopathy	1,353	1.2
20	Epilepsy	712	1.1	Liver cancer	575	1.2	Breast cancer	1,264	1.1

(continued)

Table 4.3 (continued): Leading 20 causes of fatal burden (YLL) for Indigenous Australians, by sex, 2018

Leading 20 diseases	45,891	69.2	Leading 20 diseases	30,287	64.2	Leading 20 diseases	74,887	66.0
All other diseases	*20,394*	*30.8*	*All other diseases*	*16,873*	*35.8*	*All other diseases*	*38,558*	*34.0*
Total	**66,285**	**100.0**	**Total**	**47,160**	**100.0**	**Total**	**113,445**	**100.0**

Colour legend: % of total fatal burden. ≥ 5% | 4–<5% | 3–<4% | 2–<3% | 0–<2%

COPD chronic obstructive pulmonary disease; LBW low birthweight; LRI lower respiratory infections; RTI road traffic injuries.

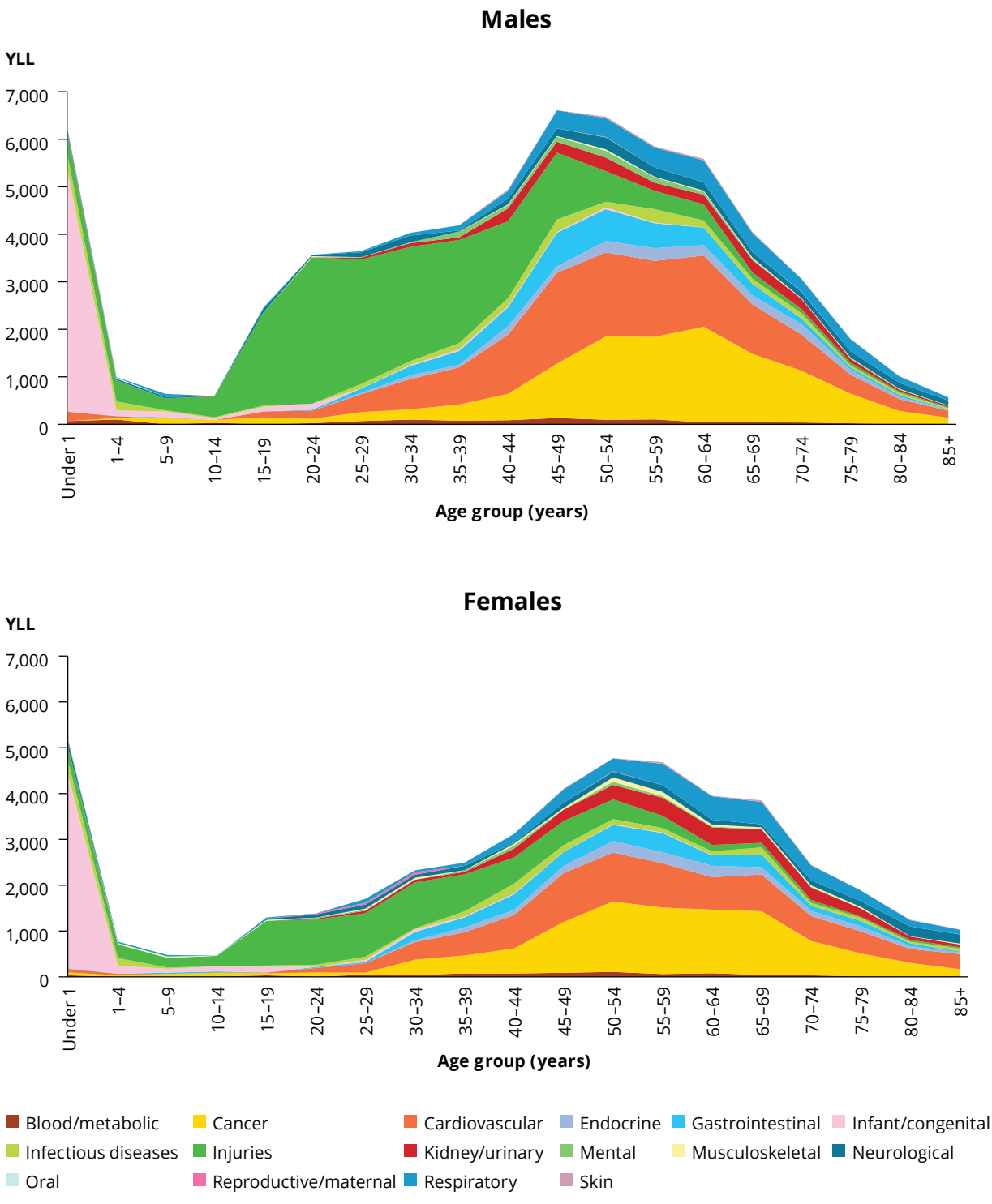
Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'. Numbers may not add to total for all columns due to rounding.

How does fatal disease burden vary across the life course?

Figures 4.4 and 4.5 show the amount (Figure 4.4) and relative proportion (Figure 4.5) of fatal burden (YLL) contributed by each disease group across the life course for Indigenous males and females in 2018. (Figure 4.4 and Figure 4.5 do not show hearing & vision disorders, as they did not cause any fatal burden.)

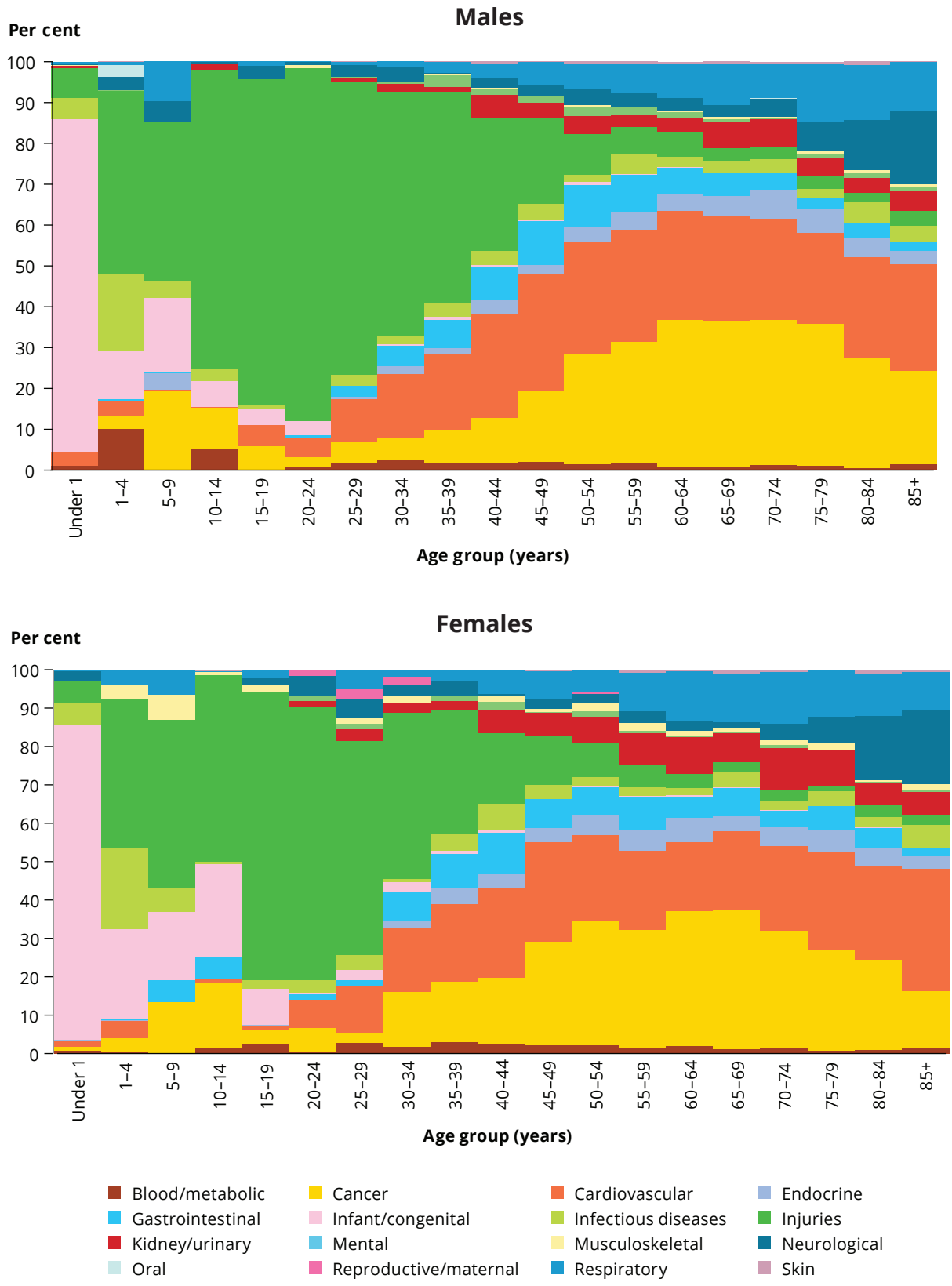
- Infant & congenital conditions were responsible for 82% of the fatal burden in Indigenous children aged under 1.
- Injuries were the leading cause of fatal burden among Indigenous Australians aged under 45 (excluding infants). Almost half (47%) of fatal burden among Indigenous children and adolescents aged 1–14 was due to injuries. Injuries also contributed 80% of the fatal burden among Indigenous young adults (aged 15–24).
- Among Indigenous Australians aged 35–44, fatal burden from injuries was still high (35% of fatal burden), however, the contribution from cardiovascular diseases was also apparent.
- In later working age (45–64), chronic diseases, mainly cancer and cardiovascular diseases, became the main contributors to fatal burden, contributing 29% and 25% respectively.
- Among older ages (65 and over), the impact from cancer and cardiovascular diseases on fatal burden continued to increase. Respiratory diseases also caused substantial fatal burden in this age group, accounting for 12% of the fatal burden.

Figure 4.4: Number of YLL (fatal burden), by disease group and age group, Indigenous males and females, 2018



Note: Hearing & vision disorders are excluded as they did not cause any fatal burden.

Figure 4.5: Relative proportion of fatal burden (YLL), by disease group and age group, Indigenous males and females, 2018



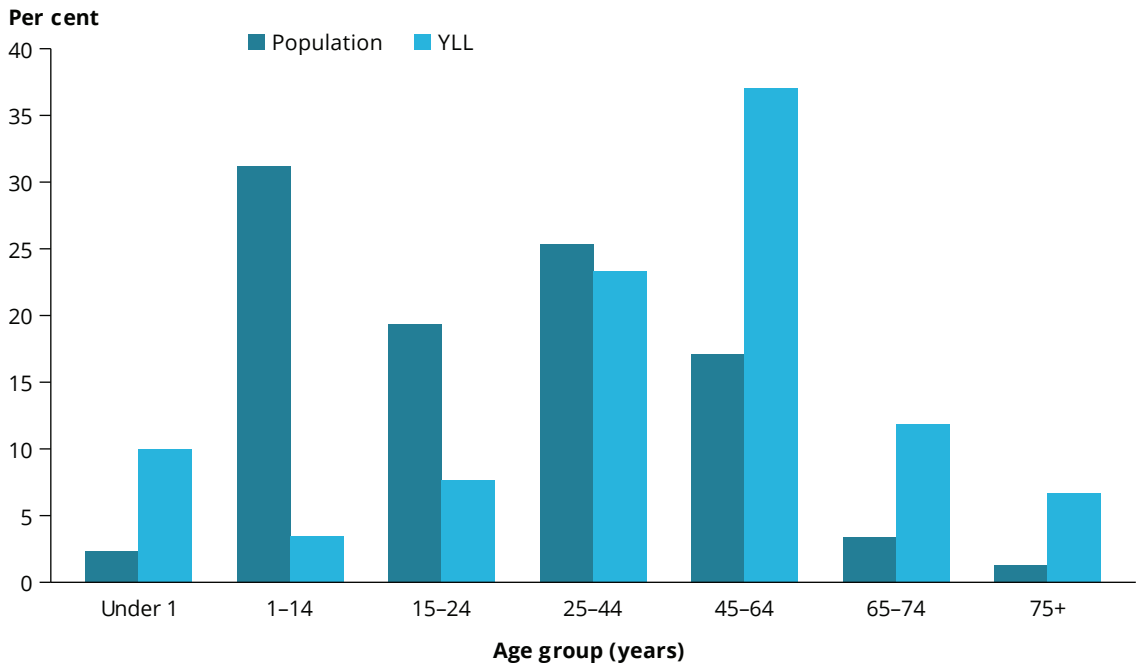
Note: Hearing & vision disorders are excluded as they did not cause any fatal burden.

Leading causes of fatal burden at various life stages

The total fatal burden, and the specific causes of fatal burden, that Indigenous Australians experienced in 2018 differed by age. The fatal burden in 7 broad age groups is described in this section, drawing on results shown in figures 4.6, 4.7, 4.8 and 4.9.

Leading causes of fatal burden among Indigenous Australians are shown in figures 4.7 (males), 4.8 (females) and 4.9 (people). Note that for many diseases, the numbers of deaths for Indigenous Australians is small. An asterisk (*) indicates YLL values where fewer than 10 deaths contributed to the calculation.

Figure 4.6: Proportion of Indigenous population and fatal burden (YLL), by age, Indigenous Australians, 2018



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

Infants (aged under 1 year)

Infants represented 2.3% of the Indigenous Australian population in 2018, yet accounted for 10% of the fatal burden, resulting from 132 deaths. Almost all life lost in infancy was due to infant & congenital conditions, such as pre-term birth & low birthweight (lbw) complications, birth trauma & asphyxia, and SIDS (sudden infant death syndrome).

Children (aged 1–14)

Children aged 1–14 accounted for 31% of the Indigenous population, but 3% the fatal burden, with 50 deaths occurring in 2018. Road traffic injuries for occupants of motor vehicles were the leading cause of YLL in both boys and girls, accounting for 13% and 11% of YLL, respectively. For boys, injuries (both intentional and unintentional) accounted for the rest of the top 5 causes of YLL, while for girls, cerebral palsy (6.4%) and lower respiratory infections (5.9%) followed suicide & self-inflicted injuries (8.2%) as the next largest contributors.

Note that no deaths from suicide were recorded in children less than 9 years of age.

Adolescents and young adults (aged 15–24)

Adolescents and young adults aged 15–24 accounted for 19% of the Indigenous population and 8% of the fatal burden. Injuries dominated as major causes of life lost in this age group, with suicide & self-inflicted injuries the top cause in both males (contributing 53% of YLL) and females (51%). Road traffic accidents and poisoning also appeared in the top 5 causes for both males and females.

Adults (aged 25–44)

Suicide & self-inflicted injuries and poisoning were the top 2 contributors to YLL for males (24% and 12% of YLL) and females (each 10%) in this age group. However, chronic diseases also began to feature as important causes of YLL, with CHD and chronic liver disease in the top 5 for both males and females. This age group accounted for 25% of the Indigenous population and 23% of the fatal burden in 2018.

Adults (aged 45–64)

This age group accounted for 17% of the Indigenous population and 37% of YLL. Injuries no longer appeared within the top 5 contributors to YLL from age 45 onwards, with chronic diseases now dominating. CHD and lung cancer were the top 2 causes of YLL for both males and females, with chronic liver disease, chronic kidney disease and COPD rounding out the top 5 in both sexes.

Adults (aged 65–74)

For adults aged 65–74, CHD and lung cancer were again the largest contributors to fatal burden for both males and females, together accounting for around one-quarter of YLL in both sexes. COPD, chronic kidney disease and type 2 diabetes were the next greatest causes of fatal burden for both males and females. This age group contributed 3.4% of the Indigenous population and 12% of YLL.

Older people (aged 75 and over)

Older Indigenous Australians contributed 6.7% of fatal burden, but accounted for only 1.3% of the Indigenous population. Although CHD was the greatest contributor to YLL in people aged 75 and over, contributing 13% in males and 12% in females, dementia and stroke also appeared as major causes of fatal burden in this age group. In males, dementia was the third greatest cause of YLL, contributing 8.1% of the total, whereas for females it was second, contributing 11%. COPD also appeared in the top 3 causes for both sexes.

Figure 4.7: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous males, by age group, 2018

Rank	Age group (years)						
	Under 1	1–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,754; 28%)	RTI/motor vehicle occupant* (282; 13%)	Suicide/self-inflicted injuries (3,187; 53%)	Suicide/self-inflicted injuries (4,005; 24%)	Coronary heart disease (4,816; 20%)	Coronary heart disease (1,164; 16%)	Coronary heart disease (435; 13%)
2nd	Birth trauma/ asphyxia* (628; 10%)	Homicide/ violence* (190; 8.5%)	RTI/motor vehicle occupant (749; 12%)	Poisoning (2,098; 12%)	Lung cancer (2,016; 8.2%)	Lung cancer (744; 10%)	COPD (374; 11%)
3rd	SIDS* (434; 7.0%)	Other unintentional injuries* (144; 6.5%)	Poisoning* (256; 4.2%)	Coronary heart disease (1,805; 11%)	Chronic liver disease (1,920; 7.8%)	COPD (588; 8.3%)	Dementia (274; 8.1%)
4th	Cardiovascular defects* (380; 6.1%)	Suicide/self-inflicted injuries* (139; 6.2%)	Homicide/ violence* (239; 4.0%)	RTI/motor vehicle occupant (970; 5.8%)	COPD (1,302; 5.3%)	Chronic kidney disease (461; 6.5%)	Lung cancer (248; 7.3%)
5th	Neonatal infections* (312; 5.0%)	RTI - pedestrians* (117; 5.3%)	RTI/motor motorcyclist* (237; 3.9%)	Chronic liver disease (739; 4.4%)	Chronic kidney disease (859; 3.5%)	Type 2 diabetes (362; 5.1%)	Stroke (200; 5.9%)
	Top 5 (56.6%)	Top 5 (39.2%)	Top 5 (77.5%)	Top 5 (57.2%)	Top 5 (44.5%)	Top 5 (46.7%)	Top 5 (45.2%)

* Number of Indigenous deaths used in YLL calculations is fewer than 10.

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions. No deaths from suicide & self-inflicted injuries were recorded in people aged less than 9 years.

Figure 4.8: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous females, by age group, 2018

Rank	Age group (years)						
	Under 1	1–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,160; 23%)	RTI/motor vehicle occupant* (184; 11%)	Suicide/self-inflicted injuries (1,369; 51%)	Poisoning (1,010; 10%)	Coronary heart disease (2,222; 13%)	Coronary heart disease (785; 12%)	Coronary heart disease (512; 12%)
2nd	Birth trauma/ asphyxia* (833; 16%)	Suicide/self-inflicted injuries* (141; 8.2%)	RTI/motor vehicle occupant* (244; 9.1%)	Suicide/self-inflicted injuries (1,008; 10%)	Lung cancer (1,561; 8.9%)	Lung cancer (708; 11%)	Dementia (476; 11%)
3rd	SIDS* (434; 8.5%)	Cerebal palsy* (110; 6.4%)	Poisoning* (208; 7.8%)	Coronary heart disease (710; 7.4%)	Chronic kidney disease (1,281; 7.3%)	COPD (686; 11%)	COPD (372; 8.9%)
4th	Cardiovascular defects* (356; 6.9%)	LRI incl influenza & pneumonia* (101; 5.9%)	Epilepsy* (75; 2.8%)	Chronic liver disease (605; 6.3%)	COPD (1,169; 6.7%)	Chronic kidney disease (547; 8.7%)	Stroke (332; 8.0%)
5th	Neonatal infections* (205; 4.0%)	Other unintentional injuries* (100; 5.8%)	Cerebal palsy* (70; 2.6%)	Homicide/ violence* (474; 4.9%)	Chronic liver disease (911; 5.2%)	Type 2 diabetes (256; 4.1%)	Chronic kidney disease (295; 7.1%)
	Top 5 (58.2%)	Top 5* (37.1%)	Top 5 (73.3%)	Top 5 (39.5%)	Top 5 (40.8%)	Top 5 (47.3%)	Top 5 (47.6%)

* Number of Indigenous deaths used in YLL calculations is fewer than 10.

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions. No deaths from suicide & self-inflicted injuries were recorded in people aged less than 9 years.

Figure 4.9: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous Australians, by age group, 2018

Rank	Age group (years)						
	Under 1	1–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (2,914; 26%)	RTI/motor vehicle occupant* (466; 12%)	Suicide/self-inflicted injuries (4,556; 52%)	Suicide/self-inflicted injuries (5,013; 19%)	Coronary heart disease (7,038; 17%)	Coronary heart disease (1,948; 15%)	Coronary heart disease (947; 13%)
2nd	Birth trauma/ asphyxia (1,461; 13%)	Homicide/ violence* (285; 7.2%)	RTI/motor vehicle occupant (994; 11%)	Poisoning (3,108; 12%)	Lung cancer (3,577; 8.5%)	Lung cancer (1,452; 11%)	Dementia (750; 9.9%)
3rd	SIDS (868; 7.7%)	Suicide/self-inflicted injuries* (280; 7.1%)	Poisoning* (464; 5.3%)	Coronary heart disease (2,515; 9.5%)	Chronic liver disease (2,831; 6.7%)	COPD (1,274; 9.5%)	COPD (746; 9.9%)
4th	Cardiovascular defects* (735; 6.5%)	Other unintentional injuries* (244; 6.2%)	Homicide/ violence* (294; 3.4%)	RTI/motor vehicle occupant (1,358; 5.1%)	COPD (2,471; 5.9%)	Chronic kidney disease (1,008; 7.5%)	Stroke (532; 7.0%)
5th	Neonatal infections* (516; 4.6%)	LRI incl influenza & pneumonia* (201; 5.1%)	RTI/motor motorcyclist* (237; 2.7%)	Chronic liver disease (1,345; 5.1%)	Chronic kidney disease (2,139; 5.1%)	Type 2 diabetes (618; 4.6%)	Lung cancer (434; 5.7%)
	Top 5 (57.3%)	Top 5 (37.4%)	Top 5 (75.2%)	Top 5 (50.4%)	Top 5 (43.0%)	Top 5 (47.0%)	Top 5 (45.1%)

* Number of Indigenous deaths used in YLL calculations is fewer than 10.

lbw low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.

See Appendix D, Box D1 for ABDS 2018 disease group colour legend.

Notes: Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'; however, residual conditions are included in totals for purposes of calculating proportions. No deaths from suicide & self-inflicted injuries were recorded in people aged less than 9 years.

5

Contribution of risk factors to burden

Key results

- Risk factors included in this study were responsible for 49% of the total burden of disease and injury in Indigenous Australians in 2018.
- The risk factors contributing the most disease burden were tobacco use (11.9%), alcohol use (10.5%), overweight (including obesity) (9.7%), illicit drug use (6.9%) and dietary risks (6.2%).
- Over 800 deaths (23% of all deaths among Indigenous Australians) were attributed to tobacco use in 2018. It also contributed the most burden to YLL (19%). Alcohol use contributed the most non-fatal burden in 2018 (9.2%).
- All risk factors combined contributed substantially to the burden for endocrine disorders (98%), kidney & urinary diseases (95%), cardiovascular diseases (77%), respiratory diseases (61%), injuries (60%) and cancer (56%).
- In males, low birthweight & short gestation was the leading contributor to burden in the under 5 age group, child abuse & neglect for ages 5–14, alcohol use for ages 15–44, and tobacco use for ages 45 and over.
- In females, low birthweight & short gestation was the leading contributor in under 5s, child abuse & neglect for ages 15–44, and tobacco use for ages 45 and over.

This chapter describes the contribution of selected risk factors to the burden of disease. Attributable burden reflects the direct link between a risk factor (for example, tobacco use) and a disease or injury outcome, referred to in this report as a linked disease (for example, lung cancer). See Box 5.1 for a description of how attributable burden is estimated.

Box 5.1: How is attributable burden measured?

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

- Select linked diseases for which there is convincing or probable evidence in the literature that the risk factor has a causal association.
- Define the exposure to the risk factor that is not associated with increased risk of the linked disease (the TMRED).
- Estimate the population attributable fractions (PAFs) by either the comparative risk assessment method or the direct method:
  - Comparative risk assessment involves using the amount of increased risk (relative risk) of linked disease morbidity or mortality due to exposure to the risk factor and an estimate of exposure to each risk factor in the population. For most risk factors, exposure to the risk factor was estimated using high-quality survey data. For information about the quality of data inputs, see 'Appendix B: How reliable are the estimates'.
  - The direct method uses comprehensive data sources such as registries to estimate the amount of the linked disease due to the risk factor.
- Estimate the attributable burden by multiplying the PAFs by the burden for each linked disease.

5.1 How are risk factors selected?

There are 39 risk factor components or exposures included in this report (such as cannabis and cocaine use) that combine into 19 individual risk factors (such as illicit drug use) (Table 5.1). The risk factors are categorised as behavioural, metabolic, dietary and environmental risks. While this list is extensive, it does not cover all potential risk factors. The risk factors included needed to meet the following criteria:

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

Some changes have been made to the list of selected risk factors compared with that for the ABDS 2011. Low birthweight & short gestation and impaired kidney function have been added, and high cholesterol revised to be based on low-density lipoprotein (LDL) cholesterol instead of total cholesterol. Further, the types of exposures measured for some risk factors (such as diet and child abuse) have been refined.

Risk factors that were social determinants (such as income, employment and education) could not be included. They have not been incorporated into burden of disease studies either in Australia or internationally, and developing methods to do so was outside the scope of this study. However, their importance is clear, and it is hoped that they may be included as risk factors in future burden of disease studies. Also note that at present the burden attributable to intimate partner violence is estimated for females only. Additional work is in progress to be able to expand this to include males in future studies (see Box 5.3).

Detailed estimates of attributable burden due to individual risk factors can be found in data visualisations on the AIHW website http://www.aihw.gov.au/burden-of-disease/.

5.2 What is the contribution of all risk factors combined?

Of the total burden of disease and injury in Indigenous Australians for 2018, 49% was attributable to all the risk factors included in this study (Table 5.1). This illustrates the potential for health gain in preventing disease and injury by reducing exposure to these risk factors. Although it may not be feasible or achievable to prevent all health loss, it quantifies what is theoretically possible.

Almost two-thirds of all deaths (63%) could be attributed to the risk factors included in this study (Table 5.2), as could a similar amount of fatal burden (60%). A smaller proportion of non-fatal burden (39%) was attributable to these risk factors. This is due to a high proportion of leading causes of fatal burden, such as injuries, cancer and cardiovascular disease (see Chapter 4), being attributable to these risk factors (Table 5.3).

5.3 Which risk factors contribute the most burden?

The individual contribution of each risk factor was calculated as the number of attributable DALY for each relevant disease. Table 5.1 shows the proportion of the total burden of disease in Indigenous Australians in 2018 attributed to each risk factor, as well as the contribution from each component of the risk factor (such as the burden from second-hand smoke as part of tobacco use).

The risk factors contributing the most disease burden were tobacco use (11.9%), alcohol use (10.5%), overweight (including obesity) (9.7%), illicit drug use (6.9%) and dietary risks (6.2%). Among the dietary risk factors, a diet low in legumes contributed the most to disease burden (1.5%). This was followed by a diet high in sodium (1.3%), diet low in fruit, diet high in red meat, and diet low in nuts & seeds (all 1.1%). For the illicit drug use risk factors, the largest contributors to disease burden were opioid use (2.2%), amphetamine use (1.9%) and cannabis use (1.6%).

Table 5.1: Proportion (%) of total burden attributable to each risk factor, Indigenous Australians, 2018

Risk factor	%	Risk factor	%
Behavioural		Physical inactivity	2.4
Tobacco use	11.9	Child abuse & neglect	5.1
Tobacco use	*11.5*	Intimate partner violence	2.1
Second-hand smoke	*0.4*	Unsafe sex	0.3
Dietary risks	6.2	**Environmental**	
Diet low in legumes	*1.5*	Occupational exposures & hazards	1.5
Diet low in whole grains & high fibre cereal	*1.0*	Air pollution	1.4
Diet high in sodium	*1.3*	Unsafe sanitation	<0.1
Diet high in red meat	*1.1*	**Metabolic/biomedical**	
Diet low in fruit	*1.1*	Overweight (including obesity)	9.7
Diet low in nuts & seeds	*1.1*	*Overweight but not obese*	*2.6*
Diet low in vegetables	*0.7*	*Obesity*	*7.2*
Diet high in processed meat	*0.6*	High blood pressure	4.3
Diet low in polyunsaturated fat	*0.1*	High blood plasma glucose	5.8
Diet low in fish & seafood	*<0.1*	*Intermediate hyperglycaemia*	*0.4*
Diet high in sugar-sweetened beverages	*0.2*	*Diabetes*	*5.4*
Diet low in milk	*0.1*	High cholesterol	3.0
Alcohol use	10.5	Impaired kidney function	5.0
Illicit drug use	6.9	*Chronic kidney disease stage 1–3*	*1.7*
Opioid use	*2.2*	*Chronic kidney disease stage 4–5*	*3.3*
Amphetamine use	*1.9*	Low birthweight & short gestation	2.3
Cocaine use	*0.4*	Low bone mineral density	0.2
Cannabis use	*1.6*	Iron deficiency	0.3
Other illicit drug use	*0.1*		
Unsafe injecting practices	*0.7*		
		Joint effect	49.1

Notes
1. The percentages for individual dietary risk factors do not add up to the overall dietary risk percentage as they were analysed independently.
2. The percentages for the individual risk factors in the table do not add up to the joint effect as the risk factors were analysed independently.
3. The burden attributable to intimate partner violence is measured for females only.

The contribution of risk factors to deaths, fatal and non-fatal burden was also calculated as part of this study. Tobacco use contributed the most to deaths and fatal burden in Indigenous Australians with over 800 deaths attributed to it (Table 5.2), which amounts to 23% of all Indigenous deaths. It also contributed to 19% of fatal burden. Tobacco was then followed by overweight (including obesity) (15% of deaths, 12% of fatal burden), alcohol use (9.7% of deaths, 11.8% of fatal burden), dietary risks (12% of deaths, 11% of fatal burden) and illicit drug use (6.2% of deaths, 8.9% of fatal burden). The risk factors that contributed the most to non-fatal burden were alcohol use (9.2%), overweight (including obesity) (7.4%), child abuse & neglect (6.1%), tobacco use (5.5%), and illicit drug use (5.1%). Note that these estimates are calculated independently and it is not appropriate to sum them due to the complex interactions between risk factors and disease development (Box 5.2).

Table 5.2: Number and proportion (%) of deaths, fatal (YLL) and non-fatal (YLD) burden attributable to each risk factor, Indigenous Australians, 2018

Risk factor	Deaths		YLL		YLD	
	Number	% of total deaths	Number	% of total YLL	Number	% of total YLD
Behavioural						
Tobacco use	835	23.1	21,544	19.0	6,969	5.5
Dietary risks	450	12.4	12,288	10.8	2,652	2.1
Physical inactivity	180	5.0	4,236	3.7	1,606	1.3
Alcohol use	350	9.7	13,424	11.8	11,661	9.2
Illicit drug use	224	6.2	10,145	8.9	6,500	5.1
Child abuse & neglect	81	2.2	4,489	4.0	7,702	6.1
Unsafe sex	20	0.6	637	0.6	149	0.1
Intimate partner violence	29	0.8	1,459	1.3	3,563	2.8
Metabolic/biomedical						
High blood pressure	348	9.6	8,729	7.7	1,653	1.3
Overweight (including obesity)	530	14.6	13,954	12.3	9,384	7.4
High blood plasma glucose	363	10.0	8,487	7.5	5,510	4.4
High cholesterol	215	5.9	6,433	5.7	693	0.5
Impaired kidney function	380	10.5	9,479	8.4	2,414	1.9
Low bone mineral density	13	0.4	220	0.2	297	0.2
Low birthweight & short gestation	59	1.6	5,108	4.5	429	0.3
Iron deficiency	<1	<0.1	3	<0.1	697	0.6
Environmental						
Air pollution	98	2.7	2,669	2.4	741	0.6
Unsafe sanitation	<1	<0.1	17	<0.1	63	0.1
Occupational exposures & hazards	37	1.0	956	0.8	2,607	2.1
Joint effect	**2,278**	**62.9**	**68,519**	**60.4**	**49,223**	**38.9**

Notes

1. The percentages for the individual risk factors in the table do not add up to the joint effect as the risk factors were analysed independently.
2. The burden attributable to intimate partner violence is measured for females only.

Linked diseases span a range of disease groups

The proportion of burden attributable to each risk factor within each disease group is presented in Table 5.3. Blank cells indicate that the risk factor was not linked to any diseases or injuries in that disease group. When interpreting this table, note that the number of DALY for each disease group differs, so the percentages need to be considered with the size of the disease group. Also note that the numbers in the table cannot be added together, as the risk factors were analysed independently (Box 5.2).

The burden estimated for each linked disease also influences the amount of burden due to each risk factor in 2018. For example, risk factors linked to cardiovascular diseases have a high attributable burden, partly because there is high burden from these diseases in Australia.

Some risk factors had linked diseases across a large number of disease groups. Tobacco use contributed to the burden for 9 disease groups, including 47% of respiratory diseases, 37% of cancer, 34% of cardiovascular diseases, 13% of infectious diseases and 10% of endocrine disorders. Overweight (including obesity) also contributed to a range of disease groups, including 59% of the burden for endocrine disorders, 52% for kidney & urinary diseases, 33% for cardiovascular diseases, 9.1% for musculoskeletal conditions and 8.5% for cancer (Table 5.3).

All the risk factors combined (the joint effect) contributed greatly to the burden for endocrine disorders (98%), kidney & urinary diseases (95%), cardiovascular diseases (77%), respiratory diseases (61%), injuries (60%) and cancer (56%) (Table 5.3).

Box 5.2: Why risk factor estimates cannot be added together

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

Further analysis is needed to combine risk factors. In this report, this has been done for all the included risk factors to produce an estimate for 'all risk factors combined'. This is referred to as the 'joint effect' of all risk factors in this study.

Table 5.3: Proportion (%) of total burden (DALY) attributable to risk factors for selected disease groups in Indigenous Australians, 2018

Risk factor	Mental	Injuries	CVD	Cancer	MSK	Respiratory	Neurological	Endocrine	Gastro.	Infections	Kidney	Hear/vis.
DALY (number)	54,300	29,800	24,600	23,700	19,200	17,900	10,100	8,000	8,000	6,500	6,400	5,800
DALY (%)												
Tobacco use			34.2	37.2	4.5	46.9	2.5	10.0	1.0	13.1		0.4
Alcohol use	19.5	29.4	6.1	9.2			7.9		12.8	4.0		
Overweight (incl. obesity)			32.5	8.5	9.1	14.4	8.2	59.3	1.4		51.7	0.4
High blood plasma glucose			10.0	7.2			4.8	97.8			23.8	0.4
Dietary risks			44.7	5.0				27.1			9.2	
Occupational exposures		0.2		2.7	5.9	5.8						11.7
Unsafe sex				2.3					0.5	3.2		
Illicit drug use	12.3	27.6		1.9					15.7	0.6		
Physical inactivity			13.7	1.7			3.9	21.0				
Air pollution			8.3	0.8		3.1		5.9		2.1		
Int. partner violence	6.2	5.5										
Child abuse & neglect	14.1	15.2										
LBW & short gestation									0.0	2.9		
Unsafe sanitation										1.2		
High blood pressure			34.3				1.2				28.6	
Iron deficiency												
High cholesterol			29.0									
Impaired kidney function			22.6		0.1		2.4				94.8	
Low BMD		1.7										
Joint effect	**48.4**	**59.7**	**77.3**	**55.9**	**17.9**	**61.2**	**25.5**	**97.8**	**28.1**	**24.1**	**94.8**	**12.8**

CVD cardiovascular diseases; MSK musculoskeletal conditions; LBW low birthweight; BMD bone mineral density.

Notes

1. Attributable burden is expressed as a percentage of total burden (DALY) for that disease group. Disease groups are ordered by number of total burden.
2. The percentages in the table cannot be added together by row or column and do not add up to the joint effect row as the risk factors were analysed independently.
3. Causes in the 'Infant & congenital conditions' group were linked only to the risk factor 'Low birthweight and short gestation', which accounted for 44% of DALY in this group. Causes in the 'Blood & metabolic disorders' group were linked only to the risk factor 'Iron deficiency', which accounted for 18% of DALY in this group. Causes in the 'Reproductive & maternal conditions' group were linked only to the risk factor 'Intimate partner violence', which accounted for 0.7% of DALY in this group. Causes in the groups 'Skin disorders' and 'Oral disorders' were not linked to any of the risk factors included in this study.
4. Blank cells indicate that the risk factor has no associated diseases or injuries in the disease group.
5. The burden attributable to intimate partner violence is measured for females only.

Box 5.3: Homicide and violence perpetrators

For ABDS 2018, additional analyses were undertaken to expand the intimate partner violence risk factor to include other perpetrator types and male victims of violence.

Direct PAFs were estimated using data from the National Homicide and Monitoring Program and the National Hospital Morbidity Database to calculate attributable burden for Indigenous males and females in the years 2003, 2011 and 2018 (see Table 5.4).

Although the number of cases among Indigenous Australian is relatively small, meaning the results vary more over time than the results for all Australians, the total disease burden for Indigenous male victims of homicide and violence was greater compared with Indigenous female victims in all years, with the relative contributions to total burden by perpetrator type also differing by sex.

Intimate partners were responsible for the most burden due to homicide and violence among female victims (81% in 2018), followed by acquaintances and family members (9.1% and 7.6%, respectively, in 2018). Family members were responsible for the most burden among male victims in 2018 (41%), followed by intimate partners and acquaintances (23% and 22%, respectively, in 2018).

Table 5.4: Number and proportion (%) of total burden (DALY) from homicide and violence, by sex and perpetrator type, Indigenous Australians

		2003		2011		2018	
Sex of victim	Perpetrator	Number	% of violence burden	Number	% of violence burden	Number	% of violence burden
Females	Acquaintance	83	7.3	389	29.4	103	9.1
	Family	104	9.1	282	21.3	87	7.6
	Intimate partner	941	83.0	633	47.9	926	81.2
	Stranger	6	0.5	18	1.3	25	2.2
	Total	**1,133**	**100.0**	**1,321**	**100.0**	**1,141**	**100.0**
Males	Acquaintance	398	25.2	882	46.3	344	21.7
	Family	686	43.4	383	20.1	652	41.1
	Intimate partner	285	18.0	290	15.2	370	23.3
	Stranger	212	13.4	349	18.3	220	13.9
	Total	**1,582**	**100.0**	**1,904**	**100.0**	**1,586**	**100.0**

Note: Numbers may not add to totals for all columns due to rounding.

5.4 How do risk factors change through the life course?

The health impacts due to risk factors varied by age and sex. Risk factors ranked by their contribution to total burden (DALY) in each age group are shown for males (Figure 5.1), females (Figure 5.2) and all Indigenous Australians (Figure 5.3). The number of attributable DALY and the proportion of attributable burden to the overall DALY by risk factor, age and sex are also shown. Rankings according to contribution to non-fatal and fatal burden for males and females are presented in Appendix D (figures D8, D9, D10, D11).

Exposure to risk factors in the past can influence the proportion of burden attributable in the reference year of the study or for a particular age group. This is because evidence of past exposure can be linked to current burden—for example, to take into account the lag time from exposure through to outcomes such as cancer. The risk factors where past exposure or any exposure during the life course contributes to the calculation of attributable burden are tobacco use, child abuse & neglect, intimate partner violence, occupational exposures & hazards, alcohol use, illicit drug use, unsafe sex and low birthweight & short gestation. For these risk factors, the onset of linked diseases may not occur until years after initial exposure. For example, the methods for tobacco use incorporated a measure of current smoking where the onset of linked diseases are given a 5-year lag from the time of exposure. Similarly, with other risk factors, burden over the lifetime of certain linked diseases is said to be attributable to past exposure, such as depression and anxiety for childhood experiences of abuse and neglect.

Overall, low birthweight & short gestation was the leading contributor to burden for ages under 5, child abuse & neglect for ages 5–14, alcohol use for ages 15–44, and tobacco use for ages 45 and over (Figure 5.3).

Young children aged under 5

In children aged under 5, low birthweight & short gestation was the leading risk factor for the total burden in both males (32%) and females (28%). Other risk factors, including unsafe sanitation, impaired kidney function, air pollution and iron deficiency, each contributed less than 1% to the total burden. Note that many other risk factors were not measured in this age group due to low disease burden of linked diseases at this age.

Children and young people aged 5–14

In children and young people aged 5–14, child abuse & neglect was the leading risk factor for the total burden in both males (2.3%) and females (5.6%), followed by overweight (including obesity) (1.6% in males and 1.5% in females). Alcohol use, high fasting plasma glucose, low birthweight & short gestation, iron deficiency and impaired kidney function each contributed less than 1% of burden for each sex. Note that many other risk factors were not measured in this age group due to low disease burden of linked diseases at this age.

Young people aged 15–24

Males

Alcohol use was the leading risk factor contributing to disease burden in males in this age group (26%). Illicit drug use (14%) and child abuse & neglect (9.6%) were also leading causes. Males experienced almost 3 times the burden from alcohol use and almost twice the burden from illicit drug use as females.

Females

Child abuse & neglect was the leading risk factor contributing to disease burden in females in this age group (16%), followed by alcohol use (12%) and illicit drug use (11%). Intimate partner violence (6.0%) and overweight (including obesity) (2.0%) made up the 5 leading risk factors.

Adults aged 25–44

Men

The leading risk factor contributing to disease burden for Indigenous men in this age group was alcohol use (23%). Illicit drug use (16%), overweight (including obesity) (6.7%), child abuse & neglect (6.4%) and tobacco use (6.4%), were also among the leading 5 causes of disease burden. Alcohol use contributed a much higher proportion of the burden in men than in women. Dietary and metabolic risk factors (high blood pressure, high cholesterol, high blood plasma glucose and impaired kidney function) made up the 10 leading risk factors causing burden in men in this age group.

Women

Child abuse & neglect (11%) was the leading risk factor for Indigenous women aged 25–44. Various behavioural and metabolic risk factors were included in the leading 10 causes of burden in women in this age group—illicit drug use ranked second (9.5%) while intimate partner violence (9.4%), overweight (including obesity) (8.0%) and alcohol use (8.0%) completed the top 5. Impaired kidney function was ranked ninth in women in this age group (2.7%).

Adults aged 45–64

For people aged 45–64, tobacco use and overweight (including obesity) were the leading 2 risk factors contributing to disease burden in both men and women. This age group experienced increased burden from metabolic and dietary risk factors, especially high blood plasma glucose and impaired kidney function; however, the amount differed by sex.

Men

In men, tobacco use (24%) ranked first, followed by overweight (including obesity) (15%), diet (13%), alcohol use (10%) and high blood plasma glucose (9.3%). Impaired kidney function accounted for 8.7% of the burden for men in this age group, and illicit drug use remained within the leading 10 causes (5.4%).

Women

Tobacco use (20%) was ranked first for women in this age group, followed by overweight (including obesity) (16%), high blood plasma glucose levels (9.7%), diet (8.4%) and impaired kidney function (7.8%). The remaining risk factors within the leading 10 for women included child abuse & neglect (4.1%) and intimate partner violence (3.7%).

Adults aged 65–74

Tobacco use, overweight (including obesity) and high blood plasma glucose were the leading 3 risk factors in adults aged 65–74, with both sexes experiencing similar amounts of burden due to these factors.

Men

Tobacco use accounted for 23% of burden among Indigenous men in this age group, followed by overweight (including obesity) (16%), high blood plasma glucose (13%), diet (11%) and impaired kidney function (10%). High blood pressure also contributed substantially to burden (9.7%).

Women

As for males, tobacco use (23%), overweight (including obesity) (18%) and high blood plasma glucose (13%) were the main causes of burden in women, followed by impaired kidney function (12%), diet (8.3%) and high blood pressure (8.0%). Child abuse & neglect and intimate partner violence no longer appeared in the top 10 risk factors for Indigenous females from this age group.

Older Indigenous Australians aged 75+

In older Indigenous Australians, the leading 3 contributors to burden were the same as among people in the 65–74 age group—tobacco use (19% in males, 15% in females), overweight (including obesity) (12% in males, 15% in females) and high blood plasma glucose (11% in both males and females). For males, diet (8.6%) and high blood pressure (8.0%) completed the top 5, followed by impaired kidney function (8.0%). Impaired kidney function made a larger contribution to burden for females than for males. Low bone mineral density also appeared in the top 10 for females in this age group, contributing 2.1% of burden.

Figure 5.1: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous males, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	LBW/short gestation (2,968; 32%)	Child abuse/neglect (162; 2.3%)	Alcohol (4,283; 26%)	Alcohol (9,045; 23%)	Tobacco (9,648; 24%)	Tobacco (2,635; 23%)	Tobacco (1,074; 19%)
2nd	Kidney function (39; 0.4%)	Overweight/obesity (112; 1.6%)	Illicit drug use (2,348; 14%)	Illicit drug use (6,324; 16%)	Overweight/obesity (6,197; 15%)	Overweight/obesity (1,866; 16%)	Overweight/obesity (688; 12%)
3rd	Unsafe sanitation (15; 0.2%)	Alcohol (59; 0.8%)	Child abuse/neglect (1,562; 9.6%)	Overweight/obesity (2,588; 6.7%)	Diet (5,398; 13%)	Blood glucose (1,474; 13%)	Blood glucose (603; 11%)
4th	Air pollution (14; 0.2%)	Blood glucose (41; 0.6%)	Overweight/obesity (231; 1.4%)	Child abuse/neglect (2,476; 6.4%)	Alcohol (4,218; 10%)	Diet (1,265; 11%)	Diet (477; 8.6%)
5th	Iron deficiency (12; 0.1%)	LBW/short gestation (40; 0.6%)	Occupational (215; 1.3%)	Tobacco (2,471; 6.4%)	Blood glucose (3,751; 9.3%)	Kidney function (1,155; 10%)	Blood pressure (445; 8.0%)
6th		Iron deficiency (26; 0.4%)	LBW/short gestation (64; 0.4%)	Diet (2,130; 5.5%)	Kidney function (3,505; 8.7%)	Blood pressure (1,099; 9.7%)	Kidney function (441; 8.0%)
7th		Kidney function (9; 0.1%)	Blood glucose (49; 0.3%)	Blood pressure (1,345; 3.5%)	Blood pressure (3,419; 8.5%)	Alcohol (665; 5.9%)	Physical inactivity (292; 5.3%)
8th				Cholesterol (1,264; 3.3%)	Cholesterol (2,712; 6.7%)	Physical inactivity (580; 5.1%)	Alcohol (216; 3.9%)
9th				Blood glucose (1,235; 3.2%)	Illicit drug use (2,167; 5.4%)	Cholesterol (440; 3.9%)	Cholesterol (189; 3.4%)
10th				Kidney function (985; 2.5%)	Physical inactivity (1,722; 4.3%)	Air pollution (285; 2.5%)	Air pollution (120; 2.2%)

LBW low birthweight. See Appendix D, Box D2 for ABDS 2018 risk factors colour legend.

Figure 5.2: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous females, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	LBW/short gestation (2,165; 28%)	Child abuse/neglect (318; 5.6%)	Child abuse/neglect (2,056; 16%)	Child abuse/neglect (3,415; 11%)	Tobacco (7,091; 20%)	Tobacco (2,610; 23%)	Tobacco (1,070; 15%)
2nd	Unsafe sanitation (15; 0.2%)	Overweight/obesity (84; 1.5%)	Alcohol (1,479; 12%)	Illicit drug use (2,868; 9.5%)	Overweight/obesity (5,795; 16%)	Overweight/obesity (2,050; 18%)	Overweight/obesity (1,055; 15%)
3rd	Air pollution (13; 0.2%)	Iron deficiency (43; 0.8%)	Illicit drug use (1,350; 11%)	Partner violence (2,836; 9.4%)	Blood glucose (3,486; 9.7%)	Blood glucose (1,432; 13%)	Blood glucose (804; 11%)
4th	Tobacco (10; 0.1%)	Blood glucose (26; 0.5%)	Partner violence (773; 6.0%)	Overweight/obesity (2,419; 8.0%)	Diet (3,041; 8.4%)	Kidney function (1,321; 12%)	Kidney function (746; 10%)
5th		Alcohol (25; 0.4%)	Overweight/obesity (252; 2.0%)	Alcohol (2,409; 8.0%)	Kidney function (2,824; 7.8%)	Diet (945; 8.3%)	Blood pressure (622; 8.5%)
6th		LBW/short gestation (21; 0.4%)	Occupational (156; 1.2%)	Tobacco (1,889; 6.2%)	Alcohol (2,144; 5.9%)	Blood pressure (910; 8.0%)	Diet (590; 8.1%)
7th			Iron deficiency (132; 1.0%)	Diet (1,095; 3.6%)	Blood pressure (2,034; 5.6%)	Physical inactivity (534; 4.7%)	Physical inactivity (428; 5.9%)
8th			Blood glucose (75; 0.6%)	Blood glucose (1,016; 3.4%)	Child abuse/neglect (1,480; 4.1%)	Alcohol (343; 3.0%)	Cholesterol (239; 3.3%)
9th			LBW/short gestation (36; 0.3%)	Kidney function (826; 2.7%)	Cholesterol (1,388; 3.8%)	Cholesterol (310; 2.7%)	Alcohol (199; 2.7%)
10th			Kidney function (32; 0.2%)	Cholesterol (585; 1.9%)	Partner violence (1,345; 3.7%)	Air pollution (246; 2.2%)	Bone density (153; 2.1%)

LBW low birthweight. See Appendix D, Box D2 for ABDS 2018 risk factors colour legend.

Figure 5.3: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous Australians, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	LBW/short gestation (5,134; 30%)	Child abuse/neglect (480; 3.7%)	Alcohol (5,763; 20%)	Alcohol (11,454; 17%)	Tobacco (16,739; 22%)	Tobacco (5,245; 23%)	Tobacco (2,144; 17%)
2nd	Kidney function (39; 0.2%)	Overweight/obesity (197; 1.5%)	Illicit drug use (3,698; 13%)	Illicit drug use (9,192; 13%)	Overweight/obesity (11,992; 16%)	Overweight/obesity (3,915; 17%)	Overweight/obesity (1,743; 14%)
3rd	Unsafe sanitation (30; 0.2%)	Alcohol (84; 0.7%)	Child abuse/neglect (3,618; 12%)	Child abuse/neglect (5,891; 8.5%)	Diet (8,439; 11%)	Blood glucose (2,905; 13%)	Blood glucose (1,406; 11%)
4th	Air pollution (27; 0.2%)	Iron deficiency (69; 0.5%)	Partner violence (773; 2.7%)	Overweight/obesity (5,007; 7.2%)	Blood glucose (7,237; 9.5%)	Kidney function (2,477; 11%)	Kidney function (1,187; 9.3%)
5th	Tobacco (18; 0.1%)	Blood glucose (67; 0.5%)	Overweight/obesity (483; 1.7%)	Tobacco (4,359; 6.3%)	Alcohol (6,362; 8.3%)	Diet (2,210; 9.8%)	Diet (1,067; 8.3%)
6th	Iron deficiency (17; 0.1%)	LBW/short gestation (60; 0.5%)	Occupational (371; 1.3%)	Diet (3,225; 4.7%)	Kidney function (6,329; 8.3%)	Blood pressure (2,009; 8.9%)	Blood pressure (1,067; 8.3%)
7th			Iron deficiency (140; 0.5%)	Partner violence (2,836; 4.1%)	Blood pressure (5,454; 7.1%)	Physical inactivity (1,114; 4.9%)	Physical inactivity (721; 5.6%)
8th			Blood glucose (124; 0.4%)	Blood glucose (2,250; 3.3%)	Cholesterol (4,099; 5.4%)	Alcohol (1,008; 4.5%)	Cholesterol (428; 3.3%)
9th			LBW/short gestation (100; 0.3%)	Blood pressure (1,853; 2.7%)	Illicit drug use (3,414; 4.5%)	Cholesterol (750; 3.3%)	Alcohol (414; 3.2%)
10th			Kidney function (39; 0.1%)	Cholesterol (1,849; 2.7%)	Physical inactivity (3,025; 4.0%)	Air pollution (531; 2.3%)	Air pollution (260; 2.0%)

LBW low birthweight. See Appendix D, Box D2 for ABDS 2018 risk factors colour legend.
Note: The burden attributable to intimate partner violence is measured for females only.

6

Gap in health outcomes

Key results

- 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 in 2018.
- Dying early caused more of the gap than living with poor health. Indigenous Australians were 2.5 times as likely as non-Indigenous Australians to die early, and 2.1 times as likely to live with poor health.
- Mental & substance use disorders, cardiovascular diseases, and injuries were the 3 largest disease group contributors to the gap in disease burden between Indigenous and non-Indigenous Australians (contributing 20%, 14% and 10% of the gap, respectively).
- For children aged 0–14, infant & congenital conditions were the largest contributor to the gap (accounting for 36% of the gap).
- Mental & substance use disorders and injuries were the largest contributors to the gap for people aged 15–24 and 25–44 (together representing 82% and 57% of the gap in these age groups, respectively).
- Cardiovascular diseases and cancer were the main contributors to the gap among people aged 45–64 and 65–74 (together representing 33% and 34% of the gap in these age groups, respectively).
- The 3 leading individual disease contributors to the gap for Indigenous males were coronary heart disease, alcohol use disorders, and COPD (accounting for 10%, 7% and 6% of the gap, respectively).
- For Indigenous females, coronary heart disease, chronic kidney disease, and COPD were the 3 leading disease contributors to the gap (accounting for 7%, 7% and 6% of the gap, respectively).
- About two-thirds (66%) of the health gap between Indigenous and non-Indigenous Australians in 2018 was due to the combined effect of the risk factors included in this study.

Measuring the 'gap' in disease burden between Indigenous and non-Indigenous Australians is of key interest to current policy makers, as reflected in the National Agreement on Closing the Gap's socioeconomic outcome target to close the gap in life expectancy within a generation (Joint Council on Closing the Gap 2020).

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 and rate differences are presented as measures of the gap in disease burden (see 'Appendix A: Methods overview' for more information). In addition, results are presented on the diseases contributing most to the health gap (measured as the proportion that each disease group contributes to the total DALY rate difference).

6.1 How big is the health gap?

In 2018, 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.

Indigenous Australians experienced non-fatal burden at over twice the rate of non-Indigenous Australians after taking into account differences in population age structure (YLD rate ratio of 2.1).

For the fatal burden, Indigenous Australians experienced YLL at 2.5 times the rate for non-Indigenous Australians (Table 6.1).

Table 6.1: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and sex, 2018

	Indigenous rate per 1,000	Non-Indigenous rate per 1,000	Rate ratio	Rate difference per 1,000
Total burden (DALY)				
Males	437.4	195.0	2.2	242.4
Females	364.4	160.9	2.3	203.5
People	399.6	177.4	2.3	222.2
Non-fatal burden (YLD)				
Males	199.0	93.4	2.1	105.6
Females	197.9	97.5	2.0	100.5
People	198.5	95.5	2.1	103.0
Fatal burden (YLL)				
Males	238.4	101.6	2.3	136.7
Females	166.5	63.4	2.6	103.1
People	201.1	81.9	2.5	119.2

Notes
1. Rates are directly age-standardised to the 2011 Australian estimated resident population as at 20 June 2001 (based on the 2001 Census).
2. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

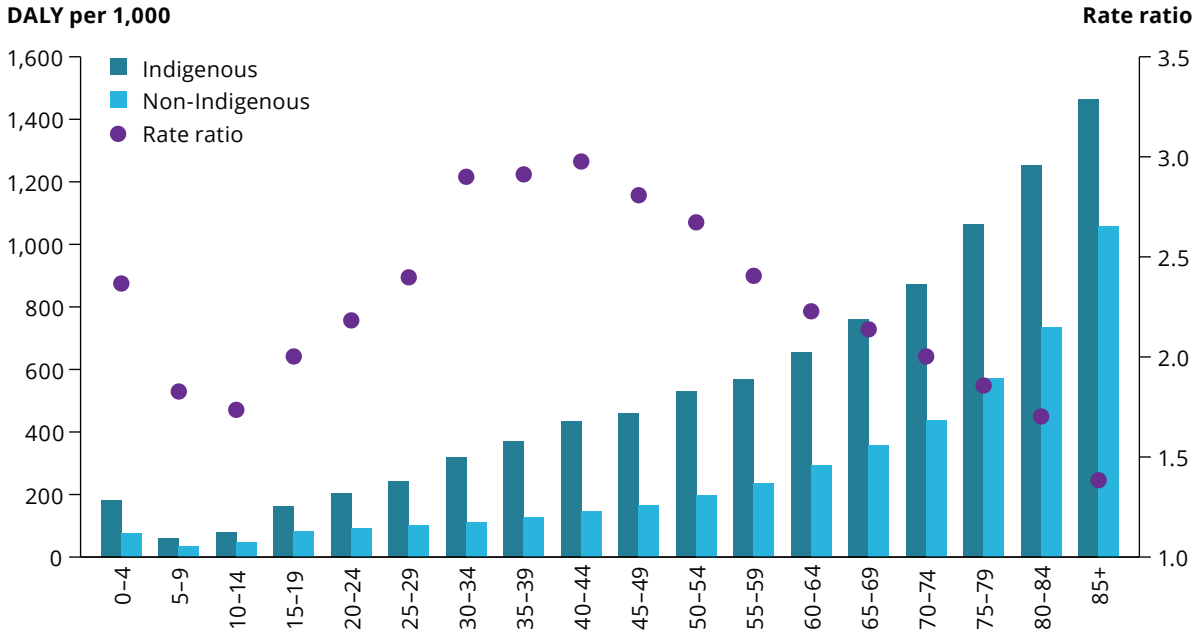
6.2 How does the gap vary by age and sex?

The relative gap in disease burden was slightly lower for males than females (DALY rate ratios of 2.2 and 2.3, respectively), however, the absolute gap was greater for males than females (DALY rate differences of 242 per 1,000 people compared with 204 per 1,000) (Table 6.1).

In all age groups, Indigenous Australians had higher rates of DALY than non-Indigenous Australians (Figure 6.1).

The largest relative differences were for people aged 30–34, 35–39 and 40–44, where DALY rates for Indigenous Australians were between 2.9 and 3.0 times those for non-Indigenous Australians.

Figure 6.1: Age-specific DALY rates (per 1,000 people) and rate ratios, by age group, Indigenous and non-Indigenous Australians, 2018



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

6.3 Which disease groups contribute the most to the gap?

In 2018, across all disease groups, Indigenous Australians experienced a higher rate of burden than non-Indigenous Australians, with the exception of reproductive & maternal conditions, for which rates were similar (ratio of 0.9).

Mental & substance use disorders were the largest contributor to the gap in disease burden between Indigenous and non-Indigenous Australians (based on age-standardised DALY rate differences), contributing 20% of the gap. This was followed by cardiovascular diseases (14%) and injuries (10%) (Table 6.2).

Table 6.2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, 2018

	DALY per 1,000[(a)]				
Disease group	Indigenous	Non-Indigenous	Rate ratio	Rate difference	Contribution to the health gap (% of total rate difference)
Mental/substance use	69.6	24.5	2.8	45.1	20.3
Cardiovascular	51.5	21.5	2.4	30.1	13.5
Injuries	38.8	15.8	2.4	22.9	10.3
Respiratory	34.2	12.7	2.7	21.5	9.7
Cancer	50.2	29.9	1.7	20.3	9.1
Musculoskeletal	36.3	23.7	1.5	12.6	5.6
Kidney/urinary	14.0	2.2	6.3	11.8	5.3
Endocrine	16.2	4.5	3.6	11.7	5.3
Neurological	23.3	13.2	1.8	10.2	4.6
Gastrointestinal	14.4	5.8	2.5	8.5	3.8
Hearing/vision	11.5	3.5	3.3	8.0	3.6
Infectious diseases	10.3	3.4	3.0	6.9	3.1
Infant/congenital	9.7	4.4	2.2	5.4	2.4
Oral	7.9	4.4	1.8	3.5	1.6
Blood/metabolic	5.5	2.2	2.5	3.3	1.5
Skin	4.4	3.5	1.3	0.9	0.4
Reproductive/maternal	1.9	2.1	0.9	–0.2	–0.1
Total all diseases	**399.6**	**177.4**	**2.3**	**222.2**	**100.0**

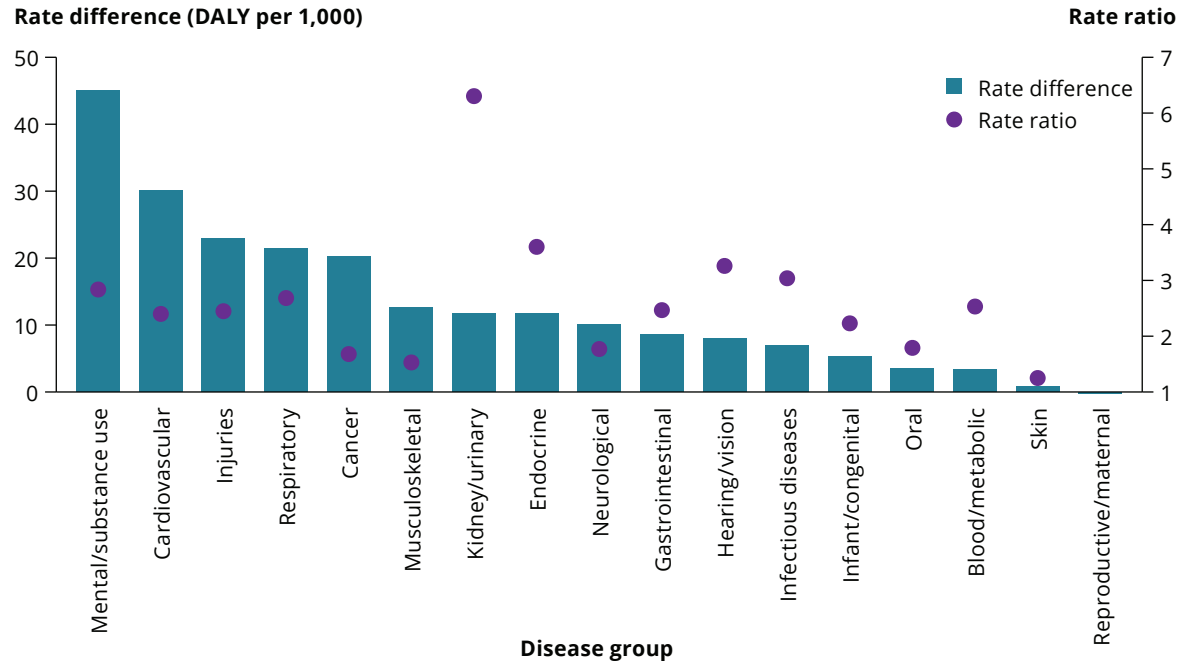
(a) Rates are directly age-standardised to the 2011 Australian estimated resident population as at 30 June 2001 (based on the 2001 Census).

Notes

1. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
2. The numbers may not add to total for all columns due to rounding.

Disease groups that 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 6.3) and endocrine disorders (including diabetes) (ratio of 3.6) (Table 6.2; Figure 6.2). While these rate ratios are much higher than for mental & substance use disorders (ratio of 2.8), cardiovascular diseases (ratio of 2.4) and injuries (ratio of 2.4), their contribution to the total health gap was lower (5% each for kidney & urinary diseases and endocrine disorders).

Figure 6.2: DALY rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group, 2018



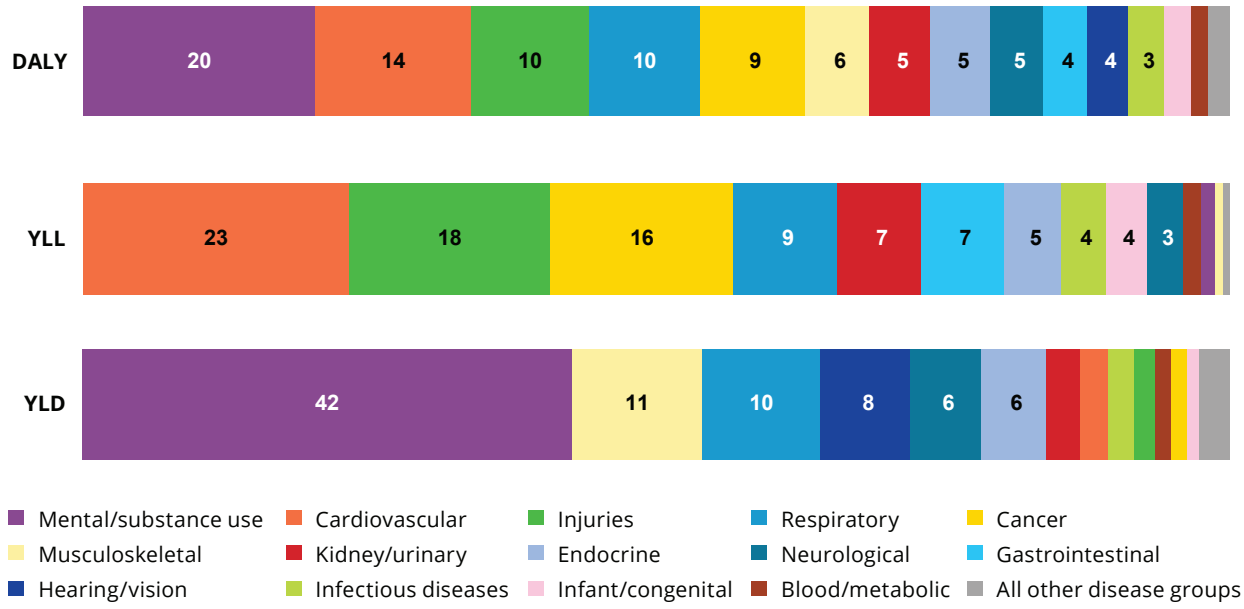
Source: Table 6.2.

Disease group contribution to fatal and non-fatal gap

The diseases contributing most to the gap between Indigenous and non-Indigenous Australians were different for fatal and non-fatal burden (Figure 6.3).

When looking at non-fatal burden, mental & substance use disorders, musculoskeletal conditions and respiratory diseases were the largest contributors to the gap between Indigenous and non-Indigenous Australians, together contributing 64% of the total gap in YLD in 2018.
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 one-half (57%) of the total gap in YLL in 2018.

Figure 6.3: Percentage contribution (%) of leading disease groups to the gap in total (DALY), fatal (YLL) and non-fatal burden (YLD), 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of gap.
2. 'All other disease groups' includes oral disorders, skin disorders and reproductive & maternal conditions.

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

Disease group contribution to the gap by sex

Mental & substance use disorders was the largest contributor to the gap in total disease burden between Indigenous and non-Indigenous Australians for both males and females in 2018, accounting for 21% and 20% of the gap respectively (Figure 6.4). Indigenous males and females experienced a rate of total burden from this disease group of 3.0 and 2.7 times the rates for non-Indigenous males and females, respectively (Appendix tables D2 and D3).

Cardiovascular diseases was the second leading contributor to the gap for both males and females (representing 14% and 13%, respectively). Indigenous males and females experienced burden of disease from cardiovascular diseases at 2.2 and 2.7 times the rate of non-Indigenous males and females, respectively.

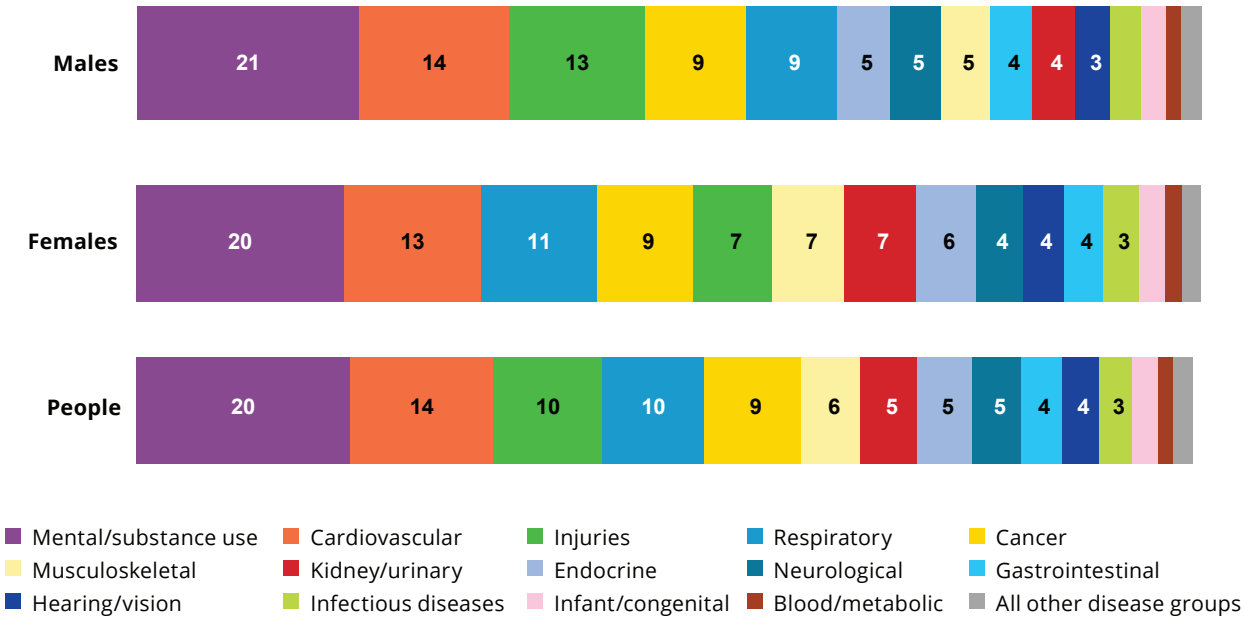
Injuries was ranked as the third leading contributor to the gap for males (13%), and ranked fifth for females (7%). Rate ratios were 2.4 for males and 2.6 for females.

Respiratory diseases was the third leading contributor to the gap for females (representing 11%), and the fifth ranked for males (representing 9%). Indigenous males and females experienced burden of disease from respiratory diseases at 2.6 and 2.7 times the rates for non-Indigenous males and females, respectively.

Cancer & other neoplasms was ranked as the fourth leading contributor to the gap for both males and females (representing 9% each). Indigenous males and females experienced burden of disease from cancer & other neoplasms at 1.7 times the rates for non-Indigenous males and females.

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 4.2 for males and 10.1 for females) and endocrine disorders (including diabetes) (rate ratios of 3.2 for males and 4.2 for females) (Appendix tables D2 and D3).

Figure 6.4: Percentage contribution (%) of leading disease groups to the gap in total disease burden (DALY), by sex, 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of the gap.
2. 'All other disease groups' includes oral disorders, skin disorders and reproductive & maternal conditions.

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

6.4 Which diseases and injuries contribute most to the gap?

Table 6.3 presents the top 20 individual diseases contributing to the gap in total burden for males and females in 2018; together they accounted for over two-thirds of the gap (70% for males and 68% for females).

Coronary heart disease was the leading contributor to the gap in total burden between Indigenous and non-Indigenous Australians for both males and females in 2018 (accounting for 10% of the gap for males, and 7% of the gap for females). COPD and type 2 diabetes also ranked among the top 5 contributors to the gap for both Indigenous males and females (each accounting for 4%–6% of the gap).

For males, alcohol use disorders and suicide & self-inflicted injuries also appeared among the top 5 contributors to the gap (accounting for 7% and 5% of the gap, respectively).

For females, chronic kidney disease and anxiety disorders rounded out the top 5 contributors to the gap (accounting for 7% and 6% of the gap, respectively).

Table 6.3: Leading 20 diseases contributing to the gap in total burden (DALY) for Indigenous males and females, 2018

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	38.2	15.0	2.6	23.2	9.6	1	Coronary heart disease	20.5	6.1	3.4	14.4	7.1
2	Alcohol use disorders	21.9	3.9	5.6	18.0	7.4	2	Chronic kidney disease	14.6	1.4	10.5	13.2	6.5
3	COPD	21.0	5.8	3.6	15.3	6.3	3	COPD	17.9	5.5	3.2	12.4	6.1
4	Suicide & self-inflicted injuries	19.6	8.1	2.4	11.5	4.7	4	Anxiety disorders	19.4	7.3	2.7	12.1	5.9
5	Type 2 diabetes	15.2	4.3	3.5	10.8	4.5	5	Type 2 diabetes	13.9	2.7	5.1	11.2	5.5
6	Chronic kidney disease	11.6	2.0	5.9	9.6	4.0	6	Depressive disorders	16.5	6.3	2.6	10.2	5.0
7	Anxiety disorders	13.5	4.8	2.8	8.7	3.6	7	Asthma	13.8	5.4	2.6	8.4	4.1
8	Lung cancer	15.0	6.3	2.4	8.7	3.6	8	Dementia	13.1	6.5	2.0	6.6	3.3
9	Chronic liver disease	10.7	2.8	3.9	7.9	3.3	9	Hearing loss	8.6	2.2	4.0	6.4	3.1
10	Dementia	12.7	5.4	2.4	7.4	3.0	10	Lung cancer	10.3	4.1	2.5	6.2	3.0
11	Depressive disorders	11.3	4.8	2.3	6.5	2.7	11	Alcohol use disorders	6.7	1.3	5.2	5.4	2.7
12	Hearing loss	9.3	2.9	3.2	6.4	2.6	12	Chronic liver disease	5.9	1.3	4.6	4.6	2.3
13	Poisoning	9.5	4.0	2.4	5.6	2.3	13	Rheumatoid arthritis	8.9	4.4	2.0	4.5	2.2
14	Drug use disorders	7.8	2.4	3.2	5.4	2.2	14	Poisoning	5.5	1.5	3.6	3.9	1.9
15	Schizophrenia	7.2	1.9	3.9	5.4	2.2	15	Drug use disorders	5.0	1.2	4.3	3.9	1.9
16	Asthma	8.7	4.7	1.9	4.0	1.6	16	Stroke	7.4	3.8	1.9	3.6	1.8
17	Homicide & violence	4.7	0.9	5.6	3.9	1.6	17	Suicide & self-inflicted injuries	6.2	2.7	2.3	3.5	1.7
18	RTI – motor vehicle occupants	6.0	2.1	2.9	3.9	1.6	18	Lower respiratory infections[(a)]	4.4	1.3	3.4	3.1	1.5
19	Rheumatoid arthritis	6.9	3.1	2.2	3.8	1.6	19	Homicide & violence	3.1	0.3	8.8	2.7	1.3
20	Stroke	8.2	4.5	1.8	3.7	1.5	20	Back pain & problems	10.9	8.3	1.3	2.7	1.3
	Total all causes	**437.4**	**195.0**	**2.2**	**242.4**	**100.0**		**Total all causes**	**364.4**	**160.9**	**2.3**	**203.5**	**100.0**

(a) Lower respiratory infections includes influenza and pneumonia.

COPD chronic obstructive pulmonary disease; RTI road traffic injuries.

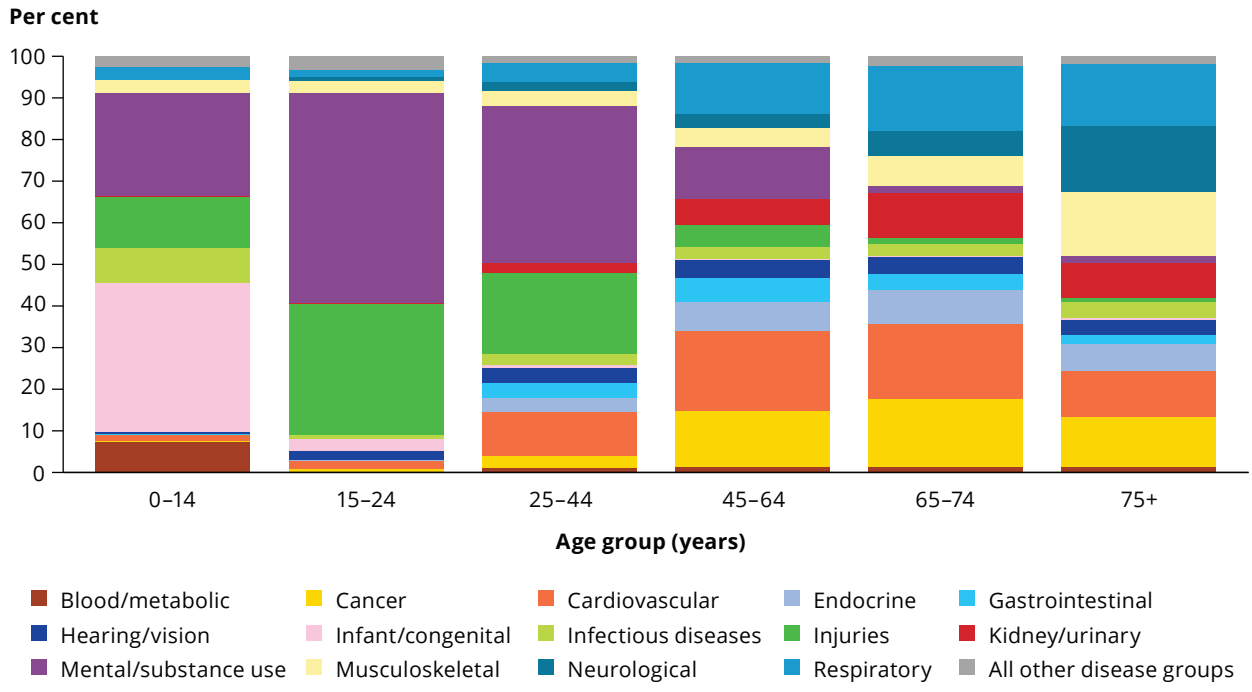
Note: Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

6.5 How does disease group contribution to the gap vary across the life course?

The contribution of different disease groups to the gap in total disease burden between Indigenous and non-Indigenous Australians varies by age (Figure 6.5).

- Infant & congenital conditions, mental & substance use disorders, and injuries were the greatest contributors to the gap among children aged 0–14. Infant & congenital conditions contributed over one-third (36%) of the gap in this age group.
- Mental & substance use disorders and injuries were the largest contributors to the gap among young people aged 15–24, together representing 82% of the gap.
- Mental & substance use disorders and injuries were also important contributors to the gap among people aged 25–44 (representing 38% and 19% of the gap respectively). Cardiovascular diseases also emerged as an important contributor in this age group, representing 11% of the gap.
- Cardiovascular diseases and cancer & other neoplasms were the main contributors to the gap among people aged 45–64 or 65–74, together representing around one-third of the gap in these age groups.
- Neurological conditions, musculoskeletal conditions, and respiratory diseases were the main contributors to the gap among people aged 75 and over, each accounting for around 15% of the gap in this age group.

Figure 6.5: Percentage contribution (%) to the health gap (based on DALY rate difference) between Indigenous and non-Indigenous Australians, by age and disease group, 2018



Note: 'All other disease groups' includes oral disorders, skin disorders and reproductive & maternal conditions.
Source: This figure is based on data in a supplementary table available online—Table S6.4.

6.6 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 Table 6.4. Due to the interactions between risk factors, it is not possible to simply sum the impact of each risk factor (see 'Chapter 5 Contribution of risk factors to burden'). Further, the 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 5, Box 5.2), Indigenous Australians experienced rates of burden attributable to the risk factors included in the study at 3.5 times the rate of non-Indigenous Australians in 2018. Together these risk factors accounted for approximately two-thirds (66%) of the health gap between Indigenous and non-Indigenous Australians.

Table 6.4: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to selected risk factors, rate ratios and rate differences, 2018

	Age-standardised DALY rate per 1,000				
Risk factor	Indigenous	Non-Indigenous	Rate ratio	Rate difference	% of health gap[(a)]
Tobacco use	58.9	13.8	4.3	45.1	20.3
Overweight (including obesity)	47.0	13.9	3.4	33.1	14.9
Alcohol use	36.8	9.8	3.8	27.0	12.2
High blood plasma glucose	30.4	6.9	4.4	23.5	10.6
Impaired kidney function	25.9	2.8	9.3	23.1	10.4
Dietary risks	30.2	8.8	3.4	21.4	9.6
Illicit drug use	22.8	6.2	3.7	16.6	7.4
High blood pressure	22.6	8.1	2.8	14.5	6.5
Child abuse & neglect	15.6	4.0	3.9	11.6	5.2
High cholesterol	13.9	4.5	3.1	9.5	4.3
Physical inactivity	13.3	3.9	3.4	9.4	4.2
Intimate partner violence[(b)]	7.2	1.6	4.5	5.6	2.5
Air pollution	7.0	2.1	3.3	4.9	2.2
LBW & short gestation	4.1	1.3	3.3	2.8	1.3
Unsafe sex	1.4	0.4	3.6	1.0	0.5
Iron deficiency	1.1	0.7	1.7	0.5	0.2
Occupational exposures	5.8	7.6	0.8	–1.8	–0.8
Low bone mineral density	2.8	7.5	0.4	–4.7	–2.1
All risk factors combined	*206.6*	*59.7*	*3.5*	*146.9*	*66.1*
Total burden	**399.6**	**177.4**	**2.3**	**222.2**	**100.0**

LBW low birthweight.

(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 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.

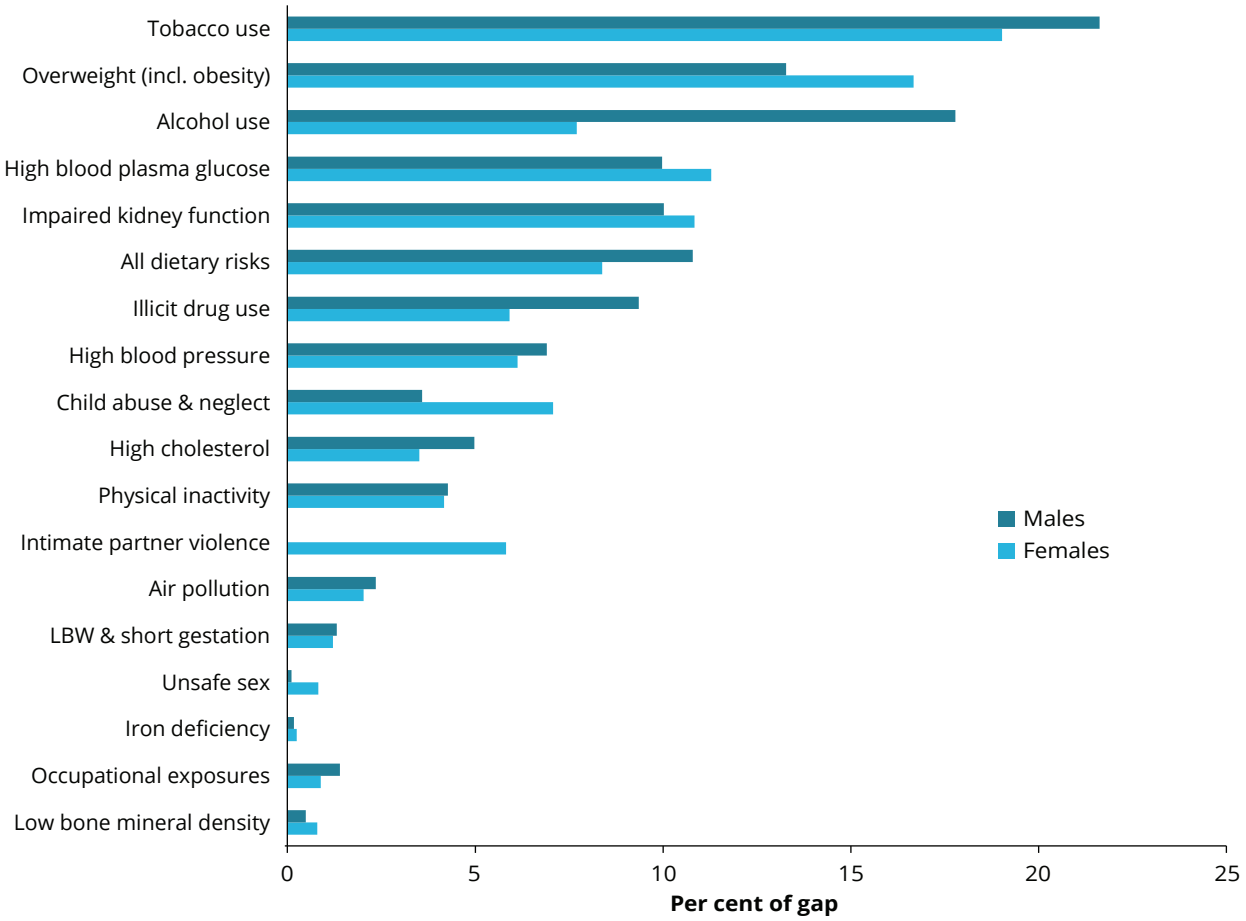
(b) The burden attributable to intimate partner violence is measured for females only.

Tobacco use contributed the most to the health gap, responsible for 20% of the gap between Indigenous and non-Indigenous total burden rates in 2018. This was followed by overweight (including obesity) (contributing to 15% of the gap), alcohol use (12%) and high blood plasma glucose (11%) (Table 6.4). 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 impaired kidney function (rate ratio of 9.3) and intimate partner violence (rate ratio of 4.5). These 2 risk factors contributed to 10% and 2.5% of the total health gap, respectively (Table 6.4).

The risk factors contributing the most to the health gap were similar for Indigenous males and females, however, alcohol use contributed a much larger proportion of the health gap for males than females (18% compared to 7.7%) and child abuse & neglect contributed a higher proportion of the gap for females (7.1% compared to 3.6% for males) (Figure 6.6).

Figure 6.6: Leading risk factors contributing to the gap in the attributable burden for males and females, 2018 (proportion (%) of the gap in total DALY due to each risk factor)



LBW low birthweight.
Note: The burden attributable to intimate partner violence is measured for females only.
Source: This figure is based on data in a supplementary table available online—Table S6.5.

7

Changes over time

Key results

- Between 2003 and 2018, the total burden of disease (number of DALY) among Indigenous Australians rose 44% (from 166,655 to 239,942 DALY). Non-fatal and fatal burden increased 69% (from 75,016 to 126,496 YLD) and 24% (from 91,639 to 113,445 YLL), respectively.
- After removing the impact of the increasing age and size of the Indigenous population (by using age-standardised rates), the rate of total burden fell 15% between 2003 and 2018. The rate of fatal burden decreased by 27% over this period, but there was no substantial change to the rate of non fatal burden.
- In 2003, dying prematurely (fatal burden) caused more burden among Indigenous Australians than the burden caused by living with illness (non-fatal burden). There was a shift toward more non-fatal burden between 2003 and 2018.
- Age-standardised rates of total burden for most disease groups decreased between 2003 and 2018 for Indigenous Australians, with the most notable decreases for cardiovascular diseases and endocrine disorders (including diabetes).
- The overall gap in total disease burden (as measured by the DALY rate difference) between Indigenous and non-Indigenous Australians decreased by 16% between 2003 and 2018.
- The decline in the gap was driven by a decrease in the gap in fatal burden (28%), while the gap in non-fatal burden increased slightly (6.6%).
- Mental & substance use disorders and cancers caused more of the gap in 2018 than they did in 2003, whereas cardiovascular diseases and endocrine disorders (including diabetes) caused less of the gap.
- Between 2003 and 2018, the total burden (number of DALY) attributable to risk factors able to be measured at both time points increased by 59% (from 68,384 to 108,962 DALY).
- After removing the impact of the increasing age and size of the Indigenous population (by using age-standardised rates), the rate of attributable total burden fell by 10% between 2003 and 2018.
- Age-standardised rates of attributable total burden for most risk factors decreased between 2003 and 2018. The exceptions were rates for illicit drug use (which rose by 76%), child abuse & neglect (which rose by 23%) and intimate partner violence (which rose by 15%).
- The gap in age-standardised attributable burden rates increased between 2003 and 2018 for illicit drug use and child abuse & neglect.

This chapter compares the disease burden for Indigenous Australians at 2 points in time: 2003 and 2018. A comparison of the gap in disease burden between Indigenous and non-Indigenous Australians in 2003 and 2018 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. To ensure comparability, estimates for the years 2003 and 2011 were calculated using the ABDS 2018 methods. Data for all reference years are available on the AIHW website.

> The estimates for 2003 and 2011 in the ABDS 2018 cannot be compared with those for 2003 and 2011 from previous Australian studies as they were developed using different methods. See 'Appendix A: Methods overview' for further information on the methods used to develop the estimates presented here.

7.1 How should changes between time points be interpreted?

When comparing estimates for the same disease between time points, please note that:

- non-fatal (YLD) and fatal (YLL) estimates may change by differing proportions, depending on prevalence and risk factor exposure, thus making different contributions to the change in DALY
- individual diseases within disease groups may have different trends: increases in estimates for individual diseases can be offset by decreases in other diseases, thereby resulting in no change overall at the disease group level
- unless adjusted for, the impact of population changes (for example, ageing and an increase in population size) may mask changes in underlying disease prevalence and/or severity
- disease occurrence data in 2003 and 2018 may not always follow the same Indigenous identification as population measurements and so some Indigenous burden of disease rates which have not had any adjustments made for under-identification may be affected by numerator/denominator inconsistencies. This should be kept in mind when interpreting any changes over time in Indigenous burden of disease estimates reported.

More detailed information about the methods used to estimate data for individual diseases, including adjustments made and notes about the impact of coding changes, is presented in the ABDS methods report *Australian Burden of Disease Study 2018: methods and supplementary material* (AIHW 2021c).

Are changes in burden due to population changes?

Differences in burden estimates 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). Information on the Indigenous population by age group for each of the reference years is provided in Appendix D (Figure D12 and Table D4). 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 are presented.

To account for differences in the population age structure and size between 2003 and 2018, direct age-standardisation has been used. This method takes the 2003 and 2018 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 (published 20 June 2013) has been used as the standard in this report.

Age-standardised rates (ASRs), rate ratios and rate differences are helpful to tease out the changes in disease burden, as distinct from the changes in population size and structure.

To help distinguish the impact of population increase compared with population ageing—as well as impacts of epidemiological changes—this study estimated the drivers of change over time. The results for these are presented in the interactive data on disease burden at https://www.aihw.gov.au/reports/burden-of-disease/abds-2018-interactive-risk-factor-indigenous/contents/about.

Estimating changes in the Indigenous population between 2 time points

In this chapter, the population denominators used to calculate rates for 2003 and 2018 Indigenous burden of disease estimates are the ABS Aboriginal and Torres Strait Islander population estimates as at 30 June 2003 and 30 June 2018 based on the 2016 Census (ABS 2019b). Using the 2016 Census backcast population estimates and projections provides consistency between the denominators used for 2003 and 2018 Indigenous burden of disease estimates, which is very important for assessing rate changes over time. However, this choice inherently applies the Indigenous identification level in 2016 to all years in the series.

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 previous Australian burden of disease studies. It does not necessarily reflect how people would have identified in 2003.

Statistics presented in this chapter

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

- **Numbers:** show the total *impact* of the disease burden on the population at each time point. Changes are expressed as the absolute change for 2018 compared with 2003 and the relative change is expressed as a *percentage*. A negative absolute or relative change indicates a decline between 2003 and 2018 and a positive value indicates an increase.
- **ASRs:** account for changes in population composition over time, such as increasing size and ageing.
  - *Rate ratios* show how many times the rate of burden was in 2018 relative to that in 2003—values greater than 1 indicate an increase in underlying burden (once changes to the population are taken into account), while values less than 1 indicate a decrease in underlying burden. Values close to 1 indicate that there has been minimal change.
  - *Rate differences* show the absolute difference (one rate minus the other) between the ASR of burden from 2003 to 2018. The differences between ASRs are also expressed as a percentage.
  - Note that it is possible to have rate ratios and rate differences 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 2018 rates, but a decrease in the absolute rate difference. In such cases, the rate difference is used as the primary measure for assessing the change over time.
- **Changes in ranking:** disease rankings are used in burden of disease reporting to describe which diseases contribute the most burden. While they are used in some places in this section, it is important not to place 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 or how much it has changed, nor of the magnitude of difference between estimates that are adjacent in rank.

7.2 How has total burden changed over time?

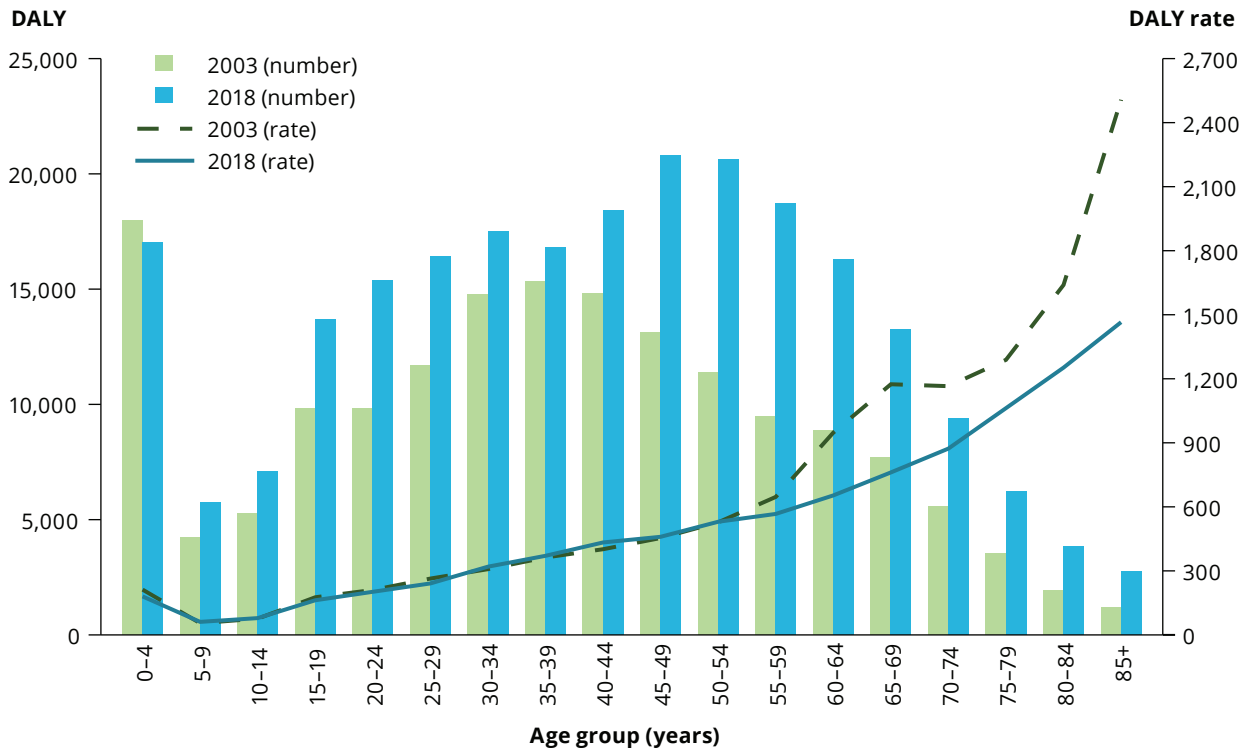
Total DALY has increased over time, but rates have decreased

The number of DALY among Indigenous Australians increased by 44% between 2003 and 2018, from 166,655 to 239,942 DALY, largely reflecting population growth (the Indigenous Australian population increased by 40% between 2003 and 2018).

Age-specific DALY rates for Indigenous Australians were similar in 2003 and 2018 for ages 0 to 54, however, from age 55 onwards rates were lower in 2018 than in 2003 (Figure 7.1).

After removing the impact of the increasing age and size of the Indigenous population (by using age-standardised rates), there was a 15% decrease in the rate of total disease burden between 2003 and 2018 (from 467 to 400 DALY per 1,000 Indigenous Australians).

Figure 7.1: Number and rate of total burden (DALY per 1,000 people), by age, Indigenous Australians, 2003 and 2018



Source: This figure is based on data in a supplementary table available online—Table S7.1.

What were the drivers of changes observed between 2003 and 2018?

Changes in non-fatal burden and fatal burden

The contributions of fatal burden (YLL) and non-fatal burden (YLD) were closer to one another in 2018 than in 2003 (the YLL to YLD ratio was 55:45 in 2003 compared with 47:53 in 2018). This shows that there has been a shift toward a greater contribution of non-fatal burden to overall burden in 2018.

The lower DALY that occurred in those aged under 5 was driven by a decrease in YLL. The higher DALY that occurred in those aged 5–49 (in 2018 compared with 2003) was driven by increases in YLD in these age groups. The increase in DALY for those aged 50 and over was driven by increases in both YLD and YLL (figures 7.3 and 7.4). The changes in YLD and YLL are described in more detail in the following sections.

Changes in total burden by disease group

Decreases in age-standardised burden rates between 2003 and 2018 for Indigenous Australians were observed for over half of the disease groups (Table 7.1). The most notable decreases were for cardiovascular diseases (decrease of 40 DALY per 1,000 people), endocrine disorders (decrease of 13 DALY per 1,000), musculoskeletal conditions (decrease of 8 DALY per 1,000) and infectious diseases (decrease of 6 DALY per 1,000).

Increases in age-standardised burden rates were observed for mental & substance use disorders (increase of 12 DALY per 1,000 people).

Table 7.1: Change in total burden (DALY) between 2003 and 2018, by disease group, Indigenous Australians

Disease group	2003 DALY ASR	2018 DALY ASR	ASR rate difference 2003 to 2018	ASR rate ratio (2018:2003)
Mental/substance use	57.5	69.6	12.1	1.2
Kidney/urinary	11.9	14.0	2.1	1.2
Oral	6.7	7.9	1.1	1.2
Neurological	22.4	23.3	0.9	1.0
Reproductive/maternal	1.7	1.9	0.2	1.1
Skin	4.5	4.4	–0.1	1.0
Blood/metabolic	5.6	5.5	–0.1	1.0
Injuries	39.7	38.8	–1.0	1.0
Infant/congenital	10.8	9.7	–1.1	0.9
Hearing/vision	14.8	11.5	–3.3	0.8
Gastrointestinal	18.1	14.4	–3.7	0.8
Cancer	54.2	50.2	–4.0	0.9
Respiratory	38.2	34.2	–4.1	0.9
Infectious diseases	16.1	10.3	–5.8	0.6
Musculoskeletal	44.4	36.3	–8.1	0.8
Endocrine	28.8	16.2	–12.6	0.6
Cardiovascular	91.9	51.5	–40.4	0.6
Total	**467.5**	**399.6**	**–67.8**	**0.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
2. ASR rate difference is calculated as 2018 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2018 ASR divided by 2003 ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. The numbers may not add to total for relevant columns due to rounding.

Changes in burden of individual diseases over time

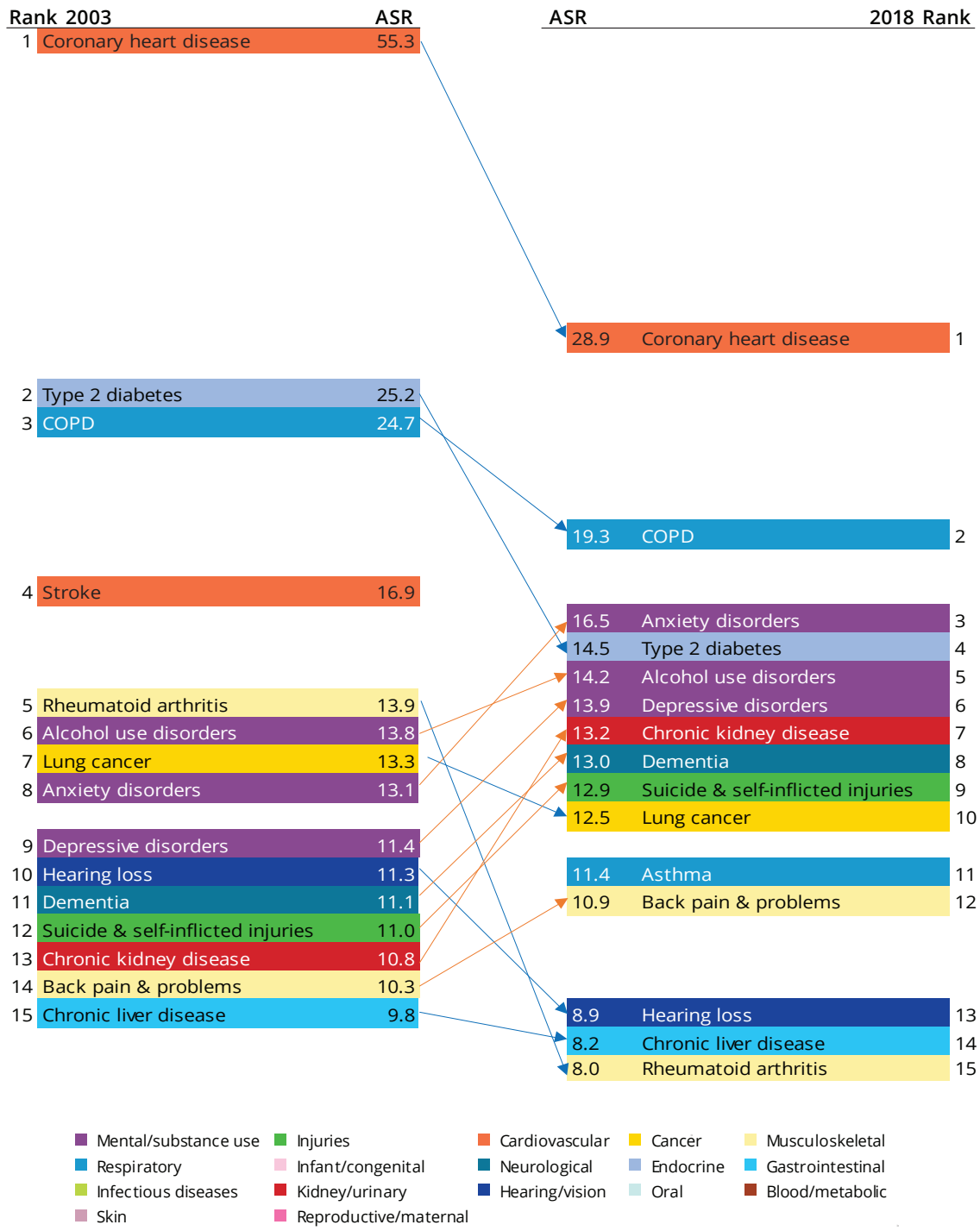
The leading causes of total burden (based on age-standardised rates) among Indigenous Australians in 2003 and 2018 remained largely the same (Figure 7.2). Although coronary heart disease remained the most burdensome disease in Australia in 2018, the total burden rate fell by 48% between 2003 and 2018 (from 55 to 29 DALY per 1,000 people).

Total burden rates also decreased notably for type 2 diabetes (42% decrease, from 25 to 15 DALY per 1,000 people), rheumatoid arthritis (43% decrease) and COPD (22% decrease).

Anxiety disorders and chronic kidney disease had the largest increases in ranking between 2003 and 2018, from eighth to third and 13th to seventh, respectively. The biggest drop in rankings was observed for rheumatoid arthritis, which fell from fifth in 2003 to 15th in 2018. Notably, stroke caused high rates of burden among Indigenous Australians in 2003, but was no longer ranked among the leading 15 diseases/injuries in 2018. Instead, asthma was ranked more highly for the Indigenous population in 2018 at 11th.

Further information on the changes within each disease group is included in ‘Chapter 9 Overview of results by disease group’.

Figure 7.2: Change in disease ranking and age-standardised DALY rate (DALY per 1,000 people), Indigenous Australians, 2003 and 2018



ASR age-standardised rate, calculated as DALY per 1,000 people; COPD chronic obstructive pulmonary disease.

Notes

1. Diseases are presented in descending order, from highest ASR to lowest ASR, with arrows indicating either an increase (orange), decrease (blue) or no change (black) in the ASR over time.
2. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.
3. There were changes in practices of coding deaths due to dementia; therefore, caution is recommended when interpreting changes over time for dementia burden.
4. Asthma was ranked 17th in 2003 with an ASR of 8.3 DALY per 1,000 people. Stroke was ranked 16th in 2018 with an ASR of 7.9 per 1,000.
5. Ranked by age-standardised DALY rates.

7.3 How have the non-fatal burden and fatal burden changed over time?

The following sections describe the changes in non-fatal burden (YLD) and fatal burden (YLL) between 2003 and 2018.

Changes in non-fatal burden

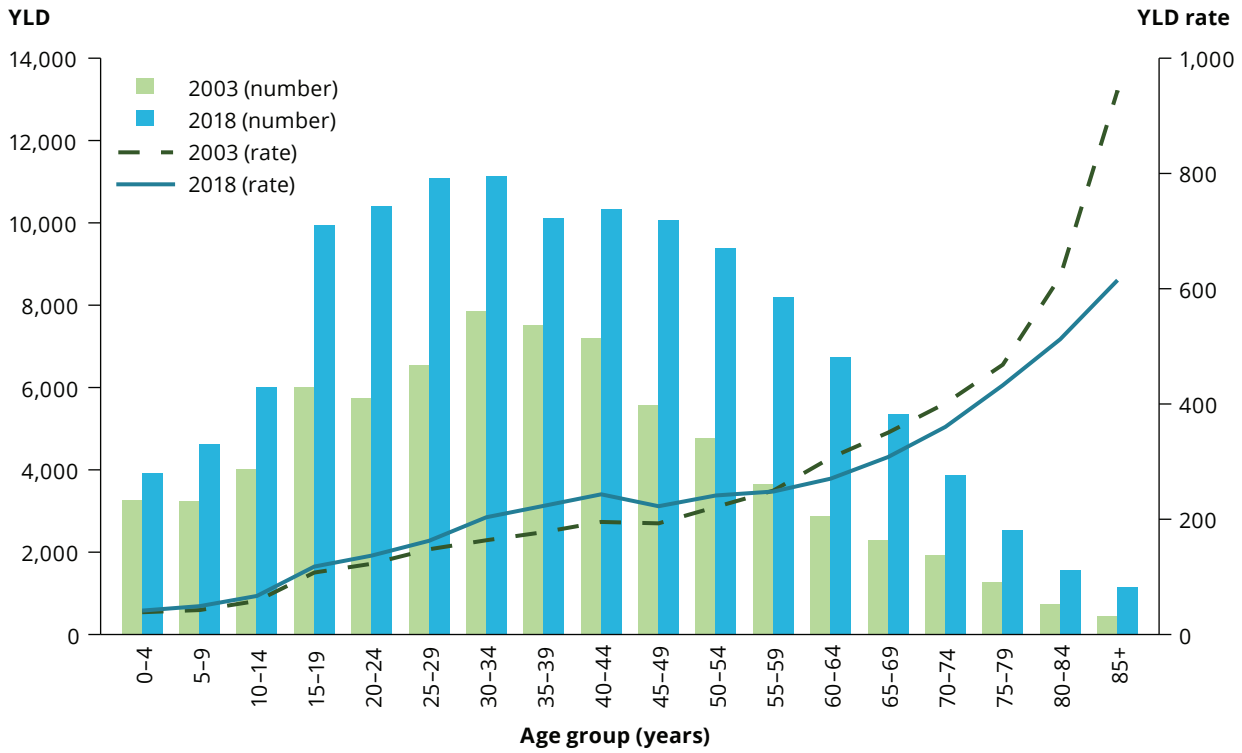
Changes in non-fatal burden (YLD) rates are influenced by changes in the prevalence and/or the severity of the disease.

Overall change in non-fatal burden

There was a 69% increase in the number of YLD among Indigenous Australians between 2003 and 2018, from 75,016 to 126,496 YLD. The rise in YLD occurred in all age groups but was largest in the older age groups.

Age-specific rates of non-fatal burden for Indigenous Australians were similar in 2003 and 2018 for ages 0 to 29. In most of the middle age groups, Indigenous YLD rates were higher in 2018 than in 2003, however, from age 60 onwards YLD rates were higher in 2003 than in 2018 (Figure 7.3).

Figure 7.3: Number and rate of non-fatal burden (YLD per 1,000 people), by age, Indigenous Australians, 2003 and 2018



Source: This figure is based on data in a supplementary table available online—Table S7.2.

After removing the impact of the increasing age and size of the Indigenous population (age-standardising), there was no substantial change in the rate of non-fatal burden for Indigenous Australians between 2003 and 2018 (Table 7.2).

Changes in non-fatal burden by disease group

Between 2003 and 2018, most disease groups showed little change in the age-standardised YLD rates for the Indigenous population. Increases were observed for mental & substance use disorders (increase of 14 YLD per 1,000 people; rate ratio 1.3) and injuries (increase of 1.7 YLD per 1,000).

Decreases in age-standardised rates of non-fatal burden for Indigenous Australians were observed for musculoskeletal conditions (decrease of 7.3 YLD per 1,000 people between 2003 and 2018), hearing & vision disorders (decrease of 3.3 YLD per 1,000) and cardiovascular diseases (decrease of 1.6 YLD per 1,000) (Table 7.2).

Table 7.2: Change in non-fatal burden (YLD) between 2003 and 2018, by disease group, Indigenous Australians

Disease group	2003 YLD ASR	2018 YLD ASR	ASR rate difference 2003 to 2018	ASR rate ratio (2018:2003)
Mental/substance use	53.7	67.8	14.1	1.3
Injuries	3.0	4.7	1.7	1.5
Oral	6.7	7.8	1.1	1.2
Kidney/urinary	3.1	4.0	0.9	1.3
Cancer	2.9	3.7	0.7	1.3
Endocrine	8.3	8.6	0.3	1.0
Reproductive/maternal	1.5	1.7	0.3	1.2
Infant/congenital	1.7	1.9	0.2	1.1
Skin	3.6	3.7	0.1	1.0
Neurological	13.6	13.6	—	1.0
Gastrointestinal	2.3	2.3	—	1.0
Blood/metabolic	2.6	2.4	–0.2	0.9
Infectious diseases	3.7	3.4	–0.2	0.9
Respiratory	19.9	19.0	–0.9	1.0
Cardiovascular	9.2	7.7	–1.6	0.8
Hearing/vision	14.8	11.5	–3.3	0.8
Musculoskeletal	42.1	34.8	–7.3	0.8
Total	**192.7**	**198.5**	**5.8**	**1.0**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
2. ASR rate difference is calculated as 2018 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2018 ASR divided by 2003 ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. The numbers may not add to total for relevant columns due to rounding.

Disease-specific changes in non-fatal burden

There were some differences between 2003 and 2018 for many of the leading causes of non-fatal burden for Indigenous Australians (Table 7.3). There were small increases in the age-standardised YLD rates for over half of the leading causes, with the largest increases observed for anxiety disorders, asthma and depressive disorders (increases of 3.4, 2.9 and 2.6 YLD per 1,000 people, respectively).

Rheumatoid arthritis, COPD and hearing loss had lower age-standardised YLD rates in 2018 than in 2003 (declines of 5.9, 3.7 and 2.4 YLD per 1,000, respectively).

It is important to note that for some diseases the absolute change in ASR between the reference years was small. Prevalence data for Indigenous Australians for some conditions are not readily available over time (see Box 7.1). Further information on data sources and data quality can be found in 'Appendix B: How reliable are the estimates'.

In terms of ranking, the same 5 diseases were the leading causes of non-fatal burden for Indigenous Australians in both 2003 and 2018, although there were some changes in the rankings. Drug use disorders (excluding alcohol) increased in rank (from eighth to sixth), as did type 2 diabetes (from 11th to eighth).

Further information on the changes within each disease group is included in 'Chapter 9 Overview of results by disease group'.

Table 7.3: Change in leading causes of non-fatal burden (YLD) between 2003 and 2018, Indigenous Australians

Disease	Rank 2003	2003 YLD ASR	2018 YLD ASR	ASR rate difference 2003 to 2018	ASR rate ratio 2018:2003	Rank 2018
Anxiety disorders	1	13.1	16.5	3.4	1.3	1
Depressive disorders	3	11.3	13.9	2.6	1.2	2
Alcohol use disorders	2	11.1	13.0	1.9	1.2	3
Asthma	5	7.3	10.2	2.9	1.4	4
Back pain & problems	4	10.2	10.9	0.7	1.1	5
Drug use disorders (excluding alcohol)	8	3.6	6.0	2.4	1.7	6
Hearing loss	6	11.3	8.9	–2.4	0.8	7
Type 2 diabetes	11	7.4	7.8	0.4	1.0	8
Schizophrenia	7	4.3	5.1	0.7	1.2	9
COPD	9	11.4	7.7	–3.7	0.7	10
Dental caries	12	3.6	4.1	0.6	1.2	11
Rheumatoid arthritis	10	13.7	7.8	–5.9	0.6	12
Bipolar affective disorder	13	2.9	3.2	0.3	1.1	13
Conduct disorder	14	1.4	1.9	0.5	1.3	14
Osteoarthritis	19	3.6	5.1	1.5	1.4	15
Dementia	22	7.2	7.4	0.2	1.0	16
Epilepsy	15	3.0	2.8	–0.2	0.9	17
Intellectual disability	16	2.0	2.3	0.3	1.1	18
Migraine	21	1.9	2.4	0.5	1.3	19
Chronic kidney disease	24	2.7	3.6	0.9	1.3	20

COPD chronic obstructive pulmonary disease.

Notes

1. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.
2. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
3. ASR rate difference is calculated as 2018 ASR minus 2003 ASR.
4. ASR rate ratio is calculated as 2018 ASR divided 2003 ASR.
5. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
6. Ranked by number of YLD.

Box 7.1: Data gaps in non-fatal health loss over time

Unlike mortality data, there is no single reliable source of data on the incidence, prevalence, severity and duration of non-fatal health loss for all conditions. Instead, morbidity data were drawn from a wide variety of sources; however, the availability and quality of data over time varied by disease.

Conditions that require hospitalisation or where a high-quality national disease registry exists provide more reliable data on disease outcomes over time, compared with diseases where data were obtained from a one-off epidemiological study or health survey.

Prevalence or incidence of conditions with limited data over time were assumed to have remained unchanged, and so any change to YLD for these conditions reflects population growth and ageing only. Therefore, these diseases will not show changes in rates over time. This highlights the need for more data on these conditions to determine if there are underlying changes in disease epidemiology in Australia.

Changes in fatal burden

Changes in fatal burden (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.

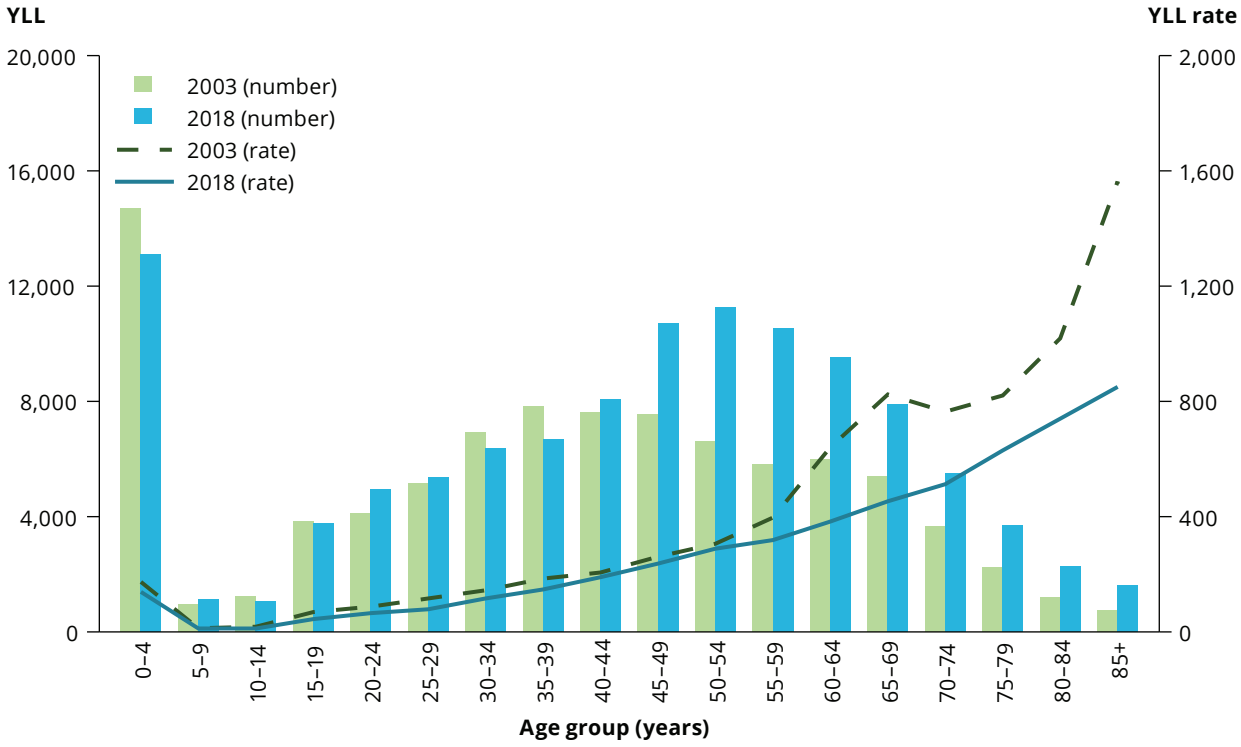
Overall change in fatal burden

There was a 24% increase in the number of YLL among Indigenous Australians between 2003 and 2018, from 91,639 to 113,445 YLL. The higher number of YLL in 2018 can in part be attributed to the natural rise in the number of deaths associated with population increases.

Age-specific YLL rates for Indigenous Australians were similar in 2003 and 2018 for ages 0 to 54; however, rates in 2018 were lower in all age groups from age 55 onwards (Figure 7.4).

After removing the impact of the increasing age and size of the Indigenous population, there was an 27% decrease in the age-standardised rates of fatal burden between 2003 and 2018 (from 275 to 201 YLL per 1,000 people) (Table 7.4).

Figure 7.4: Number and rate of fatal burden (YLL per 1,000 people), by age, Indigenous Australians, 2003 and 2018



Source: This figure is based on data in a supplementary table available online—Table S7.3.

Changes in fatal burden by disease group

For most disease groups there was a decline in the age-standardised rate of fatal burden (YLL) for Indigenous Australians between 2003 and 2018 (Table 7.4). The largest declines were observed for cardiovascular diseases (decline of 39 YLL per 1,000 people; rate ratio 0.5), endocrine disorders (decline of 13 YLL per 1,000; rate ratio 0.4) and infectious diseases (decline of 5.6 YLL per 1,000; rate ratio 0.5).

There was an increase in Indigenous age-standardised YLL rates between 2003 and 2018 for kidney & urinary diseases (increase of 1.2 YLL per 1,000; rate ratio of 1.1) and neurological conditions (increase of 0.9 YLL per 1,000; rate ratio of 1.1).

Table 7.4: Change in fatal burden (YLL) between 2003 and 2018, by disease group, Indigenous Australians

Disease group	2003 YLL ASR	2018 YLL ASR	ASR rate difference 2003 to 2018	ASR rate ratio (2018:2003)
Kidney/urinary	8.8	10.0	1.2	1.1
Neurological	8.8	9.7	0.9	1.1
Blood/metabolic	2.9	3.0	0.1	1.0
Skin	0.9	0.7	–0.2	0.8
Musculoskeletal	2.3	1.5	–0.8	0.7
Infant/congenital	9.1	7.8	–1.3	0.9
Mental/substance use	3.8	1.9	–1.9	0.5
Injuries	36.7	34.1	–2.6	0.9
Respiratory	18.4	15.2	–3.2	0.8
Gastrointestinal	15.8	12.1	–3.7	0.8
Cancer	51.3	46.5	–4.8	0.9
Infectious diseases	12.5	6.9	–5.6	0.5
Endocrine	20.5	7.6	–12.9	0.4
Cardiovascular	82.7	43.9	–38.9	0.5
Other disease groups[(a)]	0.3	0.2	—	0.9
Total	**274.8**	**201.1**	**–73.7**	**0.7**

(a) 'Other disease groups' includes reproductive & maternal conditions, oral disorders and hearing & vision disorders.

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
2. ASR rate difference is calculated as 2018 ASR minus 2003 ASR.
3. ASR rate ratio is calculated as 2018 ASR divided by 2003 ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Disease-specific changes in fatal burden

Table 7.5 shows the top ranking causes of fatal burden for Indigenous Australians in 2018 compared with 2003. There were substantial changes between 2003 and 2018 contributing to the overall decrease in YLL age-standardised rates:

- Coronary heart disease (CHD) had a much lower age-standardised YLL rate in 2018 compared with 2003 (decline of 25 YLL per 1,000 people; rate ratio 0.5).
- Type 2 diabetes, stroke and lower respiratory infections (including influenza and pneumonia) also had lower age-standardised YLL rates in 2018 than in 2003 (declines of 11, 8.8 and 3.9 YLL per 1,000, respectively).
- Poisoning, suicide & self-inflicted injuries and chronic kidney disease showed the largest increases in age-standardised YLL rates between 2003 and 2018 (increases of 4.1, 1.9 and 1.5 YLL per 1,000, respectively). The increase for poisoning may in part be explained by changes in coding practices (see Box 7.2).

In terms of ranking, the same 2 diseases were the leading causes of fatal burden for Indigenous Australians in both 2003 and 2018 (CHD and suicide & self-inflicted injuries). Lung cancer increased in rank (from seventh to third), as did poisoning (from 15th to fourth) and COPD (from 10th to fifth). The biggest drops in rankings were observed for type 2 diabetes (which fell from third to ninth) and stroke (which fell from sixth to 11th).

Further information on the changes within each disease group is included in 'Chapter 9 Overview of results by disease group'.

Table 7.5: Change in leading causes of fatal burden (YLL) between 2003 and 2018, Indigenous Australians

Disease	Rank 2003	2003 YLL ASR	2018 YLL ASR	ASR rate difference 2003 to 2018	ASR rate ratio 2018:2003	Rank 2018
Coronary heart disease	1	50.8	25.6	–25.2	0.5	1
Suicide & self-inflicted injuries	2	10.9	12.8	1.9	1.2	2
Lung cancer	7	13.0	12.2	–0.8	0.9	3
Poisoning	15	3.4	7.5	4.1	2.2	4
COPD	10	13.3	11.5	–1.8	0.9	5
Chronic liver disease	4	9.7	8.1	–1.6	0.8	6
Chronic kidney disease	14	8.1	9.6	1.5	1.2	7
RTI – motor vehicle occupants	5	6.0	4.0	–2.0	0.7	8
Type 2 diabetes	3	17.7	6.7	–11.0	0.4	9
Pre-term birth and LBW complications	12	1.7	2.1	0.3	1.2	10
Stroke	6	15.8	7.0	–8.8	0.4	11
LRI incl. influenza & pneumonia	8	7.9	4.0	–3.9	0.5	12
Homicide & violence	9	3.9	2.7	–1.2	0.7	13
Other disorders of infancy	21	1.0	1.3	0.3	1.3	14
Bowel cancer	23	4.1	3.9	–0.2	0.9	15
Liver cancer	41	2.0	3.3	1.3	1.6	16
Other blood & metabolic disorders	29	2.5	2.7	0.2	1.1	17
Other unintentional injuries	11	3.5	1.7	–1.8	0.5	18
Pancreatic cancer	44	2.2	3.3	1.2	1.5	19
Birth trauma and asphyxia	16	1.4	1.1	–0.3	0.8	20

COPD chronic obstructive pulmonary disease; RTI road traffic injuries; LBW low birthweight; LRI lower respiratory infections.
Notes
1. Disease rankings exclude 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.
2. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
3. ASR rate difference is calculated as 2018 ASR minus 2003 ASR.
4. ASR rate ratio is calculated as 2018 ASR divided by 2003 ASR.
5. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
6. Ranked by number of YLL.

Box 7.2: Death data coding changes for poisoning impacting on trends

Since newer software for coding cause of death was implemented by the Australian Bureau of Statistics in 2013, there have been some notable changes to causes of death data and, specifically, for some injuries. Previously, where a death was due to an accidental overdose with a known addiction to the drug, it would have been coded to a mental and behavioural disorder. Under the newer coding system, the drug overdose is captured as the underlying cause (accidental poisoning) while the addiction is maintained as an associated cause. As a result, since 2013 some of the increase in deaths (and YLL) due to poisoning may be influenced by these coding changes. These changes will have an impact on comparisons made between 2003 and 2018.

7.4 How have risk factors changed over time?

Analyses of the effects of changes in risk factors are provided only for those risk factors that were included in both the 2003 and 2018 estimates for Indigenous Australians. The risk factors that were not measured for 2003 were air pollution, high blood plasma glucose, unsafe sanitation, and low birthweight & short gestation.

Results are expressed as changes in the total burden (DALY), non-fatal burden (YLD) and fatal burden (YLL) attributable to each risk factor.

Changes in attributable burden

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

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

Overall change in attributable burden

The risk factors able to be measured in 2003 contributed 41% of the total burden in 2003. These same risk factors contributed to 45% of the total burden in 2018, indicating that there was an increase in the proportion of burden attributable to these risk factors over the 15 years overall. However, there are differences when looking at individual risk factors over time, as outlined in the sections below.

Changes in attributable burden by risk factor

The attributable burden (number of DALY) increased for most risk factors between 2003 and 2018 (Table 7.6). Alcohol use caused the most burden out of the risk factors in 2003, responsible for 10.4% of the total burden. Its contribution was stable over time, responsible for 10.5% of the burden in 2018, however, its contribution fell to second as the burden attributable to tobacco use increased. The burden attributable to tobacco use rose from 10% in 2003 to 11.9% in 2018, largely the result of increased numbers of deaths from linked cancers. The burden attributable to overweight (including obesity) also increased, from 8.1% to 9.7%; it was the third greatest contributor to attributable burden in both 2003 and 2018.

Between 2003 and 2018, there was an increase in the number of DALY attributable to illicit drug use (130% increase), impaired kidney function (78%), overweight (including obesity) (73%), tobacco use (71%), child abuse & neglect (69%), occupational exposures & hazards (55%), intimate partner violence (49%), alcohol use (44%), and unsafe sex (21%). However, considering differences between the 2018 and 2003 population size and structure, the attributable burden rates for most of these risk factors either decreased or stayed the same (Table 7.6; Figure 7.5). This indicates that population changes (growth and ageing) are a major driver of the increase in DALY attributable to these risk factors. The exception is illicit drug use, where the ASR of attributable burden rose by 77%. This increase in age-standardised rate is primarily driven by increases in the use of opioids and amphetamines.

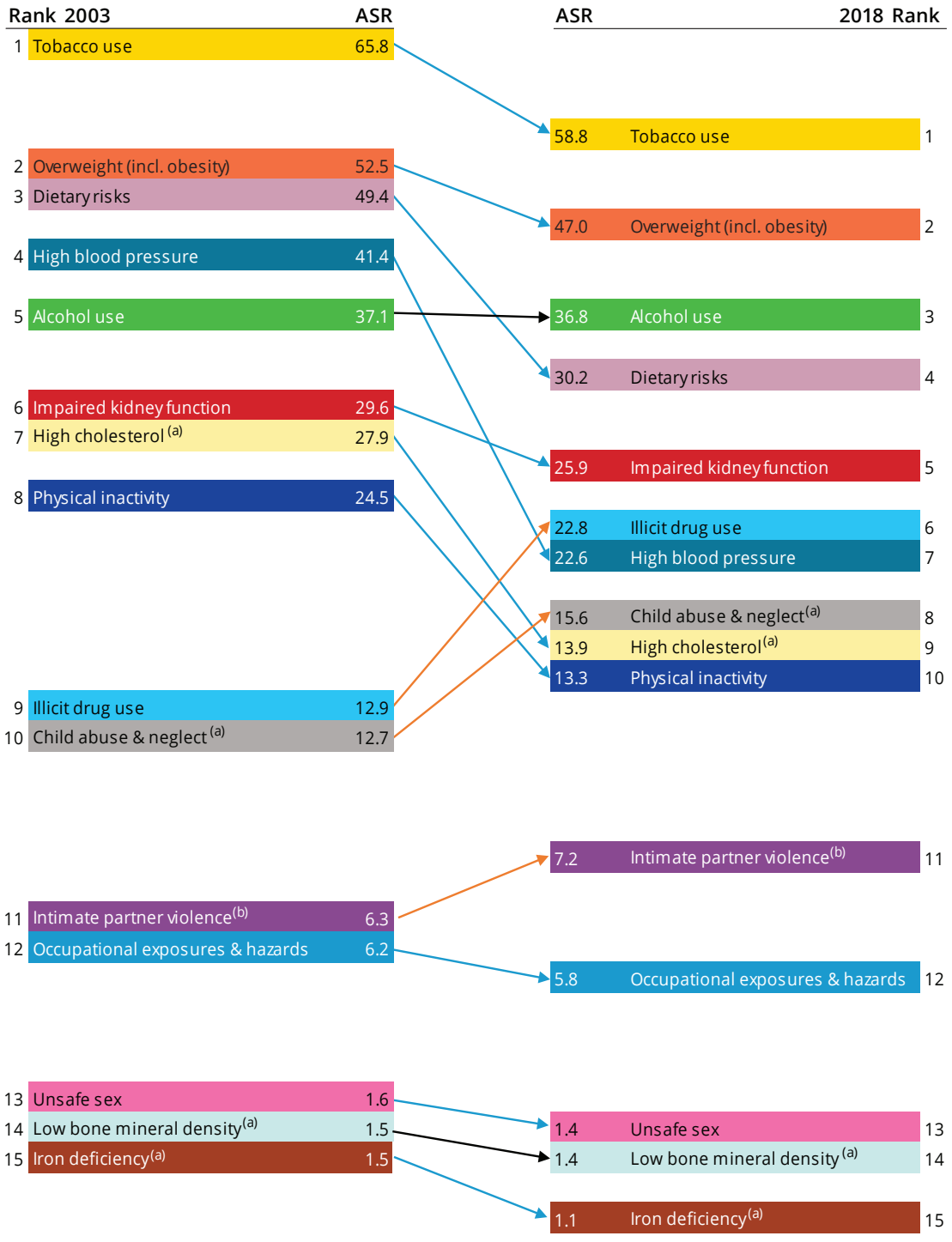
Note that these results are summary measures that are influenced by the changes in the fatal or non-fatal burden of the linked diseases, so caution should be applied when interpreting the results. For example, the decrease seen in the attributable burden ASR for dietary risk factors is primarily driven by declines in the linked disease burden for coronary heart disease and stroke, rather than changes to risk factor exposure, which has increased slightly. Other possible reasons are too complex to unpack within the scope of this report; however, a focus on tobacco and overweight (including obesity) is provided in the section that follows. Further information on specific disease burden attributable to each risk factor, and on the drivers of change in risk factors attributable burden, can be found via the interactive data on risk factor burden on the AIHW website at https://auth.aihw.gov.au/reports/burden-of-disease/abds-2018-interactive-risk-factor-indigenous/contents/about.

Table 7.6: Change in total attributable burden between 2003 and 2018, by risk factor

Risk factor	2003 Attributable DALY	2018 Attributable DALY	Change in Attributable DALY	Change in Attributable DALY (%)	2003 Attributable DALY ASR	2018 Attributable DALY ASR	Change in ASR (rate difference)	Change in ASR (%)	Rate ratio 2018:2003
Tobacco use	16,638	28,514	11,875	71.4	65.8	58.8	-6.9	-10.6	0.9
Alcohol use	17,404	25,085	7,681	44.1	37.1	36.8	-0.3	-0.9	1.0
Overweight (incl. obesity)	13,494	23,338	9,844	72.9	52.5	47.0	-5.5	-10.4	0.9
Illicit drug use	7,231	16,645	9,414	130.2	12.9	22.8	9.9	76.5	1.8
Dietary risks	13,028	14,940	1,912	14.7	49.4	30.2	-19.2	-38.9	0.6
Child abuse & neglect[a]	7,220	12,191	4,971	68.9	12.7	15.6	2.9	22.7	1.2
Impaired kidney function	6,688	11,893	5,205	77.8	29.6	25.9	-3.8	-12.8	0.9
High blood pressure	9,639	10,382	742	7.7	41.4	22.6	-18.8	-45.3	0.5
High cholesterol[a]	8,207	7,126	-1,082	-13.2	27.9	13.9	-13.9	-50.0	0.5
Physical inactivity	5,479	5,843	364	6.6	24.5	13.3	-11.3	-45.9	0.5
Intimate partner violence[b]	3,371	5,022	1,651	49.0	6.3	7.2	0.9	14.8	1.1
Occupational exposures & hazards	2,298	3,563	1,265	55.1	6.2	5.8	-0.4	-7.2	0.9
Unsafe sex	649	787	138	21.2	1.6	1.4	-0.2	-12.6	0.9
Iron deficiency[a]	536	700	164	30.6	1.5	1.1	-0.4	-24.6	0.8
Low bone mineral density[a]	200	518	317	158.4	1.5	1.4	-0.1	-4.9	1.0
All risk factors combined[c]	**68,384**	**108,962**	**40,578**	**59.3**	**217.0**	**195.3**	**-21.7**	**-10.0**	**0.9**

(a) The same PAFs have been used in 2003 and 2018 and any change in attributable burden is due to changes in the ASRs of the linked disease.
(b) The age-standardised rates for intimate partner violence are based on attributable burden and population estimates in females only.
(c) All risk factors combined estimate excludes high blood plasma glucose, air pollution, unsafe sanitation, and low birthweight & short gestation, which were not estimated in 2003.
Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
2. Rate ratios divide 2018 ASRs by corresponding 2003 ASRs.
3. Rate differences subtract 2018 ASRs from the corresponding 2003 ASRs.
4. Data for risk factors subcategories (such as individual dietary components) are provided in Appendix Table D5.

Figure 7.5: Risk factor rankings by age-standardised attributable burden rate (per 1,000 people), 2003 and 2018



ASR age-standardised rate, calculated as attributable DALY per 1,000 people.

(a) The same PAFs have been used in 2003 and 2018 and any change in attributable burden is due to changes in the ASRs of the linked disease.

(b) ASRs for intimate partner violence are based on estimates in females only.

Notes

1. Risk factors are presented in descending order, from highest ASR to lowest ASR, with arrows indicating either an increase (orange), decrease (blue) or no change (black) in the ASR over time.
2. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
3. Rankings are based on age-standardised attributable DALY rates.
4. High blood plasma glucose, air pollution, unsafe sanitation, and low birthweight & short gestation are excluded since these were not estimated for 2003.

Changes in attributable burden: a focus on tobacco use and overweight (including obesity)

Tobacco use

The total burden (number of DALY) attributable to tobacco increased between 2003 and 2018 (71% increase) (Table 7.6). The burden attributable to the direct use of tobacco (as second-hand smoke exposure could not be estimated for Indigenous Australians in 2003) increased by 66%. Analyses of the key drivers of change in direct tobacco use attributable burden over time indicates that this overall increase resulted from:

- 22% increase due to changes in exposure to tobacco use
- 33% decline due to changes in linked disease burden
- 41% increase due to population growth
- 36% increase due to population ageing.

The largest impact from tobacco use is on cancer, respiratory diseases and cardiovascular diseases. While the burden of cancer and respiratory diseases due to tobacco use rose (by approximately 6,200 and 5,300 DALY, respectively), the burden of cardiovascular diseases remained stable (at around 8,400 DALY in both years).

After taking into account population growth and ageing, the ASR of burden attributable to tobacco use dropped 11% (rate ratio 0.9) in 2018 compared with 2003 (Table 7.6). This change varied between diseases linked to tobacco use. The rate ratios for cancer and respiratory diseases were 1.7 and 1.3, respectively, compared with 0.5 for cardiovascular diseases. This is likely to be due to health improvements from reductions in tobacco use taking longer to become apparent in cancer and chronic respiratory diseases than in cardiovascular diseases (US DHHS 2020).

Overweight (including obesity)

The total burden (number of DALY) attributable to overweight (including obesity) was 73% higher in 2018 than in 2003. The change over time was larger for the burden attributable to obesity (101% higher in 2018 than in 2003) than to overweight (24% higher in 2018 than in 2003) (Appendix Table D5). Analyses of the key drivers of change in overweight and obesity attributable burden over time indicate that this increase was driven by:

- 53% increase due to changes in obesity prevalence
- 12% decline due to changes in overweight prevalence
- 36% decline due to changes in the linked disease burden
- 45% increase due to population growth
- 35% increase due to population ageing.

After taking into account population growth and ageing, the ASR of total burden attributable to overweight (including obesity) was 10% lower in 2018 than in 2003 (rate ratio 0.9) (Table 7.6). This includes a slightly higher rate of burden attributable to obesity (5.5% higher in 2018 than in 2003, rate ratio 1.1) and a lower rate of burden attributable to overweight (37% lower in 2018 than in 2003, rate ratio 0.6) (Appendix Table D5).

Overweight (including obesity) is linked to a number of different diseases, including cardiovascular diseases, cancer, respiratory diseases, kidney & urinary diseases, endocrine disorders and musculoskeletal conditions. There was a fall in the age-standardised rate of attributable burden (rate ratio 0.7 for each) for cardiovascular diseases and endocrine disorders due to overweight (including obesity), but this was balanced by a rise in the attributable burden rate for respiratory diseases (rate ratio of 1.8), musculoskeletal conditions (rate ratio of 1.6), kidney & urinary diseases (rate ratio of 1.4) and cancers (1.1).

Data on the drivers of change in risk factor attributable burden can be explored in the interactive data on risk factor burden at https://auth.aihw.gov.au/reports/burden-of-disease/abds-2018-interactive-risk-factor-indigenous/contents/about.

Changes in attributable non-fatal and fatal burden

The following sections describe the changes in the contribution of risk factors to non-fatal (YLD) and fatal (YLL) burden between 2003 and 2018.

Changes in attributable non-fatal burden

Between 2003 and 2018, there was an increase in the number of YLD attributable to all of the risk factors measured at both time points (Table 7.7). However, considering differences between the 2003 and 2018 population size and structure, the attributable non-fatal burden rates for most of these risk factors either decreased or remained similar. The exceptions are overweight (including obesity) (rate ratio of 1.3), intimate partner violence (1.3) and illicit drug use (1.6). Although the age-standardised attributable non-fatal burden rate increased by more than 50% for low bone mineral density and unsafe sex, these were the smallest risk factors in both 2003 and 2018, with rates of less than 1 YLD per 1,000 people. For more information on changes in attributable burden over time and on drivers of change, see the interactive data on risk factor burden at https://auth.aihw.gov.au/reports/burden-of-disease/abds-2018-interactive-risk-factor-indigenous/contents/about.

Table 7.7: Change in attributable non-fatal burden between 2003 and 2018, by risk factor

Risk factor	Rank 2003	Change in Attributable YLD	Change in Attributable YLD (%)	Change in ASR	Rate ratio 2018:2003	Rank 2018
Alcohol use	1	4,667	66.7	2.9	1.2	1
Overweight (including obesity)	3	5,508	142.1	4.4	1.3	2
Child abuse & neglect[a]	2	3,184	70.5	2.0	1.2	3
Tobacco use	4	3,436	97.2	–0.9	0.9	4
Illicit drug use	5	3,477	115.0	3.1	1.6	5
Intimate partner violence[b]	6	1,476	70.7	1.1	1.3	6
Dietary risks	8	1,181	80.3	–0.2	1.0	7
Occupational exposures & hazards	7	928	55.2	0.2	1.1	8
Impaired kidney function	9	1,385	134.7	0.9	1.2	9
High blood pressure	10	656	65.7	–0.9	0.8	10
Physical inactivity	11	699	77.0	–0.4	0.9	11
Iron deficiency[a]	13	166	31.3	–0.3	0.8	12
High cholesterol[a]	12	110	18.8	–0.7	0.7	13
Low bone mineral density[a]	14	220	284.5	0.3	1.5	14
Unsafe sex	15	97	185.9	0.1	1.7	15
All risk factors combined[c]		**21,844**	**85.6**	**10.5**	**1.2**	

(a) The same PAFs have been used in 2003 and 2018 and any change in attributable burden is due to changes in the ASRs of the linked disease.

(b) Estimates for intimate partner violence are for females only.

(c) All risk factors combined estimate excludes high blood plasma glucose, air pollution, unsafe sanitation and low birthweight & short gestation, which were not estimated in 2003.

Notes

1. Ranking based on number of attributable YLD.
2. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
3. Rate ratios divide 2018 ASRs by corresponding 2003 ASRs.
4. Rate differences subtract 2018 ASRs from the corresponding 2003 ASRs.

Changes in attributable fatal burden

There was a fall in the number of YLL attributable to high cholesterol (16%), iron deficiency (45%) and physical inactivity (7.3%) between 2003 and 2018 (Table 7.8). After adjusting for changes in the age structure and size of the population, the attributable fatal burden rate (ASR) decreased for these risk factors as well as for several other risk factors, including overweight (including obesity) (rate ratio of 0.7), occupation exposures & hazards (0.7), impaired kidney function (0.8), high blood pressure (0.5) and dietary risks (0.6).

Between 2003 and 2018, there was an increase in the number of YLL attributable to illicit drug use (141%), impaired kidney function (68%), child abuse & neglect (66%), tobacco use (64%), overweight (including obesity) (45%), alcohol use (29%) and intimate partner violence (14%). However, considering differences between the 2003 and 2018 population size and structure, the attributable fatal burden rates for most of these risk factors decreased. The exceptions were illicit drug use (rate ratio of 1.9) and child abuse & neglect (1.2).

Table 7.8: Change in attributable fatal burden between 2003 and 2018, by risk factor

Risk factor	Rank 2003	Change in Attributable YLL	Change in Attributable YLL (%)	Change in ASR	Rate ratio 2018:2003	Rank 2018
Tobacco use	1	8,440	64.4	–6.1	0.9	1
Overweight (incl. obesity)	4	4,335	45.1	–9.9	0.7	2
Alcohol use	3	3,014	28.9	–3.3	0.9	3
Dietary risks	2	731	6.3	–19.0	0.6	4
Illicit drug use	9	5,938	141.1	6.8	1.9	5
Impaired kidney function	7	3,820	67.5	–4.6	0.8	6
High blood pressure	5	87	1.0	–17.9	0.5	7
High cholesterol[a]	6	–1,192	–15.6	–13.2	0.5	8
Child abuse & neglect[a]	10	1,787	66.1	0.9	1.2	9
Physical inactivity	8	–335	–7.3	–10.9	0.5	10
Intimate partner violence[b]	11	175	13.6	–0.2	0.9	11
Occupational exposures & hazards	12	337	54.6	–0.6	0.7	12
Unsafe sex	13	41	6.8	–0.3	0.8	13
Low bone mineral density[a]	14	97	79.2	–0.3	0.7	14
Iron deficiency[a]	15	–2	–44.7	–0.1	0.2	15
All risk factors combined[c]		**18,733**	**43.7**	**–32.2**	**0.8**	

(a) The same PAFs have been used in 2003 and 2018 and any change in attributable burden is due to changes in the ASRs of the linked disease.

(b) Estimates for intimate partner violence are for females only.

(c) All risk factors combined estimate excludes high blood plasma glucose, air pollution, unsafe sanitation and low birthweight & short gestation, which were not estimated in 2003.

Notes

1. Rank based on number of attributable YLL.
2. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
3. Rate ratios divide 2018 ASRs by corresponding 2003 ASRs.
4. Rate differences subtract 2018 ASRs from the corresponding 2003 ASRs.

7.5 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 as measured by the DALY rate difference between Indigenous and non-Indigenous Australians decreased by 16% between 2003 and 2018 (DALY rate differences of 263 and 222 per 1,000 people, respectively) (Table 7.9). This decline was driven by a decrease in the gap in fatal burden (28% decrease in the YLL rate difference from 167 to 119 YLL per 1,000 people), while the gap in non-fatal burden increased slightly (6.6% increase in YLD rate difference from 97 to 103 YLD per 1,000 people).

Table 7.9: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status, 2003 and 2018

	Indigenous age-standardised rate	Non-Indigenous age-standardised rate	ASR rate ratio	ASR rate difference
Total burden (DALY)				
2003	467.5	204.2	2.3	263.3
2018	399.6	177.4	2.3	222.2
Non-fatal burden (YLD)				
2003	192.7	96.1	2.0	96.6
2018	198.5	95.5	2.1	103.0
Fatal burden (YLL)				
2003	274.8	108.1	2.5	166.7
2018	201.1	81.9	2.5	119.2

Notes
1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. ASR rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

There was a slightly greater decrease in the gap in total disease burden and fatal burden for males than females between 2003 and 2018. Over this period there was a 19% decrease in the DALY gap between Indigenous and non-Indigenous males compared with a 13% decrease in the gap for females; and there was a 31% decline in the YLL gap for males compared with a 26% decline for females. For non-fatal burden, there were similar increases over time for both males and females (6% increase in the YLD gap for males, 7% increase for females) (Appendix Table D6).

Changes in the gap by disease group

Table 7.10 presents age-standardised DALY rate ratios and rate differences for each disease group in 2003 and 2018, 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 2018, can be found in Appendix tables D7–D9.

Over the period 2003 to 2018, there was a decrease in the health gap between Indigenous and non-Indigenous Australians for more than half of the 17 disease groups, as measured by the DALY rate difference (Table 7.10):

- The largest decreases in the absolute gap were observed for cardiovascular diseases (decline in the DALY rate difference of 26 per 1,000 people) and endocrine disorders (decline of 12 DALY per 1,000). These disease groups also had decreases in the relative gap as measured by rate ratios.
- The largest increases in the absolute gap were observed for mental & substance use disorders (increase in the DALY rate difference of 11 per 1,000) and cancers (increase of 4 DALY per 1,000). These disease groups also had increases in the relative gap as measured by rate ratios.

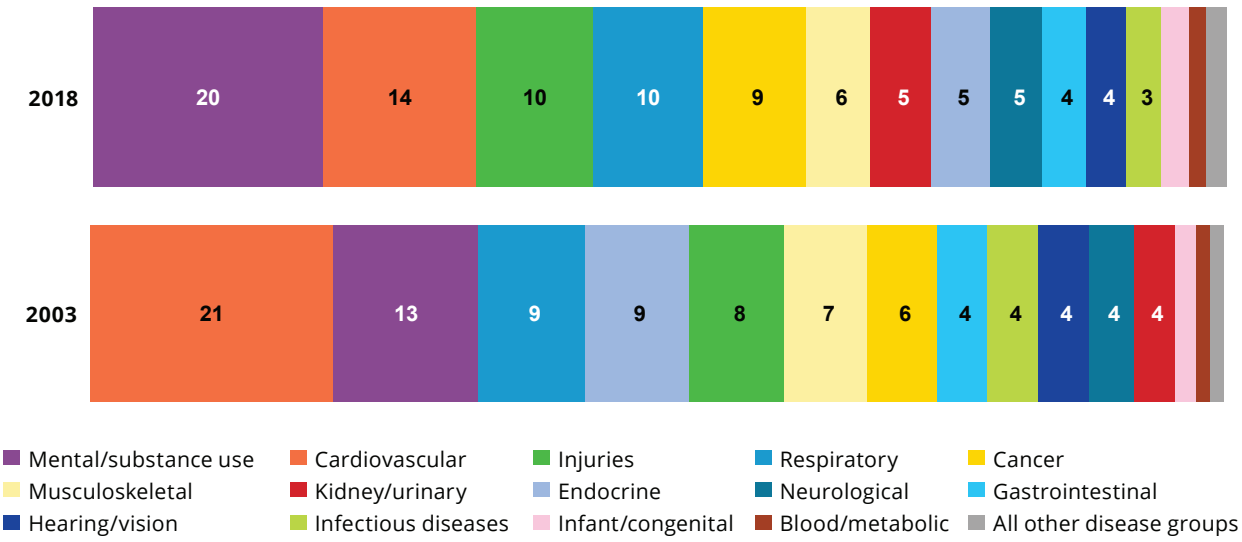
Table 7.10: Gap measures of total burden (DALY rate ratios and rate differences per 1,000 people) by disease group, 2003 and 2018

	DALY rate ratio			DALY rate difference (per 1,000)			
	2003	2018	Direction of change	2003	2018	Direction of change	Change in DALY rate difference 2003 to 2018
Cardiovascular	2.6	2.4	↓	56.4	30.1	↓	–26.3
Endocrine	6.2	3.6	↓	24.1	11.7	↓	–12.4
Musculoskeletal	1.8	1.5	↓	19.3	12.6	↓	–6.7
Infectious diseases	3.7	3.0	↓	11.8	6.9	↓	–4.9
Hearing/vision	4.8	3.3	↓	11.7	8.0	↓	–3.8
Gastrointestinal	2.9	2.5	↓	11.8	8.5	↓	–3.3
Respiratory	2.8	2.7	↓	24.7	21.5	↓	–3.2
Neurological	1.9	1.8	↓	10.4	10.2	↓	–0.3
Blood/metabolic	2.6	2.5	↓	3.4	3.3	↓	–0.1
Skin	1.3	1.3	—	1.0	0.9	↓	–0.1
Reproductive/maternal	0.8	0.9	↑	–0.3	–0.2	↑	0.1
Infant/congenital	1.8	2.2	↑	4.7	5.4	↑	0.6
Injuries	2.3	2.4	↑	22.2	22.9	↑	0.7
Oral	1.6	1.8	↑	2.5	3.5	↑	1.0
Kidney/urinary	5.4	6.3	↑	9.7	11.8	↑	2.1
Cancer	1.4	1.7	↑	16.1	20.3	↑	4.2
Mental/substance use	2.4	2.8	↑	33.7	45.1	↑	11.3
Total	**2.3**	**2.3**	—	**263.3**	**222.2**	↓	**–41.0**

Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 people.
2. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
5. The numbers may not add to total for all columns due to rounding.

Between 2003 and 2018 there was a shift in the leading disease groups contributing to the gap in total burden, both in terms of which groups were the top contributors and the amount they contributed to the gap (as measured by the DALY rate difference) (Figure 7.6). In 2018, mental & substance use disorders was the leading contributor to the gap, accounting for 20%, followed by cardiovascular diseases (contributing 14% to the gap) and injuries (10%). In 2003 cardiovascular diseases was the leading contributor to the gap, accounting for 21%, followed by mental & substance use disorders (contributing 13% to the gap) and respiratory diseases (9%). Injuries was the fifth leading contributor to the gap in 2003, accounting for 8% of the gap.

Figure 7.6: 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 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of gap.
2. 'All other disease groups' includes oral disorders, skin disorders and reproductive & maternal conditions.
Source: This figure is based on data in a supplementary table available online—Table S7.4.

Changes in the risk factors contributing to the gap

Between 2003 and 2018, the age-standardised rate of disease burden attributed to several key risk factors, including high blood pressure, high cholesterol, impaired kidney function, physical inactivity, overweight (including obesity) and tobacco use, declined for both Indigenous and non-Indigenous Australians (Appendix Table D10). 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, occupational exposures & hazards, and low bone mineral density, indicating that the declines in burden observed for the Indigenous population were greater than for the non-Indigenous population.
- a widening of the gap (increase in both the DALY rate ratio and rate difference) for illicit drug use and child abuse & neglect, indicating that the declines in burden observed for the non-Indigenous population were greater than for the Indigenous population.
- an increase in the DALY rate ratio but a decrease (or no change) in the DALY rate difference for high cholesterol, impaired kidney function and tobacco use, indicating that the absolute difference in rates of burden due to these risk factors decreased (or remained stable) between 2003 and 2018, but the relative difference increased.
- a decrease in the DALY rate ratio but no change in the DALY rate difference for alcohol use, intimate partner violence and iron deficiency, indicating that the absolute difference in rates of burden due to these risk factors remained stable between 2003 and 2018, but the relative difference decreased (Table 7.11).

Table 7.11: 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), 2003 and 2018

	DALY rate ratio			DALY rate difference (per 1,000 people)			
Risk factor	2003	2018	Direction of change	2003	2018	Direction of change	Change in DALY rate difference 2003 to 2018
Tobacco use	3.2	4.3	↑	45.0	45.1	—	0.1
Overweight (incl. obesity)	3.6	3.4	—	37.8	33.1	↓	–4.8
Alcohol use	4.2	3.8	↓	28.4	27.0	—	–1.3
Impaired kidney function	8.2	9.3	↑	26.0	23.1	↓	–3.0
Dietary risks	3.2	3.4	—	34.1	21.4	↓	–12.7
Illicit drug use	3.1	3.7	↑	8.7	16.6	↑	7.9
High blood pressure	2.6	2.8	—	25.4	14.5	↓	–10.9
Child abuse & neglect	3.2	3.9	↑	8.7	11.6	↑	2.9
High cholesterol	2.9	3.1	↑	18.2	9.5	↓	–8.7
Physical inactivity	4.1	3.4	↓	18.6	9.4	↓	–9.2
Intimate partner violence	5.1	4.5	↓	5.0	5.6	—	0.5
Unsafe sex	2.8	3.6	↑	1.0	1.0	—	—
Iron deficiency	2.8	1.7	↓	1.0	0.5	—	–0.5
Occupational exposures & hazards	1.6	0.8	↓	2.2	–1.8	↓	–4.0
Low bone mineral density	2.5	0.4	↓	1.8	–4.7	↓	–6.5

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.

8

Health-adjusted life expectancy

Key results

- Health-adjusted life expectancy (HALE) for Indigenous males and females born in 2018 was 56.0 and 58.8 years, respectively. On average, males could expect to spend an average of 80% of their lives in full health, and females 79%.
- On average, Indigenous females born in 2018 expected to live 4.4 years longer and have 2.8 more years of healthy life than Indigenous males.
- Indigenous Australians aged 65 in 2018 could expect, on average, three-fifths of their remaining life to be lived in full health.
- The gap in HALE at birth between Indigenous and non-Indigenous Australians in 2018 was 15.5 years for males and 14.7 years for females.

HALE by state and territory

- HALE at birth in 2018 was greatest for Indigenous males and females in New South Wales (57.3 years and 60.5 years, respectively).
- The gap in HALE at birth between Indigenous and non-Indigenous Australians was smallest in Queensland and largest in Western Australia for both males and females.

HALE by remoteness area

- HALE at birth for Indigenous males and females in 2018 in *Remote and very remote* areas was 4.0 and 4.4 years shorter, respectively, than for those in *Major cities*.
- The HALE gap at birth between Indigenous and non-Indigenous Australians in 2018 was largest in *Remote and very remote* areas.

HALE extends the concept of life expectancy by considering the time spent living with ill health from disease and injury. It reflects the length of time an individual at a specific age could, on average, expect to live in full health without disease or injury. It can be measured at any age but is typically reported from birth (which represents the average life expectancy for a baby born that year) and at age 65, describing health in an ageing population. See Appendix A for an overview of methods used to estimate HALE.

Data in this chapter are reported as being for the reference year 2018, however, the results are derived using non-fatal burden estimates for 2018 and Indigenous and non-Indigenous life tables for the period 2015–2017. Life tables for Aboriginal and Torres Strait Islander people are derived by the ABS only for the 3-year periods centred on Census years.

The relatively large proportion (21.4%) of the increase in Census counts between 2011 and 2016 that can be attributed to changing propensities to identify and methodological improvements, as well as intercensal increases in factors such as level of education and income, mean that it is difficult to interpret changes in Aboriginal and Torres Strait Islander life expectancy estimates over time (ABS 2018c). Therefore, this report provides results for the 2018 reference year only.

8.1 HALE as a measure of population health

Measures of HALE show whether longer lives are accompanied by more or less years lived in full health. HALE is comparable across populations; differences in age composition of the populations being compared are overcome as the age-specific health and mortality experiences are applied to a hypothetical population.

HALE is most meaningful when compared with life expectancy. The difference between HALE and life expectancy represents the average number of years that a person can expect to live in less than full health. The ratio of HALE to life expectancy, expressed as a percentage, represents the proportion of life expectancy that is spent in full health.

8.2 Years lived in full health

HALE and life expectancy at birth

Life expectancy and HALE at birth represent the average number of years of life and equivalent years of healthy life, respectively, that a newborn in a particular year could expect if mortality and morbidity rates (of that particular year) remained throughout their lives.

Life expectancy in Australia for Indigenous boys born in 2018 was 70.0 years compared with 74.4 years for girls (Appendix Table D11). The average number of healthy years (HALE) for these babies was 56.0 years for males and 58.8 years for females. The difference between life expectancy and HALE in this cohort—that is, the time expected in less than full health—was 14.0 years for males and 15.6 years for females.

Looking at the percentage of life expectancy in full health, Indigenous males and females could expect to spend 80% and 79% of their lives, respectively, in full health.

While Indigenous females born in 2018 expected, on average, to live 4.4 years longer than males, they also expected 2.8 more years of healthy life than males.

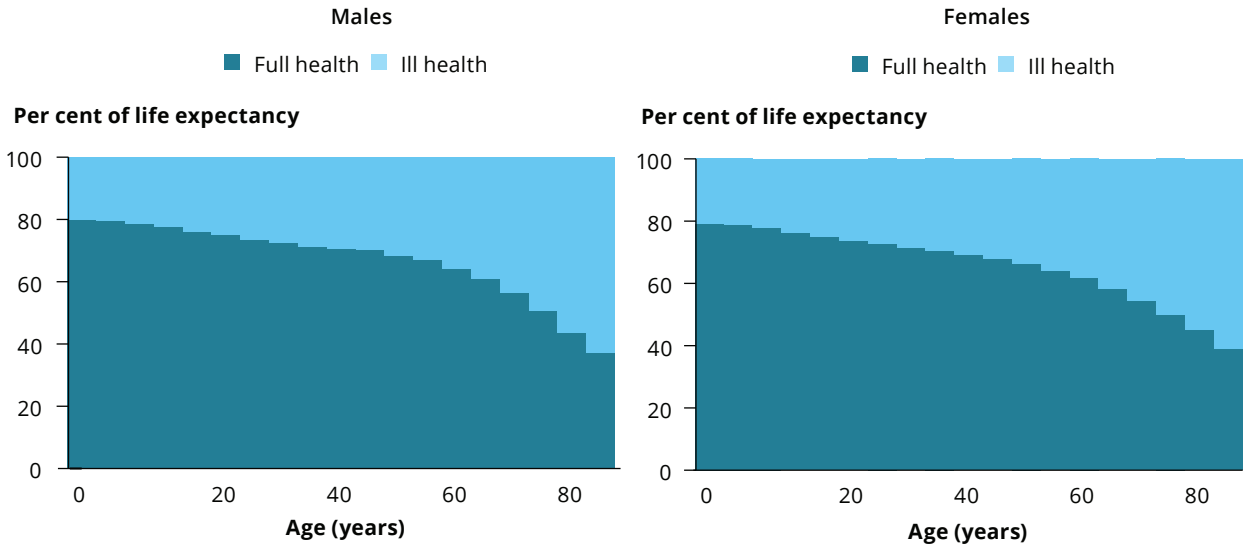
HALE and life expectancy at older ages

Estimates of life expectancy and HALE at older ages describe the extent to which people spend their final years of life in full health.

Life expectancy in 2018 for Indigenous men and women aged 65 was 14.9 and 16.3 years, respectively (Appendix Table D12; Figure 8.1). At this age, men could expect 9.1 healthy years and women, 9.5. Accordingly, the average time per person expected to live in less than full health was 5.8 and 6.8 years for men and women, respectively.

At age 65, around three-fifths of Indigenous life expectancy was healthy years: 61% for men and 58% for women.

Figure 8.1: Percentage of remaining life expectancy in full health and ill health at each age, by sex, Indigenous Australians, 2018



Source: Appendix Table D12.

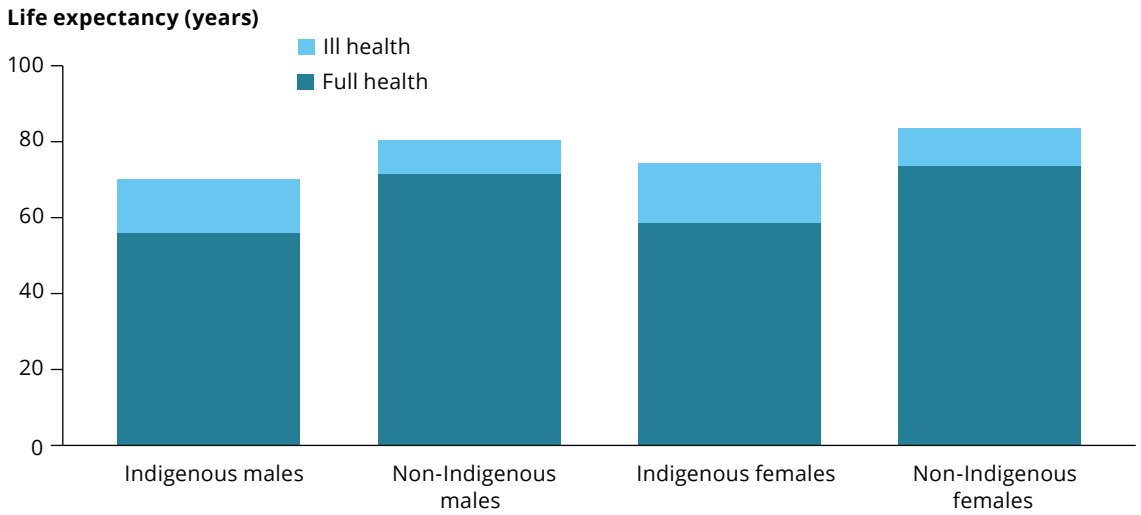
8.3 Gap in HALE

Gap in HALE at birth

As with life expectancy, HALE for Indigenous Australians is considerably lower than that for non-Indigenous Australians. Indigenous males born in 2018 could expect to live 56.0 years in full health, compared with 71.5 years for non-Indigenous males, a gap of 15.5 years (Figure 8.2). This is larger than the gap in life expectancy at birth (10.2 years), indicating that Indigenous Australian males will spend a larger proportion of their life in less than full health compared with non-Indigenous Australian males.

For females born in 2018, the gap in HALE was smaller at 14.7 years (HALE of 58.8 years for Indigenous females and 73.5 years for non-Indigenous females) (Figure 8.2). This was again larger than the gap in life expectancy at birth (9.1 years).

Figure 8.2: Life expectancy at birth as years lived in full health (HALE) and years lived in ill health, by sex and Indigenous status, 2018



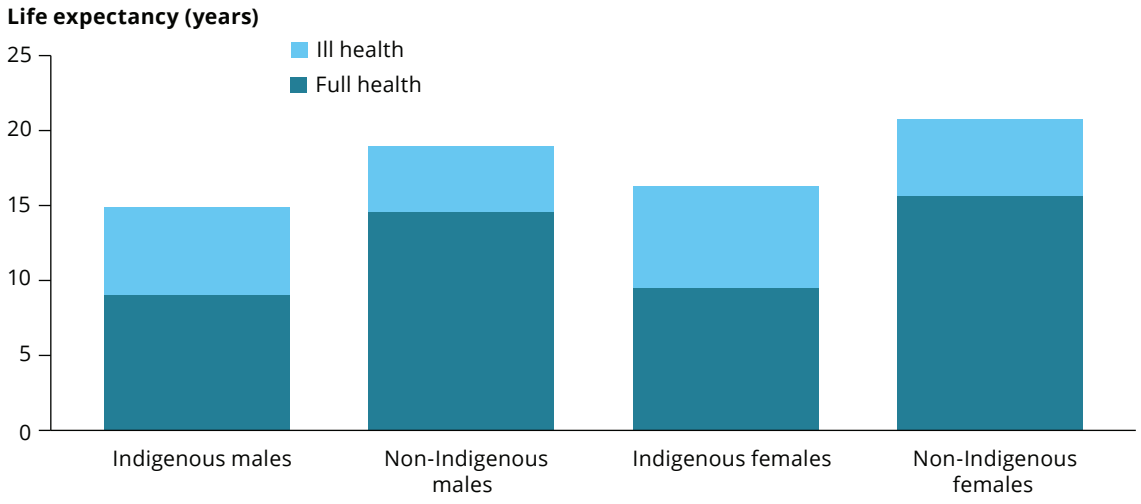
Source: Appendix Table D13.

Gap in HALE at age 65

Indigenous males aged 65 in 2018 could expect to live a further 9.1 years in full health, compared with 14.6 years for non-Indigenous males, a gap of 5.5 years. For females, the gap was slightly larger at 6.2 years (HALE of 9.5 years for Indigenous females and 15.7 years for non-Indigenous females) (Figure 8.3).

For both sexes, the gap in HALE was larger than the gap in life expectancy at age 65, indicating that older Indigenous males and females will spend a greater proportion of their remaining lifespan in less than full health compared with their non-Indigenous counterparts.

Figure 8.3: Life expectancy at age 65 as years lived in full health (HALE) and years lived in ill health, by sex and Indigenous status, 2018



Source: Appendix Table D13.

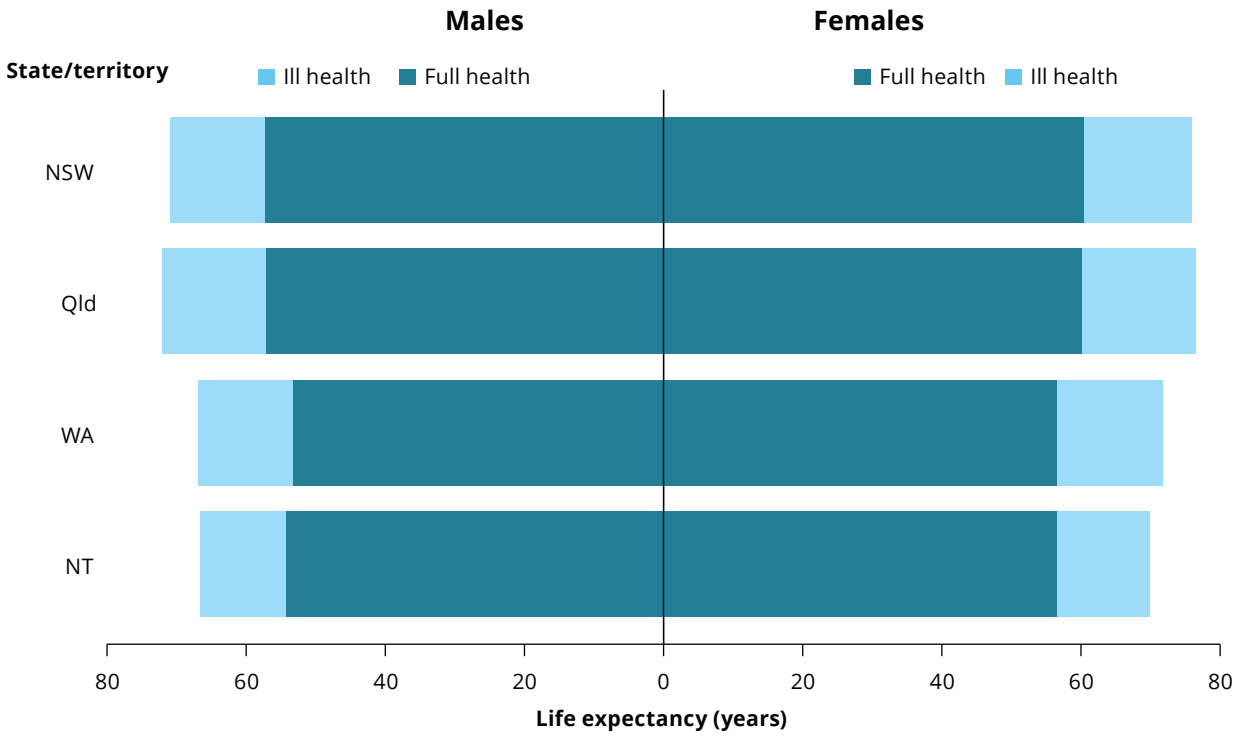
8.4 HALE by state and territory

HALE at birth varied across states and territories (Figure 8.4). HALE at birth in 2018 for Indigenous males was highest in New South Wales (57.3 years) and lowest in Western Australia (53.3 years) (Appendix Table D11)—a difference of 4 healthy years between these jurisdictions. For females, the highest HALE was in New South Wales (60.5 years) and the lowest in the Northern Territory (56.6 years)—a difference of 3.9 healthy years (Appendix Table D11).

The variation in HALE between the jurisdictions reflects both geographical variation in life expectancy and variation in disease burden.

The percentage of healthy years of life expectancy at birth for males ranged from 79% in Queensland to 81% in the Northern Territory (Appendix Table D11). For females, this percentage ranged from 79% in Queensland and Western Australia to 81% in the Northern Territory.

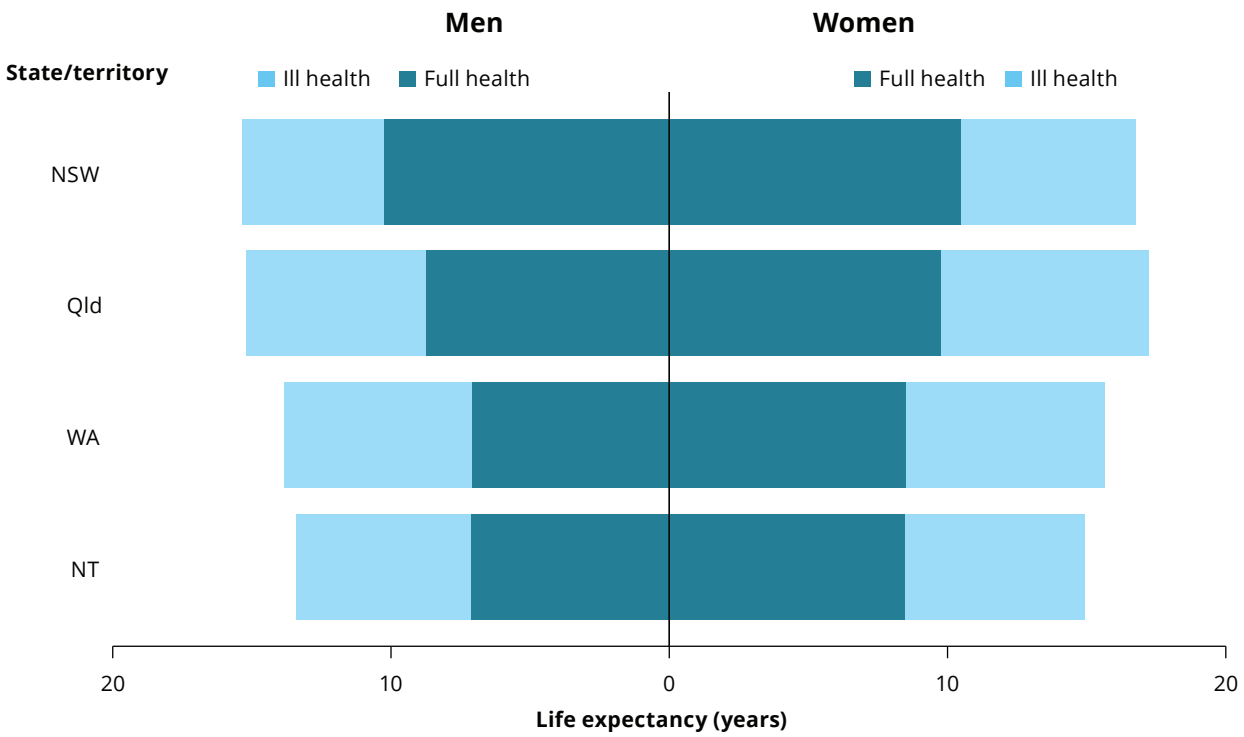
Figure 8.4: Life expectancy at birth in full health (HALE) and ill health, by sex and state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018



Source: Appendix Table D11.

The results for Indigenous Australians aged 65 are shown in Figure 8.5. The Northern Territory and Western Australia had the lowest HALE for people aged 65 (7.1 years for men and 8.5 years for women), with Western Australia having the lowest percentage of remaining life as healthy years (51% for men and 54% for women) compared with the other jurisdictions (Appendix Table D11).

Figure 8.5: Life expectancy at age 65 in full health (HALE) and ill health, by sex and state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018



Source: Appendix Table D11.

Gap in HALE by state and territory

In 2018, the gap between Indigenous and non-Indigenous males in HALE at birth ranged from 13.8 years in Queensland to 18.3 years in Western Australia. The gap for females ranged from 11.7 years in the Northern Territory to 16.8 years in Western Australia (Table 8.1).

For males aged 65 in 2018, the gap in HALE between Indigenous and non-Indigenous Australians was smallest in the Northern Territory (3.9 years) and largest in Western Australia (7.4 years). For females, the gap was also smallest in the Northern Territory (0.9 years) and largest in Western Australia (6.9 years).

Table 8.1: HALE and gap in HALE at birth and at age 65, selected states and territories, Indigenous and non-Indigenous Australians, 2018

		HALE (years)		
Sex	State/territory	Indigenous	Non-Indigenous	Gap (years)
At birth				
Males	NSW	57.3	71.9	14.6
	Qld	57.2	71.0	13.8
	WA	53.3	71.6	18.3
	NT	54.3	68.9	14.6
Females	NSW	60.5	74.2	13.7
	Qld	60.2	72.9	12.8
	WA	56.7	73.5	16.8
	NT	56.6	68.2	11.7
At age 65				
Males	NSW	10.3	14.8	4.5
	Qld	8.7	14.4	5.7
	WA	7.1	14.5	7.4
	NT	7.1	11.0	3.9
Females	NSW	10.5	16.1	5.6
	Qld	9.8	15.3	5.5
	WA	8.5	15.4	6.9
	NT	8.5	9.3	0.9

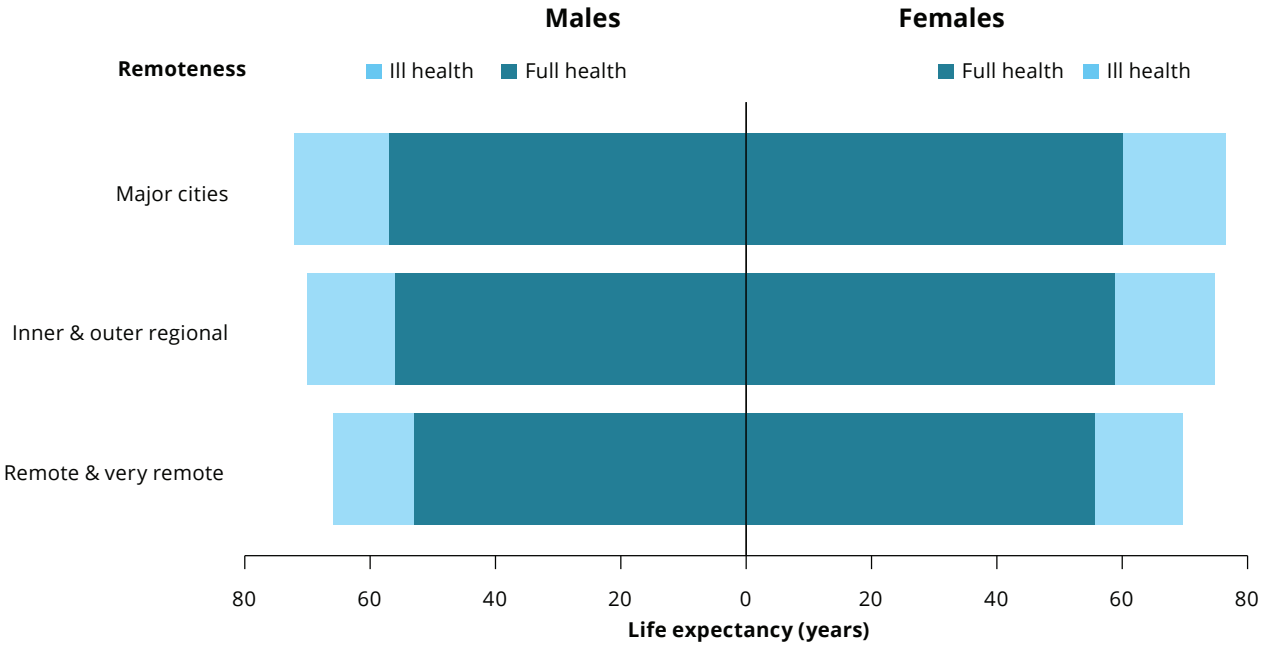
Note: Difference in HALE figures may not equate to gap shown due to rounding.

8.5 HALE by remoteness

There is considerable variation in the burden of disease by remoteness area (see Chapter 10). Life expectancy and HALE also vary by region of remoteness. Life expectancy and HALE for Indigenous Australians at birth in 2018 were highest in *Major cities* and declined with increasing remoteness.

HALE and life expectancy for Indigenous Australians were higher for males and females in *Major cities* than in *Remote and very remote* areas, both at birth and at age 65 (Appendix Table D11). In 2018, Indigenous males and females in *Remote and very remote* areas expected 4.0 and 4.4 fewer years of full health (at birth), respectively, than their counterparts in Major cities (Appendix Table D11; Figure 8.6).

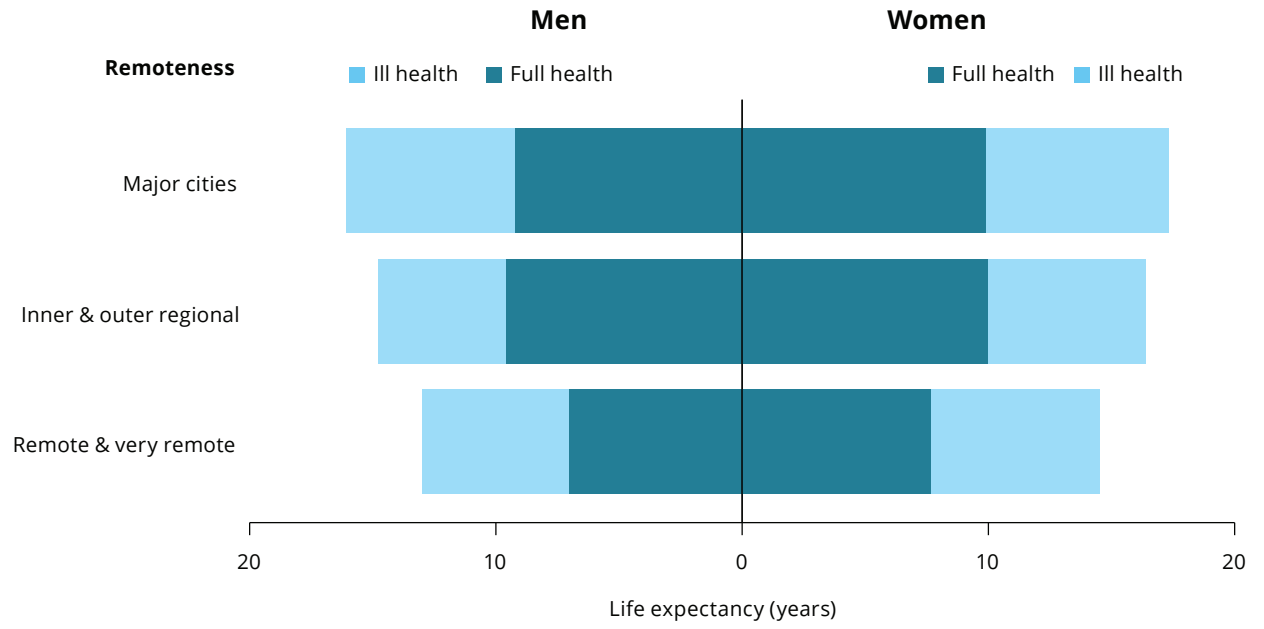
Figure 8.6: Life expectancy at birth in full health (HALE) and ill health, by sex and remoteness area, Indigenous Australians, 2018



Source: Appendix Table D11.

At age 65, Indigenous Australians in *Remote and very remote* areas had shorter life expectancy and 2.2 fewer years of full health than Indigenous Australians in *Major cities* (Figure 8.7).

Figure 8.7: Life expectancy at age 65 in full health (HALE) and ill health, by sex and remoteness area, Indigenous Australians, 2018



Source: Appendix Table D11.

Gap in HALE by remoteness

In 2018, the gap between Indigenous and non-Indigenous Australians in HALE at birth was highest in *Remote and very remote* areas for both males and females (18.1 and 15.1 years, respectively). The gaps in *Major cities* and *Inner and outer regional* areas were considerably smaller at around 14 years for both males and females (Table 8.2).

For males aged 65 in 2018, the gap in HALE between Indigenous and non-Indigenous Australians was largest in *Remote and very remote* areas (6.8 years). For females aged 65, the gap was similar across remoteness areas, but slightly smaller in *Remote and very remote* areas than in non-remote areas.

Table 8.2: HALE and gap in HALE at birth and at age 65, by remoteness area, Indigenous and non-Indigenous Australians, 2018

		HALE (years)		
Sex	Remoteness area	Indigenous	Non-Indigenous	Gap (years)
At birth				
Males	Major cities	57.1	71.8	14.8
	Inner and outer regional	56.1	70.3	14.2
	Remote and very remote	53.1	71.1	18.1
Females	Major cities	60.1	73.8	13.7
	Inner and outer regional	58.9	72.6	13.7
	Remote and very remote	55.7	70.8	15.1
At age 65				
Males	Major cities	9.2	14.5	5.2
	Inner and outer regional	9.6	14.9	5.2
	Remote and very remote	7.0	13.8	6.8
Females	Major cities	9.9	15.6	5.7
	Inner and outer regional	10.0	15.8	5.8
	Remote and very remote	7.7	13.2	5.5

Note: Difference in HALE figures may not equate to gap shown due to rounding.

9

Overview of results by disease group

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 the contribution of risk factors.

Before reading this chapter it is recommended to first read chapters 2, 3 and 4 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.

Data are presented in this chapter for each of the following disease groups:

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

Information on the quality of estimates is included in the ABDS methods report (AIHW 2021c).

9.1 Mental & substance use disorders

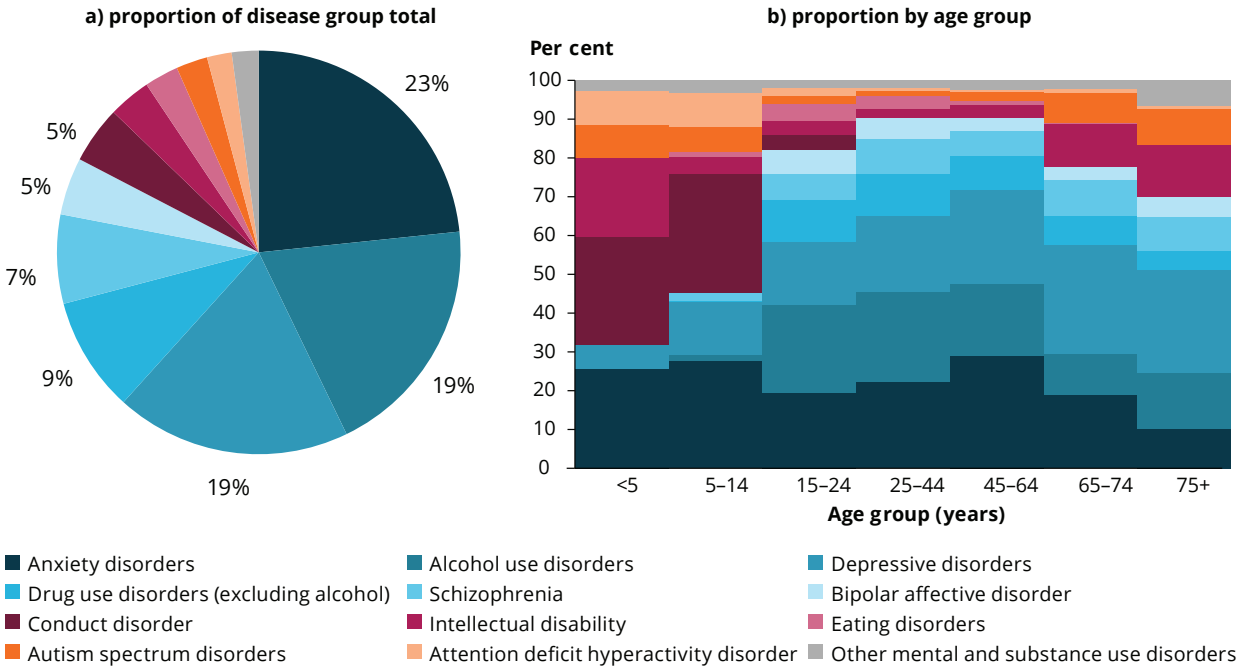
The mental & substance use disorders disease group encompasses a broad range of conditions including affective disorders (major depressive disorder, dysthymia and bipolar disorder), anxiety disorders, alcohol & drug use disorders, child behavioural & developmental disorders, schizophrenia, and intellectual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

Mental & substance use disorders was the leading cause of total burden and non-fatal burden among Indigenous Australians in 2018. Mental & substance use disorders made up 23% (54,263 DALY) of total burden, 42% (53,238 YLD) of non-fatal burden and 0.9% (1,025 YLL) of fatal burden.

The main causes of mental & substance use burden were anxiety disorders (23%), alcohol use disorders (19%) and depressive disorders (19%) (Figure 9.1.1a).

The contribution of individual conditions to mental & substance use burden varied across the life course (Figure 9.1.1b). Among children under 15, conduct disorder and anxiety disorders were the leading causes of mental & substance use burden, each accounting for over a quarter of the burden in this age group (30% and 28%, respectively). For ages 15–64, anxiety disorders (23%), alcohol use disorders (22%) and depressive disorders (20%) were the leading causes of burden. For those 65 and over, depressive disorders (28%), anxiety disorders (17%) and intellectual disability (12%) were the leading causes of burden.

Figure 9.1.1: Contribution of individual causes to mental & substance use disorders total burden (DALY), Indigenous Australians, 2018



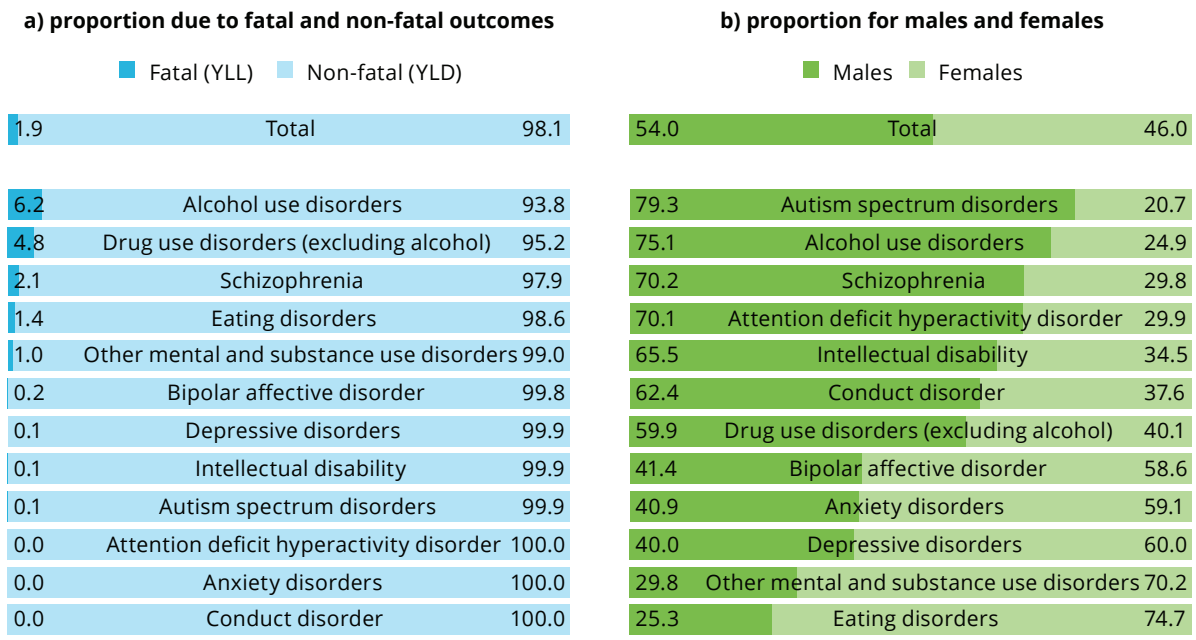
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. Estimates in relation to conduct disorder and autism should be interpreted with caution as they are subject to data quality issues.
3. 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 the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Only a very small proportion (1.9%) of mental & substance use burden was fatal (Figure 9.1.2a), the large majority of which was due to alcohol use disorders (64% of fatal burden for mental & substance use disorders) and drug use disorders (23%).

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 (54%) than by Indigenous females (46%) (Figure 9.1.2b). This proportion differed by the type of mental disorder. A larger proportion of burden was experienced by Indigenous males for autism spectrum disorders (79%), alcohol use disorders (75%), schizophrenia (70%), ADHD (70%), intellectual disability (66%), conduct disorder (62%) and drug use disorders (60%). In contrast, Indigenous females experienced a greater proportion of the burden for eating disorders (75%), other mental & substance use disorders (70%), depressive disorders (60%), anxiety disorders (59%) and bipolar affective disorders (59%).

Figure 9.1.2: Mental & substance use disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The joint effect of all risk factors combined contributed just under one-half (48%) to the burden for mental & substance use disorders. For this disease group, the biggest risk factors were alcohol use (20%) and child abuse & neglect (14%) (Chapter 5, Table 5.3).

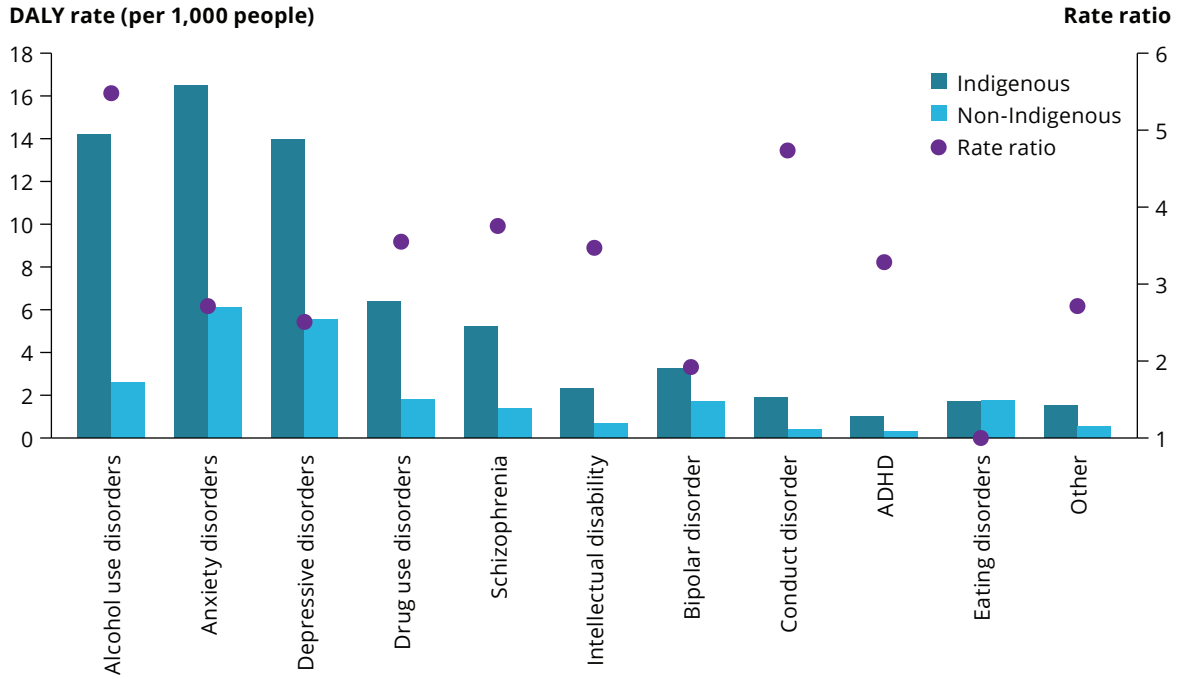
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to mental & substance use disorders for Indigenous Australians was 2.8 times the rate for non-Indigenous Australians (age-standardised rates of 69.6 and 24.5 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 11.6 DALY per 1,000 people), anxiety disorders (rate difference of 10.4 DALY per 1,000) and depressive disorders (rate difference of 8.4 DALY per 1,000) (Figure 9.1.3).

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 5.5), conduct disorder (4.7), schizophrenia (3.8), drug use disorders (3.6) and intellectual disability (3.5).

Figure 9.1.3: Mental & substance use disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



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.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to mental & substance use disorders for Indigenous Australians increased from 58 to 70 DALY per 1,000 people—an increase of 21%. This was driven by an increase in the non-fatal burden (26%), mainly from anxiety disorders (increase of around 3.4 YLD per 1,000; equivalent to a 26% increase in YLD) (see Supplementary Table S9.1).

Rates of fatal burden due to mental & substance use disorders decreased between 2003 and 2018 in the Indigenous population (from 3.8 to 1.9 YLL per 1,000; decrease of 51%).

9.2 Injuries

In the ABDS, 2 perspectives are used to report injury burden:

- **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)
- **external cause of injury**, 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).

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).

Both perspectives are shown in Table 9.2.1. The ICD-10 codes used to identify external causes can be found in the ABDS methods report (AIHW 2021c).

Table 9.2.1: ABDS 2018 Disease list for injuries, by nature and external cause of injury

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

RTI road traffic 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

In 2018, injuries accounted for 12% (29,769 DALY) of total burden among Indigenous Australians, 23% (26,471 YLL) of fatal burden and 2.6% (3,297 YLD) of non-fatal burden.

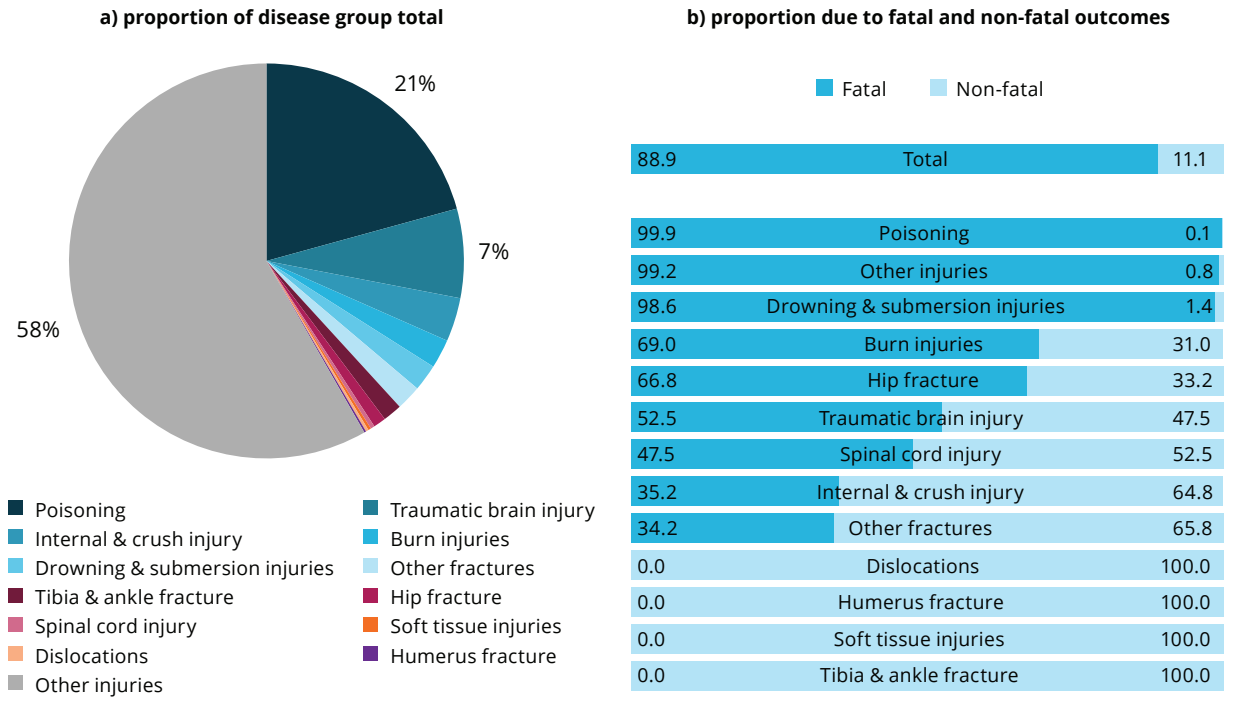
Overall, injuries was the second leading cause of total burden among Indigenous Australians, the leading cause of fatal burden and the ninth leading cause of non-fatal burden. Most injury burden (89%) was due to early death (fatal burden), with only 11% due to non-fatal burden.

Nature of injury

Using the nature of injury perspective, the broad group of 'other injuries' accounted for over half (58%) of the total injury burden in Indigenous Australians (Figure 9.2.1a). 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 (21%) and traumatic brain injury (7%).

Fatal burden was greater than non-fatal burden for poisoning (99.9%), other injuries (99.2%), drowning & submersion injuries (98.6%), burn injuries (69%) and hip fractures (66.8%) (Figure 9.2.1b). For soft tissue injuries and dislocations—and tibia, ankle and humerus fractures—all burden was non-fatal.

Figure 9.2.1: Injury total burden (DALY), by nature of injury, Indigenous Australians, 2018



Notes

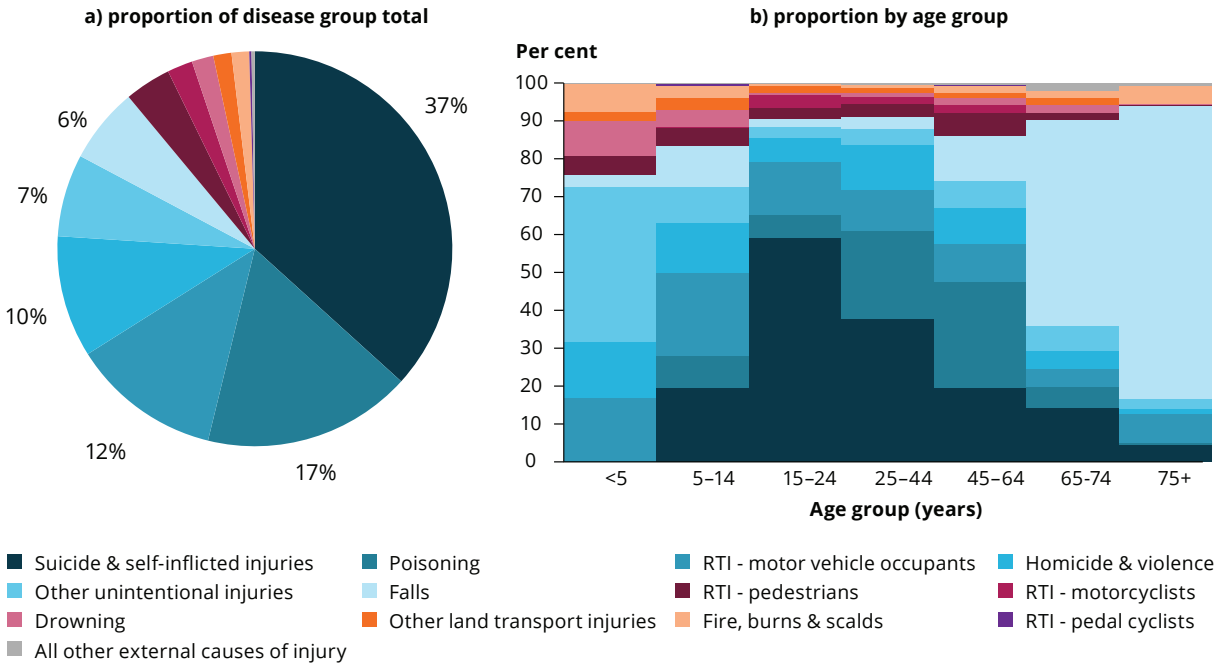
1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other injuries' includes open wounds, nerve injuries and all other injuries not aligned to an ABDS cause such as unspecified injuries. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

External cause of injury

Using the external cause of injury perspective, suicide & self-inflicted injuries accounted for 37% of the total injury burden among Indigenous Australians, followed by poisoning (17%), road traffic injuries (RTI) of motor vehicle occupants (12%) and homicide & violence (10%) (Figure 9.2.2a).

The contribution of individual causes to injury burden varied across the life course (Figure 9.2.2b). Among Indigenous children under 5, other unintentional injuries (41%) was the leading cause of injury burden, followed by RTI of motor vehicle occupants (17%). For children aged 5–14, RTI of motor vehicle occupants and suicide & self-inflicted injuries were the 2 leading causes of injury burden (accounting for 22% and 20%, respectively). Suicide & self-inflicted injuries accounted for over half (59%) of injury burden among Indigenous Australians aged 15–24. Among adults aged 25–64, suicide & self-inflicted injuries and poisoning were the 2 leading causes of injury burden together accounting for over half of the injury burden in this age group (33% and 25%, respectively). For those aged 65 and over, falls were the leading cause of injury burden (accounting for 63%).

Figure 9.2.2: Injury total burden (DALY), contribution of external causes of injury, Indigenous Australians, 2018



RTI road traffic injuries.

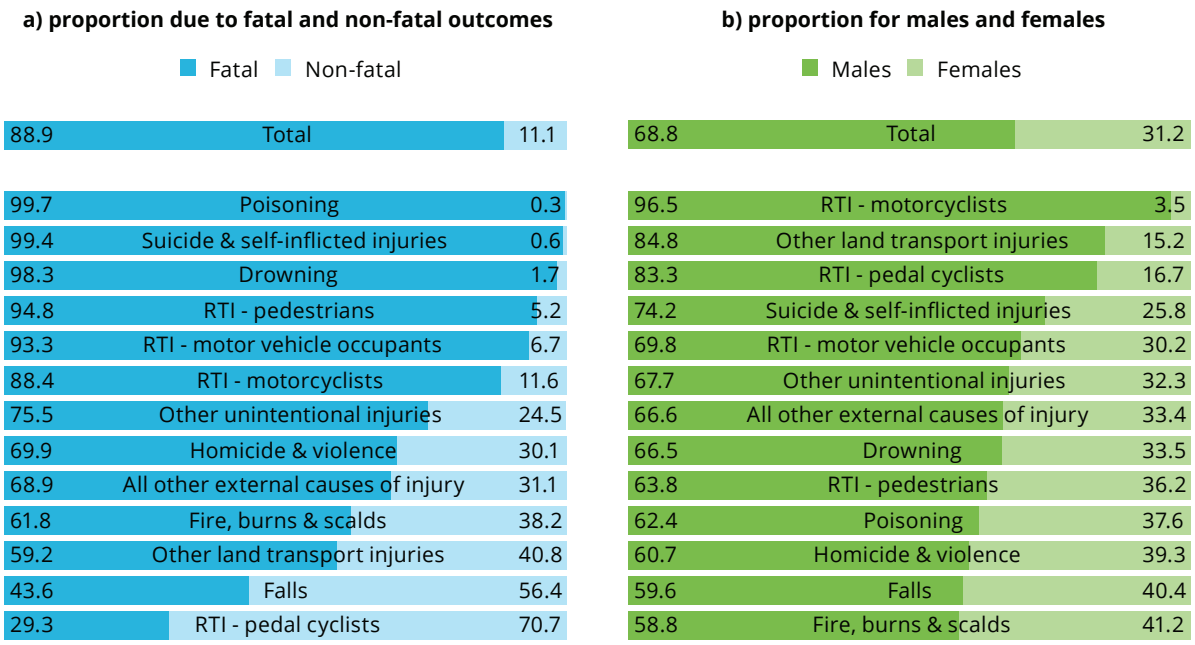
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'All other external causes of injury' includes all causes included in injuries (external cause) not specifically listed in the figure. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Most injury burden (89%) was due to early death (fatal burden) (Figure 9.2.3a). The majority of the fatal burden for injury was due to suicide & self-inflicted injuries (41%), poisoning (19%) and RTI of motor vehicle occupants (13%).

Overall, a larger proportion of burden due to injuries was experienced by Indigenous males (69%) than by Indigenous females (31%) (Figure 9.2.3b). Indigenous males experienced a higher proportion of injury burden than Indigenous females across all causes, with the largest differences for RTI of motorcyclists (97% males), other land transport injuries (85% males), RTI of cyclists (83% males) and suicide & self-inflicted injuries (74% males).

Figure 9.2.3: Injury burden (DALY), by external cause of injury, Indigenous Australians, 2018



RTI road traffic injuries.

Risk factor contribution

The joint effect of all risk factors combined contributed 60% to the burden for injuries. For this disease group, the biggest risk factors were alcohol use (29%) and drug use (28%) (Chapter 5, Table 5.3).

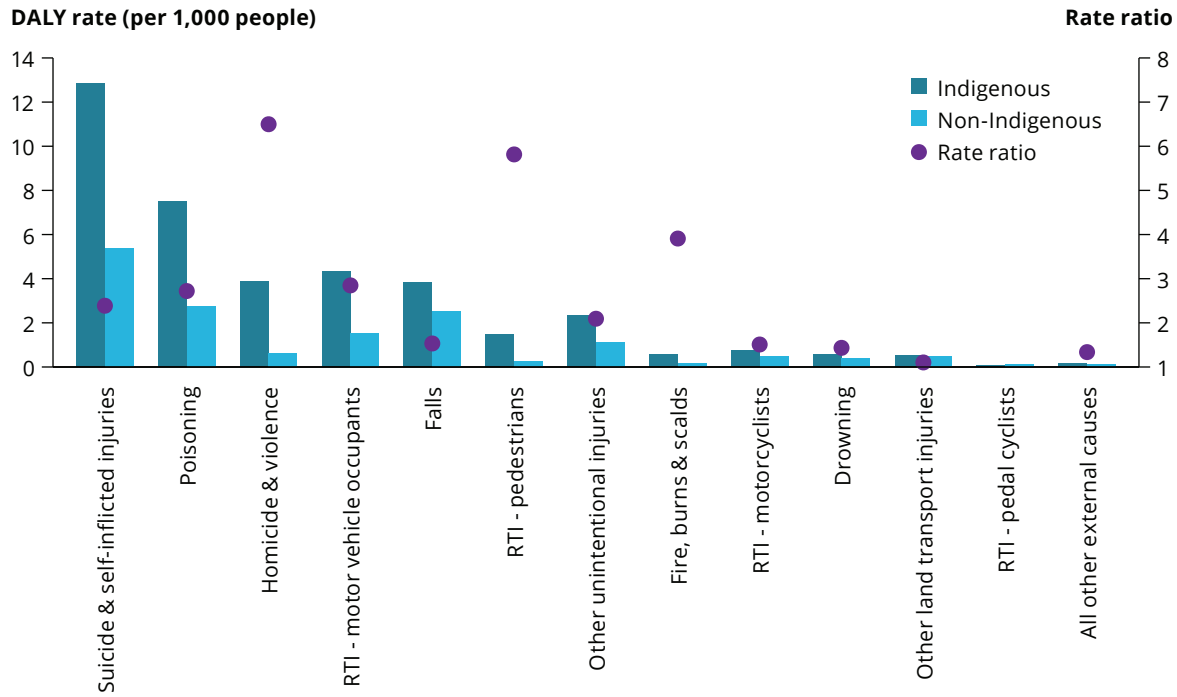
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to injuries for Indigenous Australians was 2.4 times the rate for non-Indigenous Australians (age-standardised rates of 38.8 and 15.8 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for suicide & self-inflicted injuries (rate difference of 7.5 DALY per 1,000 people), poisoning (rate difference of 4.7 DALY per 1,000) and homicide & violence (rate difference of 3.3 DALY per 1,000) (Figure 9.2.4).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for homicide & violence (rate ratio of 6.5), RTI of pedestrians (5.8) and fire, burns & scalds (3.9).

Figure 9.2.4: Injury age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by external cause of injury, 2018



RTI road traffic injuries.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to injuries for Indigenous Australians remained relatively stable overall (40 and 39 DALY per 1,000 people, respectively). Rates of non-fatal burden due to injuries increased (from 3.0 to 4.7 YLD per 1,000; increase of 55%), whereas rates of fatal burden decreased (from 37 to 34 YLL per 1,000; decrease of 7%) (see Supplementary Table S9.2).

Although most causes of injury showed a decrease in fatal burden between 2003 and 2018, there were notable increases for poisoning and suicide & self-inflicted injuries (increases of 4.1 and 1.9 DALY per 1,000 people, respectively; equivalent to increases of 121% and 17%, respectively).

9.3 Cardiovascular diseases

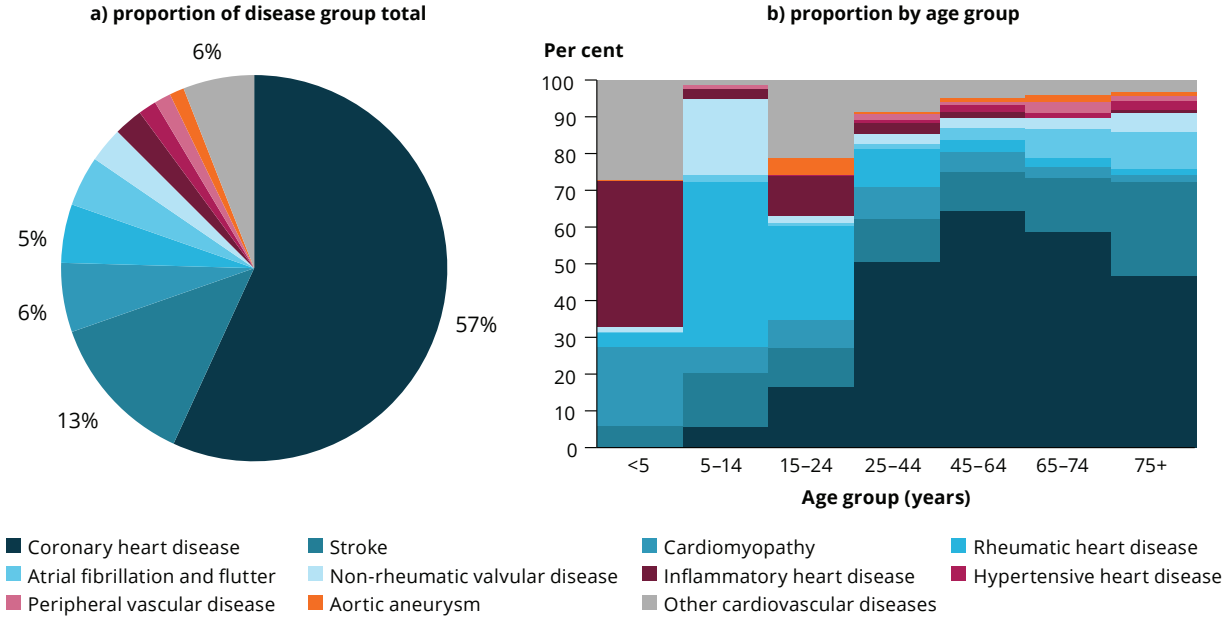
The cardiovascular disease (CVD) group includes many different conditions affecting the heart and blood vessels. The main underlying cause of the most common diseases in this group is atherosclerosis (hardening of the arteries). It is most serious when it results in reduced or blocked blood supply to the heart as part of coronary heart disease (CHD), or to the brain (causing a stroke). 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 accounted for 10% (24,612 DALY) of total burden, 19% (21,266 YLL) of fatal burden and 2.6% (3,346 YLD) of non-fatal burden.

The main causes of CVD burden were CHD (57%) and stroke (13%) (Figure 9.3.1a).

The contribution of individual diseases to total CVD burden varied across the life course (Figure 9.3.1b). Among children under 5, inflammatory heart disease (40%), other cardiovascular diseases (27%) and cardiomyopathy (21%) were the leading causes of CVD burden. For ages 5–14, rheumatic heart disease and non-rheumatic valvular disease were the leading causes of burden (46% and 21%, respectively). For those aged 15–24, rheumatic heart disease and other cardiovascular diseases were the leading causes of burden (25% and 21%, respectively). CHD accounted for over half the CVD burden in those aged 25 and over.

Figure 9.3.1: Contribution of individual diseases to cardiovascular disease total burden (DALY), Indigenous Australians, 2018



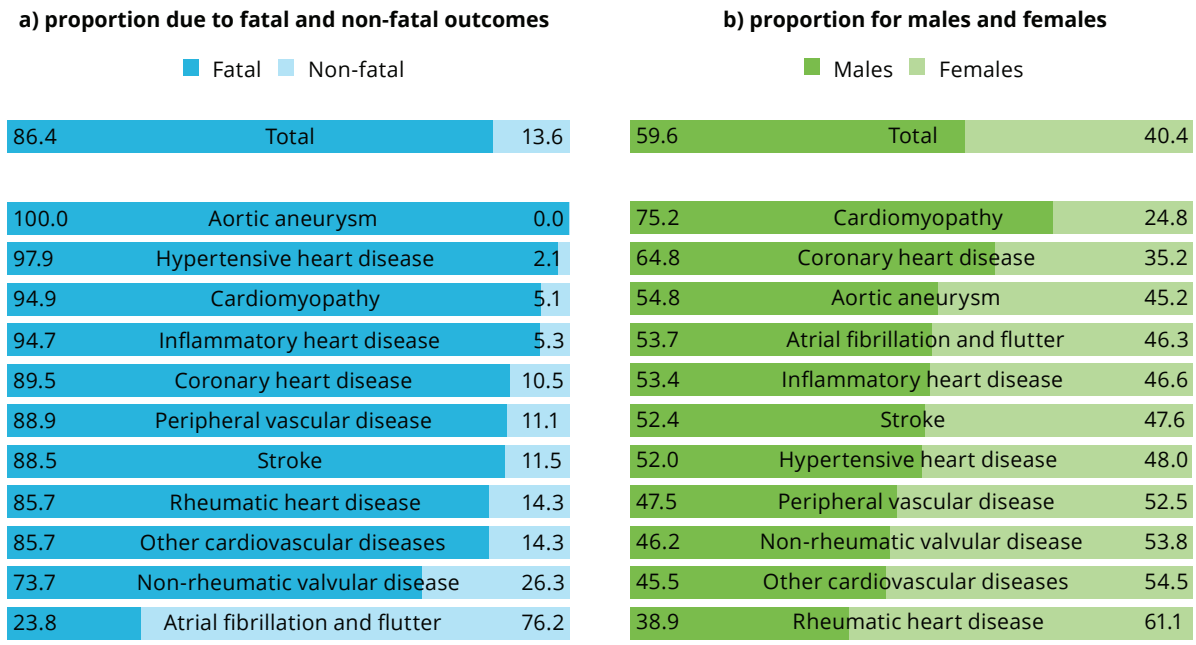
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. Rheumatic heart disease includes acute rheumatic fever.
3. 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 the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Overall, 86% of CVD burden was fatal (Figure 9.3.2a), the majority of which was due to CHD (59% of fatal burden for CVD).

Overall, a larger proportion of burden due to CVD was experienced by Indigenous males (60%) than by Indigenous females (40%) (Figure 9.3.2b). This proportion also differed by the type of CVD. A larger proportion of burden was experienced by Indigenous males for cardiomyopathy (75%) and CHD (65%). In contrast, Indigenous females experienced a greater proportion of the burden for rheumatic heart disease (including acute rheumatic fever) (61%).

Figure 9.3.2: Cardiovascular disease burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Note: Rheumatic heart disease includes acute rheumatic fever.

Risk factor contribution

The joint effect of all risk factors combined contributed just over three-quarters of the burden for CVD (77%). For this disease group, the biggest risk factors were dietary risks (45%), high blood pressure (34%), tobacco use (34%) and overweight (including obesity) (33%) (Chapter 5, Table 5.3).

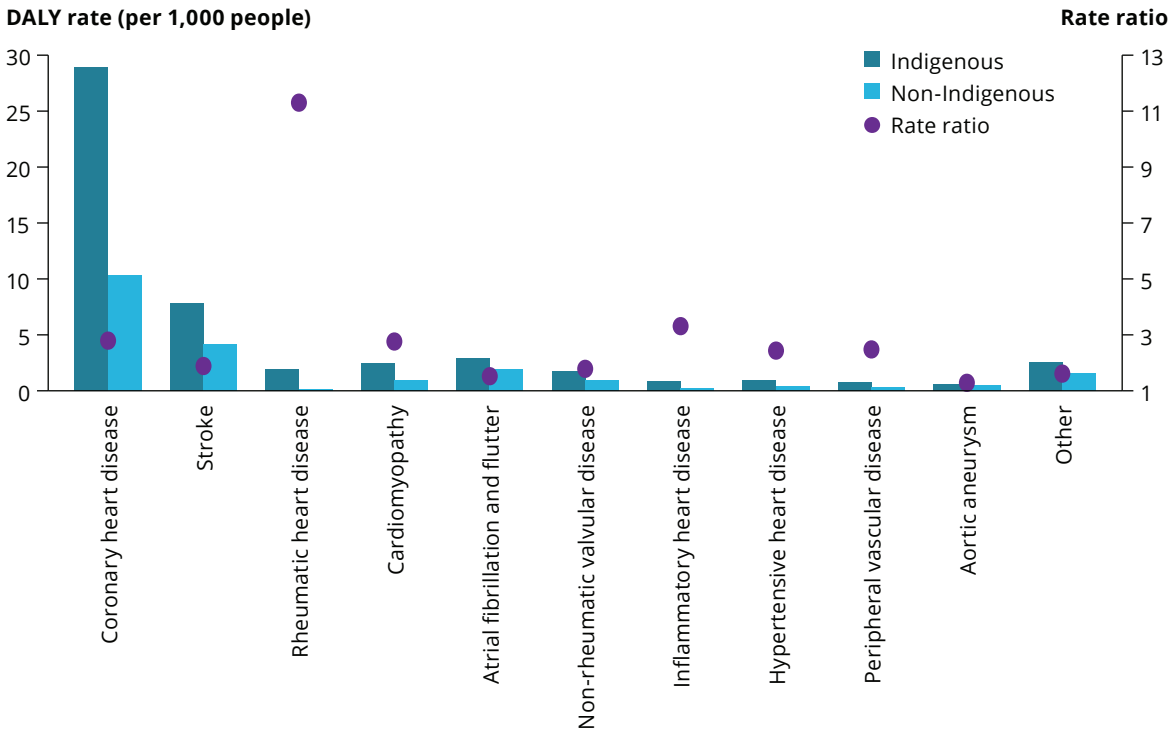
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to CVD for Indigenous Australians was 2.4 times the rate for non-Indigenous Australians (age-standardised rates of 52 and 22 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for CHD (rate difference of 18.5 DALY per 1,000 people) and stroke (rate difference of 3.7 DALY per 1,000) (Figure 9.3.3).

Rheumatic heart disease (including acute rheumatic fever) represented the largest relative difference (based on age-standardised rate ratios) between Indigenous and non-Indigenous Australians with a rate ratio of 11.3, though contributing only 5% of DALY for the CVD group overall.

Figure 9.3.3: Cardiovascular diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Note: Rheumatic heart disease includes acute rheumatic fever.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to CVD for Indigenous Australians decreased from 92 to 52 DALY per 1,000 people—a decrease of 44%. This was driven by a decrease in the fatal burden (47%), mainly from CHD and stroke (decreases of 25 and 8.8 YLL per 1,000, respectively; equivalent to decreases of 50% and 56%, respectively) (see Supplementary Table S9.3).

Rates of non-fatal burden due to CVD also decreased between 2003 and 2018 in the Indigenous population (from 9.2 to 7.7 YLD per 1,000; decrease of 17%).

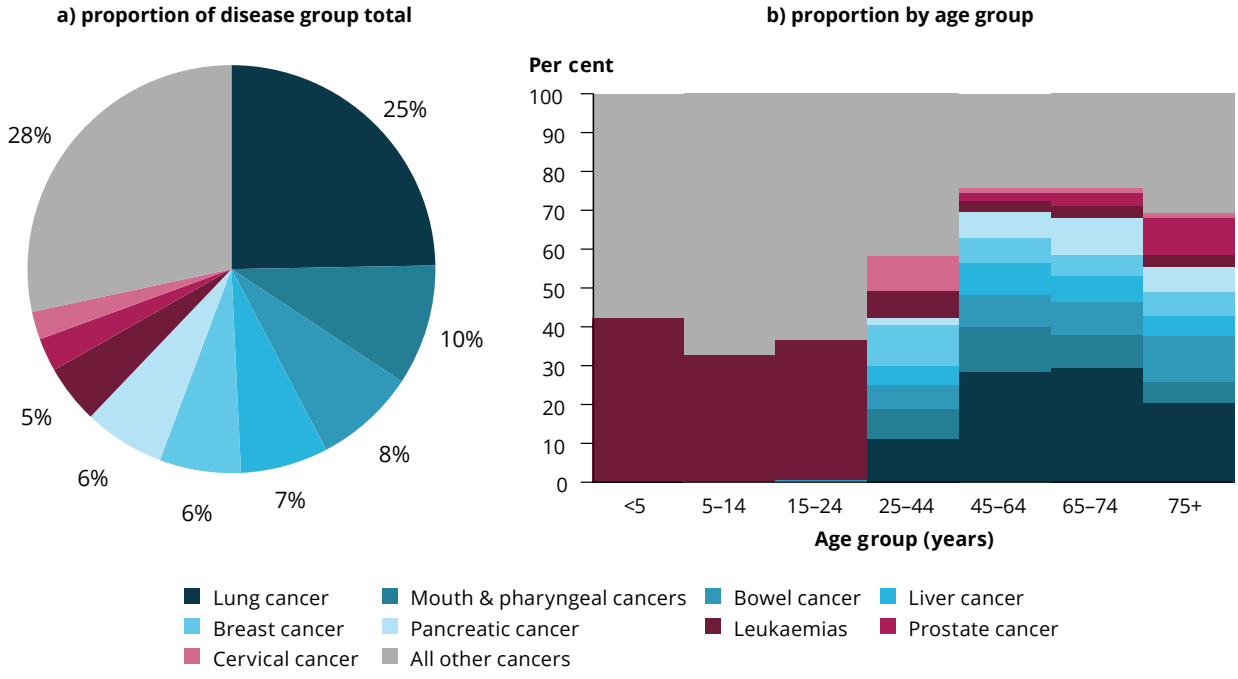
9.4 Cancer & other neoplasms

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 conditions disease group. For a complete list of individual cancers included in this study, see the ABDS methods report (AIHW 2021c).

Cancer & other neoplasms made up 10% (23,742 DALY) of total burden, 20% (22,225 YLL) of fatal burden and 1.2% (1,517 YLD) of non-fatal burden among Indigenous Australians in 2018. Lung (25%), mouth & pharyngeal (10%), bowel (8%) and liver (7%) cancers accounted for half (50%) of the cancer burden among Indigenous Australians (Figure 9.4.1a).

The contribution of individual cancers to total cancer burden varied across the life course (Figure 9.4.1b). Among Indigenous Australians under 25, leukaemias were the leading cause of cancer burden, accounting for 36% of total cancer burden. For ages 25–44, lung (11%), breast (11%) and cervical (9%) cancers were the leading causes. For ages 45–64, lung (28%), mouth & pharyngeal (12%), liver (8.4%) and bowel (8.1%) cancers were the leading causes. For those aged 65 and over, lung (27%), bowel (9.5%) and pancreatic (8.7%) cancers were the leading causes of cancer burden.

Figure 9.4.1: Contribution of individual cancers to cancer & other neoplasms total burden (DALY), Indigenous Australians, 2018



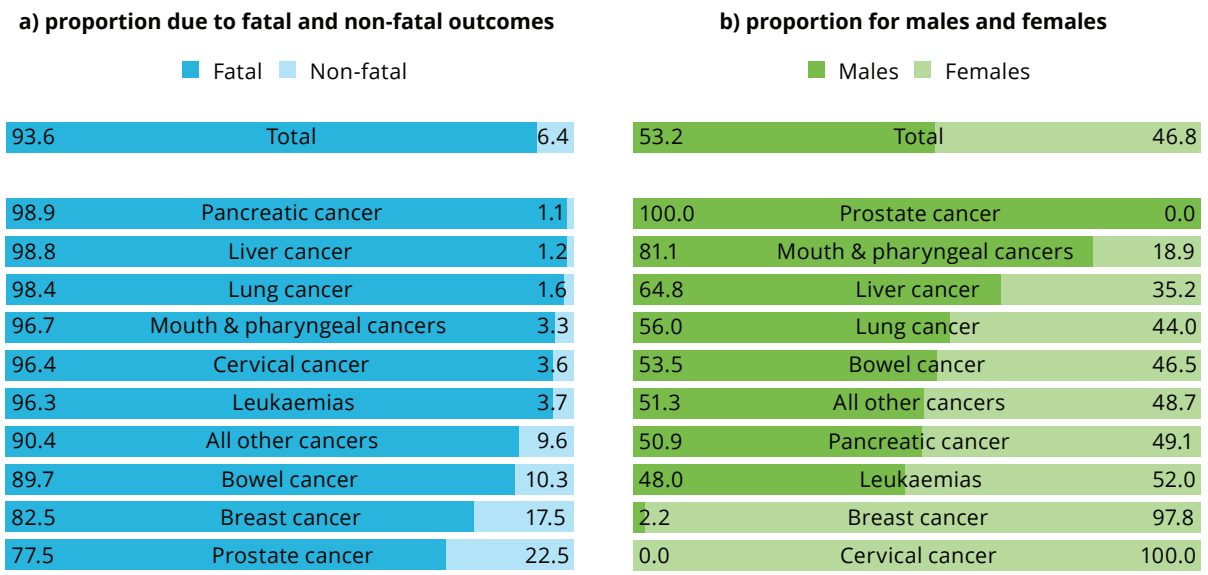
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'All other cancers' includes other malignant neoplasms (cancers), unknown primary, brain and central nervous system cancer, stomach cancer, non-hodgkin lymphoma, kidney cancer, ovarian cancer, bladder cancer, uterine cancer, non-melanoma skin cancer, other benign, insitu and uncertain neoplasms, myeloma, benign and uncertain brain tumours, melanoma of the skin, gallbladder cancer, mesothelioma, other lymphohaematopoietic (blood) cancers, thyroid cancer, hodgkin lymphoma, testicular cancer and ductal carcinoma in situ (breast). See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Cancer burden was almost entirely due to dying prematurely, with only 6.4% of this burden due to living with cancer (Figure 9.4.2a).

The overall cancer burden was higher in Indigenous males (53%) than females (47%), this proportion also differed by type of cancer (Figure 9.4.2b). Indigenous males experienced the entire burden due to prostate cancer (100%) as well as a greater share of burden due to mouth & pharyngeal cancers (81%), liver cancer (65%) and lung cancer (56%) than Indigenous females. In contrast, Indigenous females experienced the majority of the burden for breast cancer (98%) and the entire burden due to cervical cancer (100%).

Figure 9.4.2: Cancer & other neoplasms burden (DALY), cancers by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The joint effect of all risk factors combined contributed more than half of the burden for cancer (56%). For this disease group, the biggest risk factors were tobacco use (37%) and alcohol use (9.2%) (Chapter 5, Table 5.3).

Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to cancer & other neoplasms for Indigenous Australians was 1.7 times the rate for non-Indigenous Australians (age-standardised rates of 50 and 30 DALY per 1,000 people, respectively).

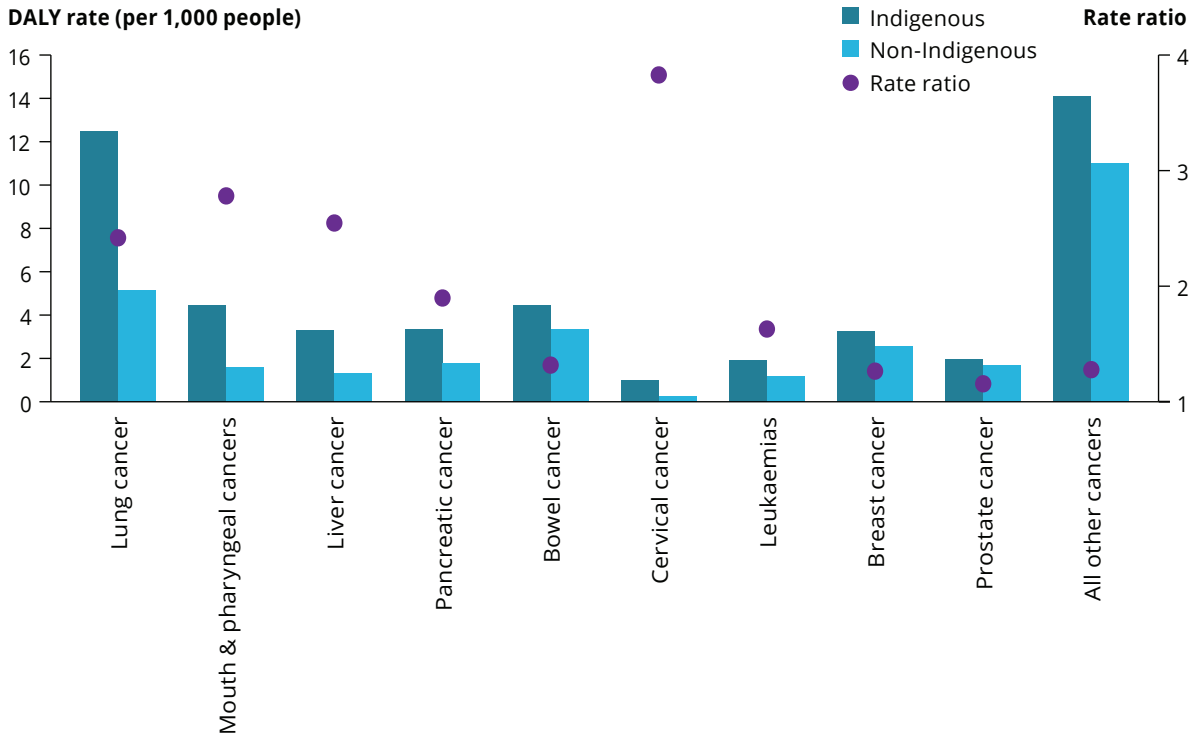
The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for lung cancer (rate difference of 7.3 DALY per 1,000 people), all other cancers (rate difference of 3.1 DALY per 1,000) mouth & pharyngeal cancers (rate difference of 2.9 DALY per 1,000) and liver cancer (rate difference of 2.0 DALY per 1,000) (Figure 9.4.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for cervical cancer (rate ratio of 3.8), mouth & pharyngeal cancers (2.8), liver cancer (2.5) and lung cancer (2.4).

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, mouth & pharyngeal and liver cancers.

Evidence that is available on the participation in cervical screening by Indigenous women suggests that Indigenous women are under-screened (AIHW 2019b; Cunningham et al. 2008). This may have led to higher burden of cervical cancer in Indigenous women.

Figure 9.4.3: Cancer & other neoplasms age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by cancer, 2018



Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to cancer among Indigenous Australians decreased from 54 to 50 DALY per 1,000 people—a decrease of 7.5%. This was driven by a decrease in the fatal burden (9.3%), mainly from mouth & pharyngeal cancers (decrease of around 2.1 YLL per 1,000; equivalent to a 33% decrease in YLL) and breast cancer (decrease of around 0.9 YLL per 1,000; 26% decrease) (see Supplementary Table S9.4).

Rates of non-fatal burden due to cancer & other neoplasms increased slightly between 2003 and 2018 in the Indigenous population (from 2.9 to 3.7 YLD per 1,000).

9.5 Musculoskeletal conditions

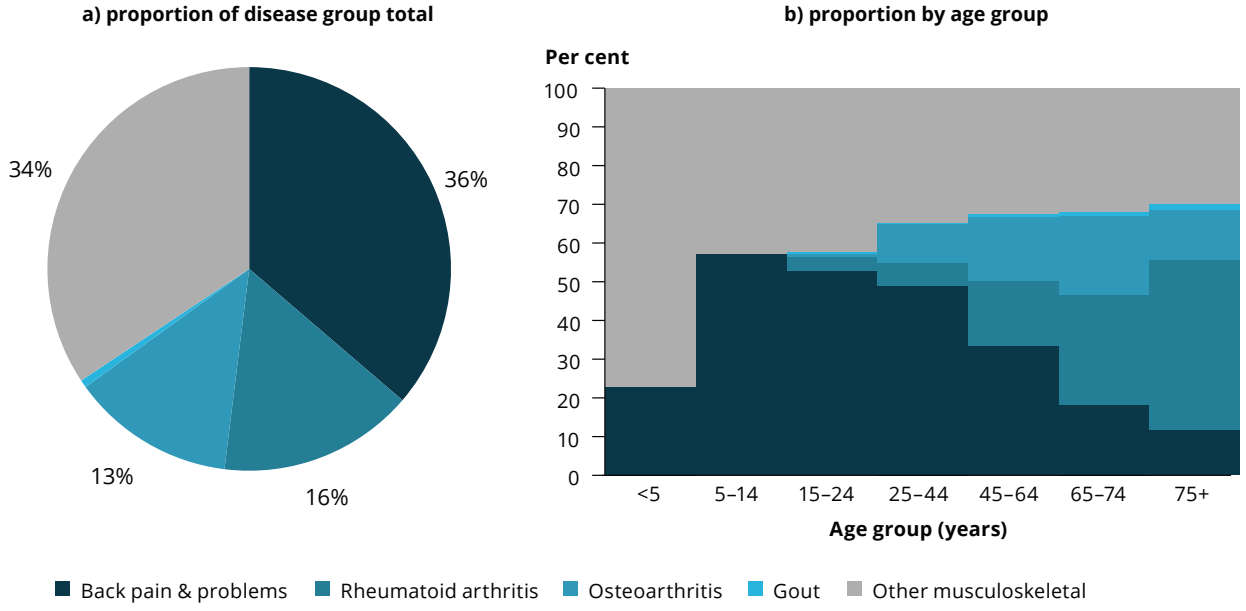
Musculoskeletal conditions are the most common chronic conditions in Australia. They are diseases and disorders of the bones, muscles and their attachments (for example, joints and ligaments). This disease group includes osteoarthritis, gout, rheumatoid arthritis, back pain & problems, along with the residual 'other musculoskeletal conditions' (which includes a range of conditions such as other and ill-defined arthritis, chronic pain in joints, muscles and other soft tissue, and systematic lupus erythematous). See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes. Osteoporosis (low bone mineral density) was considered a risk factor and the burden attributed to this risk factor was analysed, see results presented in Chapter 5.

Musculoskeletal conditions made up 8% (19,168 DALY) of total burden, 15% (18,402 YLD) of non-fatal burden and 0.7% (766 YLL) of fatal burden.

The main causes of musculoskeletal burden were back pain & problems (36%) and other musculoskeletal conditions (34%) (Figure 9.5.1a).

Two-thirds (67%) of burden due to musculoskeletal conditions occurred in those aged 25–64 with very little burden present in younger age groups (5% for 0–14; 8% for 15–24). The contribution of individual conditions to musculoskeletal burden varied across the life course (Figure 9.5.1b). Back pain & problems and other musculoskeletal conditions caused almost all (97%) of the musculoskeletal burden among Indigenous Australians under 25. For those aged 25–64, back pain & problems (39%) and other musculoskeletal conditions (33%) were the leading causes of musculoskeletal burden, but osteoarthritis (14%) and rheumatoid arthritis (13%) also accounted for considerable burden. For those aged 65 and over, rheumatoid arthritis (34%), other musculoskeletal conditions (31%) and osteoarthritis (18%) were the leading causes of musculoskeletal burden.

Figure 9.5.1: Contribution of individual conditions to musculoskeletal conditions total burden (DALY), Indigenous Australians, 2018



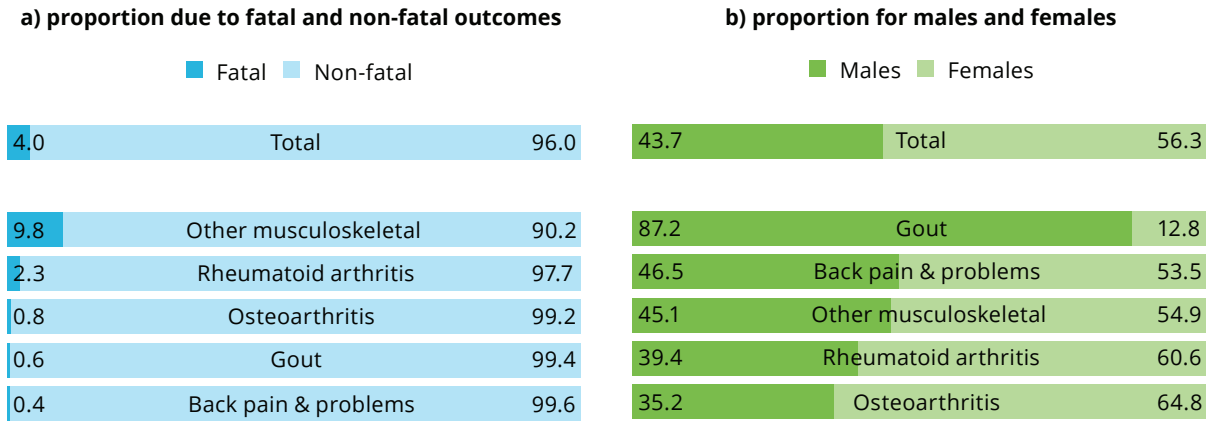
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other musculoskeletal conditions' are musculoskeletal conditions not included in osteoarthritis, gout, rheumatoid arthritis and back pain & problems. Other musculoskeletal conditions will include conditions like systemic lupus erythematosus, fibromyalgia and tendonitis. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Only a very small proportion (4%) of musculoskeletal burden was fatal (Figure 9.5.2a), the large majority of which was due to other musculoskeletal conditions (85% of fatal burden for musculoskeletal conditions).

There were notable differences between males and females. Overall, Indigenous females experienced more (56%) of the burden due to musculoskeletal conditions than Indigenous males (44%) (Figure 9.5.2b). This proportion also differed by the type of musculoskeletal condition. A larger proportion of burden was experienced by Indigenous females for osteoarthritis (65%), rheumatoid arthritis (61%) and other musculoskeletal conditions (55%). In contrast, Indigenous males experienced a greater proportion of the burden for gout (87%).

Figure 9.5.2: Musculoskeletal burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The joint effect of all risk factors combined contributed 18% to the burden for musculoskeletal conditions. For this disease group, the biggest risk factor was overweight (including obesity) (9.1%), followed by occupational exposures & hazards (5.9%) (Chapter 5, Table 5.3).

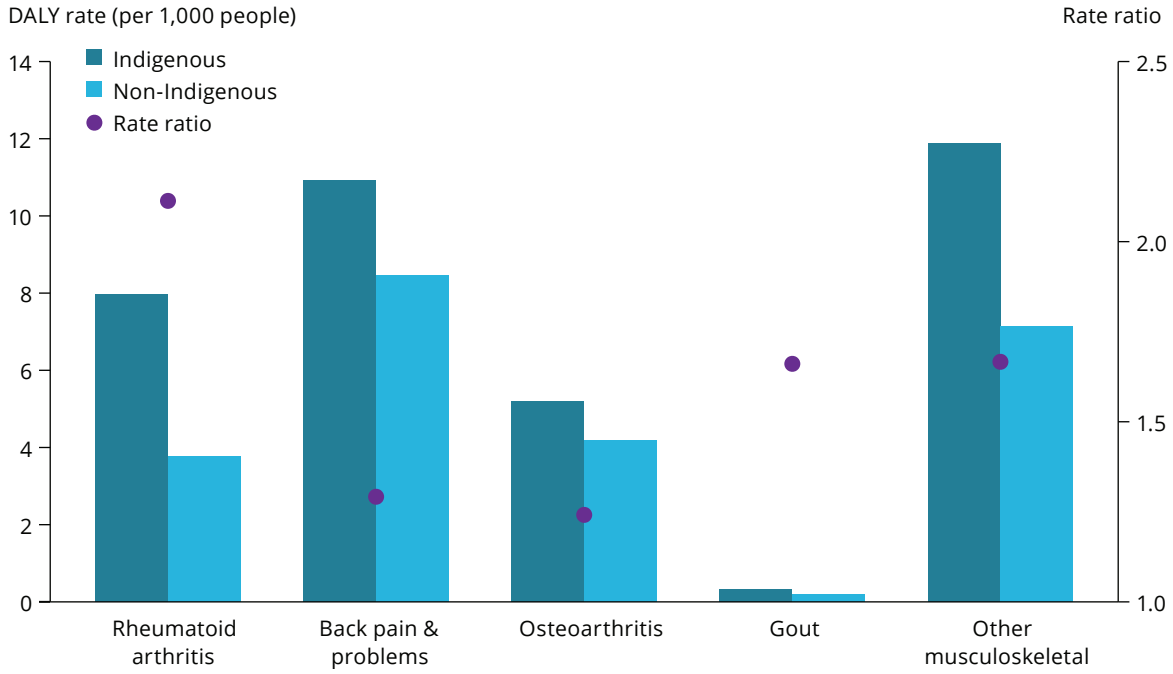
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to musculoskeletal conditions for Indigenous Australians was 1.5 times the rate for non-Indigenous Australians (age-standardised rates of 36 and 24 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for other musculoskeletal conditions (rate difference of 4.8 DALY per 1,000 people) and rheumatoid arthritis (rate difference of 4.2 DALY per 1,000) (Figure 9.5.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) was observed for rheumatoid arthritis (rate ratio of 2.1).

Figure 9.5.3: Musculoskeletal conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to musculoskeletal conditions for Indigenous Australians decreased from 44 to 36 DALY per 1,000 people—a decrease of 18%. This was driven by a decrease in the non-fatal burden (17%), mainly from rheumatoid arthritis (decrease of 5.9 YLD per 1,000; equivalent to a 43% decrease in YLD) and other musculoskeletal conditions (decrease of 3.6 YLD per 1,000; equivalent to a 25% decrease in YLD) (see Supplementary Table S9.5).

Rates of fatal burden due to musculoskeletal conditions also decreased between 2003 and 2018 in the Indigenous population (from 2.3 to 1.5 YLL per 1,000).

9.6 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 (asbestosis, silicosis and other pneumoconiosis), upper respiratory conditions (mainly allergic rhinitis—also known as hay fever) and other respiratory diseases (including bronchiectasis and respiratory disease due to inhalation of chemicals, gases, fumes and vapours).

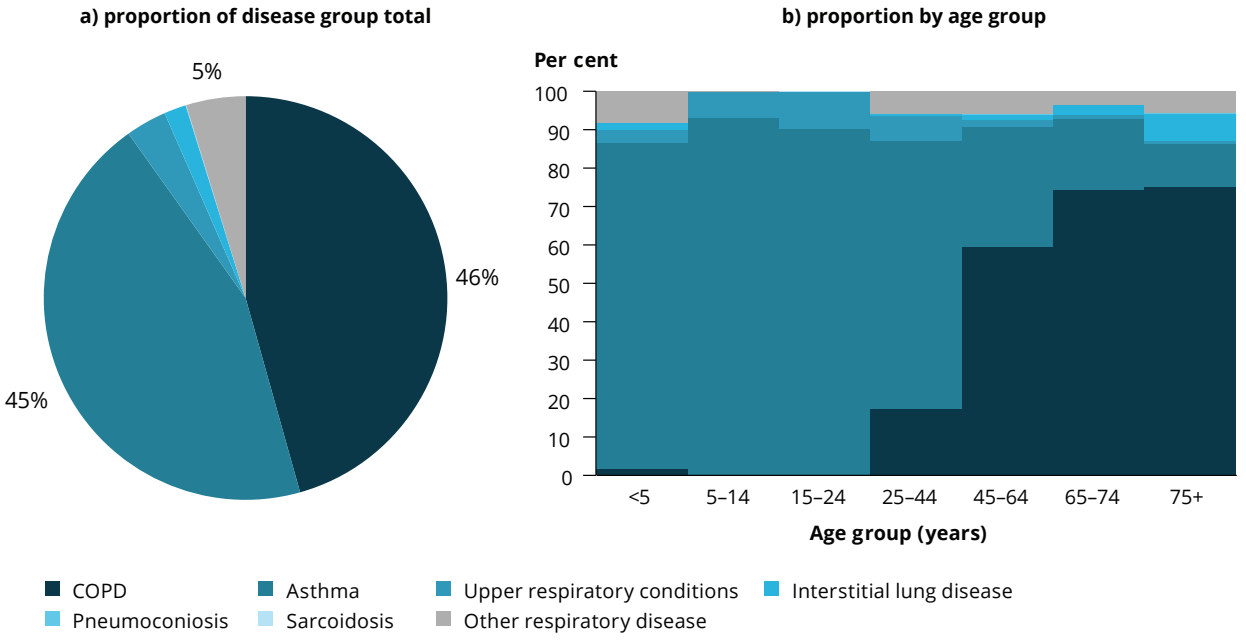
This disease group excludes any acute respiratory infections, influenza or pneumonia—which are part of the infectious diseases group—and nasal skin infections—which are part of the skin disorders group.

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 2020).

Respiratory diseases contributed 7.5% (17,920 DALY) of total burden, 9.0% (11,332 YLD) of non-fatal burden and 5.8% (6,588 YLL) of fatal burden. COPD and asthma accounted for most (90%) of the burden from respiratory diseases (Figure 9.6.1a).

Asthma was the leading cause of respiratory burden among Indigenous Australians under 45, contributing 80% of respiratory burden (Figure 9.6.1b). COPD was the leading cause of respiratory burden for those aged 45 and older, contributing 65% of respiratory burden.

Figure 9.6.1: Contribution of individual diseases to respiratory diseases total burden (DALY), Indigenous Australians, 2018



COPD chronic obstructive pulmonary disease.

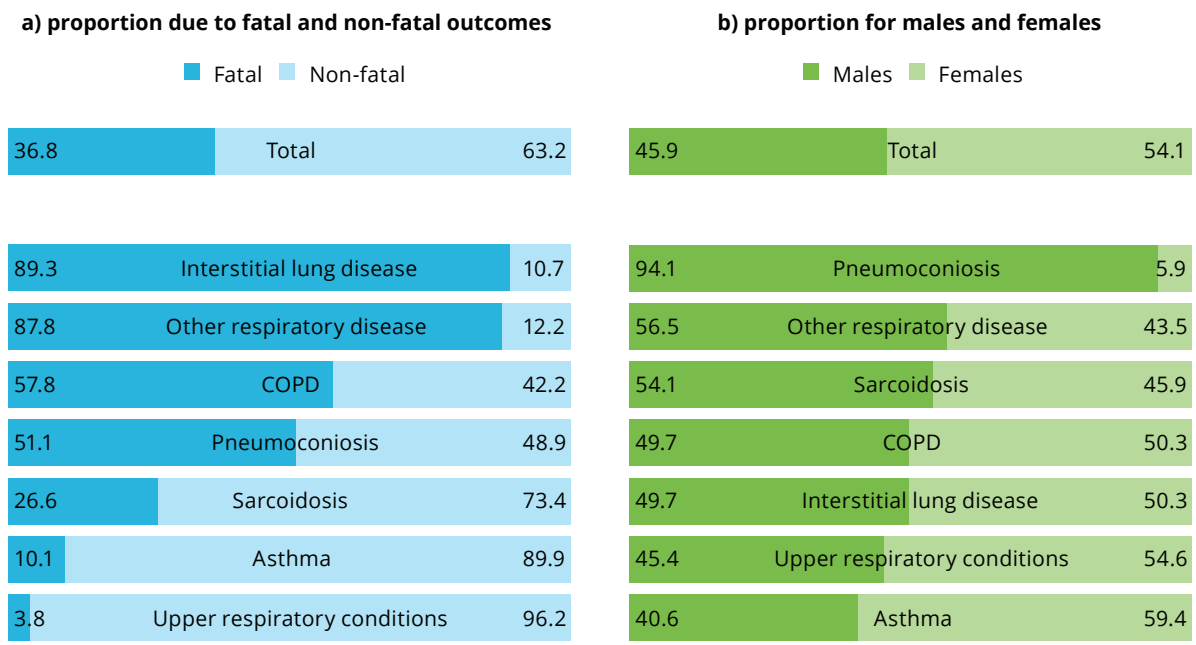
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. Pneumoconiosis includes asbestosis, silicosis and other pneumoconiosis.
3. The residual cause 'Other respiratory diseases' includes bronchiectasis and respiratory disease due to inhalation of chemicals, gases, fumes and vapours. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Almost two-thirds (63%) of respiratory burden was non-fatal (Figure 9.6.2a), the majority of which was due to asthma and COPD (63% and 30% of non-fatal burden, respectively).

Overall, a larger proportion of burden due to respiratory diseases was experienced by Indigenous females (54%) than by Indigenous males (46%) (Figure 9.6.2b). This proportion also differed by the type of respiratory disease. A larger proportion of burden was experienced by Indigenous females for asthma (59%) and upper respiratory conditions (55%). In contrast, Indigenous males experienced almost all of the burden for pneumoconiosis (94%).

Figure 9.6.2: Respiratory burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



COPD chronic obstructive pulmonary disease.

Risk factor contribution

The joint effect of all risk factors combined contributed three-fifths of the burden for respiratory diseases (61%). The majority of this burden was due to tobacco use (47%) (Chapter 5, Table 5.3).

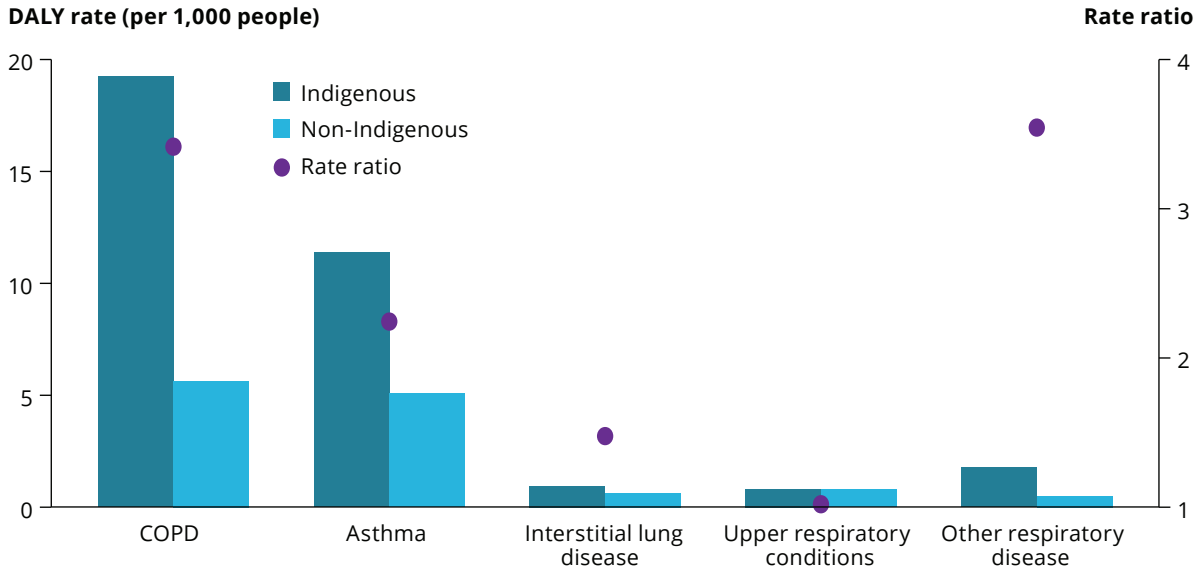
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to respiratory diseases for Indigenous Australians was 2.7 times the rate for non-Indigenous Australians (age-standardised rates of 34 and 13 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for COPD (rate difference of 13.6 DALY per 1,000 people) and asthma (rate difference of 6.3 DALY per 1,000) (Figure 9.6.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for other respiratory diseases (rate ratio of 3.5), COPD (3.4) and asthma (2.2).

Figure 9.6.3: Respiratory diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



COPD chronic obstructive pulmonary disease.
Note: Due to small numbers, data not shown for pneumoconiosis and sarcoidosis.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to respiratory diseases for Indigenous Australians decreased slightly from 38 to 34 DALY per 1,000 people—a decrease of 11%. This was driven by a decrease in the fatal burden (17%), mainly from COPD (decrease of around 1.8 YLL per 1,000) (see Supplementary Table S9.6).

Rates of non-fatal burden due to respiratory diseases remained relatively stable between 2003 and 2018 in the Indigenous population (20 and 19 YLD per 1,000, respectively).

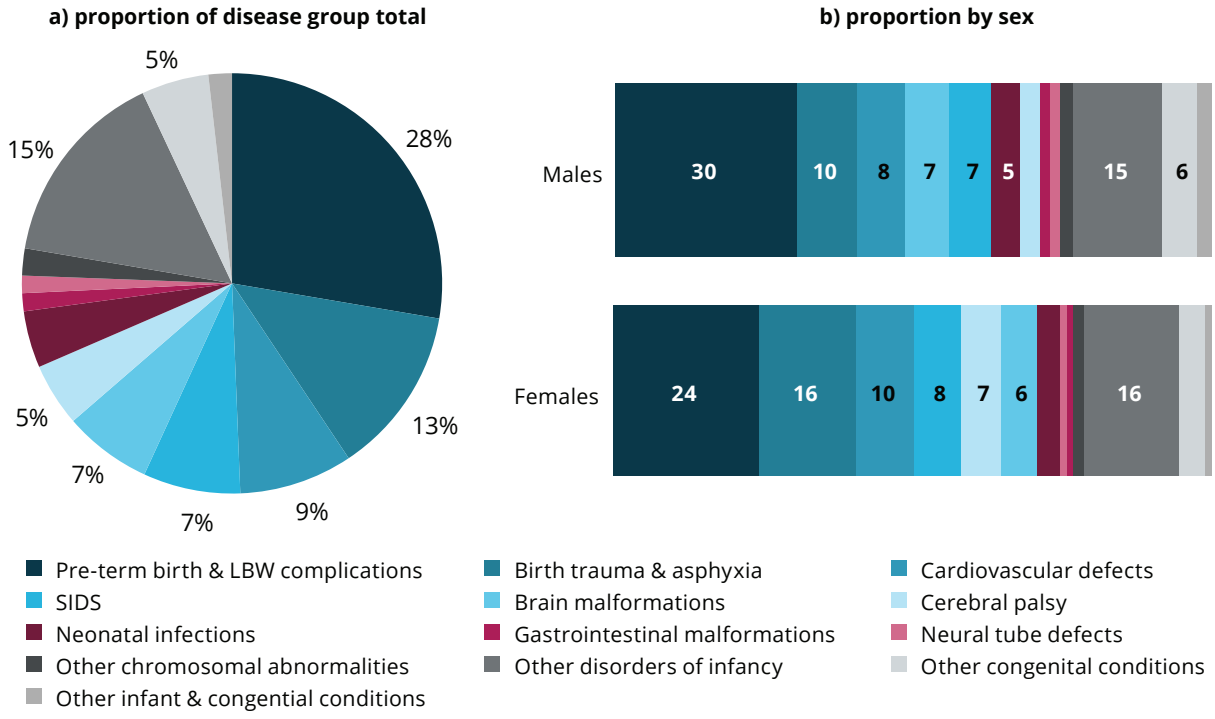
9.7 Infant & congenital conditions

The infant & congenital conditions 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). 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.

Infant & congenital conditions made up 5.1% (12,163 DALY) of total burden, 9.4% (10,613 YLL) of fatal burden and 1.2% (1,550 YLD) of non-fatal burden among Indigenous Australians in 2018. The impact of this disease group primarily occurs during infancy and early childhood (81% of burden was among children under 5), with little ongoing burden at older ages.

The leading causes of infant & congenital burden were pre-term birth & low birthweight (LBW) complications (28%), birth trauma & asphyxia (13%), cardiovascular defects (9%) and sudden infant death syndrome (SIDS) (7%) (Figure 9.7.1a). Overall, a larger proportion of burden due to infant & congenital conditions was experienced by Indigenous males (55%) than by Indigenous females (45%). Pre-term birth & low birthweight complications were responsible for a higher proportion of the burden in Indigenous males (30%) than in Indigenous females (24%), whereas birth trauma & asphyxia was responsible for a higher proportion of the burden in Indigenous females (16% in females, 10% in males) (Figure 9.7.1b).

Figure 9.7.1: Contribution of individual conditions to infant & congenital conditions total burden (DALY), Indigenous Australians, 2018



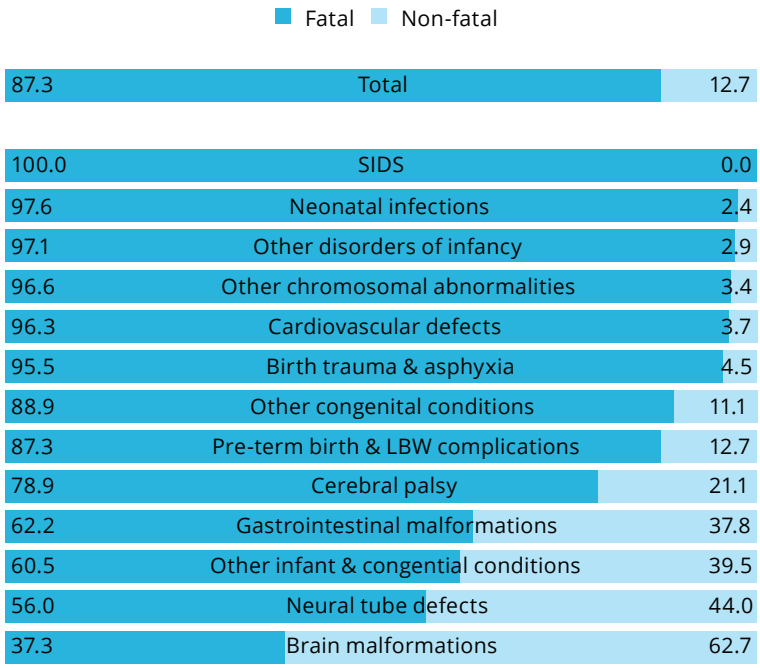
LBW low birthweight; SIDS sudden infant death syndrome.

Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. There are 3 residual causes in this group which each include a range of conditions; 'Other chromosomal abnormalities' (for example, Edwards syndrome and fragile X chromosome), 'Other disorders of infancy' (for example, neonatal diabetes mellitus and umbilical polyp of newborn) and 'Other congenital conditions' (for example, congenital malformations of the respiratory and musculoskeletal systems). See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.
3. The 'Other infant & congenital conditions' category includes Down syndrome, cleft lip and/or palate and urogenital malformations, which together account for 1.8% of DALY due to infant & congenital conditions.

Premature death (fatal burden) was responsible for 87% of the overall burden in Indigenous Australians for this disease group (Figure 9.7.2). This was largely due to deaths within the first year of life, highlighting 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 brain malformations (63%), neural tube defects (44%), gastrointestinal malformations (38%) and cerebral palsy (21%).

Figure 9.7.2: Infant & congenital burden (DALY), proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2018



LBW low birthweight; SIDS sudden infant death syndrome.

Risk factor contribution

Conditions in this disease group were linked to the risk factor low birthweight & short gestation, which accounted for 44% of the burden (Chapter 5, Table 5.3). No other risk factors included in this study were linked to this disease group.

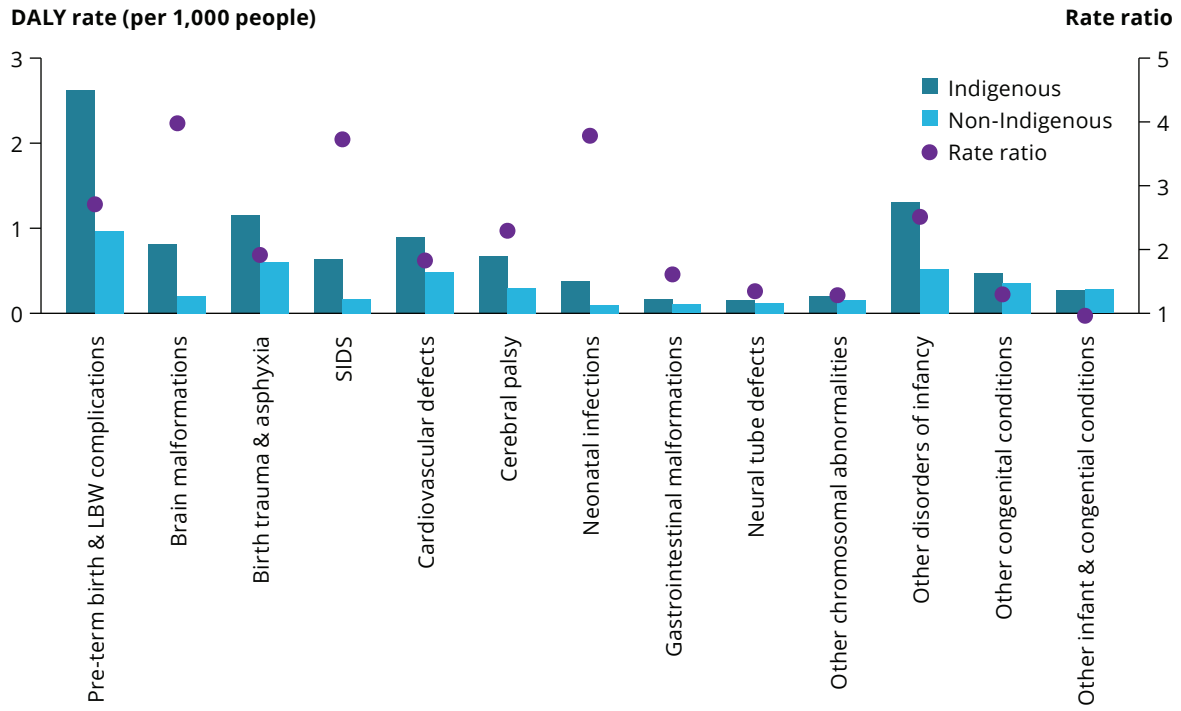
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to infant & congenital conditions for Indigenous Australians was 2.2 times the rate for non-Indigenous Australians (age-standardised rates of 9.7 and 4.4 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for pre-term birth & low birthweight complications (rate difference of 1.7 DALY per 1,000 people) (Figure 9.7.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for brain malformations (rate ratio of 4.0), neonatal infection (3.8) and SIDS (3.7).

Figure 9.7.3: Infant & congenital burden age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



LBW low birthweight; SIDS sudden infant death syndrome.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to infant & congenital conditions for Indigenous Australians decreased slightly from 10.8 to 9.7 DALY per 1,000 people—a decrease of 10%. This was driven by a decrease in the fatal burden (14%), mainly from SIDS (decrease of around 1.0 YLL per 1,000; equivalent to a 61% decrease in YLL) (see Supplementary Table S9.7).

Rates of non-fatal burden due to infant & congenital conditions remained relatively stable between 2003 and 2018 in the Indigenous population (1.7 and 1.9 YLD per 1,000 people, respectively).

9.8 Neurological conditions

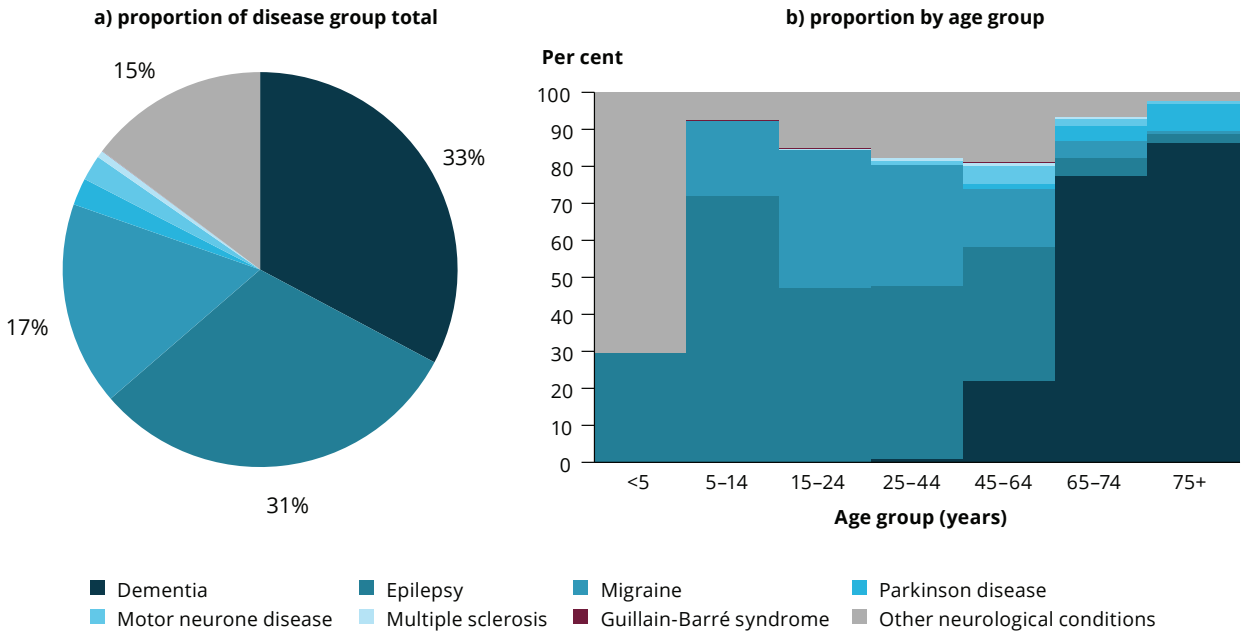
Neurological conditions are diseases and disorders of the central and peripheral nervous system. These include epilepsy, dementia, Parkinson disease, multiple sclerosis, motor neurone disease (which includes amyotrophic lateral sclerosis), migraine and Guillain-Barré syndrome (GBS), along with the residual 'other neurological conditions'. It excludes infections of the nervous system (which are included in infectious diseases) and cerebral palsy (which is included in infant & congenital conditions). Parkinson disease, multiple sclerosis, motor neurone disease and GBS are rare in the Indigenous population.

Neurological conditions made up 4.2% (10,056 DALY) of total burden, 5.0% (6,379 YLD) of non-fatal burden and 3.2% (3,677 YLL) of fatal burden among Indigenous Australians in 2018.

The main causes of neurological conditions burden were dementia (33%) and epilepsy (31%) (Figure 9.8.1a).

The contribution of individual conditions to neurological burden varied across the life course (Figure 9.8.1b). Among Indigenous children under 5, other neurological conditions and epilepsy were the leading causes of neurological burden (70% and 29%, respectively). For ages 15–64, epilepsy (42%) and migraines (25%) were the leading causes of burden. For Indigenous Australians aged 65 and over, dementia (83%) was the leading cause of burden.

Figure 9.8.1: Contribution of individual conditions to neurological conditions total burden (DALY), Indigenous Australians, 2018

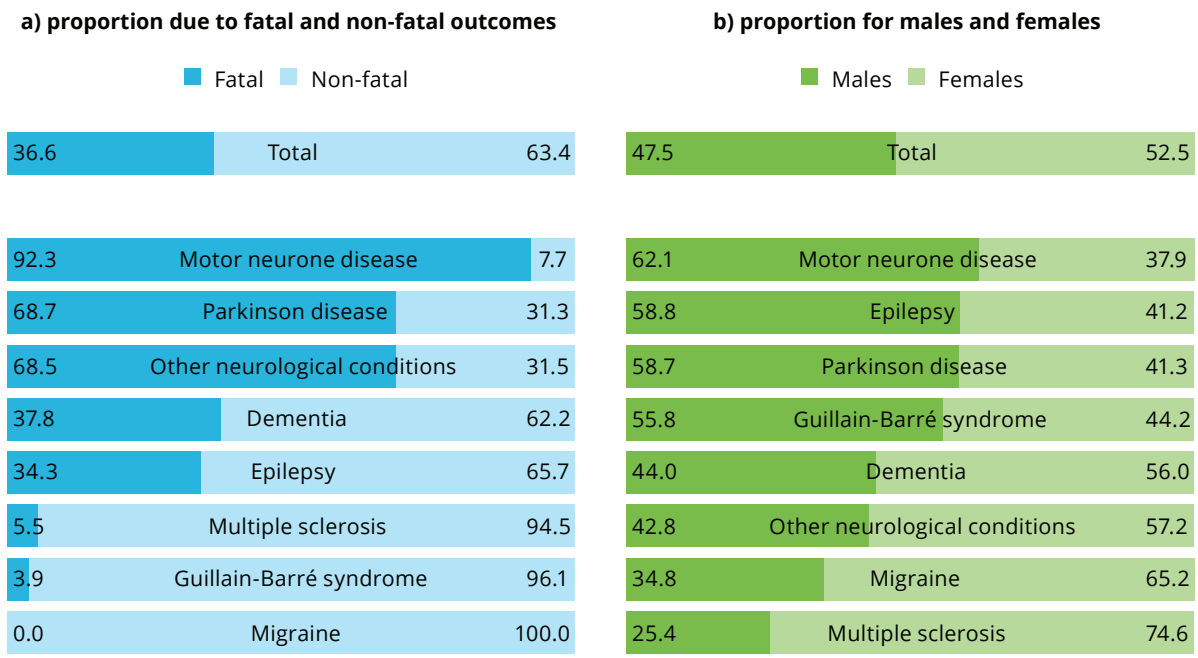


Notes
1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other neurological conditions' includes a range of conditions such as dystonia, narcolepsy and Bell palsy. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

The majority (63%) of burden due to neurological conditions was non-fatal. This is because the most burdensome diseases (dementia, epilepsy and migraine) contributed more non-fatal burden than fatal burden (Figure 9.8.2a).

Overall, a similar proportion of burden due to neurological conditions was experienced by Indigenous males (47%) and females (53%), although the proportion differed by type of condition (Figure 9.8.2b). A larger proportion of burden was experienced by Indigenous females for multiple sclerosis (75%) and migraine (65%). In contrast, Indigenous males experienced a greater proportion of the burden for motor neurone disease (62%), epilepsy (59%) and Parkinson disease (59%).

Figure 9.8.2: Neurological conditions burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The join effect of all risk factors combined accounted for 26% of the burden from neurological conditions. The largest contributors to this were overweight (including obesity) (8.2%) and alcohol use (7.9%) (Chapter 5, Table 5.3).

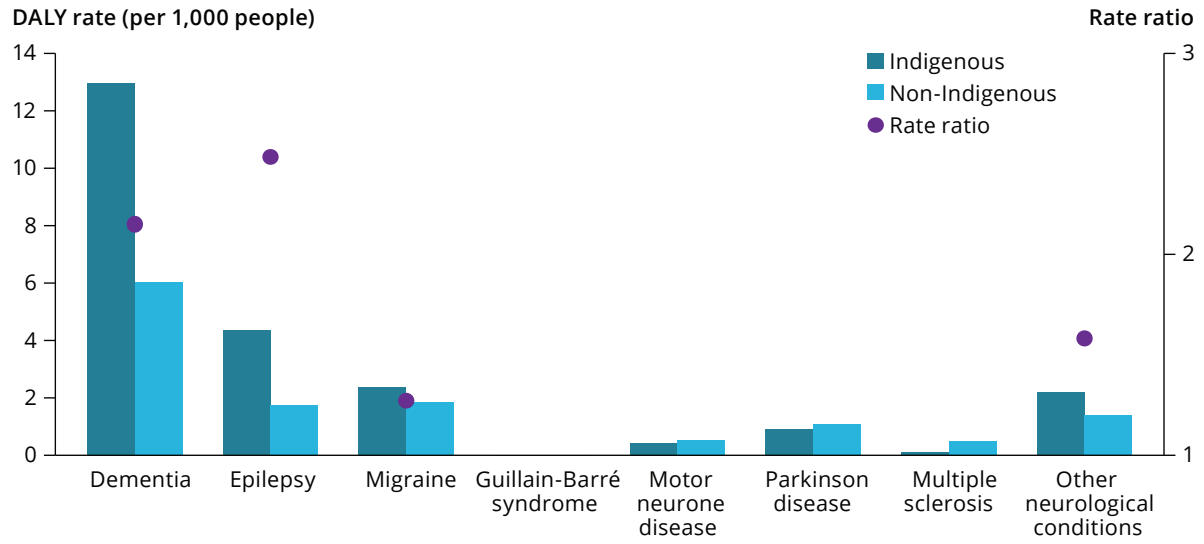
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to neurological conditions for Indigenous Australians was 1.8 times the rate for non-Indigenous Australians (age-standardised rates of 23 and 13 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for dementia (rate difference of 6.9 DALY per 1,000 people) and epilepsy (rate difference of 2.6 DALY per 1,000) (Figure 9.8.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for epilepsy (rate ratio of 2.5) and dementia (2.2).

Figure 9.8.3: Neurological conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Note: Rate ratios not shown on graph if ratio is less than 1.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to neurological conditions for Indigenous Australians remained relatively stable (22 and 23 DALY per 1,000 people, respectively). Over the same period, there was a small increase in the age-standardised rate of fatal burden for this disease group (9.8%), mainly from dementia (increase of around 1.7 YLL per 1,000) (see Supplementary Table S9.8).

Rates of non-fatal burden due to neurological conditions did not change between 2003 and 2018 in the Indigenous population (14 YLL per 1,000 for both reference years).

9.9 Endocrine disorders

The endocrine disorders disease group contains only 3 specific diseases: type 1 diabetes mellitus (diabetes), type 2 diabetes and other diabetes. It excludes gestational diabetes (which is included in reproductive & maternal conditions). The residual group of 'other endocrine disorders' includes thyroid disorders and disorders of other endocrine glands. It excludes polycystic ovarian syndrome (which is included in reproductive & maternal conditions).

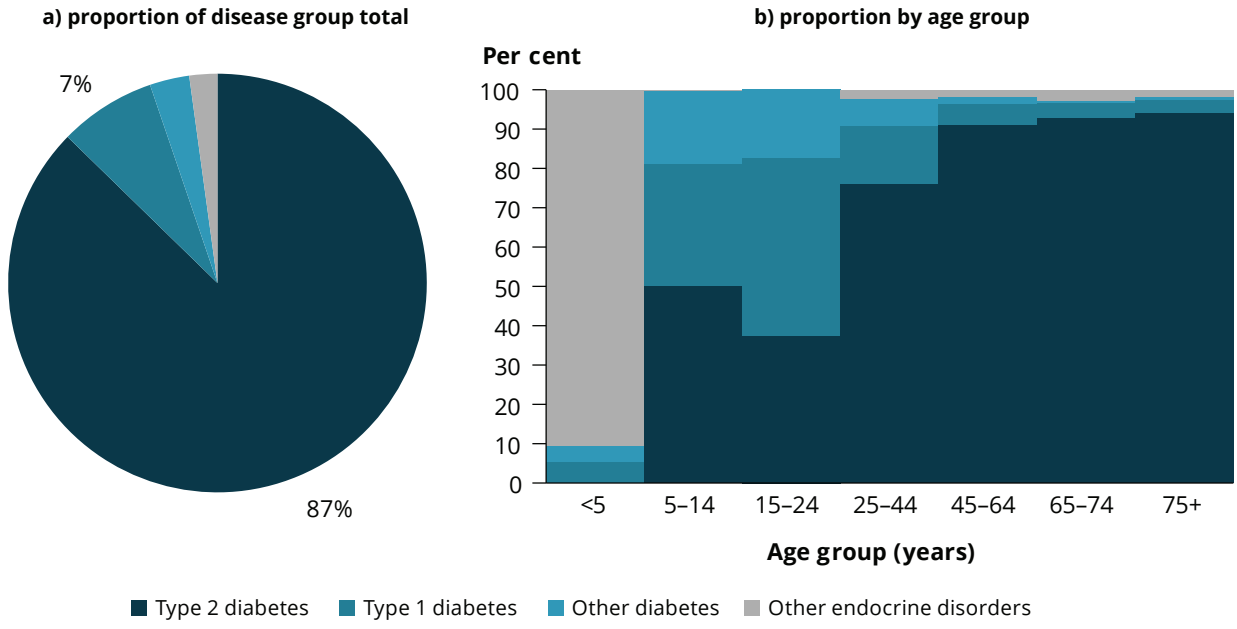
The figures provided here represent the direct impact of endocrine disorders. Diabetes, in particular, is an important risk factor for other diseases such as CHD and chronic kidney disease (CKD). These indirect impacts from diabetes are not included here, but are instead included in the disease group where the disease effects are more immediate—for these examples, in cardiovascular diseases and kidney & urinary diseases, respectively. An estimate of the impact of diabetes on these other diseases can be seen through considering high blood plasma glucose as a risk factor, as presented in Chapter 5.

Endocrine disorders made up 3.3% (7,966 DALY) of total burden, 3.6% (4,507 YLD) of non-fatal burden and 3.0% (3,460 YLL) of fatal burden among Indigenous Australians.

The main cause of endocrine burden was type 2 diabetes (87%) (Figure 9.9.1a).

Among Indigenous Australians, almost all (97%) endocrine burden occurred in those aged 25 and over, with very little burden present in younger age groups (1.1% for 0–14 year olds and 1.5% for 15–24 year olds). Type 2 diabetes was the leading cause of burden for those aged 25 and over (89%) (Figure 9.9.1b).

Figure 9.9.1: Contribution of individual disorders to endocrine disorders total burden (DALY), Indigenous Australians, 2018



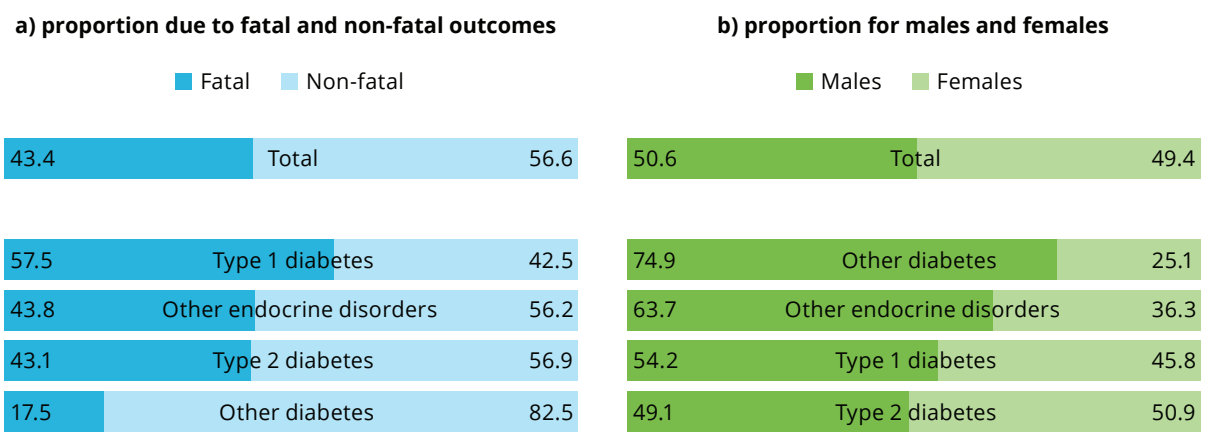
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. 'Other diabetes' includes diabetes due to other conditions, such as genetic disorders, infections, or pancreatic disease. The residual 'Other endocrine disorders' includes thyroid disorders and disorders of other endocrine glands. It excludes polycystic ovarian syndrome (which is included in reproductive & maternal conditions). See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Endocrine disorders caused more non-fatal (57%) than fatal burden (43%) (Figure 9.9.2a).

Overall, the division of burden due to endocrine disorders was fairly even between Indigenous males (51%) and females (49%), although the proportion differed by the type of disorder (Figure 9.9.2b). A larger proportion of burden was experienced by Indigenous males for other diabetes (75%) and other endocrine disorders (64%).

Figure 9.9.2: Endocrine disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The joint effect of all risk factors combined explained nearly all of the burden for endocrine disorders (98%). For this disease group, the biggest risk factors were high blood plasma glucose (98%), overweight (including obesity) (59%) and dietary risks (27%) (Chapter 5, Table 5.3).

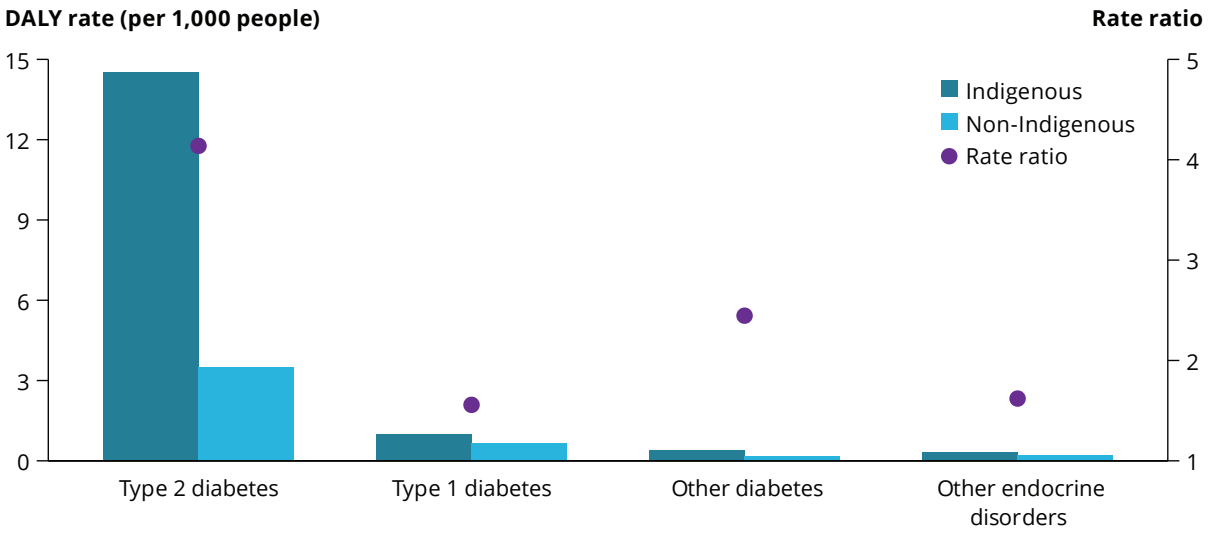
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to endocrine disorders for Indigenous Australians was 3.6 times the rate for non-Indigenous Australians (age-standardised rates of 16.2 and 4.5 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for type 2 diabetes (rate difference of 11 DALY per 1,000 people) (Figure 9.9.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for type 2 diabetes (rate ratio of 4.1) and other diabetes (rate ratio of 2.4).

Figure 9.9.3: Endocrine disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to endocrine disorders for Indigenous Australians decreased from 29 to 16 DALY per 1,000 people—a decrease of 44%. This was driven by a decrease in the fatal burden (63%), mainly from type 2 diabetes (decrease of around 11 YLL per 1,000; equivalent to a 62% decrease in YLL) (see Supplementary Table S9.9).

Rates of non-fatal burden due to endocrine disorders remained relatively stable between 2003 and 2018 in the Indigenous population (8.3 and 8.6 YLD per 1,000, respectively).

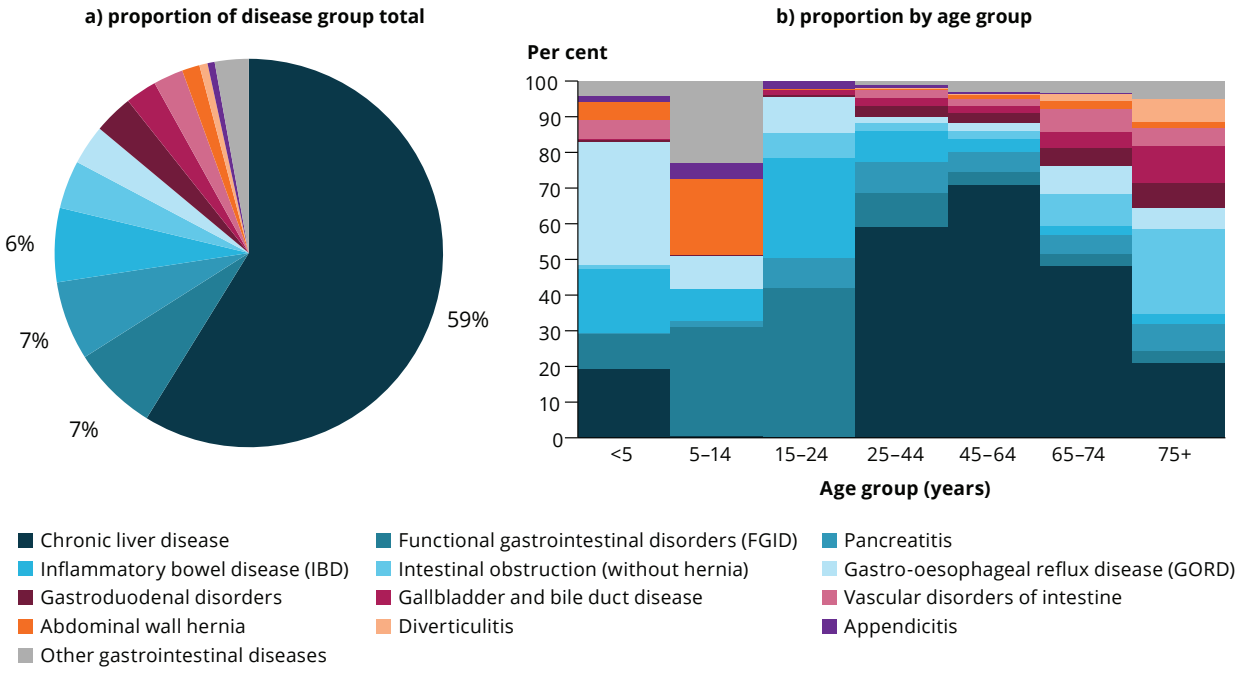
9.10 Gastrointestinal disorders

The gastrointestinal disorders 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 gastrointestinal disorders (included in infant & congenital conditions), gastrointestinal infections (included in infectious diseases; specifically: salmonella, campylobacter, rotavirus and other gastrointestinal infections) and gastrointestinal cancers (included in cancer & other neoplasms).

Gastrointestinal disorders accounted for 3.3% (7,962 DALY) of total burden, 5.7% (6,472 YLL) of fatal burden and 1.2% (1,490 YLD) of non-fatal burden among Indigenous Australians in 2018. The main causes of gastrointestinal burden were chronic liver disease (CLD) (59%), functional gastrointestinal disorders (FGID) (7%) and pancreatitis (7%) (Figure 9.10.1a).

The contribution of individual conditions to gastrointestinal burden varied across the life course (Figure 9.10.1b). Among Indigenous children under 5, gastro-esophageal reflux disorder (GORD) and CLD were the main causes of burden (34% and 19%, respectively). For ages 5–14, FGID (30%), other gastrointestinal disorders (23%) and abdominal wall hernia (21%) were the leading causes of burden. For those aged 15–24, the leading causes of burden were FGID (42%) and inflammatory bowel disease (28%). For those aged 25–64, CLD accounted for over two-thirds (67%) of the total gastrointestinal burden. For those aged 65 and over, the leading causes of gastrointestinal burden were CLD (40%) and intestinal obstruction (without hernia) (13%).

Figure 9.10.1: Contribution of individual disorders to gastrointestinal disorders total burden (DALY), Indigenous Australians, 2018



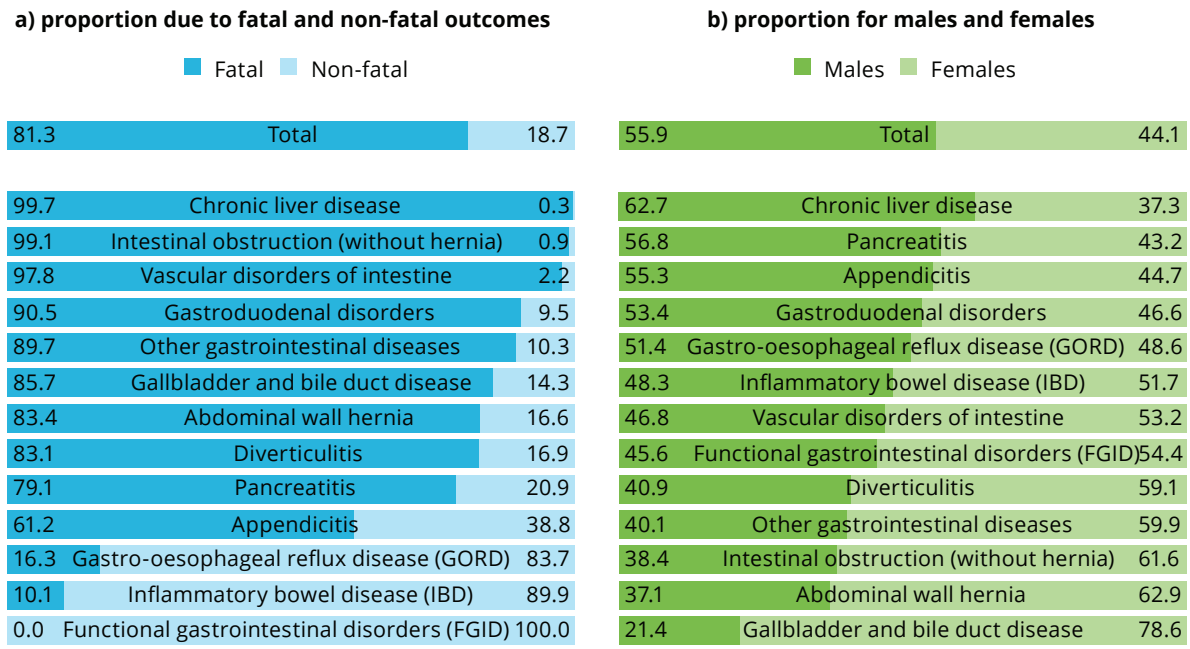
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other gastrointestinal disorders' includes diseases of the oesophagus, dyspepsia, irritable bowel syndrome, coeliac disease and intestinal malabsorption. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

The majority (81%) of burden due to gastrointestinal disorders in Indigenous Australians was fatal burden (Figure 9.10.2a). In particular, CLD, which accounted for 59% of gastrointestinal burden, was almost all fatal burden (99.7%). Conversely, for FGID, which accounted for 7% of gastrointestinal burden, 100% of the burden was non-fatal.

The overall gastrointestinal burden was higher for Indigenous males than females (56% and 44%, respectively) but this varied by disease (Figure 9.10.2b). Indigenous males accounted for a larger proportion of burden due to CLD (63%) and pancreatitis (57%) while Indigenous females experienced a larger proportion of burden due to gallbladder & bile duct disease (79%) and abdominal wall hernia (63%).

Figure 9.10.2: Gastrointestinal disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

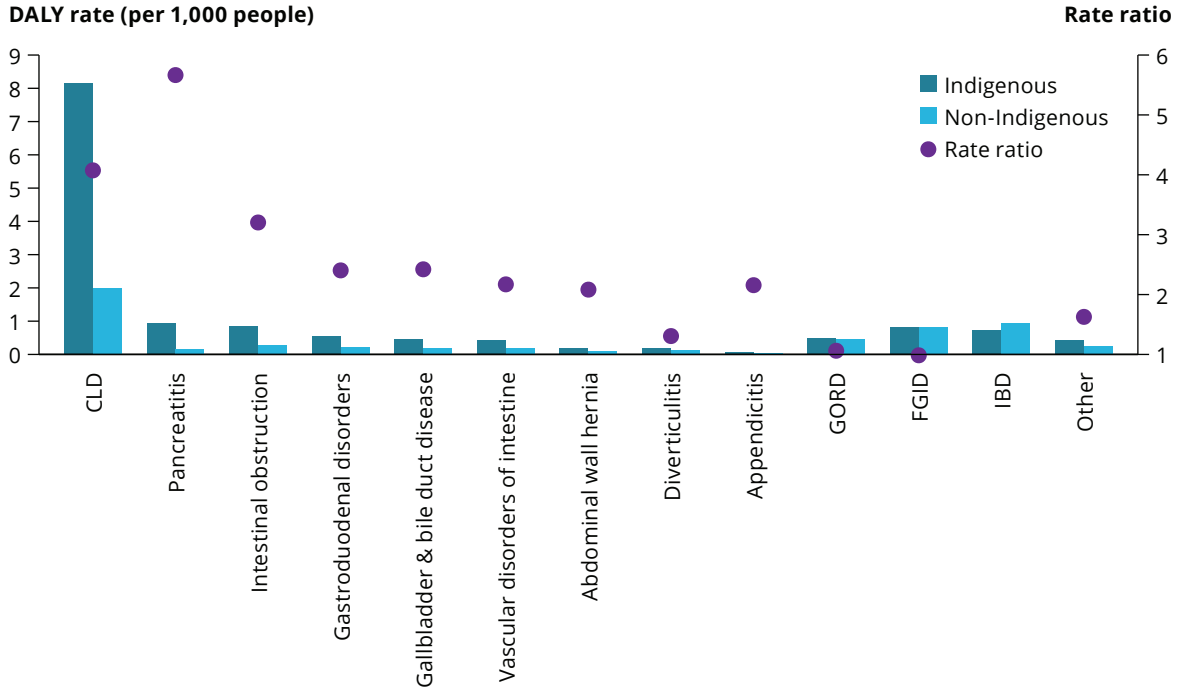
The joint effect of all risk factors combined contributed 28% to the burden for gastrointestinal disorders. For this disease group, the biggest risk factors were drug use (16%) and alcohol use (13%) (Chapter 5, Table 5.3).

Comparisons with non-Indigenous

The age-standardised rate of burden due to gastrointestinal disorders for Indigenous Australians was 2.5 times for the rate for non-Indigenous Australians (age-standardised rates of 14.4 and 5.8 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates for gastrointestinal burden between Indigenous and non-Indigenous Australians was for CLD (rate difference of 6.2 per 1,000 people) (Figure 9.10.3). The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for pancreatitis (rate ratio of 5.7), CLD (4.1) and intestinal obstruction (without hernia) (3.2).

Figure 9.10.3: Gastrointestinal disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



CLD chronic liver disease; GORD gastro-oesophageal reflux disease; FGID functional gastrointestinal disorders; IBD inflammatory bowel disease.

Note: Rate ratios not shown on graph if ratio is less than 1.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to gastrointestinal disorders for Indigenous Australians decreased from 18 to 14 DALY per 1,000 people—a decrease of 21%. This was driven by a decrease in the rate of fatal burden (24%), mainly from CLD (decrease of around 1.6 YLL per 1,000; equivalent to a 16% decrease in YLL) (see Supplementary Table S9.10).

Rates of non-fatal burden due to gastrointestinal disorders were the same in 2003 and 2018 in the Indigenous population (both were 2.3 YLD per 1,000).

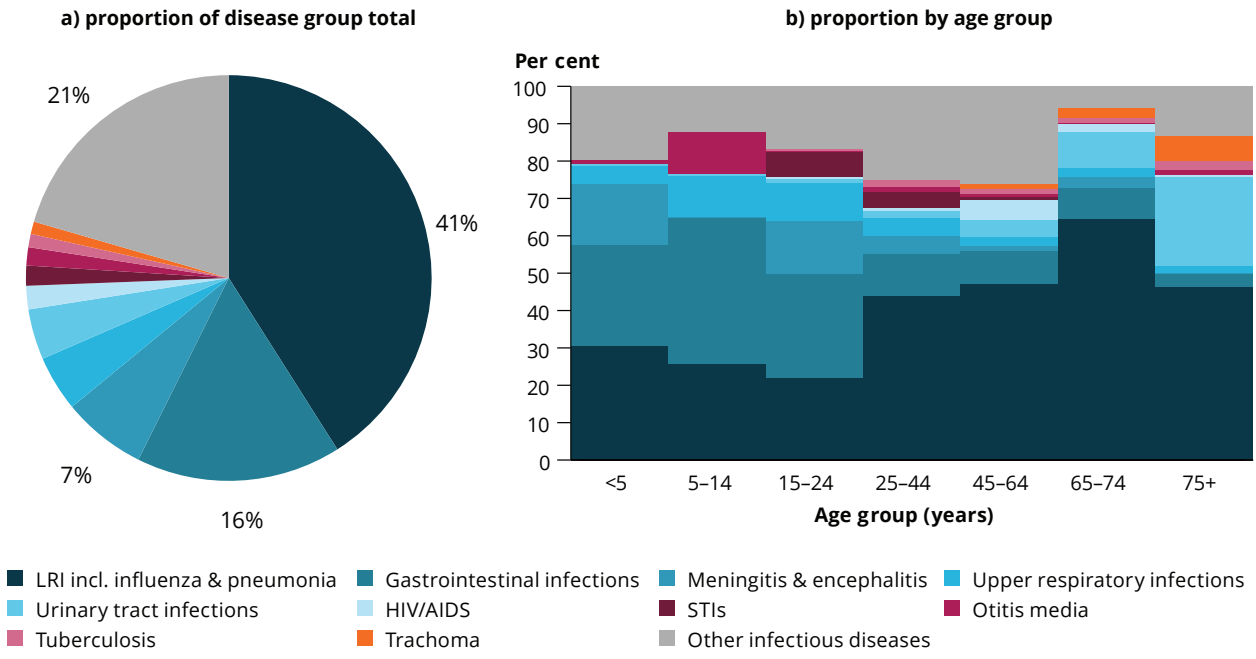
9.11 Infectious diseases

The infectious diseases group includes a wide range of 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 disorders and infant & congenital conditions disease groups, respectively.

Infectious diseases made up 2.7% (6,497 DALY) of total burden, 3.5% (3,986 YLL) of fatal burden and 2.0% (2,511 YLD) of non-fatal burden among Indigenous Australians in 2018. The main causes of infectious disease burden were lower respiratory infections including influenza & pneumonia (41%), gastrointestinal infections (16%) and meningitis & encephalitis (7%) (Figure 9.11.1a).

The contribution of individual diseases to infectious disease burden varied across the life course (Figure 9.11.1b). Among Indigenous children under 15, lower respiratory infections (including influenza & pneumonia) and gastrointestinal infections were the leading causes of infectious diseases burden (accounting for 30% and 29% of the burden in this age group, respectively). For ages 15–64, lower respiratory infections (including influenza & pneumonia) (43%) and gastrointestinal infections (12%) were the leading causes of infectious diseases burden (the residual cause 'other infectious diseases' accounted for 25% of burden in this age group). For people 65 and over, lower respiratory infections (including influenza & pneumonia) (57%) and urinary tract infections (16%) were the leading causes of burden.

Figure 9.11.1: Contribution of individual diseases to infectious diseases total burden (DALY), Indigenous Australians, 2018



LRI lower respiratory infections; HIV/AIDS human immunodeficiency virus/acquired immune deficiency syndrome; STIs sexually transmitted infections.

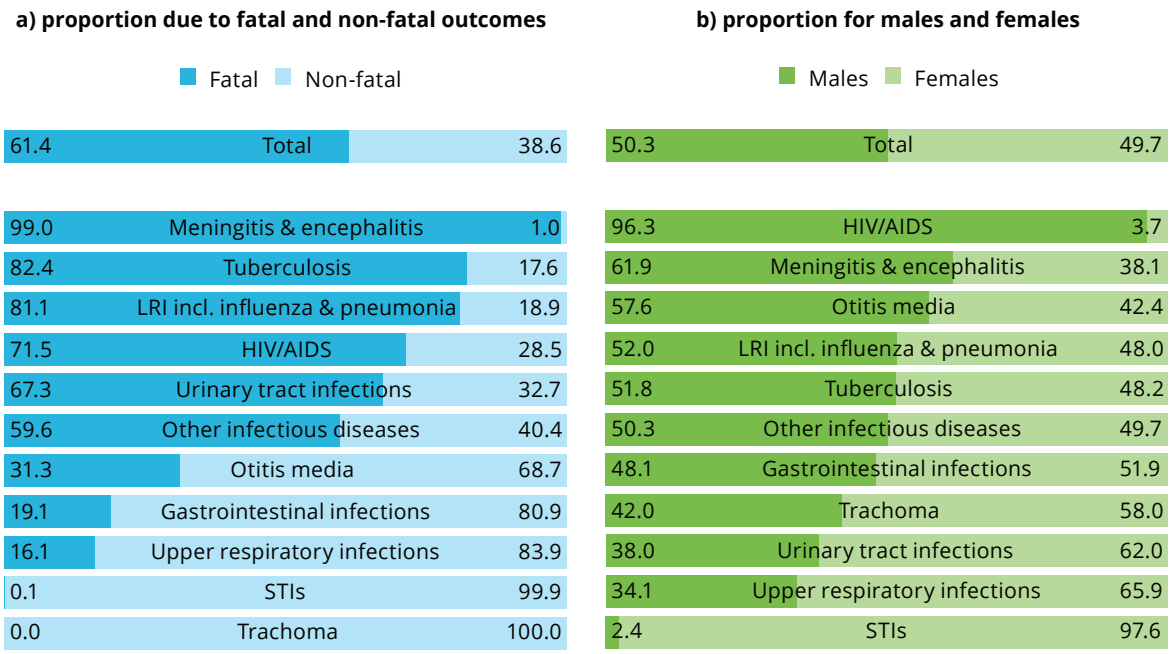
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other infectious diseases' includes hepatitis B (acute), pertussis, herpes-zoster, diphtheria, Ross River virus, dengue, varicella, Barmah Forest virus, hepatitis C (acute), mumps, hepatitis A, rubella, measles, tetanus, malaria and all other infections not specifically listed in other categories. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Over half (61%) of infectious diseases burden was fatal (Figure 9.11.2a), the majority of which was due to lower respiratory infections (including influenza & pneumonia) (54% of fatal burden for infectious diseases). There was considerable variation in the contribution of fatal and non-fatal outcomes to the total infectious diseases burden by cause. For example, premature death was responsible for 99% of the burden due to meningitis & encephalitis but only 16% of the burden due to upper respiratory infections, almost none (0.1%) of the burden due to sexually transmitted infections (STIs) and none of the burden due to trachoma. 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.

Overall, the proportion of burden due infectious diseases was experienced evenly between Indigenous males (50%) and Indigenous females (50%) (Figure 9.11.2b). However, these proportions differed by the type of infectious disease. A larger proportion of burden was experienced by Indigenous males for HIV/AIDS (96%), meningitis & encephalitis (62%) and otitis media (58%). In contrast, Indigenous females experienced a greater proportion of the burden for STIs (98%), upper respiratory infections (66%), urinary tract infections (62%) and trachoma (58%).

Figure 9.11.2: Infectious diseases burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



LRI lower respiratory infections; HIV/AIDS human immunodeficiency virus/acquired immune deficiency syndrome; STIs sexually transmitted infections.

Risk factor contribution

The joint effect of all risk factors combined contributed 24% to the burden for infectious diseases. For this disease group, the biggest risk factors were tobacco use (13%), alcohol use (4.0%) and unsafe sex (3.2%) (Chapter 5, Table 5.3).

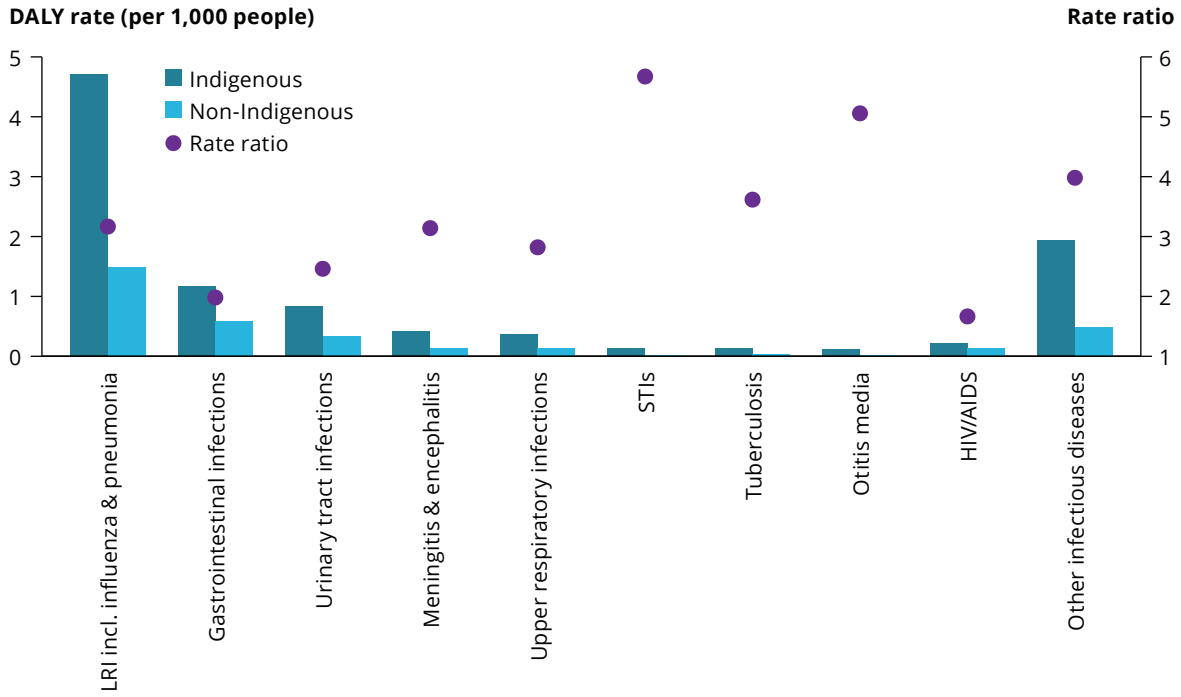
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to infectious diseases for Indigenous Australians was 3 times the rate for non-Indigenous Australians (age-standardised rates of 10.3 and 3.4 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for lower respiratory infections (including influenza & pneumonia) (rate difference of 3.2 DALY per 1,000 people) (Figure 9.11.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for STIs (rate ratio of 5.7), otitis media (5.1), other infectious diseases (4.0) and tuberculosis (3.6).

Figure 9.11.3: Infectious diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



LRI lower respiratory infections; HIV/AIDS human immunodeficiency virus/acquired immune deficiency syndrome; STIs sexually transmitted infections.

Note: Due to the small number of cases in the non-Indigenous population the rate ratio for trachoma is not considered reliable and is therefore not shown on the graph.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to infectious diseases for Indigenous Australians decreased from 16 to 10 DALY per 1,000 people—a decrease of 36%. This was driven by a decrease in the fatal burden (45%), mainly from lower respiratory infections (including influenza & pneumonia) (decrease of around 3.9 YLL per 1,000; equivalent to a 49% decrease in YLL) (see Supplementary Table S9.11).

Rates of non-fatal burden due to infectious diseases in the Indigenous population decreased slightly between 2003 and 2018 (from 3.7 to 3.4 YLD per 1,000).

9.12 Kidney & urinary diseases

The kidney & urinary disease group includes chronic kidney disease (CKD), enlarged prostate, interstitial nephritis, kidney stones and the residual group 'other kidney & urinary diseases'.

It is important to note that the results provided here represent the direct impact of kidney and urinary diseases. CKD, in particular impaired kidney function, 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. Indirect effects can be estimated in some cases by considering impaired kidney function as a risk factor for other diseases, as presented in Chapter 5.

CKD is a substantial health problem in Indigenous Australians. CKD among Indigenous Australians is multifactorial, and many of its risk factors are associated with social disadvantage and accelerated lifestyle change (Hoy et al. 1998). Indigenous Australians—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 Indigenous Australians are high, with prevalence rates twice those of non-Indigenous Australians (ABS 2014).

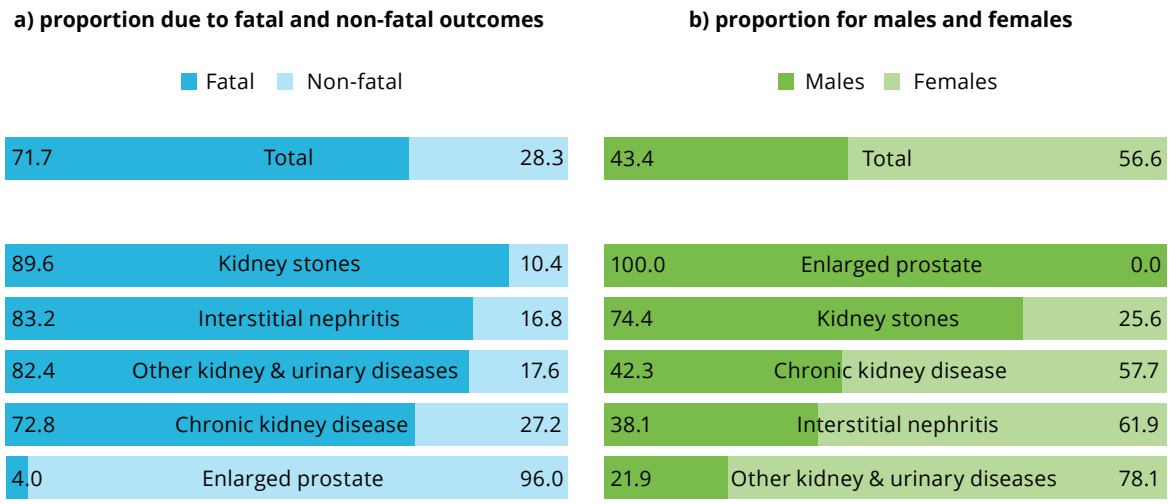
Although end-stage kidney disease—the most severe form of CKD—usually occurs in older age, in Indigenous Australians it occurs more often in middle age. The need for dialysis, which involves strict treatment protocols and frequent treatment—normally 4–5 hour sessions 3 times per week for in-centre dialysis—has 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).

Kidney & urinary diseases accounted 2.7% (6,398 DALY) of total burden, 4.0% (4,589 YLL) of fatal burden and 1.4% (1,809 YLD) of non-fatal burden among Indigenous Australians in 2018. CKD was the largest contributor to burden due to kidney & urinary diseases, accounting for 95% of the total burden.

Almost three-quarters (72%) of burden due to kidney & urinary diseases was fatal burden (Figure 9.12.1a), the majority of which was due to CKD (96% of fatal burden for kidney & urinary diseases). Premature death was responsible for the majority of burden across all kidney & urinary diseases with the exception of enlarged prostate where only 4% of the burden was fatal.

Overall, burden due to kidney & urinary diseases was higher for Indigenous females than males (57% and 43%, respectively), but this varied by disease (Figure 9.12.1b). Indigenous females accounted for a larger proportion of burden due to other kidney & urinary diseases (78%), interstitial nephritis (62%) and CKD (58%) while Indigenous males experienced a larger proportion of the burden due to kidney stones (74%) and all of the burden due to enlarged prostate.

Figure 9.12.1: Contribution of individual diseases to kidney & urinary diseases total burden (DALY), Indigenous Australians, 2018

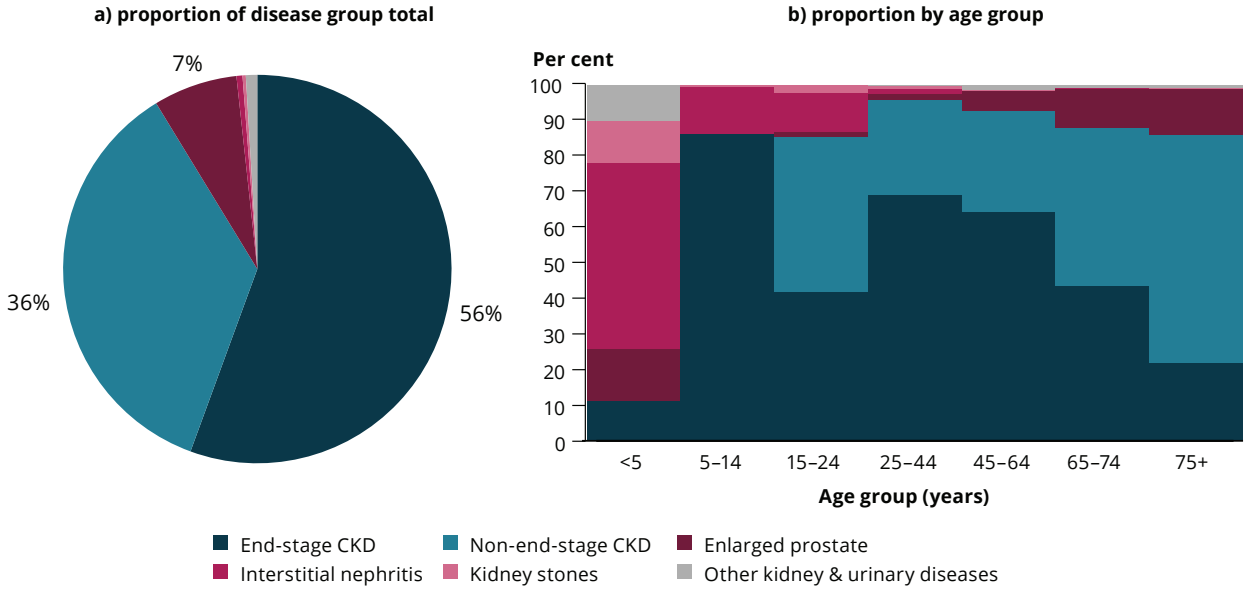


Non-fatal burden

CKD accounted for 91% of the non-fatal burden due to kidney & urinary diseases experienced by Indigenous Australians in 2018. CKD can be split into end-stage and non-end-stage disease, which, respectively, accounted for 56% and 36% of the non-fatal burden due to kidney & urinary diseases (Figure 9.12.2a).

The majority (86%) of non-fatal kidney & urinary burden among Indigenous Australians occurred in those aged 45 and over. End-stage CKD was the largest cause of non-fatal burden among those aged 45–64, accounting for almost two-thirds (64%) of the non-fatal burden (Figure 9.12.2b). However, for those aged 65 and over, non-end-stage CKD was the largest cause of non-fatal burden, accounting for just over half (51%) of the non-fatal burden.

Figure 9.12.2: Kidney & urinary disease non-fatal (YLD) burden, contribution of sequelae, Indigenous Australians, 2018



CKD chronic kidney disease.

Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other kidney & urinary diseases' includes a range of diseases such as cystitis, stress incontinence and acute prostatitis. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Risk factor contribution

The joint effect of all risk factors combined contributed most of the burden for kidney & urinary diseases (95%). For this disease group, the biggest risk factors were impaired kidney function (95%) and overweight (including obesity) (52%) (Chapter 5, Table 5.3).

Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to kidney & urinary diseases for Indigenous Australians was over 6 times the rate for non-Indigenous Australians (age-standardised rates of 14.0 and 2.2 DALY per 1,000 people, respectively) (Table 9.12.1).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for CKD (rate difference of 11.5 DALY per 1,000 people) (Table 9.12.1). CKD also accounted for the largest relative difference in age-standardised DALY rates between Indigenous and non-Indigenous Australians (rate ratio of 8.0).

Table 9.12.1: Age-standardised rates of total burden (DALY per 1,000 people) for kidney & urinary diseases, by Indigenous status & disease, 2018

	Indigenous rate (DALY per 1,000 people)	Non-Indigenous rate (DALY per 1,000 people)	Rate ratio	Rate difference
Chronic kidney disease	13.2	1.7	8.0	11.5
Interstitial nephritis	0.1	—	3.1	0.1
Kidney stones	0.1	—	3.4	0.1
Enlarged prostate	0.4	0.4	0.9	0.0
Other kidney & urinary diseases	0.2	0.1	2.7	0.1
Total kidney & urinary	**14.0**	**2.2**	**6.3**	**11.8**

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to kidney & urinary diseases for Indigenous Australians increased from 12 to 14 DALY per 1,000 people—an increase of 17%. This was driven by increases in both the fatal and non-fatal burden (increases of around 1.2 YLL per 1,000 and 0.9 YLD per 1,000, respectively). The increases seen in fatal and non-fatal burden were mainly due to increases in CKD (increases of around 1.5 YLL per 1,000 and 0.9 YLD per 1,000, respectively) (see Supplementary Table S9.12).

9.13 Hearing & vision disorders

Hearing & vision disorders include the burden of visual disorders, hearing loss and auditory system disorders (for example, Meniere disease). Vision disorders include vision loss due to refractive error, cataract, glaucoma and age-related macular degeneration, as well as vision loss and visual disturbance due to other causes such as eye injuries. The burden of hearing loss includes all conditions leading to long-term hearing impairment.

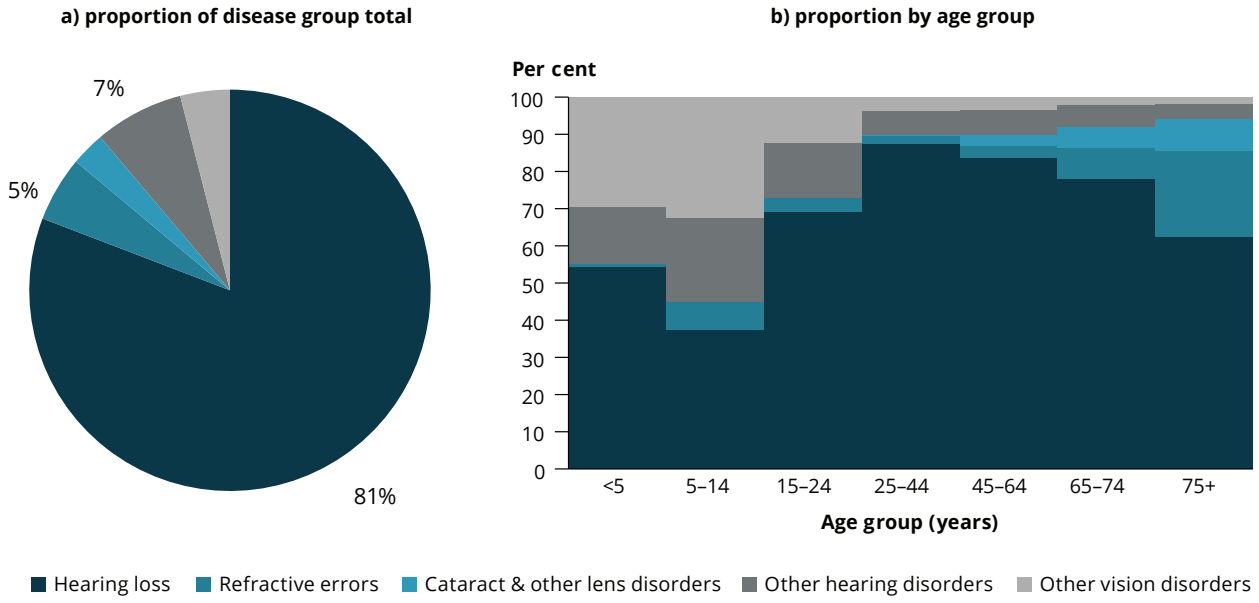
Eye and ear cancers are included in the cancer & other neoplasms group, and eye and ear infections (for example, trachoma and otitis media) in the infectious diseases group. Non-permanent hearing loss due to otitis media in children (which may last several months) is also captured in the infectious diseases group. Visual impairment caused by trachoma and diabetes are captured in their respective diseases.

Hearing & vision disorders made up 2.4% (5,833 DALY) of total burden among Indigenous Australians in 2018. Conditions in this disease group do not directly cause death; however, it is acknowledged that vision loss may be associated with increased risk of mortality (Ehrlich et al. 2021). Therefore, DALY estimates are equal to the YLD estimates for this disease group.

Hearing loss accounted for 81% of the total burden for hearing & vision disorders in Indigenous Australians in 2018 (Figure 9.13.1a).

Hearing loss was the largest cause of hearing & vision burden across all age groups, ranging from 38% of burden in 5–14 year olds to 88% of burden in 25–44 year olds (Figure 9.13.1b). The contribution of refractive errors and cataract & other lens disorders to hearing & vision burden increased with age—contributing almost a third (32%) of burden among Indigenous Australians 75 and over.

Figure 9.13.1: Contribution of individual disorders to hearing & vision disorders total burden (DALY), Indigenous Australians, 2018

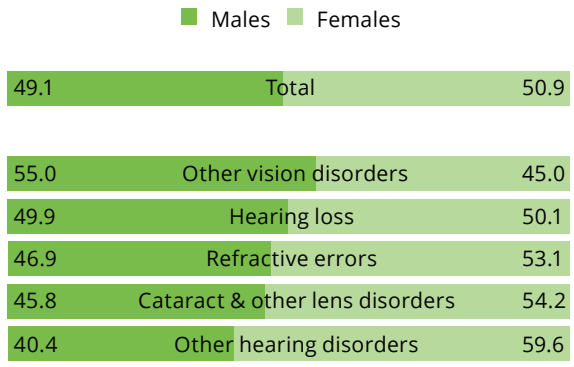


Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The group 'Other vision disorders' includes a range of disorders such as age-related macular degeneration, glaucoma, vision loss due to eye injuries and disorders of the vitreous body while 'Other hearing disorders' includes otitis externa and diseases of the inner ear. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

The overall burden from hearing & vision disorders was similar in Indigenous males (49%) and females (51%) (Figure 9.13.2). Indigenous females experienced more burden from refractive errors (53%) and cataract & other lens disorders (54%) than Indigenous males (47% and 46%, respectively); however, this is due to more women living to older ages as opposed to the disorder occurring more in females.

Figure 9.13.2: Hearing & vision disorders burden (DALY), by disease: proportion for males and females, Indigenous Australians, 2018



Risk factor contribution

All risk factors combined accounted for 13% of the hearing & vision disorders burden in 2018. The risk factors linked to this disease group were occupational exposures & hazards (12%), tobacco use, overweight (including obesity) and high blood plasma glucose (each 0.4%) (Chapter 5, Table 5.3).

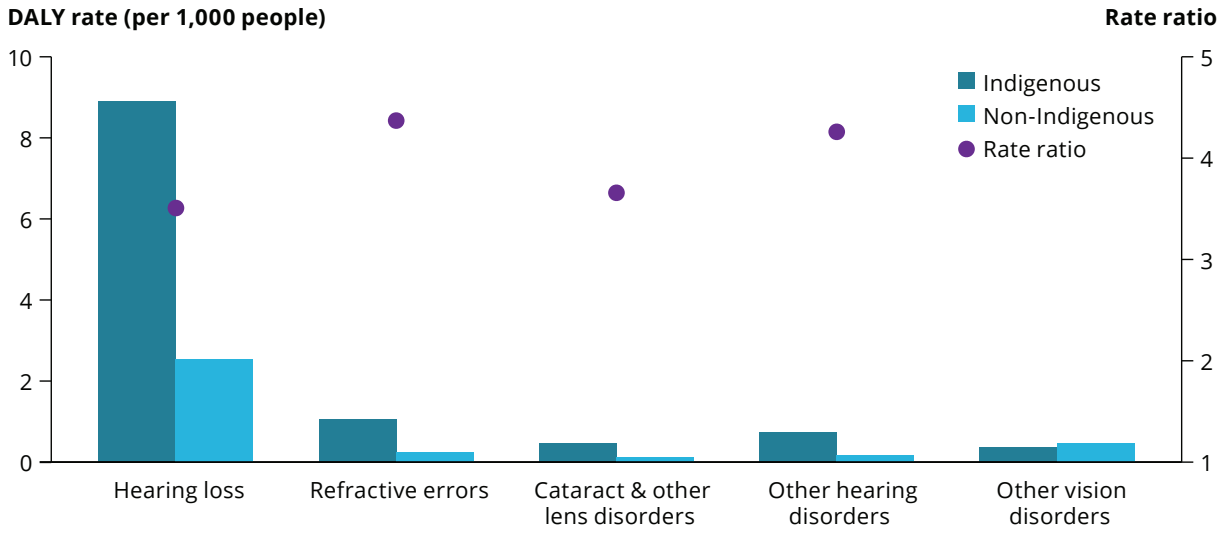
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to hearing & vision disorders for Indigenous Australians was 3.3 times the rate for non-Indigenous Australians (age-standardised rates of 11.5 and 3.5 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for hearing loss (rate difference of 6.4 DALY per 1,000 people), (Figure 9.13.3).

The relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were similar for refractive errors (rate ratio of 4.4), other hearing disorders (4.3), cataract & other lens disorders (3.7) and hearing loss (3.5).

Figure 9.13.3: Hearing & vision disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Note: Rate ratios not shown on graph if ratio is less than 1.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to hearing & vision disorders among Indigenous Australians decreased from 15 to 12 DALY per 1,000 people—a decrease of 23%. This was mainly driven by a decrease in the burden due to hearing loss (decrease of around 2.4 YLD per 1,000; equivalent to a 21% decrease in YLD) (see Supplementary Table S9.13).

9.14 Oral disorders

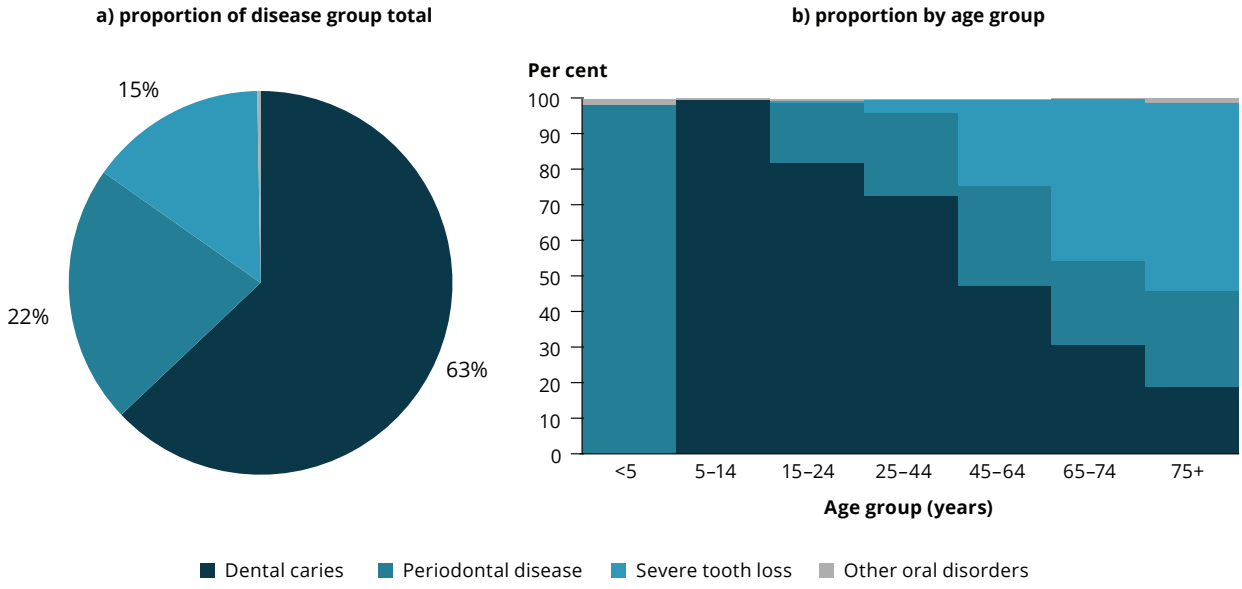
The oral disorders disease group includes burden due to dental caries & pulpitis, periodontal disease, tooth loss, embedded and impacted teeth, and diseases of the salivary glands, lips, oral mucosa and tongue. Dental caries includes burden due to failed restorations (for example, when a filling fails and the original decay is re-exposed). The 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.

Oral disorders contributed 2.1% (4,952 DALY) of total burden, 3.9% (4,917 YLD) of non-fatal burden and almost no fatal burden (36 YLL, 0.03% of fatal burden) among Indigenous Australians in 2018.

Dental caries made up the majority (63%) of the burden due to oral disorders, followed by periodontal disease (22%) and severe tooth loss (15%) (Figure 9.14.1a).

The contribution of individual conditions to the total burden due to oral disorders varied across the life course (Figure 9.14.1b). Periodontal disease was the most prominent cause of burden among Indigenous children under the age of 5 (98%) while dental caries accounted for almost all the burden among those aged 5–14 (99.7%). For ages 15–64, dental caries and periodontal disease were the leading causes of burden (65% and 24%, respectively). Conversely, for those aged 65 and over, severe tooth loss was the leading cause of burden (48%), followed by dental caries (27%) and periodontal disease (25%).

Figure 9.14.1: Contribution of individual conditions to oral disorders total burden (DALY), Indigenous Australians, 2018



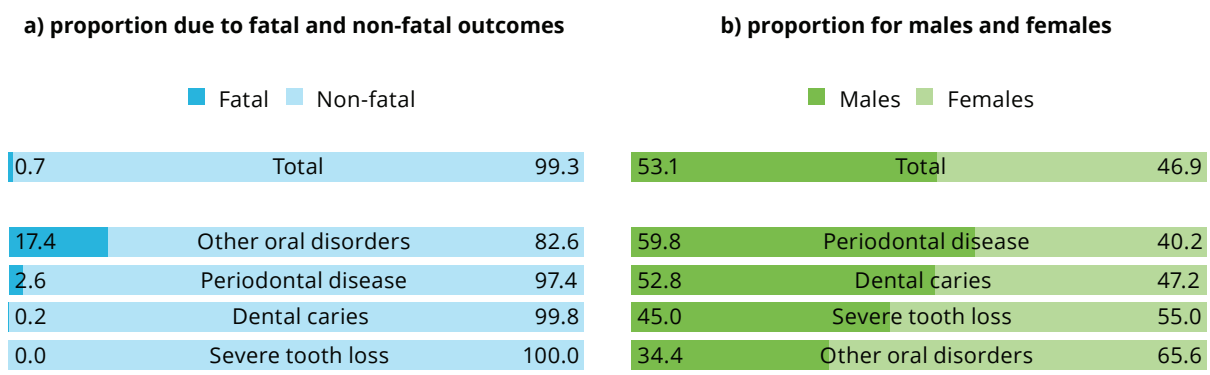
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other oral disorders' includes disorders of tooth development and eruption, embedded and impacted teeth, other diseases of hard tissues of teeth, other disorders of gingiva and edentulous alveolar ridge, dentofacial anomalies [including malocclusion], other disorders of teeth and supporting structures, cysts of oral region, not elsewhere classified, other diseases of jaws, diseases of salivary glands, stomatitis and related lesions, other diseases of lip and oral mucosa, diseases of tongue. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Almost all of the burden due to oral disorders was non-fatal (99.3%) (Figure 9.14.2a).

Indigenous males experienced more burden due to oral disorders than Indigenous females (53% and 47%, respectively). A larger proportion of burden was experienced by Indigenous males for periodontal disease and dental caries (60% and 53%) while Indigenous females experienced a larger proportion of burden for other oral disorders and severe tooth loss (66% and 55%, respectively) (Figure 9.14.2b).

Figure 9.14.2: Oral disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

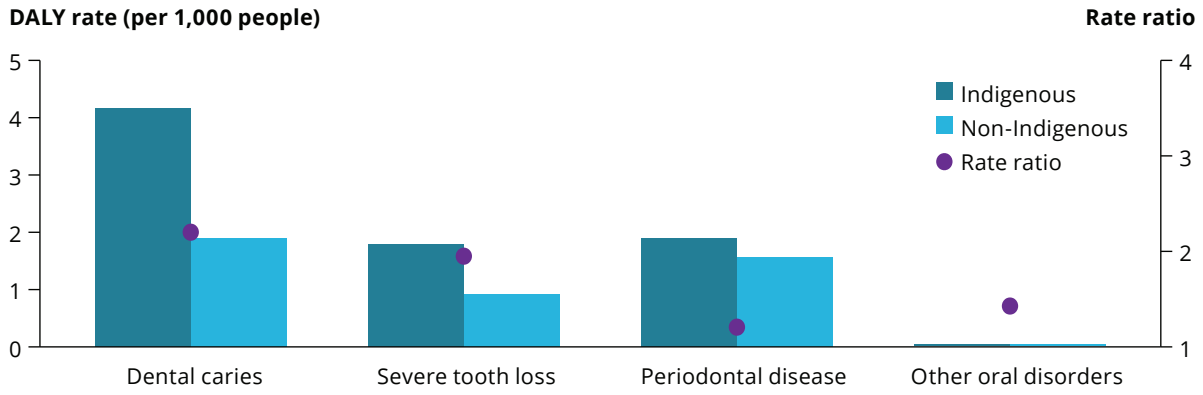
None of the risk factors considered in this study were linked to the conditions in this disease group.

Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to oral disorders for Indigenous Australians was 1.8 times the rate for non-Indigenous Australians (age-standardised rates of 7.9 and 4.4 DALY per 1,000 people, respectively).

The largest absolute difference in DALY rates between Indigenous and non-Indigenous Australians was observed for dental caries (rate difference of 2.3 DALY per 1,000 people) (Figure 9.14.3). Dental caries also accounted for the largest relative difference in age-standardised DALY rates between Indigenous and non-Indigenous Australians (rate ratio of 2.2).

Figure 9.14.3: Oral disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to oral disorders for Indigenous Australians increased from 6.7 to 7.9 DALY per 1,000 people—an increase of 17%. This was driven by an increase in the non-fatal burden (17%), mainly from dental caries (increase of around 0.6 YLD per 1,000; equivalent to a 16% increase in YLD) and periodontal disease (increase of around 0.5 YLD per 1,000; equivalent to a 41% increase in YLD) (see Supplementary Table S9.14).

There was little or no fatal burden due to oral disorders in either year.

9.15 Blood & metabolic disorders

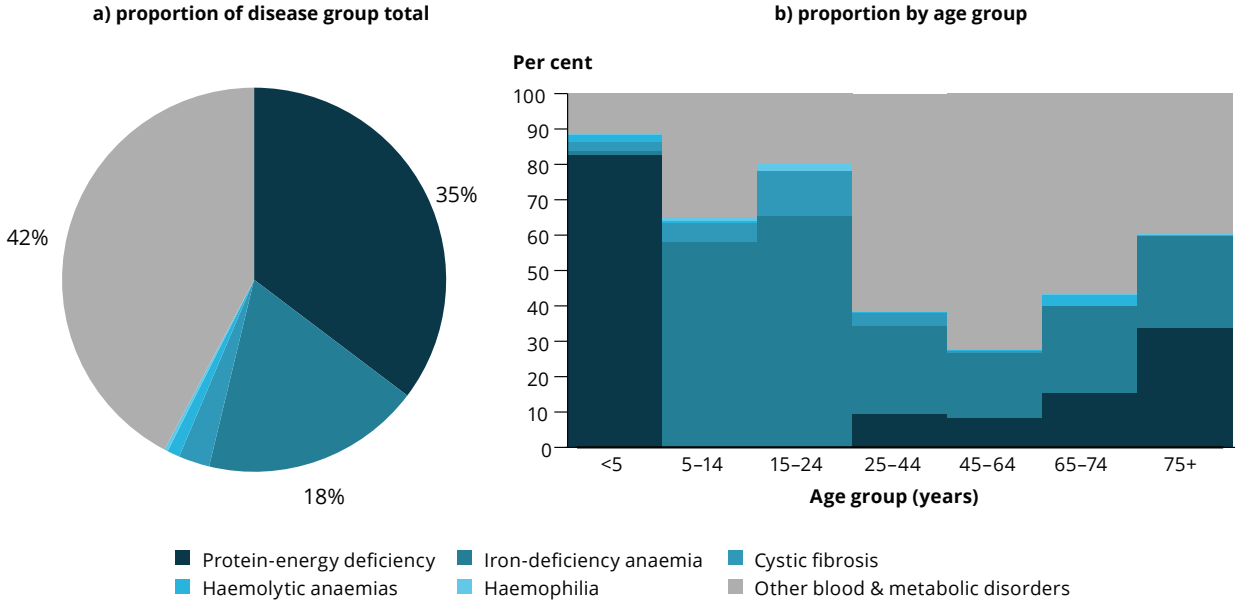
Blood & metabolic disorders capture the burden from bleeding conditions, nutritional disorders and conditions affecting immune or metabolic processes. Diseases not included in this group include leukaemia and other blood cancers (refer to cancer & other neoplasms), infections that lower immunity (HIV/AIDS; 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 anaemias, 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.

In 2018, blood & metabolic disorders accounted for 1.6% (3,789 DALY) of total burden in Indigenous Australians. The main causes of blood & metabolic burden were other blood & metabolic disorders (42%), protein-energy deficiency (35%) and iron-deficiency (18%) (Figure 9.15.1a).

The contribution of individual conditions to the total burden due to blood & metabolic disorders varied across the life course (Figure 9.15.1b). Among Indigenous children under 5, protein-energy deficiency (83%) was the leading cause of blood & metabolic burden. Iron-deficiency anaemia was the leading cause of blood & metabolic burden for ages 5–24 (63% of blood & metabolic burden). Other blood & metabolic disorders accounted for over half of the burden among Indigenous Australians 25 and over.

Figure 9.15.1: Contribution of individual conditions to blood & metabolic disorders total burden (DALY), Indigenous Australians, 2018

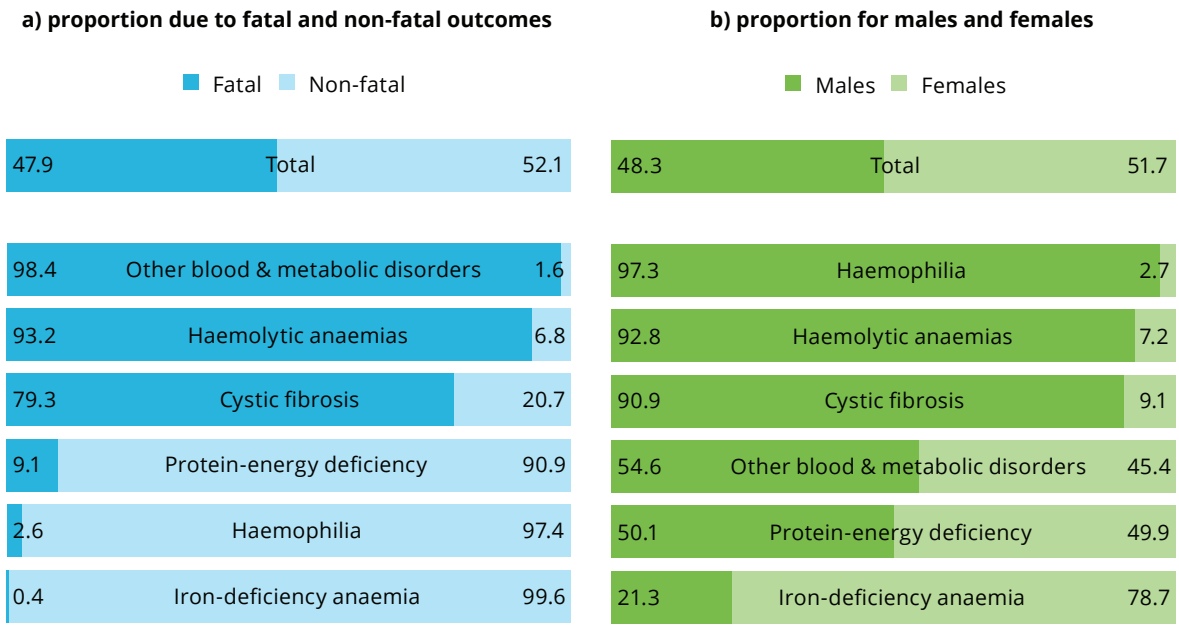


Notes
1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other blood & metabolic disorders' includes a range of diseases such as nutritional anaemias (excluding iron-deficiency anaemia), acquired haemolytic anaemias, coagulation defects, immune mechanism disorders, mineral or vitamin deficiencies and metabolic disorders. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

A slightly larger proportion of burden due to blood & metabolic disorders was non-fatal compared to fatal (52% and 48%, respectively) (Figure 9.15.2a). The majority of the non-fatal burden was due to protein-energy deficiency and iron-deficiency anaemia (62% and 35%, respectively).

There were notable differences between males and females. Overall, a similar proportion of burden due to blood & metabolic disorders was experienced by Indigenous males (52%) and females (48%), although this proportion differed by the type of disorder (Figure 9.15.2b). A larger proportion of burden was experienced by Indigenous females for iron-deficiency anaemia (79%) while Indigenous males experienced a larger proportion of burden for haemophilia (97%), haemolytic anaemias (93%) and cystic fibrosis (91%).

Figure 9.15.2: Blood & metabolic disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

The only risk factor associated with blood & metabolic disorders in the current study was iron deficiency, which contributed 18% to the burden for this disease group (Chapter 5, Table 5.3).

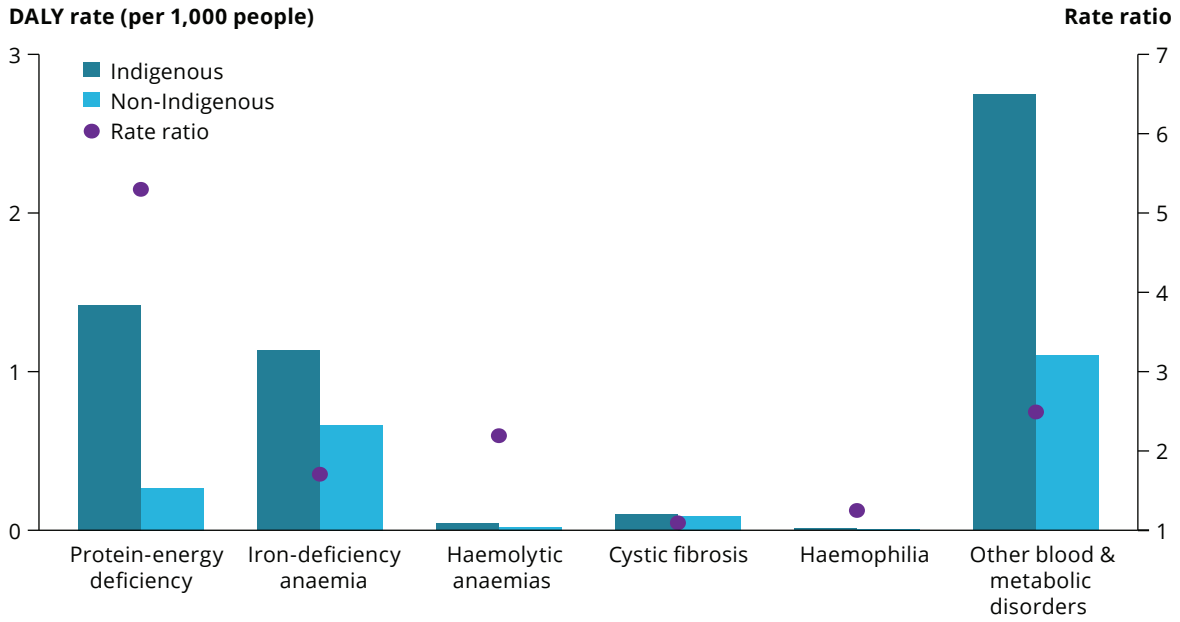
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to blood & metabolic disorders for Indigenous Australians was 2.5 times the rate for non-Indigenous Australians (age-standardised rates of 5.5 and 2.2 DALY per 1,000 people, respectively).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for other blood & metabolic disorders (rate difference of 1.6 DALY per 1,000 people) and protein-energy deficiency (rate difference of 1.2 DALY per 1,000) (Figure 9.15.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for protein-energy deficiency (rate ratio of 5.3), other blood & metabolic disorders (rate ratio of 2.5) and haemolytic anaemias (rate ratio of 2.2).

Figure 9.15.3: Blood & metabolic disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to blood & metabolic disorders for Indigenous Australians remained relatively stable (5.6 and 5.5 DALY per 1,000 people, respectively). Rates of fatal burden and non-fatal burden due to blood & metabolic disorders also remained relatively stable between 2003 and 2018 (see Supplementary Table S9.15).

9.16 Skin disorders

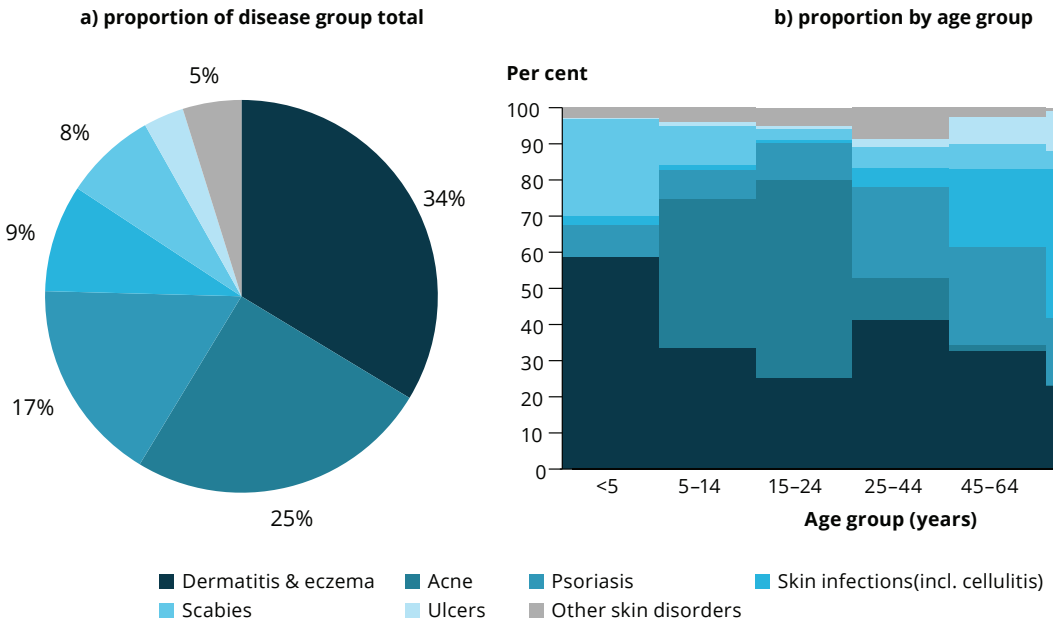
The skin disorders disease group includes burden due to chronic and acute skin conditions, including skin infections. It excludes burden due to skin neoplasms (which is included in cancer & other neoplasms).

Skin disorders made up 1.4% (3,383 DALY) of total burden, 2.4% (3,070 YLD) of non-fatal burden and 0.3% (313 YLL) of fatal burden among Indigenous Australians in 2018. 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 main causes of burden due to skin disorders were dermatitis & eczema (34%), acne (25%) and psoriasis (17%) (Figure 9.16.1a).

The contribution of individual conditions to the burden due to skin disorders varied across the life course (Figure 9.16.1b). Dermatitis & eczema was the leading cause of burden among Indigenous children under 5 and among adults aged 25–64 (accounting for 59% and 37% of the burden due to skin disorders in these age groups, respectively). Acne was the leading cause of burden among those aged 5–24, contributing almost half (49%) of the burden in this age group. For Indigenous Australians 65 and over, skin infections (39%) and dermatitis & eczema (22%) were the leading causes of burden. Scabies was the second leading cause of burden among Indigenous children under 5, contributing over a quarter (27%) of the burden due to skin disorders in this age group.

Figure 9.16.1: Contribution of individual conditions to skin disorders total burden (DALY), Indigenous Australians, 2018



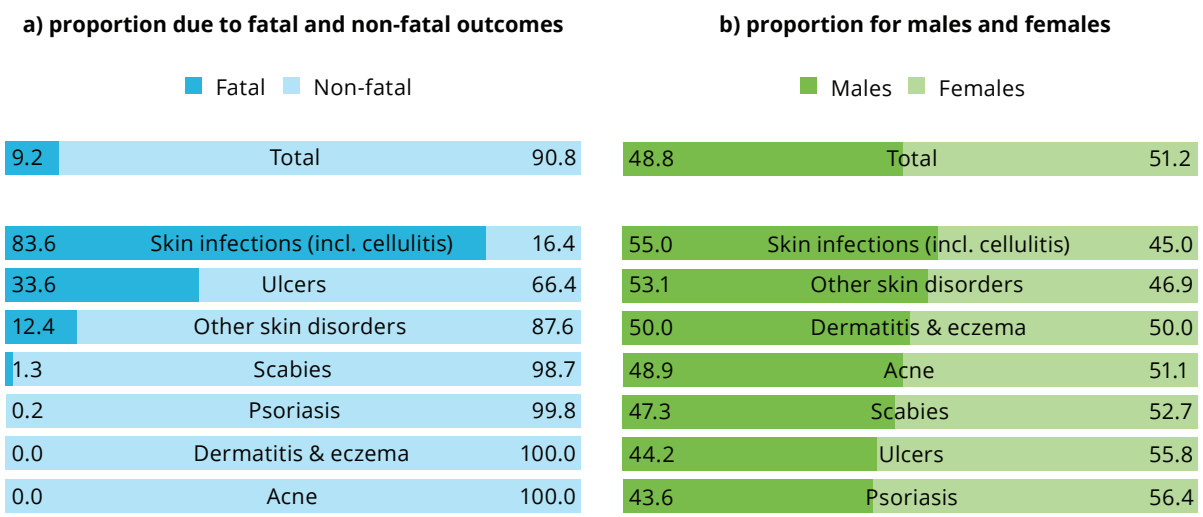
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other skin disorders' includes a range of diseases such as pilonidal cysts, bullous disorders and urticarial. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Fatal burden made up 9.2% of the total burden due to skin disorders in Indigenous Australians (Figure 9.16.2a). Two causes contributed almost all (92%) of the fatal burden due to skin disorders: skin infections (80% of fatal burden for skin disorders) and ulcers (12%).

The overall burden from skin disorders was similar in Indigenous males (49%) and females (51%), although the proportion differed by the type of skin disorder (Figure 9.16.2b). A larger proportion of burden was experienced by Indigenous females for psoriasis and ulcers (both 56%). In contrast, Indigenous males experienced a greater proportion of the burden for skin infections (55%).

Figure 9.16.2: Skin disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

None of the risk factors considered in this study were linked to the conditions in this disease group.

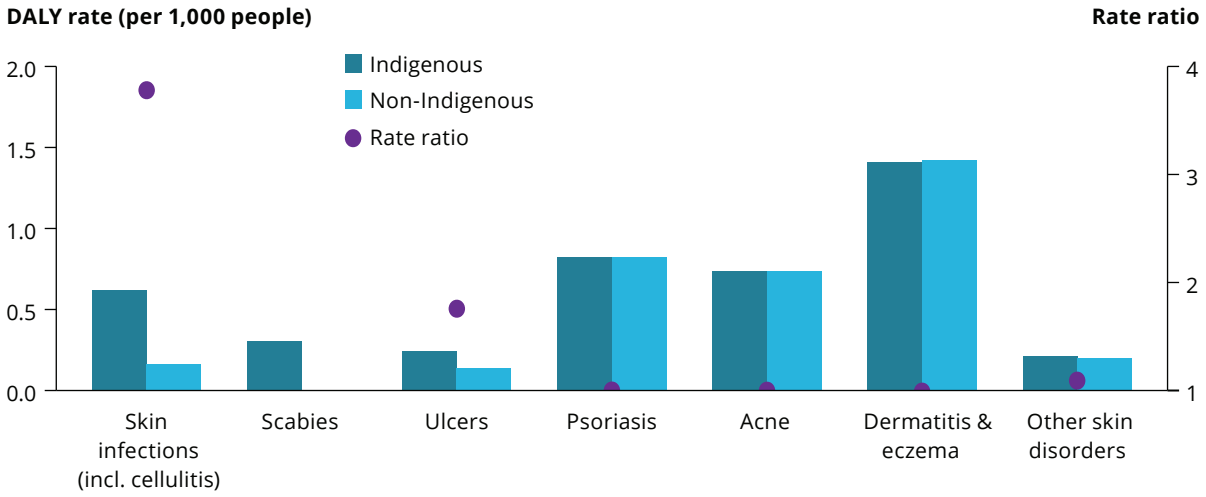
Comparisons with non-Indigenous

In 2018, the age-standardised rate of burden due to skin disorders was higher for Indigenous Australians than for non-Indigenous Australians (age-standardised rates of 4.4 and 3.5 DALY per 1,000 people, respectively; rate ratio of 1.3).

The largest absolute differences in DALY rates between Indigenous and non-Indigenous Australians were observed for skin infections (rate difference of 0.5 DALY per 1,000 people) and scabies (rate difference of 0.3 DALY per 1,000) (Figure 9.16.3).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) were observed for skin infections (rate ratio of 3.8) and ulcers (1.8).

Figure 9.16.3: Skin disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Note: Due to the small number of cases in the non-Indigenous population the rate ratio for scabies is not considered reliable and is therefore not shown on the graph.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to skin disorders for Indigenous Australians remained relatively stable (4.5 and 4.4 DALY per 1,000 people, respectively). The rates of fatal and non-fatal burden were also stable (at around 1 YLL and 4 YLD per 1,000 for both reference years, respectively) (see Supplementary Table S9.16).

9.17 Reproductive & maternal conditions

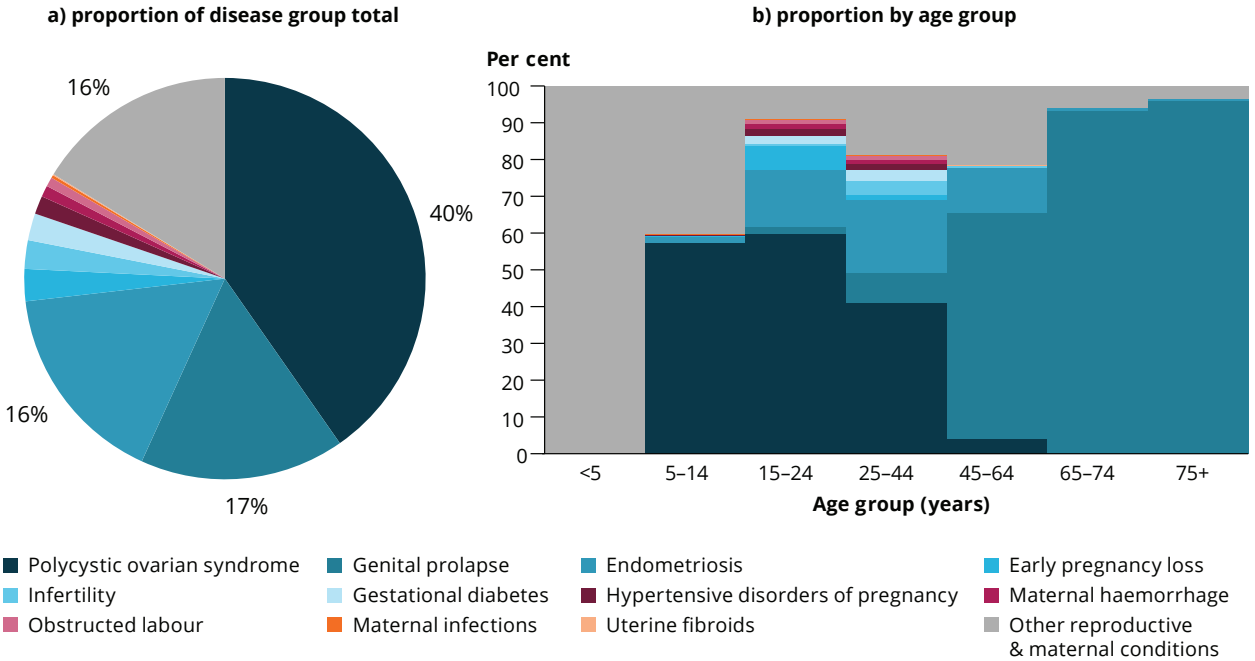
Burden due to reproductive & maternal conditions includes disorders affecting reproductive systems (in both men and women) and conditions arising during pregnancy or delivery. Sexually transmitted infections (STIs), benign prostatic hypertrophy, reproductive cancers (excluding uterine fibroids) and health 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 STIs. 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.

Reproductive & maternal conditions made up 0.6% (1,467 DALY) of total burden, 1.0% (1,326 YLD) of non-fatal burden and 0.1% (141 YLL) of fatal burden among Indigenous Australians.

The main causes of reproductive & maternal burden were polycystic ovarian syndrome (40%), genital prolapse (17%), endometriosis (16%) and other reproductive & maternal conditions (16%) (Figure 9.17.1a).

Almost all (94%) of the burden due to reproductive & maternal conditions occurred between the ages of 15–64. The contribution of individual conditions to the total burden due to reproductive & maternal conditions varied across the life course (Figure 9.17.1b). For ages 15–44, polycystic ovarian syndrome (48%) and endometriosis (18%) were the leading causes of burden. For ages 45–64, genital prolapse (61%) and other reproductive & maternal conditions (22%) were the leading causes of burden.

Figure 9.17.1: Contribution of individual conditions to reproductive & maternal conditions total burden (DALY), Indigenous Australians, 2018



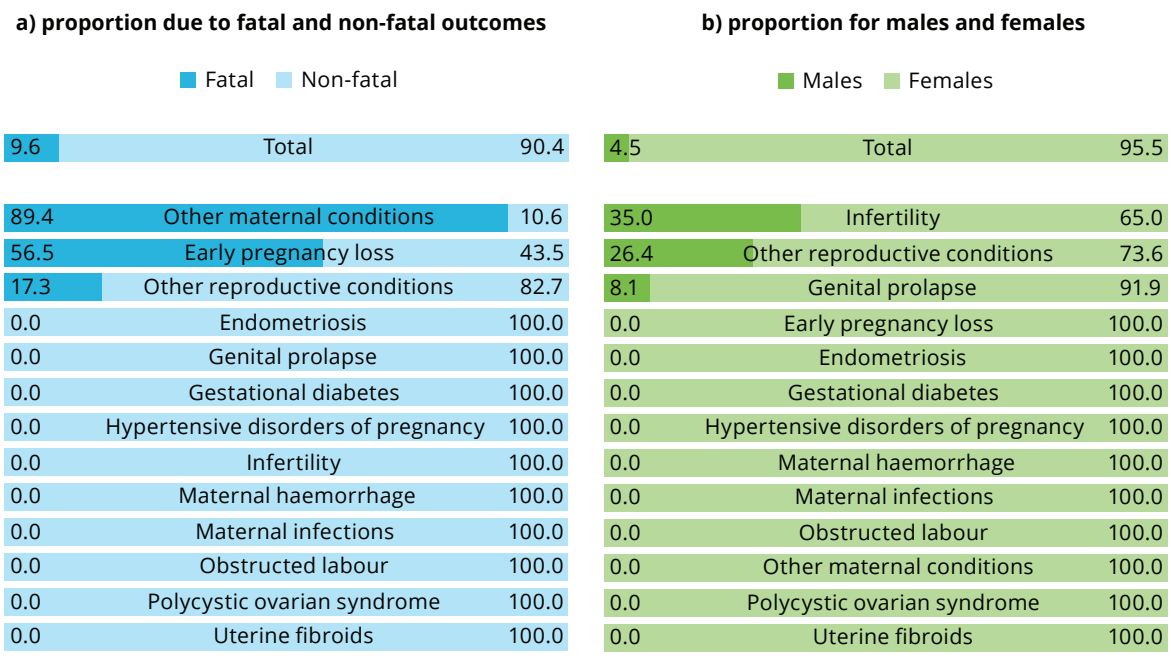
Notes

1. Percentage labels are not shown for disease groups contributing less than 4.5% of burden.
2. The residual cause 'Other reproductive & maternal conditions' includes a range of conditions such as placental disorders, labour complications, maternal care, testicular torsion, menstrual disorders, vaginal fistulas and conditions affecting female reproductive organs that were not included separately in the cause list. See the ABDS methods report (AIHW 2021c) for a full list of ICD-10 codes.

Only a small proportion (9.6%) of reproductive & maternal burden was fatal (Figure 9.17.2a), the large majority of which was due to other maternal conditions (69% of fatal burden for reproductive & maternal conditions), other reproductive conditions (16%) and early pregnancy loss (15%).

Indigenous males experienced 5% of the total burden from reproductive & maternal conditions (Figure 9.17.2b). Genital prolapse, infertility and other reproductive conditions were the only conditions in this group experienced by both males and females. A larger proportion of burden was experienced by Indigenous females for these 3 conditions, 92% for genital prolapse, 74% for other reproductive conditions and 65% for infertility.

Figure 9.17.2: Reproductive & maternal burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018



Risk factor contribution

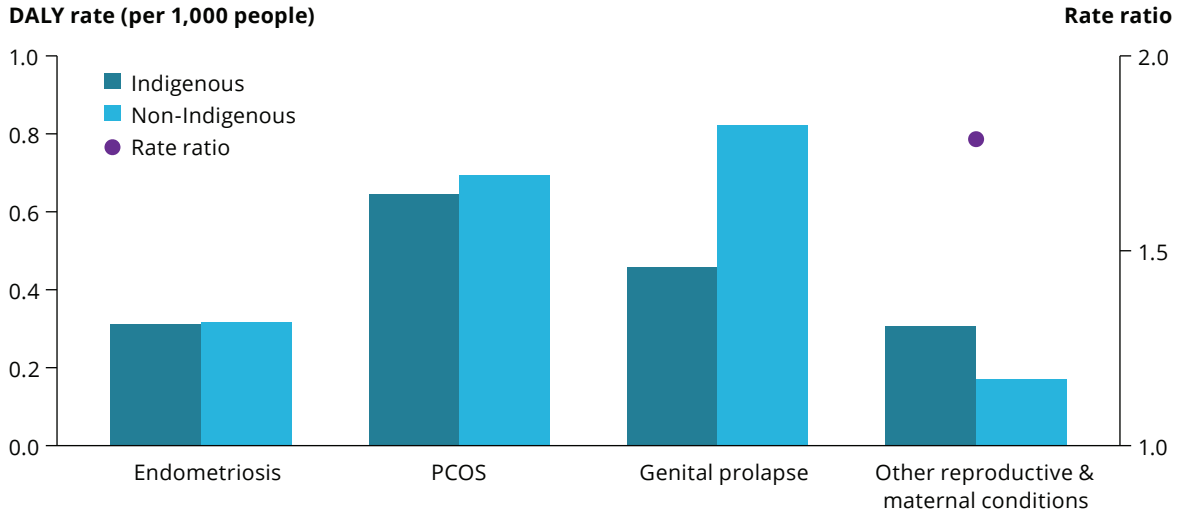
The only risk factor associated with reproductive & maternal conditions in the current study was intimate partner violence, which contributed 0.7% to the burden for this disease group (Chapter 5, Table 5.3).

Comparisons with non-Indigenous

In 2018, Indigenous Australians experienced similar rates of burden due to reproductive & maternal conditions as non-Indigenous Australians (age-standardised rates of 1.9 and 2.1 DALY per 1,000 people, respectively).

The largest relative differences in DALY rates between Indigenous and non-Indigenous Australians (based on age-standardised rate ratios) was observed for other reproductive & maternal conditions (rate ratio of 1.8) (Figure 9.17.3).

Figure 9.17.3: Reproductive & maternal conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018



Notes
1. Rate ratios not shown on graph if ratio is less than 1.
2. Data only shown for top 4 conditions.

Changes since 2003

Between 2003 and 2018, the age-standardised rate of total burden due to reproductive & maternal conditions for Indigenous Australians remained relatively stable (1.7 and 1.9 DALY per 1,000 people, respectively) (see Supplementary Table S9.17).

10

Variation across geographic and population groups

Key results

Differences between states and territories

Indigenous burden of disease estimates are reported for 4 states and territories in 2018: New South Wales, Queensland, Western Australia and the Northern Territory.

- Rates of total burden were higher in the Northern Territory and Western Australia (479 and 468 DALY per 1,000 people, respectively) than in New South Wales and Queensland (397 and 383 DALY per 1,000, respectively).
- Mental & substance use disorders, injuries, cancer & other neoplasms and cardiovascular diseases were the biggest causes of burden in all 3 states and the Northern territory.
- The gap between Indigenous and non-Indigenous Australians was largest in Western Australia, where Indigenous Australians experienced a rate of total burden at 2.7 times the rate of non-Indigenous Australians.

Differences between cities and regional and remote areas

- Indigenous Australians in *Very remote* and *Remote* areas experienced higher rates of total burden than those in cities and regional areas across Australia.
- Mental & substance use disorders, such as anxiety and alcohol use disorders, was the leading contributor to burden in all remoteness categories, contributing between 17% and 27% of burden.
- The gap between Indigenous and non-Indigenous Australians was largest in *Very remote* areas, where Indigenous Australians experienced a rate of total burden at 2.7 times the rate of non-Indigenous Australians.

Differences between levels of disadvantage

- Indigenous Australians in the most disadvantaged areas experienced more than 3 times the amount of total burden compared with Indigenous Australians in the least disadvantaged areas (591 and 164 DALY per 1,000 people, respectively).

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 2016 Indigenous Relative Socioeconomic Outcomes (IRSEO) index was used for Indigenous estimates (Biddle & Markham 2017). As a comparable index for the non-Indigenous population is not available, measures of the gap in socioeconomic disadvantage are not presented.

Indigenous subnational estimates were calculated at the disease group level only (not at the detailed cause level) due to small numbers. Subnational estimates of YLL were calculated directly from mortality data adjusted for Indigenous under-identification using state/territory and remoteness specific adjustment factors. For subnational YLD estimates, a proxy approach was used to disaggregate national-level Indigenous YLD into subnational categories. This involved applying the subnational distribution pattern for a particular disease group from either hospitalisation data (adjusted for under-identification), Indigenous-specific health survey data or population proportions to disaggregate the national-level Indigenous YLD estimates for each disease group. Indigenous DALY estimates were then calculated by summing the YLL and YLD estimates for each disease group and subnational category. More information on the methods used to calculate subnational Indigenous burden of disease estimates in the ABDS is provided in 'Appendix A: Methods overview'.

It should be noted that the sum of the Indigenous and non-Indigenous YLD and DALY estimates for each subnational category (3 states and 1 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 2018* (AIHW 2021a). This is because different methods and/or data sources may have been used to calculate these estimates.

10.1 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 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; these have been shaded in relevant tables. 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 A: Methods overview'.

Results are generally presented as age-standardised rates, a method that removes the influence of differences in population size and age structure.

Estimates of HALE by state and territory for Indigenous and non-Indigenous Australians are presented elsewhere in this report (Chapter 8).

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 10.1.1). Western Australia and the Northern Territory accounted for a higher proportion of burden (15% and 12%, respectively) than population (13% and 9.2%, respectively).

Table 10.1.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden by state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018

	NSW	Qld	WA	NT	NSW, Qld, WA & the NT combined	Australia[(a)]
Indigenous population (no.)	275,810	230,954	104,770	76,599	**688,133**	830,542
Indigenous population %	33.2	27.8	12.6	9.2	**82.9**	100.0
DALY no.	78,521	60,969	35,441	27,696	**202,628**	239,942
DALY %	32.7	25.4	14.8	11.5	**84.4**	100.0
YLD no.	40,809	33,540	16,165	11,331	**101,844**	126,496
YLD %	32.3	26.5	12.8	9.0	**80.5**	100.0
YLL no.	37,712	27,429	19,276	16,366	**100,783**	113,445
YLL %	33.2	24.2	17.0	14.4	**88.8**	100.0

(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: The numbers may not add to totals due to rounding.

Among the 4 jurisdictions for which Indigenous burden estimates have been calculated, the age-standardised rates of total burden were highest in the Northern Territory (479 DALY per 1,000 people) and Western Australia (468 DALY per 1,000), followed by New South Wales and Queensland (397 and 383 DALY per 1,000, respectively).

Western Australia had the highest rates of non-fatal burden for Indigenous Australians (age-standardised rate of 204 YLD per 1,000), while the Northern Territory had the highest rates of fatal burden (292 YLL per 1,000). There was greater variation in Indigenous rates of fatal burden across the 4 jurisdictions than in rates of non-fatal burden (Table 10.1.2).

Table 10.1.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts and age-standardised rates (per 1,000 people[a]), by state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018

	Total burden		Non-fatal burden		Fatal burden[b]		
State/territory	DALY	ASR	YLD	ASR	YLL	ASR	Deaths
NSW	78,521	397.2	40,809	191.2	37,712	206.0	1,303
Qld	60,969	382.6	33,540	197.9	27,429	184.7	879
WA	35,441	467.9	16,165	204.2	19,276	263.7	568
NT	27,696	479.4	11,331	187.0	16,366	292.4	484
NSW, Qld, WA & the NT combined	**202,628**	**411.8**	**101,844**	**193.5**	**100,783**	**218.3**	**3,234**
Australia[c]	239,942	399.6	126,496	198.5	113,445	201.1	3,619

(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 A4).
(c) 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: The numbers may not add to totals due to rounding.

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 A: 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 Indigenous health survey data. The distribution for the disease groups that contributed the most to the non-fatal burden for Indigenous Australians—mental & substance use disorders, musculoskeletal conditions and respiratory diseases—was drawn from the 2018–19 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS). 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 total burden rates by jurisdiction was evident for Indigenous males and females, with higher rates for males than females (Figure 10.1.1).

Figure 10.1.1: Age-standardised total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by sex and state/territory (NSW, Qld, WA and the NT), 2018

Source: This figure is based on data in a supplementary table available online—Table S10.1.

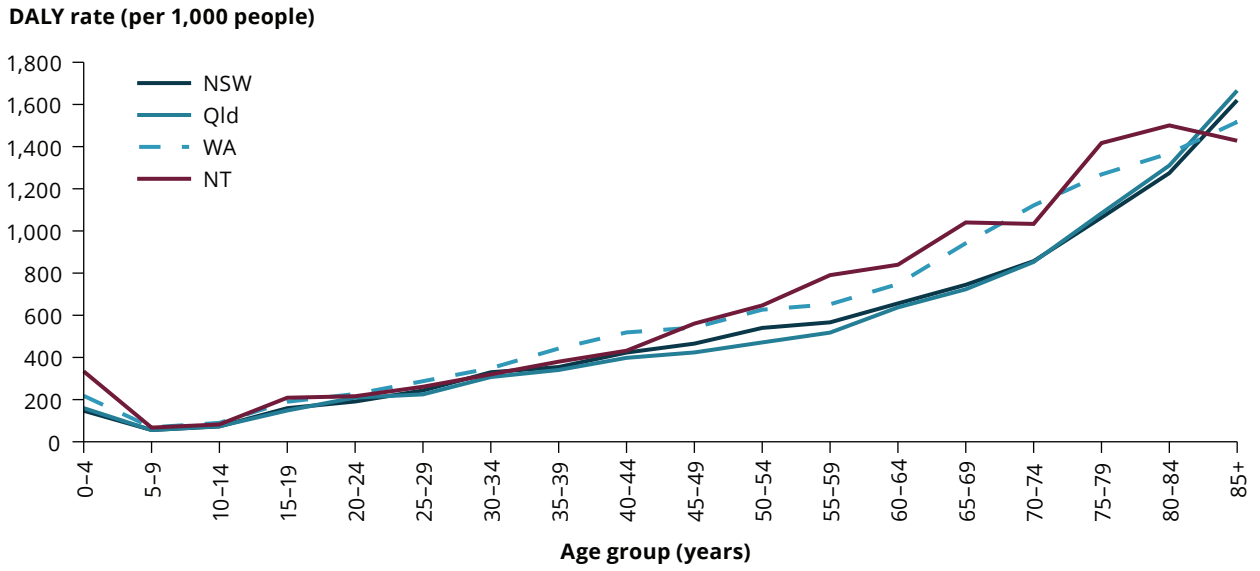
Proportions of total burden were higher for males than for females across all 4 jurisdictions (Figure 10.1.2). Distributions by fatal and non-fatal burden show that fatal burden contributed a larger proportion of total burden in the Northern Territory and Western Australian than in the other 2 jurisdictions.

Figure 10.1.2: Proportion of total burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and state/territory (NSW, Qld, WA and the NT), 2018

Source: This figure is based on data in a supplementary table available online—Table S10.2.

The total burden rates for Indigenous Australians typically increased with age in all 4 jurisdictions and were fairly similar up until around ages 35–44 (Figure 10.1.3). From age 45 onwards the rates were generally higher for Indigenous Australians living in Western Australia and the Northern Territory than in the other 2 jurisdictions.

Figure 10.1.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and state/territory (NSW, Qld, WA and the NT), 2018



Source: This figure is based on data in a supplementary table available online—Table S10.3.

Total burden by disease group

Table 10.1.3 compares Indigenous age-standardised total burden (DALY) rates by disease group, and Figure 10.1.4 presents the proportional contribution of disease groups to total burden in the Indigenous population for New South Wales, Queensland, Western Australia and the Northern Territory in 2018:

- Western Australia and the Northern Territory had higher rates of disease burden for Indigenous Australians due to cardiovascular diseases, kidney & urinary diseases, injuries, endocrine disorders (including diabetes) and infectious diseases compared to New South Wales and Queensland.
- Western Australia had the highest Indigenous total burden rates for injuries; and the Northern Territory had the highest rates for kidney & urinary diseases, blood & metabolic disorders and infant & congenital conditions (Table 10.1.3).
- New South Wales had the highest total burden rates for respiratory diseases; and New South Wales, Queensland and Western Australia had higher rates for musculoskeletal conditions and mental & substance use disorders compared to the Northern Territory.

Table 10.1.3: Age-standardised total burden (DALY) rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018

Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & the NT combined[(a)]	Australia[(a)]
Mental/substance use	70.9	68.5	68.1	57.5	**67.7**	69.6
Cardiovascular	47.8	47.5	72.8	75.3	**54.9**	51.5
Cancer	54.8	51.3	54.7	59.2	**54.2**	50.2
Injuries	40.2	33.8	57.0	52.5	**42.1**	38.8
Musculoskeletal	39.3	34.7	32.9	21.7	**34.7**	36.3
Respiratory	41.7	31.6	28.9	31.1	**35.5**	34.2
Neurological	22.4	23.7	26.4	27.6	**23.8**	23.3
Endocrine	14.7	15.5	24.5	27.5	**17.8**	16.2
Gastrointestinal	15.5	11.8	18.6	19.1	**15.2**	14.4
Kidney/urinary	6.9	14.1	23.8	37.2	**15.0**	14.0
Hearing/vision	11.2	12.3	10.3	8.4	**11.0**	11.5
Infectious diseases	7.5	9.5	18.0	17.9	**10.9**	10.3
Infant/congenital	8.1	9.5	10.3	15.0	**9.5**	9.7
Oral	5.2	8.0	9.0	11.2	**7.3**	7.9
Blood/metabolic	5.2	4.7	5.9	11.0	**5.8**	5.5
Skin	4.2	4.2	4.8	5.0	**4.4**	4.4
Reproductive/maternal	1.6	2.0	2.0	2.2	**1.8**	1.9
Total	**397.2**	**382.6**	**467.9**	**479.4**	**411.8**	**399.6**

(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.

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.

Mental & substance use disorders were the leading cause of total burden for Indigenous Australians in all 4 jurisdictions, contributing between 16% and 24% of DALY (Figure 10.1.4).

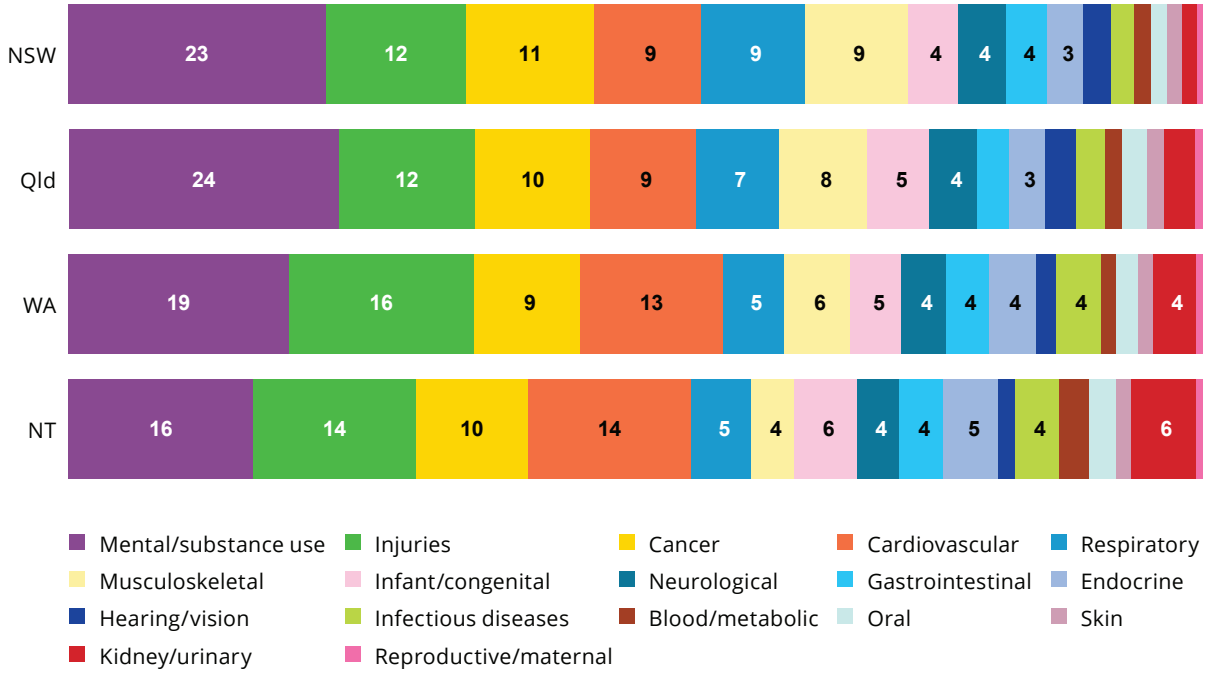
Injuries were the second leading cause of burden for Indigenous Australians in New South Wales (12%), Queensland (12%) and Western Australia (16%) and the third leading cause in the Northern Territory (14%).

Cardiovascular diseases were the second leading cause of disease burden for Indigenous Australians in the Northern Territory (14%), the third leading cause in Western Australia (13%) and the fourth leading cause in New South Wales (9.4%) and Queensland (9.3%).

Kidney & urinary diseases ranked higher (fifth) in the Northern Territory than in the 3 states, contributing 5.7% of burden.

Musculoskeletal conditions ranked lower (11th) and contributed less to total burden (3.8% of DALY) in the Northern Territory than in the 3 states (ranked fifth or sixth).

Figure 10.1.4: Leading causes of total burden (proportion of DALY %), by state/ territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018



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 S10.4.

Non-fatal burden

Table 10.1.4 compares Indigenous age-standardised non-fatal burden (YLD) rates by disease group, and Figure 10.1.5 presents the proportional contribution of disease groups to non-fatal burden in the Indigenous population for New South Wales, Queensland, Western Australia and the Northern Territory in 2018.

There was relatively little variation in Indigenous rates of non-fatal burden across the 4 jurisdictions by disease group (Table 10.1.4). The greatest differences were observed for:

- Musculoskeletal conditions, where the age-standardised rate of non-fatal burden was highest in New South Wales (38 YLD per 1,000 people) and lowest in the Northern Territory (19 YLD per 1,000)
- Mental & substance use disorders, where the rate of non-fatal burden was highest in New South Wales (69 YLD per 1,000 people) and lowest in the Northern Territory (56 YLD per 1,000)
- Respiratory diseases, where the rate of non-fatal burden was highest in New South Wales (21 YLD per 1,000) and lowest in the Northern Territory (7.9 YLD per 1,000)
- Kidney & urinary diseases, where the rate of non-fatal burden was highest in the Northern Territory (12 YLD per 1,000) and lowest in New South Wales (1.8 YLD per 1,000).

Table 10.1.4: Age-standardised non-fatal (YLD) burden rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018

Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & the NT combined[a]	Australia[a]
Mental/substance use	68.5	67.0	65.8	55.5	**65.7**	67.8
Musculoskeletal	38.2	33.4	30.0	18.6	**33.0**	34.8
Respiratory	21.1	18.8	16.9	7.9	**18.2**	19.0
Neurological	11.7	14.6	16.0	13.3	**13.3**	13.6
Hearing/vision	11.2	12.3	10.3	8.4	**11.0**	11.5
Endocrine	8.3	8.2	12.1	13.6	**9.4**	8.6
Oral	5.2	8.0	8.9	11.0	**7.3**	7.8
Cardiovascular	5.8	8.2	9.8	10.4	**7.6**	7.7
Injuries	3.4	4.3	7.3	8.1	**4.8**	4.7
Kidney/urinary	1.8	3.8	5.8	12.2	**4.2**	4.0
Cancer	3.2	4.0	3.7	3.2	**3.5**	3.7
Skin	3.6	3.7	3.7	3.7	**3.7**	3.7
Infectious diseases	2.4	3.3	4.8	8.1	**3.6**	3.4
Blood/metabolic	1.5	2.3	2.9	6.4	**2.4**	2.4
Gastrointestinal	2.1	2.1	2.7	2.4	**2.2**	2.3
Infant/congenital	1.8	1.9	1.8	2.0	**1.8**	1.9
Reproductive/maternal	1.5	1.9	1.8	2.1	**1.7**	1.7
Total	**191.2**	**197.9**	**204.2**	**187.0**	**193.5**	**198.5**

(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.

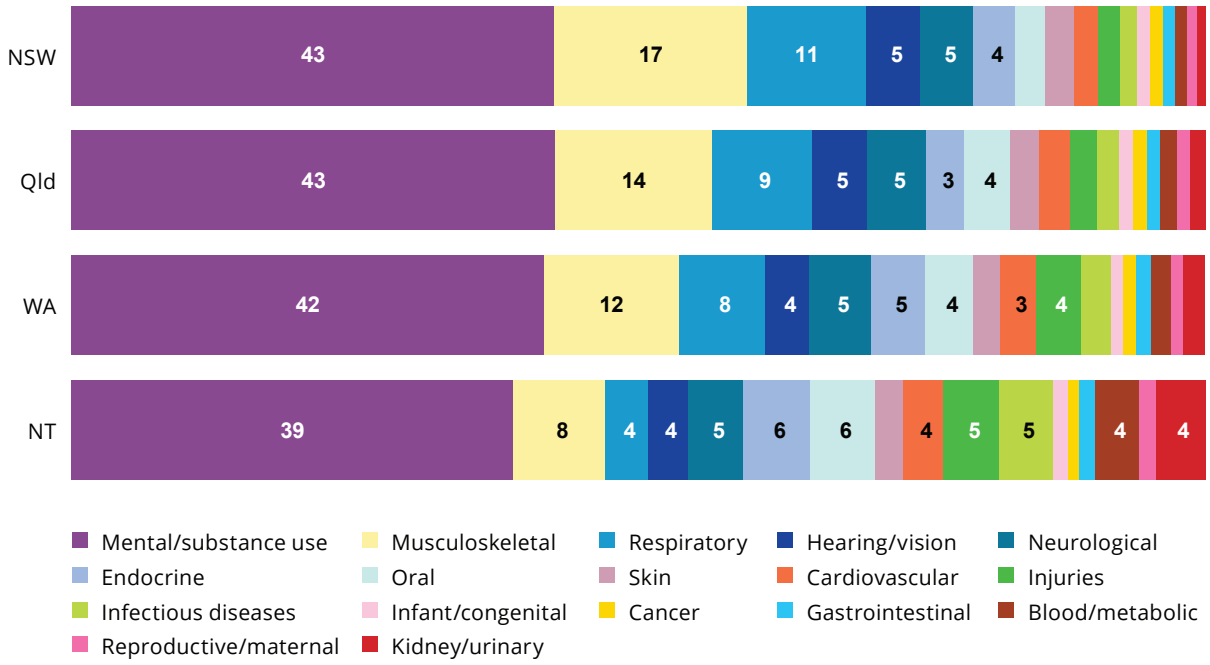
Notes

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.

Mental & substance use disorders and musculoskeletal conditions were ranked as the top 2 leading causes of non-fatal burden for all 4 jurisdictions (Figure 10.1.5). Mental & substance use disorders contributed around 40% of the non-fatal burden for each state and territory, however, musculoskeletal conditions contributed quite different proportions across the jurisdictions, ranging from 8.1% of the non-fatal burden in the Northern Territory to 17% in New South Wales.

Respiratory diseases ranked as the third leading cause of non-fatal burden in all 3 states, but only ranked in 10th position in the Northern Territory.

Figure 10.1.5: Leading causes of non-fatal burden (proportion of YLD %), by state/ territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018



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 S10.5.

Fatal burden

In contrast to non-fatal burden, rates of fatal burden experienced by Indigenous Australians in 2018 differed considerably across the 4 jurisdictions for most disease groups.
Large differences were observed for cardiovascular diseases, injuries and kidney & urinary diseases (Table 10.1.5):

- For cardiovascular diseases, the age-standardised rate of fatal burden ranged from 39 YLL per 1,000 people in Queensland to 65 YLL per 1,000 in the Northern Territory.
- For injuries, the rate of fatal burden ranged from 30 YLL per 1,000 in Queensland to 50 YLL per 1,000 in Western Australia.
- For kidney & urinary diseases, the rate of fatal burden ranged from 5.1 YLL per 1,000 in New South Wales to 25 YLL per 1,000 in the Northern Territory.

Table 10.1.5: Age-standardised fatal (YLL) burden rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018

Disease group	NSW	Qld	WA	NT	NSW, Qld, WA & the NT combined[(a)]	Australia[(a)]
Cancer	51.6	47.3	51.0	56.0	**50.8**	46.5
Cardiovascular	42.0	39.3	63.0	64.9	**47.3**	43.9
Injuries	36.8	29.5	49.7	44.3	**37.3**	34.1
Respiratory	20.5	12.8	12.0	23.3	**17.3**	15.2
Gastrointestinal	13.5	9.6	16.0	16.7	**13.0**	12.1
Kidney/urinary	5.1	10.3	18.0	24.9	**10.9**	10.0
Neurological	10.7	9.0	10.3	14.3	**10.5**	9.7
Infant/congenital	6.3	7.5	8.5	13.0	**7.7**	7.8
Endocrine	6.4	7.3	12.3	13.9	**8.5**	7.6
Infectious diseases	5.2	6.2	13.2	9.8	**7.3**	6.9
Blood/metabolic	3.8	2.4	3.0	4.6	**3.3**	3.1
Mental/substance use	2.3	1.5	2.3	2.0	**2.0**	1.9
Musculoskeletal	1.1	1.3	2.9	3.1	**1.7**	1.5
Skin	0.5	0.4	1.1	1.4	**0.7**	0.7
Reproductive/maternal	0.1	0.1	0.2	—	**0.1**	0.2
Oral	0.1	–	0.1	0.2	**0.1**	0.1
Total	**206.0**	**184.7**	**263.7**	**292.4**	**218.3**	**201.1**

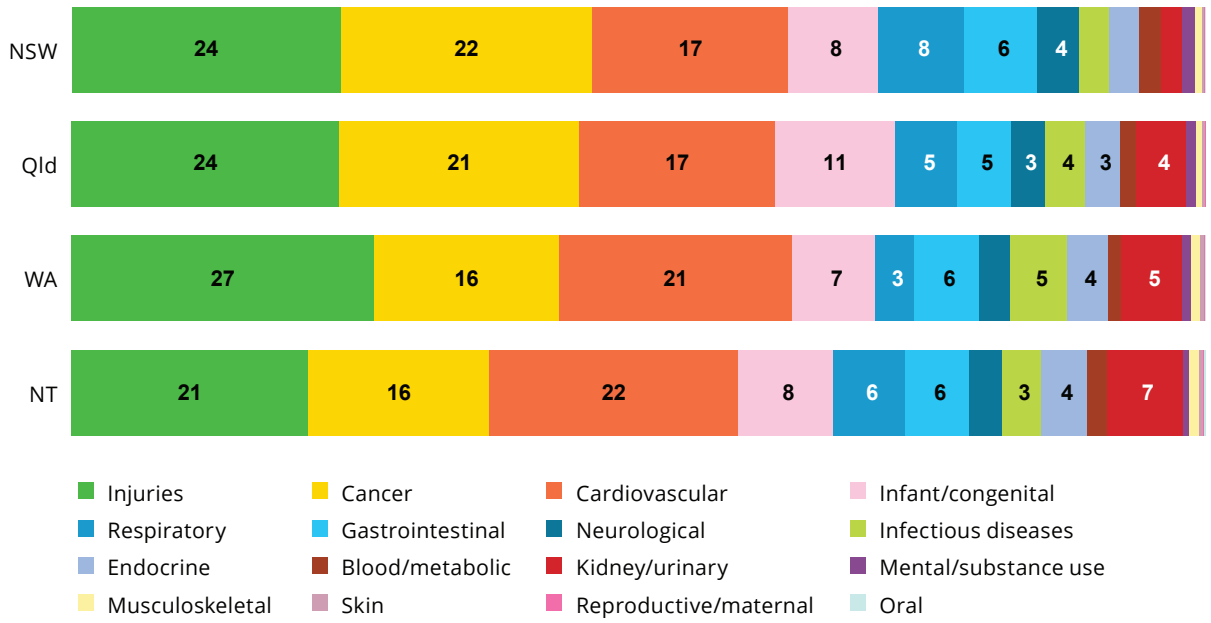
(a) Estimates for the 4 jurisdictions combined and Australia are not directly comparable as different methods and/or data sources may have been used to calculate the state/territory level estimates and the national estimates for the Indigenous population.

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

Injuries, cardiovascular diseases and cancer & other neoplasms ranked in the top 3 leading causes of fatal burden for all 4 jurisdictions:

- Injuries were the leading cause of fatal burden for Indigenous Australians in New South Wales, Queensland and Western Australia, contributing 24%, 24% and 27% of YLL, respectively (Figure 10.1.6). Injuries ranked second in the Northern Territory and contributed 21% of YLL.
- Cardiovascular diseases were the leading cause of fatal burden for Indigenous Australians in the Northern Territory (contributing to 22% of YLL), and were ranked second in Western Australia and third in the other 2 states.
- Kidney & urinary diseases ranked as the fifth leading cause of fatal burden in the Northern Territory (contributing 7% of YLL) and sixth in Western Australia (5% of YLL).

Figure 10.1.6: Leading causes of fatal burden (proportion of YLL %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018



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 S10.6.

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 2018 for the 4 jurisdictions, 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 total disease burden between Indigenous and non-Indigenous Australians was in Western Australia (rate ratio of 2.7; rate difference of 293 DALY per 1,000 people). Queensland had the lowest total burden rate ratio (2.1) and rate difference (200 DALY per 1,000) (Table 10.1.6).

The gap in fatal burden between Indigenous and non-Indigenous Australians was greater than the gap in non-fatal burden for the Northern Territory, Western Australia and New South Wales (Figure 10.1.7). For Queensland the fatal and non-fatal burden gaps were similar (rate differences of 99 YLL and 101 YLD per 1,000 people).

The largest gap in fatal burden was observed in the Northern Territory (rate difference of 195 YLL per 1,000 people) and the smallest in Queensland (rate difference of 99 YLL per 1,000) (Figure 10.1.7). By comparison there was less variation in the gap in non-fatal burden, with rate differences ranging from 83 YLD per 1,000 in the Northern Territory to 109 YLD per 1,000 in Western Australia (Figure 10.1.7).

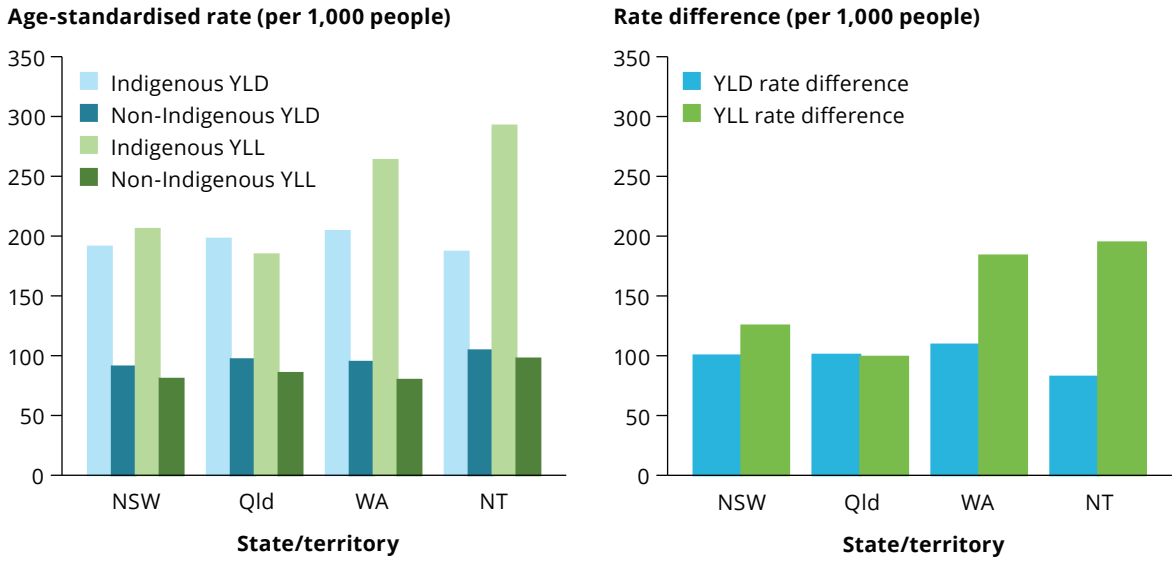
Table 10.1.6: Age-standardised total burden (DALY) rates (per 1,000 people), rate ratios and rate differences by Indigenous status, state/territory (NSW, Qld, WA and the NT) and Australia, 2018

	Age-standardised DALY rate per 1,000		Health gap	
State/territory	Indigenous	Non-Indigenous	Rate difference	Rate ratio
NSW	397.2	171.7	225.5	2.3
Qld	382.6	182.5	200.0	2.1
WA	467.9	174.7	293.2	2.7
NT	479.4	202.1	277.3	2.4
NSW, Qld, WA & the NT combined	**411.8**	**175.6**	**236.2**	**2.3**
Australia	399.6	177.4	222.2	2.3

Notes

1. Rates are directly age-standardised to the 2001 Australian estimated resident population (ERP) as at 30 June 2001 (based on the 2001 Census).
2. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Figure 10.1.7: Age-standardised rates of non-fatal (YLD) and fatal (YLL) burden, by Indigenous status, and the non-fatal (YLD) and fatal (YLL) gap by state/territory (NSW, Qld, WA and the NT), 2018

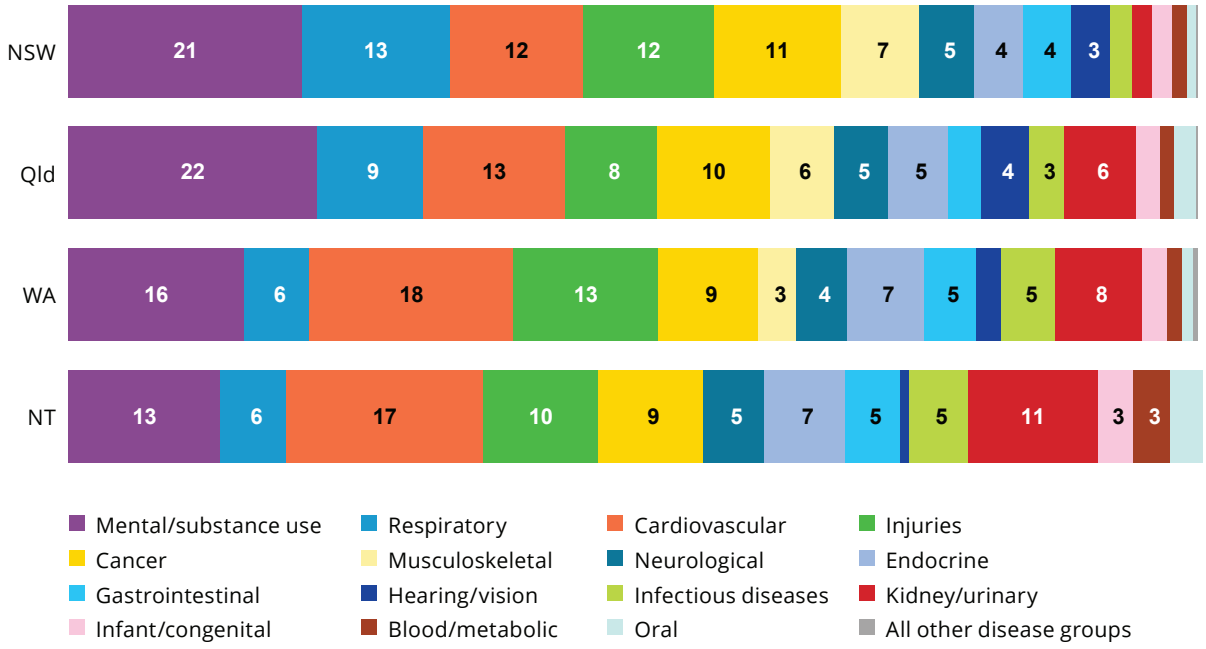


Source: This figure is based on data in a supplementary table available online—Table S10.7.

Figure 10.1.8 shows the leading disease groups contributing to the gap in total burden between Indigenous and non-Indigenous Australians in 2018 for New South Wales, Queensland, Western Australia and the Northern Territory.

- Mental & substance use disorders was the leading disease group contributing to the gap in New South Wales and Queensland (contributing 21% and 22% to the gap, respectively).
- Cardiovascular diseases was the leading contributor to the gap in Western Australia and the Northern Territory (18% and 17%, respectively) with mental & substance use disorders ranked second (16% and 13%, respectively).
- Cardiovascular diseases was the second leading contributor to the gap in Queensland (12%) and the third leading contributor in New South Wales (12%).
- Respiratory diseases ranked higher (second) and contributed a larger proportion of the gap (13%) in New South Wales than in any of the other 3 jurisdictions.
- Kidney & urinary diseases ranked higher (third) and contributed a larger proportion of the gap in the Northern Territory (11%), than in Western Australia (7.6%), Queensland (6.3%) and New South Wales (1.8%).
- Injuries and cancer & other neoplasms both ranked in the top 5 for all 4 jurisdictions.

Figure 10.1.8: 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), 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of gap.
2. 'All other disease groups' includes reproductive & maternal conditions and skin disorders

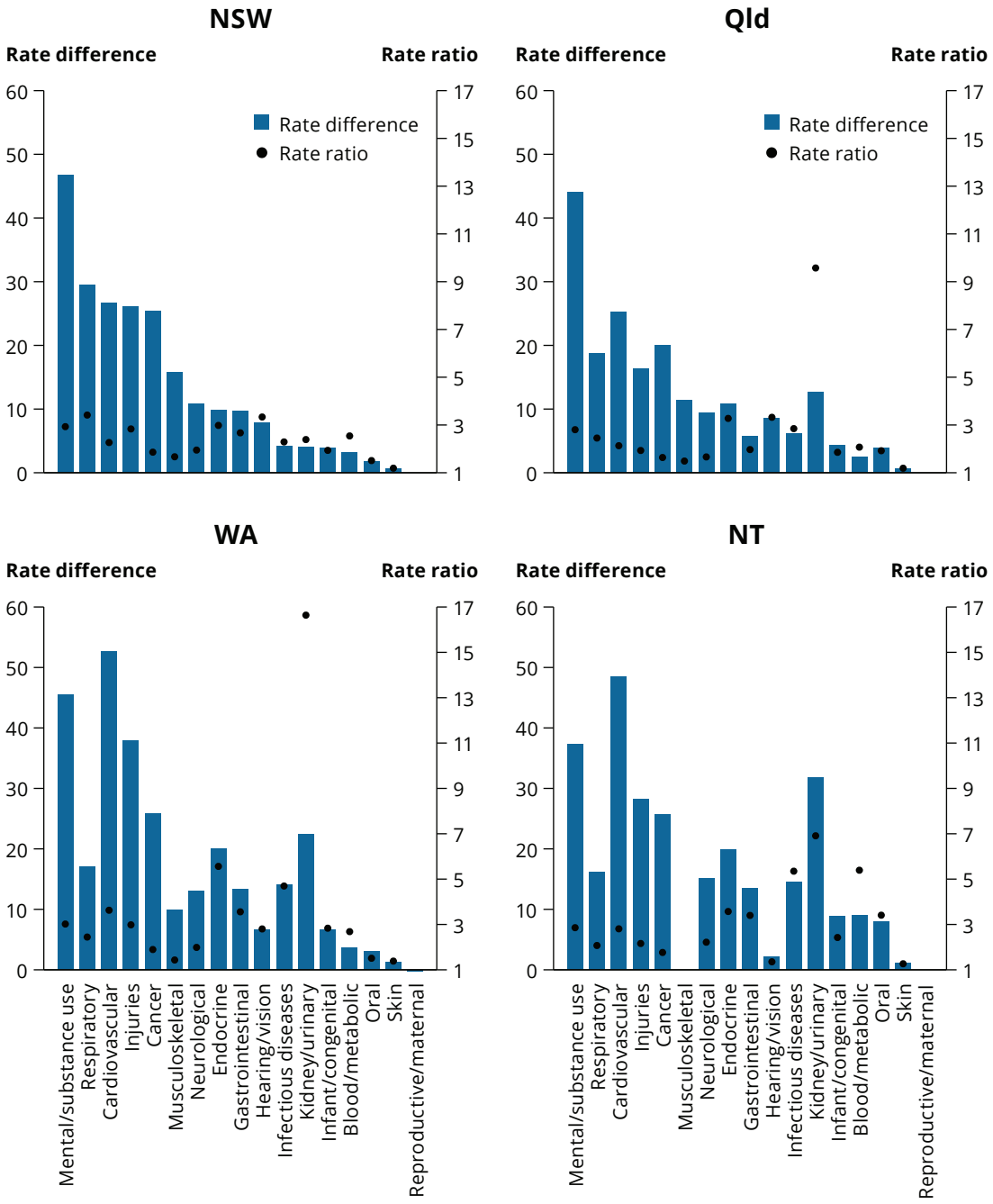
Source: This figure is based on data in a supplementary table available online—Table S10.8.

Figure 10.1.9 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 respiratory diseases (3.4), while in Western Australia, Queensland and the Northern Territory the highest rate ratios were for kidney & urinary diseases (17, 9.6 and 6.9, respectively).

- The largest differences in rates between Indigenous and non-Indigenous Australians (as measured by age-standardised DALY rate differences) were for mental & substance use disorders in New South Wales and Queensland. In Western Australia and the Northern Territory, mental & substance use disorders had the second largest rate difference, behind cardiovascular diseases.

Figure 10.1.9: Total burden (DALY) rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group and state/territory (NSW, Qld, WA and the NT), 2018



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 S10.8.

Data quality

Data quality for fatal burden is considered reasonably high for all 4 jurisdictions for which estimates are reported, being based on mortality data adjusted for Indigenous under-identification using state/territory-specific adjustment factors from the ABS 2015–2017 CDE study (ABS 2018c). Indigenous deaths for the Northern Territory and Queensland required the least adjustment and are considered of very high quality. Despite the adjustments made to reduce the bias in Indigenous fatal burden 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 fatal burden 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 that 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 is because direct prevalence data at the state/territory level were 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 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 Indigenous health survey data (2018–19 NATSIHS; 2012–2013 Australian Aboriginal and Torres Strait Islander Health Survey (AATSIHS) biomedical data). Indigenous non-fatal burden estimates derived from the Indigenous health surveys 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, hospitalisation data were used to undertake distribution by state/territory for 10 of the 17 disease groups. Distribution for 5 groups (respiratory diseases, mental & substance use disorders, endocrine disorders (including diabetes), musculoskeletal disorders, and hearing & vision disorders) was undertaken using Indigenous health survey data. A combination of Indigenous health survey data and data from the Australian and New Zealand Dialysis and Transplant Registry (ANZDATA) was used for one group (kidney & urinary diseases), and population distribution data were used for one group (skin disorders) due to a lack of relevant data from other sources.

10.2 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 2018, most (62%) 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 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).

Estimates of HALE by remoteness for Indigenous and non-Indigenous Australians are presented elsewhere in this report (Chapter 8).

Total burden

The overall pattern of disease burden among Indigenous Australians broadly followed population size, though the total burden in *Major cities* and *Inner regional* areas was somewhat lower than might be expected based on population (Table 10.2.1). *Outer regional*, *Remote* and *Very remote* areas accounted for a higher proportion of disease burden (22%, 8.2% and 14%, respectively) than population (20%, 6.6% and 12%, respectively).

Table 10.2.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden, by remoteness, Indigenous Australians, 2018

	Major cities	Inner regional	Outer regional	Remote	Very remote	Total[a]
Indigenous population (no.)	313,303	198,457	167,494	54,800	96,488	**830,542**
Indigenous population %	37.7	23.9	20.2	6.6	11.6	**100.0**
DALY no.	85,494	54,408	55,237	20,401	34,115	**249,656**
DALY %	34.2	21.8	22.1	8.2	13.7	**100.0**
YLD no.	46,139	31,567	25,238	9,164	14,439	**126,547**
YLD %	36.5	24.9	19.9	7.2	11.4	**100.0**
YLL no.[b]	39,355	22,841	29,999	11,237	19,676	**123,108**
YLL %	32.0	18.6	24.4	9.1	16.0	**100.0**

(a) Totals exclude records with unknown/missing remoteness classification.

(b) Deaths used in the calculation of YLL estimates have been adjusted for Indigenous under-identification using ABS adjustment factors (see Appendix Table A4).

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

When examining age-standardised total burden rates, *Very remote* areas had the highest rate experienced by the Indigenous population in 2018 (492 DALY per 1,000 people), followed by *Remote* areas (486 DALY per 1,000). *Inner regional* areas and *Major cities* had the lowest rates of total burden (390 and 393 DALY per 1,000, respectively) (Table 10.2.2):

- Rates of fatal burden experienced by the Indigenous population followed a similar pattern by remoteness, being highest in *Very remote* and *Remote* areas.
- There was less variation in Indigenous rates of non-fatal burden, which were highest in *Remote* and *Inner regional* areas (each at 210 YLD per 1,000 people) and lowest in *Outer regional* areas (191 YLD per 1,000).

Table 10.2.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts and age-standardised rates (per 1,000 people[a]), by remoteness, Indigenous Australians, 2018

	Total burden		Non-fatal burden		Fatal burden[b]		
	DALY	ASR	YLD	AS	YLL	ASR	Deaths
Major cities	85,494	392.8	46,139	198.8	39,355	193.9	1,255
Inner regional	54,408	390.0	31,567	210.0	22,841	180.0	789
Outer regional	55,237	445.5	25,238	191.1	29,999	254.4	997
Remote	20,401	486.2	9,164	209.7	11,237	276.5	357
Very remote	34,115	491.6	14,439	196.1	19,676	295.5	593

(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 A4).
Note: The numbers may not add to total due to rounding.

The same general pattern in total burden rates by remoteness was evident for Indigenous males and females (Figure 10.2.1).

Figure 10.2.1: Age-standardised total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by sex and remoteness, 2018

Source: This figure is based on data in a supplementary table available online—Table S10.9.

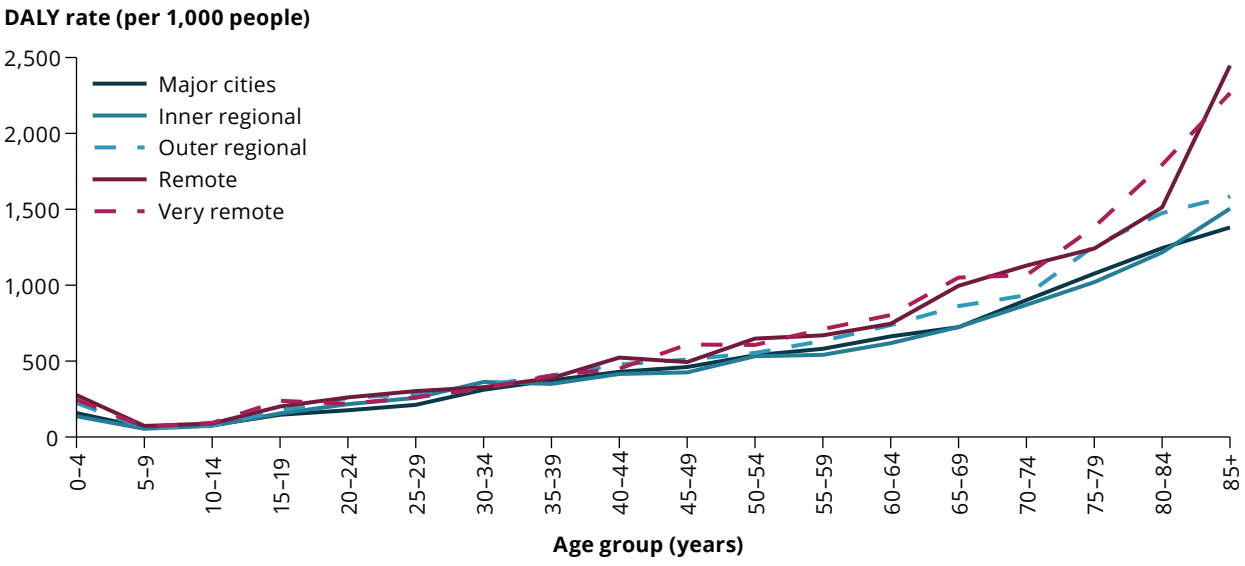
Proportions of total burden were higher for males than for females across all remoteness areas (Figure 10.2.2). Distributions by fatal and non-fatal burden show that fatal burden contributed a larger proportion of total burden in *Outer regional*, *Remote* and *Very remote* areas than in the other remoteness areas.

Figure 10.2.2: Proportion of total burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and remoteness, 2018

Source: This figure is based on data in a supplementary table available online—Table S10.10.

While Indigenous total burden rates increased with age in all remoteness areas, rates for Indigenous Australians living in *Remote* and *Very remote* areas were generally higher than for Indigenous Australians living in the other remoteness areas from age 65 onwards (Figure 10.2.3).

Figure 10.2.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and remoteness, 2018



Source: This figure is based on data in a supplementary table available online—Table S10.11.

Total burden by disease group

In 2018, mental & substance use disorders, cancer & other neoplasms and cardiovascular diseases had the highest age-standardised rates of total burden among Indigenous Australians in all 5 remoteness categories, however, there was variation in rates across remoteness area by disease group (Table 10.2.3). The greatest differences were observed for:

- Cardiovascular diseases, where the rate of burden was highest in *Very remote* areas (83 DALY per 1,000 people) and lowest in *Inner regional* areas (44 DALY per 1,000)
- Kidney & urinary diseases, where the rate of burden was highest in *Very remote* areas (33 DALY per 1,000 people) and lowest in *Major cities* (6.1 DALY per 1,000)
- Endocrine disorders (including diabetes), where the rate of burden was highest in *Very remote* areas (36 DALY per 1,000 people) and lowest in *Major cities* (12 DALY per 1,000).

Table 10.2.3: Age-standardised total burden (DALY) rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018

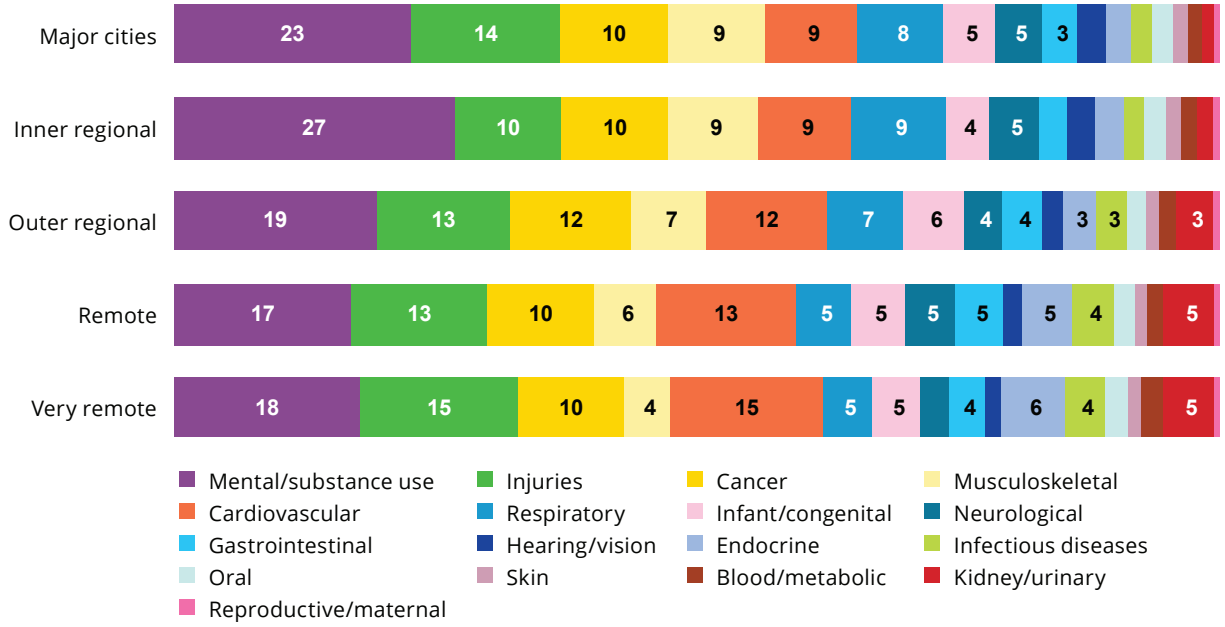
Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Mental/substance use	66.6	82.2	69.4	65.1	62.2
Cancer	53.0	51.3	62.3	57.1	61.9
Cardiovascular	46.9	43.7	64.0	74.9	83.4
Injuries	43.2	32.8	45.6	50.4	52.9
Musculoskeletal	41.6	37.6	34.7	32.3	25.8
Respiratory	36.7	39.5	37.0	29.7	28.7
Neurological	24.4	25.1	21.6	36.0	23.2
Gastrointestinal	14.4	11.7	18.3	22.2	17.4
Hearing/vision	13.1	12.3	10.1	9.9	9.4
Endocrine	11.6	12.9	17.1	26.1	36.1
Infant/congenital	9.1	7.4	12.5	13.1	11.7
Infectious diseases	8.0	6.6	13.2	17.4	19.4
Oral	7.4	7.6	7.4	9.6	10.1
Kidney/urinary	6.1	8.0	19.3	30.1	33.3
Blood/metabolic	4.9	5.0	6.2	6.5	8.8
Skin	4.1	4.4	4.3	4.0	5.6
Reproductive/maternal	1.6	1.9	2.5	1.9	1.8
Total	**392.8**	**390.0**	**445.5**	**486.2**	**491.6**

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.

Mental & substance use disorders was the leading contributor to total burden in all remoteness categories, contributing between 17% and 27% of burden (Figure 10.2.4). Injuries and cancer & other neoplasms were also leading contributors to burden, ranking in the top 4 across all remoteness categories.

Cardiovascular diseases contributed more to total burden in *Very remote* (15%, ranked third) and *Remote* (13%, ranked second) areas than in the other remoteness categories. Endocrine disorders (including diabetes) and kidney & urinary diseases ranked much higher (fifth and sixth, respectively) in *Very remote* areas than in the other remoteness categories, contributing 6.0% and 5.0% of burden, respectively.

Figure 10.2.4: Leading causes of total burden (proportion of DALY %), by remoteness, Indigenous Australians, 2018



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 S10.12.

Non-fatal burden

There was some variation in Indigenous age-standardised rates of non-fatal burden across remoteness area by disease group. The greatest differences were observed for:

- Mental & substance use disorders, where the rate of non-fatal burden was highest in *Inner regional* areas (81 YLD per 1,000 people) and lowest in *Very remote* areas (61 YLD per 1,000)
- Musculoskeletal conditions, where the rate of non-fatal burden was highest in *Major cities* (40 YLD per 1,000) and lowest in *Very remote* areas (22 YLD per 1,000)
- Endocrine disorders (including diabetes), where the rate of non-fatal burden was highest in *Very remote* areas (21 YLD per 1,000) and lowest in *Inner regional* areas (6.0 YLD per 1,000) (Table 10.2.4).

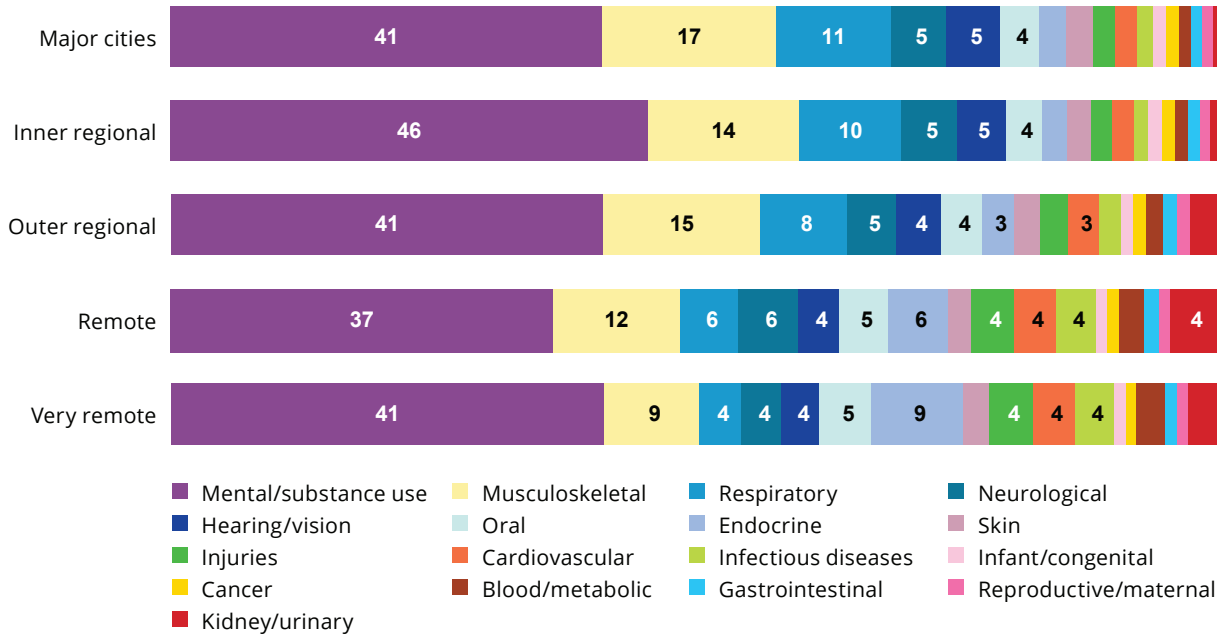
Mental & substance use disorders and musculoskeletal conditions were the top 2 contributors to non-fatal burden in all remoteness categories (Figure 10.2.5). Respiratory diseases ranked third in *Major cities*, *Inner regional* and *Outer regional* areas, but ranked fifth and sixth in *Remote* and *Very remote* areas, respectively.

Table 10.2.4: Age-standardised non-fatal (YLD) burden rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Mental/substance use	64.6	80.6	67.1	62.0	60.9
Musculoskeletal	40.4	36.5	33.3	29.4	22.4
Respiratory	23.7	21.9	16.5	12.0	8.7
Neurological	14.5	14.8	11.6	16.6	11.6
Hearing/vision	13.1	12.3	10.1	9.9	9.4
Oral	7.4	7.5	7.4	9.6	9.9
Endocrine	6.7	6.0	6.8	13.6	21.2
Cardiovascular	6.3	6.3	7.9	11.7	12.5
Cancer	3.9	4.0	3.4	3.5	3.2
Injuries	3.9	3.8	4.7	7.8	7.5
Skin	3.7	3.7	3.6	3.6	3.7
Infectious diseases	2.5	2.5	3.3	7.1	6.9
Gastrointestinal	2.0	2.4	2.6	2.9	2.1
Infant/congenital	1.9	2.1	1.9	1.8	1.6
Blood/metabolic	1.8	1.9	2.3	4.1	4.8
Reproductive/maternal	1.6	1.7	2.0	1.9	1.7
Kidney/urinary	1.0	1.9	6.4	12.2	8.1
Total	**198.8**	**210.0**	**191.1**	**209.7**	**196.1**

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.

Figure 10.2.5: Leading causes of non-fatal burden (proportion of YLD %), by remoteness, Indigenous Australians, 2018



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 S10.13.

Fatal burden

For almost all disease groups, age standardised rates of fatal burden experienced by Indigenous Australians in 2018 were highest in *Remote* or *Very remote* areas (exceptions were for cancer & other neoplasms, respiratory diseases and reproductive & maternal conditions, for which fatal burden rates were highest in *Outer regional* areas). Large differences in the rates of fatal burden by remoteness were observed for cardiovascular diseases, kidney & urinary diseases and injuries (Table 10.2.5):

- For cardiovascular diseases, the rate of fatal burden ranged from 37 YLL per 1,000 people in *Inner regional* areas to 71 YLL per 1,000 in *Very remote* areas.
- For kidney & urinary diseases, the rate of fatal burden ranged from 5.1 YLL per 1,000 people in *Major cities* to 25 YLL per 1,000 in *Very remote* areas.
- For injuries, the rate of fatal burden ranged from 29 YLL per 1,000 people in *Inner regional* areas to 45 YLL per 1,000 in *Very remote* areas.

Figure 10.2.6 shows the proportional contribution of disease groups to fatal burden in each of the remoteness categories.

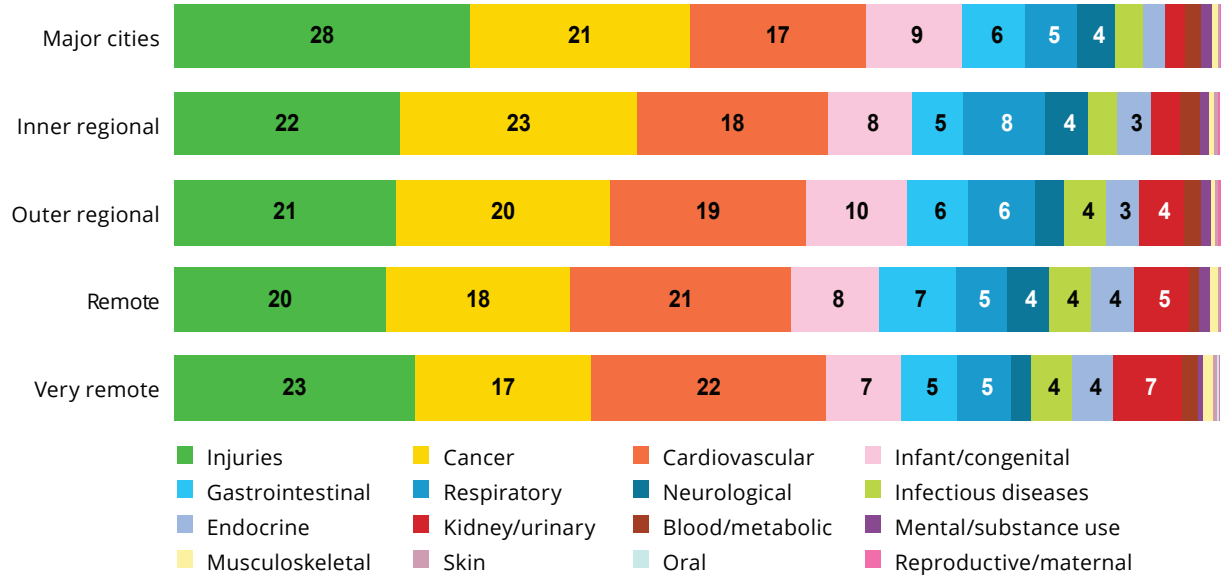
- Injuries, cancer & other neoplasms and cardiovascular diseases were the top 3 contributors to fatal burden in all remoteness categories, although the order of the top 3 differed across areas.
- Infant & congenital conditions was also a leading contributor to fatal burden, ranking fourth across all remoteness categories.
- Other leading contributors to fatal burden were gastrointestinal disorders and respiratory diseases, which ranked in fifth to seventh across all remoteness categories.
- Kidney & urinary diseases ranked fifth in *Very remote* areas and sixth in *Remote* areas but did not feature in the top 6 for any other areas.

Table 10.2.5: Age-standardised fatal (YLL) burden rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018

Disease group	Major cities	Inner regional	Outer regional	Remote	Very remote
Cancer	49.1	47.3	58.9	53.6	58.7
Cardiovascular	40.6	37.4	56.1	63.2	70.9
Injuries	39.4	28.9	40.9	42.6	45.4
Respiratory	13.0	17.6	20.5	17.7	20.0
Gastrointestinal	12.4	9.3	15.7	19.3	15.3
Neurological	10.0	10.3	10.0	19.4	11.6
Infant/congenital	7.2	5.3	10.6	11.2	10.0
Infectious diseases	5.6	4.1	9.8	10.2	12.5
Kidney/urinary	5.1	6.2	12.8	17.8	25.2
Endocrine	4.9	6.9	10.2	12.6	14.9
Blood/metabolic	3.1	3.0	3.9	2.4	3.9
Mental/substance use	2.0	1.6	2.3	3.2	1.3
Musculoskeletal	1.2	1.1	1.4	2.8	3.5
Skin	0.4	0.7	0.7	0.4	1.8
Oral	0.1	0.1	—	—	0.2
Reproductive/maternal	—	0.2	0.4	—	0.2
Total	**193.9**	**180.0**	**254.4**	**276.5**	**295.5**

Notes
1. Hearing & vision disorders are excluded as they did not cause any fatal burden.
2. Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 people.
3. The numbers may not add to total for all columns due to rounding.

Figure 10.2.6: Leading causes of fatal burden (proportion of YLL %), by remoteness, Indigenous Australians, 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of burden.
2. Hearing & vision disorders are excluded as they did not cause any fatal burden.

Source: This figure is based on data in a supplementary table available online—Table S10.14.

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 total disease burden between Indigenous and non-Indigenous Australians was in *Very remote* areas (rate ratio of 2.7; rate difference of 309 DALY per 1,000 people). *Inner regional* areas had the lowest total burden rate ratio (2.0) and rate difference (193 DALY per 1,000) (Table 10.2.6).

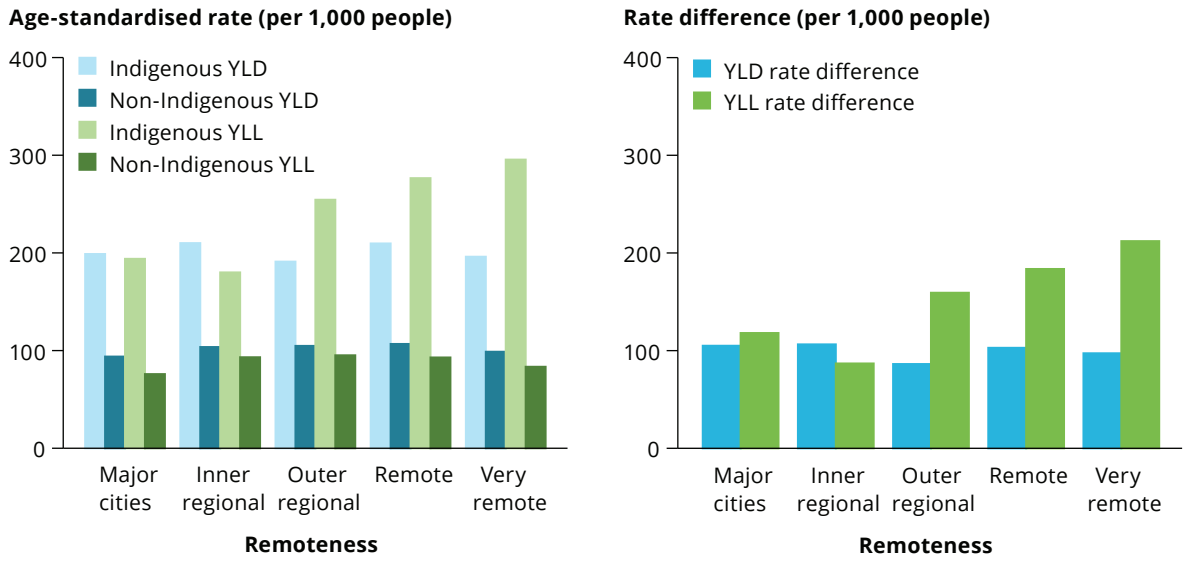
- For fatal burden, the greatest disparity in rates between Indigenous and non-Indigenous Australians was observed in *Very remote* areas, followed by *Remote* areas (Figure 10.2.7).
- By comparison there was less variation across remoteness areas in the gap between Indigenous and non-Indigenous Australians in rates of non-fatal burden.
- The gap in fatal burden was considerably larger than the gap in non-fatal burden for *Very remote*, *Remote* and *Outer regional* areas, and slightly larger in *Major cities*. For *Inner regional* areas, the gap in fatal burden was slightly lower than the gap in non-fatal burden (Figure 10.2.7).

Table 10.2.6: Age-standardised total burden (DALY) rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and remoteness, 2018

	Age-standardised DALY rate per 1,000		Health gap	
	Indigenous	Non-Indigenous	Rate difference	Rate ratio
Major cities	392.8	169.8	223.0	2.3
Inner regional	390.0	196.8	193.2	2.0
Outer regional	445.5	199.9	245.5	2.2
Remote	486.2	199.7	286.5	2.4
Very remote	491.6	182.2	309.4	2.7

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

Figure 10.2.7: Age-standardised rates of non-fatal (YLD) and fatal (YLL) burden, by Indigenous status, and the non-fatal (YLD) and fatal (YLL) gap by remoteness, 2018

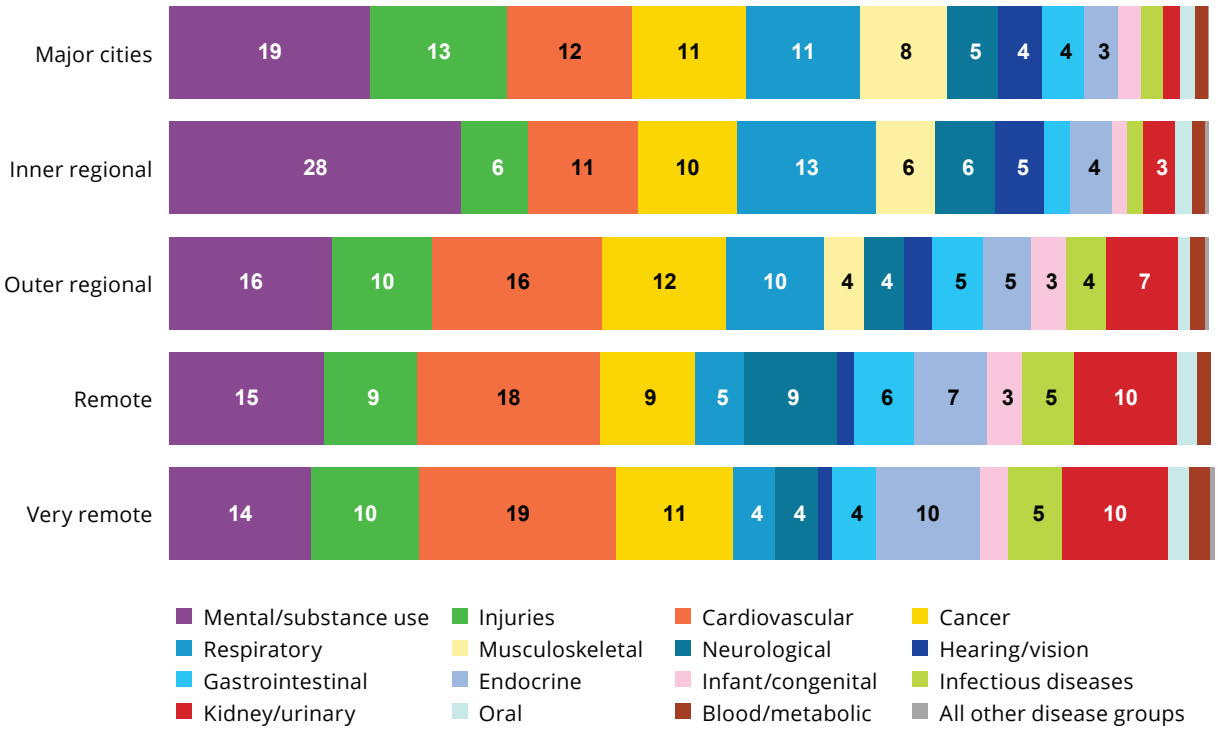


Source: This figure is based on data in a supplementary table available online—Table S10.15.

Figure 10.2.8 shows the leading disease groups contributing to the gap in total burden between Indigenous and non-Indigenous Australians in 2018 (as measured by age-standardised rate differences) in each of the 5 remoteness categories.

- Mental & substance use disorders was the leading disease group contributing to the gap in total burden in *Major cities* and *Inner regional* areas, contributing 19% and 28% of the gap in these areas, respectively. Mental & substance use disorders was the second leading contributor to the gap in the other 3 remoteness areas, contributing 14%–16% of the gap.
- Cardiovascular diseases was the leading contributor to the gap in total burden in *Outer regional*, *Remote* and *Very remote* areas, contributing 16%–19% of the gap in these 3 areas.
- Injuries were the second leading contributor to the gap in *Major cities* (13%), while respiratory diseases ranked second in *Inner regional* areas (13%).
- Respiratory diseases ranked higher and contributed a larger proportion of the gap in burden in *Inner regional* areas (13%), *Major cities* (11%) and *Outer regional* areas (10%) than in *Remote* and *Very remote* areas (5% and 4%, respectively).
- Kidney & urinary diseases ranked higher and contributed a larger proportion of the gap in *Very remote* areas (10%), *Remote* areas (10%) and *Outer regional* areas (6.9%), than in *Inner regional* areas (3.1%) and *Major cities* (1.7%).
- Cancer & other neoplasms contributed to between 9% and 12% of the gap for all 5 remoteness categories.

Figure 10.2.8: Percentage contribution (%) of leading causes of the gap in total burden between Indigenous and non-Indigenous Australians (based on DALY rate difference), by remoteness, 2018

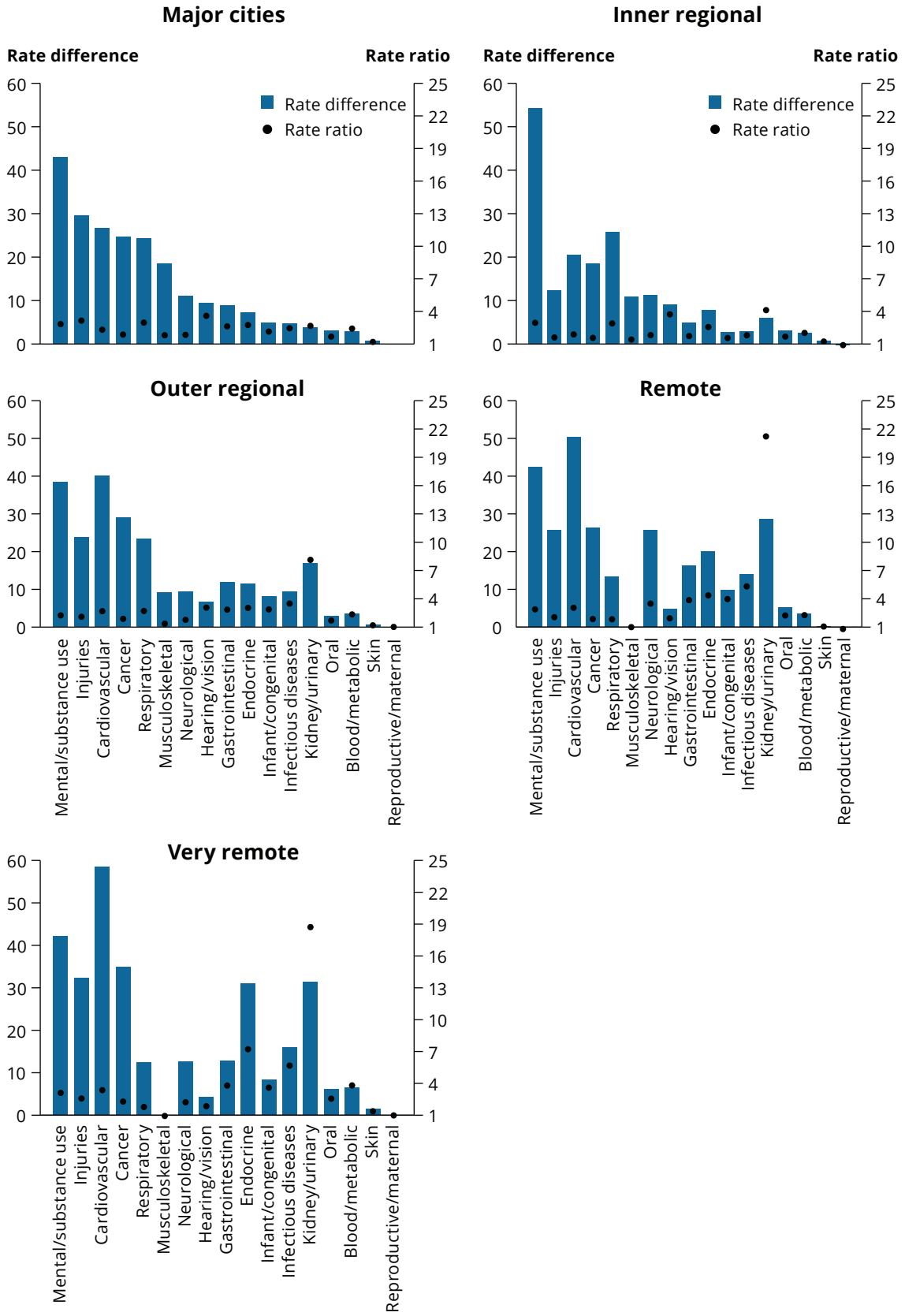


Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of burden.
2. 'All other disease groups' includes reproductive & maternal conditions and skin disorders.
Source: This figure is based on data in a supplementary table available online—Table S10.16.

Figure 10.2.9 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.

Mental & substance use disorders had the largest rate differences between Indigenous and non-Indigenous Australians in *Major cities* and *Inner regional* areas, whereas cardiovascular diseases had the largest rate differences in *Outer regional*, *Remote* and *Very remote* areas. Kidney & urinary diseases had the largest rate ratios in *Very remote*, *Remote*, *Outer regional* and *Inner regional* areas (rate ratios of 19, 21, 8.1 and 4.1, respectively), whereas the largest rate ratio in *Major cities* was for hearing & vision disorders (3.6).

Figure 10.2.9: Total burden (DALY) rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group and remoteness, 2018



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 S10.16.

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 ABS 2015–2017 CDE study (ABS 2018c). 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. Despite the adjustments made to reduce the bias in Indigenous fatal burden results, the adjustment factors themselves introduce a degree of uncertainty around the true level of mortality among Indigenous Australians. It is important to note that the fatal burden estimates by remoteness presented in this report are not comparable to fatal burden estimates presented in other sections which were adjusted using national-level factors by age.

Data quality for non-fatal burden estimates for each of the remoteness categories is considered of lower quality than fatal estimates. This is because direct prevalence data at the remoteness level were 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 ABS Indigenous health survey data (2018–19 NATSIHS; 2012–2013 AATSIHS biomedical data) were used to disaggregate the national Indigenous non-fatal burden estimates 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 health survey are subject to issues with small sample size and numbers in *Very remote* areas for some disease groups. In this analysis, hospitalisation data were used to undertake distribution by remoteness area for 10 of the 17 disease groups. Distribution for 5 groups (respiratory diseases, mental & substance use disorders, endocrine disorders (including diabetes), musculoskeletal disorders, and hearing & vision disorders) was undertaken using Indigenous health survey data. A combination of Indigenous health survey data and ANZDATA was used for one group (kidney & urinary diseases), and population distribution data were used for one group (skin disorders) due to a lack of relevant data from other sources.

10.3 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: the 2016 Indigenous Relative Socioeconomic Outcomes (IRSEO) index. It reflects the level of socioeconomic disadvantage experienced by Indigenous Australians living in each Indigenous Area in Australia and incorporates 9 variables from the 2016 Census of Population and Housing that measure employment, occupation, education, income and housing (Biddle & Markham 2017). 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 index described here incorporates 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 index.

Total burden

Total disease burden (DALY) among Indigenous Australians varied across socioeconomic disadvantage quintiles (based on the IRSEO index) (Table 10.3.1). There was no clear relationship between the distribution of Indigenous population and total disease burden across the socioeconomic disadvantage quintiles.

Table 10.3.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden, by socioeconomic disadvantage quintile, Indigenous Australians, 2018

	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Total[(a)]
Indigenous population (no.)	88,448	132,572	203,099	221,090	185,304	**830,513**
Indigenous population %	10.6	16.0	24.5	26.6	22.3	**100.0**
DALY no.	52,231	54,979	58,429	42,292	30,345	**238,276**
DALY %	21.9	23.1	24.5	17.7	12.7	**100.0**
YLD no.	31,088	30,725	30,399	20,243	14,041	**126,495**
YLD %	24.6	24.3	24.0	16.0	11.1	**100.0**
YLL no.	21,144	24,254	28,030	22,049	16,304	**111,781**
YLL %	18.9	21.7	25.1	19.7	14.6	**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.

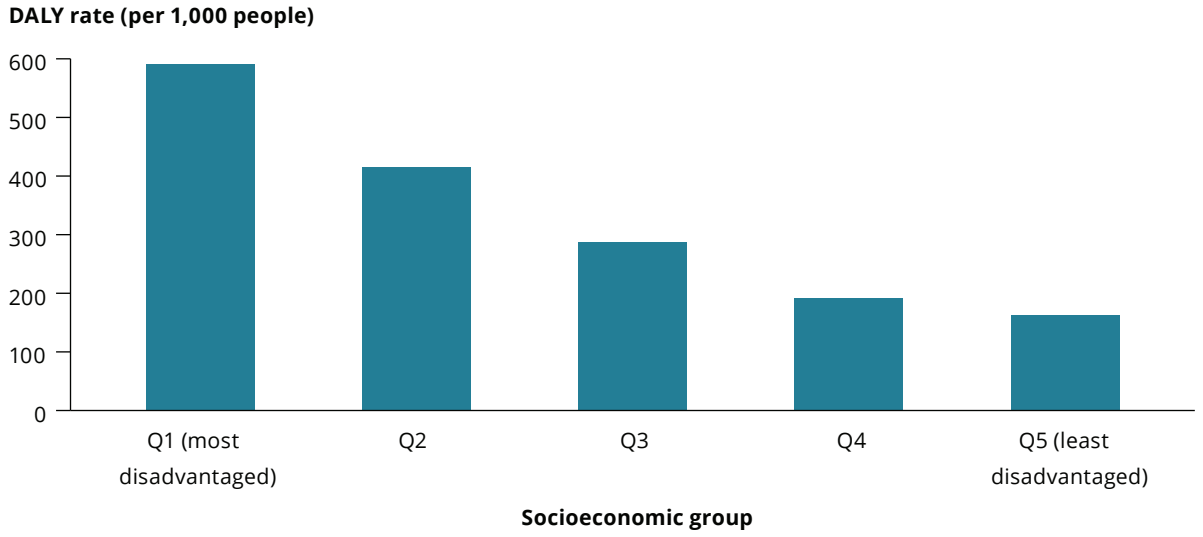
Table 10.3.2 shows the number, proportion and rates of total, non-fatal and fatal burden experienced by Indigenous Australians in 2018 by socioeconomic disadvantage quintile (based on the IRSEO index). As the IRSEO index quintiles are based on the number of regions in Australia, rather than the number 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 10.3.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts, proportions and crude rates (per 1,000 people), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018

	Total burden			Non-fatal burden			Fatal burden		
	DALY	% of DALY	Rate per 1,000	YLD	% of YLD	Rate per 1,000	YLL	% of YLL	Rate per 1,000
Q1 (most disadvantaged)	52,231	21.9	590.5	31,088	24.6	351.5	21,144	18.9	239.1
Q2	54,979	23.1	414.7	30,725	24.3	231.8	24,254	21.7	182.9
Q3	58,429	24.5	287.7	30,399	24.0	149.7	28,030	25.1	138.0
Q4	42,292	17.7	191.3	20,243	16.0	91.6	22,049	19.7	99.7
Q5 (least disadvantaged)	30,345	12.7	163.8	14,041	11.1	75.8	16,304	14.6	88.0

When examining total burden rates, a general trend of increasing rates with increasing level of socioeconomic disadvantage was observed (Figure 10.3.1). Indigenous Australians living in areas with the most socioeconomic disadvantage experienced the highest rate of total burden (591 DALY per 1,000 people), more than 3 times the rate of burden in areas with the least socioeconomic disadvantage (164 DALY per 1,000).

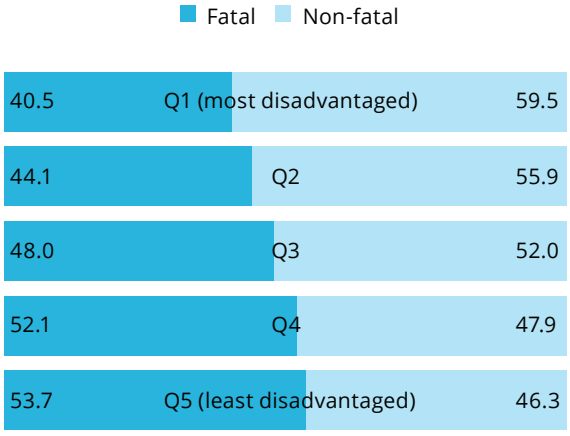
Figure 10.3.1: Total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by socioeconomic disadvantage quintile (IRSEO index), 2018



Source: Table 10.3.2.

Distributions by fatal and non-fatal burden show an increasing percentage contribution of non-fatal burden to total burden with increasing levels of socioeconomic disadvantage (Figure 10.3.2).

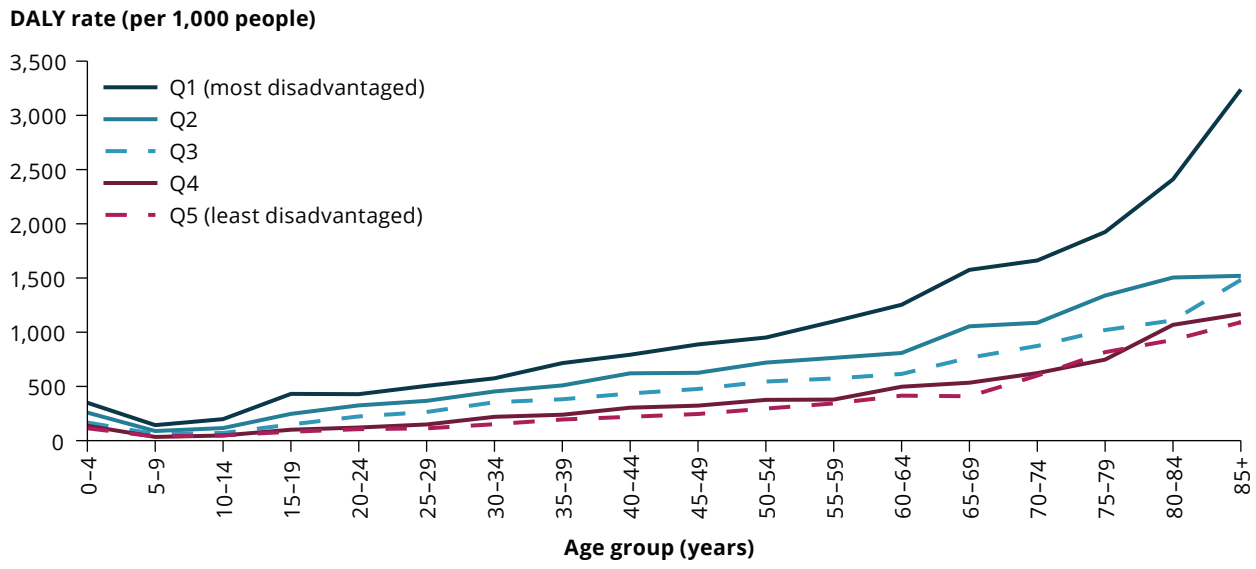
Figure 10.3.2: Proportion of total burden (DALY) for Indigenous Australians, by fatal/non-fatal burden and socioeconomic disadvantage quintile (IRSEO index), 2018



Source: This figure is based on data in a supplementary table available online—Table S10.17.

Rates of total burden generally increased with age over the 5 socioeconomic disadvantage quintiles (Figure 10.3.3). Across all age groups, Indigenous Australians living in the most disadvantaged areas experienced higher burden rates compared to Indigenous Australians living elsewhere.

Figure 10.3.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and socioeconomic disadvantage quintile (IRSEO index), 2018



Source: This figure is based on data in a supplementary table available online—Table S10.18.

Total burden by disease group

Table 10.3.3 shows relative and absolute differences in rates of total burden, comparing the most and least disadvantaged areas by disease group for Indigenous Australians in 2018.

The most disadvantaged areas experienced greater burden than the least disadvantaged areas in every disease group, indicated by a rate ratio higher than 1.0. A gradient of increasing burden with increasing disadvantage was observed in most disease groups.

The greatest relative differences were for kidney & urinary diseases, mental & substance use disorders and musculoskeletal conditions, with the most disadvantaged quintile experiencing disease burden at more than 5 times the rate of the least disadvantaged quintile.

The greatest absolute differences were for mental & substance use disorders (a difference of 140 DALY per 1,000 people) followed by musculoskeletal conditions, cardiovascular diseases and injuries (differences of 49, 42, and 37 DALY per 1,000 between the most and least disadvantaged quintiles, respectively).

Table 10.3.3: Crude total (DALY) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018

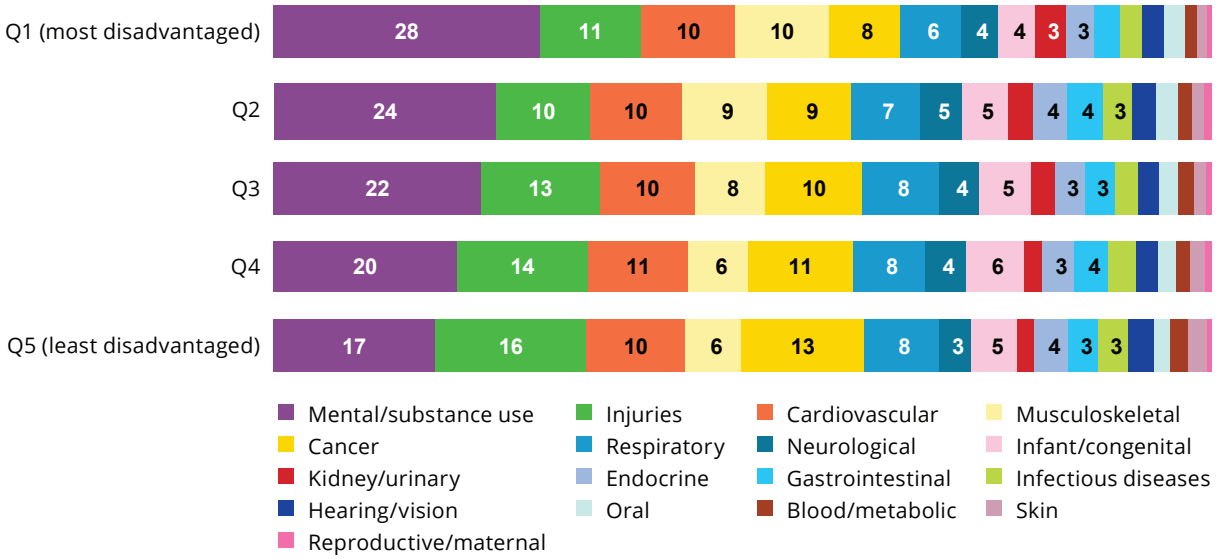
Disease group	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Rate ratio	Rate difference
Mental/substance use	167.6	98.5	63.5	37.3	28.1	6.0	139.5
Injuries	63.6	41.3	36.6	26.7	26.5	2.4	37.1
Cardiovascular	59.6	40.6	28.9	20.5	17.2	3.5	42.4
Musculoskeletal	58.6	37.9	21.8	12.2	9.9	5.9	48.7
Cancer	45.0	37.0	29.8	21.3	21.4	2.1	23.7
Respiratory	38.0	30.3	23.4	14.8	13.1	2.9	24.9
Neurological	23.8	18.8	12.5	8.3	5.6	4.3	18.2
Infant/congenital	22.8	20.0	15.7	11.8	8.1	2.8	14.7
Kidney/urinary	20.1	11.4	7.5	3.8	2.8	7.1	17.3
Endocrine	17.7	15.0	9.1	6.4	6.1	2.9	11.7
Gastrointestinal	15.8	15.7	9.2	7.1	5.2	3.0	10.5
Infectious diseases	13.8	12.7	7.1	5.5	5.1	2.7	8.7
Hearing/vision	13.8	10.8	6.5	4.6	4.6	3.0	9.3
Oral	13.3	9.6	5.8	3.7	2.8	4.7	10.5
Blood/metabolic	7.7	6.5	4.8	2.9	3.1	2.5	4.6
Skin	6.1	5.4	3.8	3.1	3.4	1.8	2.7
Reproductive/maternal	3.1	3.1	1.8	1.2	0.7	4.3	2.4
Total	**590.5**	**414.7**	**287.7**	**191.3**	**163.8**	**3.6**	**426.8**

Notes
1. The numbers may not add to total for all columns due to rounding.
2. Rate ratios calculated as the most disadvantaged quintile (Q1) rate divided by the least disadvantaged quintile (Q5) rate.
3. Rate differences calculated as the most disadvantaged quintile (Q1) rate minus by the least disadvantaged quintile (Q5) rate.
4. Analysis excludes records with unknown IRSEO index quintile.

Figure 10.3.4 presents the proportional contribution of disease groups 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 6 contributors to the total disease burden—mental & substance use, injuries, cardiovascular diseases, musculoskeletal conditions, cancer & other neoplasms and respiratory diseases—although the order of the disease group rankings and proportions differed across quintiles.

Figure 10.3.4: Leading causes of total burden (proportion of DALY %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018



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 S10.19.

Non-fatal burden

Table 10.3.4 shows relative and absolute differences in rates of non-fatal burden, comparing the most and least disadvantaged areas by disease group for Indigenous Australians in 2018.

The most disadvantaged areas experienced greater non-fatal burden than the least disadvantaged areas in every disease group, indicated by a rate ratio higher than 1.0. A gradient of increasing non-fatal burden with increasing disadvantage was observed in most disease groups.

The greatest relative differences were for neurological conditions, cancer & other neoplasms, mental & substance use disorders and musculoskeletal conditions, with the most disadvantaged quintile experiencing non-fatal disease burden at more than 6 times the rate of the least disadvantaged quintile.

The greatest absolute differences were for mental & substance use disorders (a difference of 140 YLD per 1,000 people) followed by musculoskeletal conditions, respiratory diseases and neurological conditions (differences of 47, 17, and 17 YLD per 1,000 between the most and least disadvantaged quintiles, respectively).

Table 10.3.4: Crude non-fatal (YLD) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018

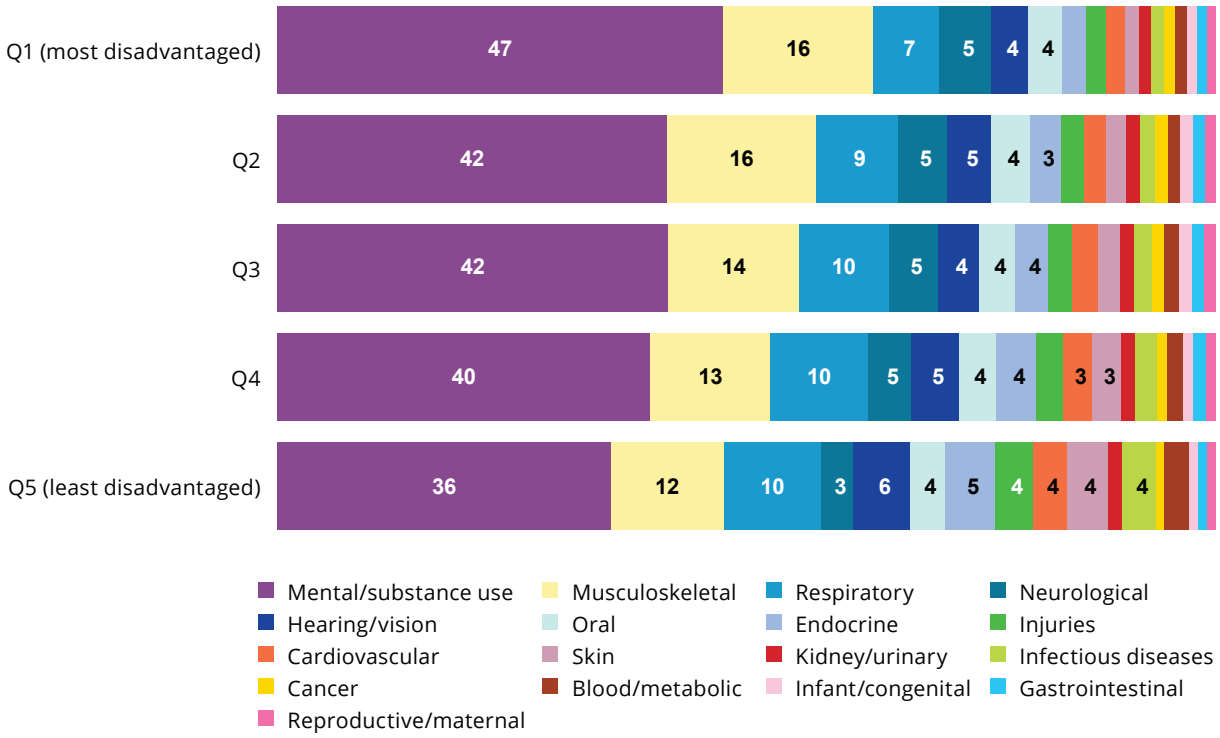
Disease group	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Rate ratio	Rate difference
Mental/substance use	166.9	96.3	62.4	36.4	26.9	6.2	140.0
Musculoskeletal	56.5	36.8	20.9	11.8	9.1	6.2	47.4
Respiratory	24.8	20.2	14.3	9.5	7.9	3.1	16.9
Neurological	19.3	12.3	7.9	4.3	2.6	7.5	16.7
Hearing/vision	13.8	10.8	6.5	4.6	4.6	3.0	9.3
Oral	12.9	9.6	5.8	3.7	2.8	4.6	10.0
Endocrine	8.8	7.7	5.3	3.9	4.1	2.2	4.7
Injuries	7.6	5.6	3.7	2.6	3.0	2.5	4.6
Cardiovascular	7.0	5.5	4.2	2.9	2.8	2.5	4.2
Skin	5.4	4.9	3.5	2.8	3.3	1.6	2.1
Kidney/urinary	4.6	3.3	2.2	1.3	1.1	4.0	3.5
Infectious diseases	4.5	3.9	3.0	2.2	2.8	1.6	1.7
Cancer	4.4	3.2	1.9	1.0	0.6	7.2	3.8
Blood/metabolic	4.3	3.0	2.4	1.5	2.0	2.1	2.3
Infant/congenital	3.8	3.2	2.1	1.0	0.7	5.6	3.1
Gastrointestinal	3.8	2.8	1.9	1.2	0.7	5.3	3.1
Reproductive/maternal	3.1	2.6	1.8	1.0	0.7	4.3	2.4
Total	**351.5**	**231.8**	**149.7**	**91.6**	**75.8**	**4.6**	**275.7**

Notes
1. The numbers may not add to total for all columns due to rounding.
2. Rate ratios calculated as the most disadvantaged quintile (Q1) rate divided by the least disadvantaged quintile (Q5) rate.
3. Rate differences calculated as the most disadvantaged quintile (Q1) rate minus by the least disadvantaged quintile (Q5) rate.
4. Analysis excludes records with unknown IRSEO index quintile.

Figure 10.3.5 presents the proportional contribution of disease groups 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 hearing & vision disorders ranked fourth or fifth in all 5 socioeconomic disadvantage quintiles, with the exception of the least disadvantaged quintile where endocrine disorders (including diabetes) ranked fifth and neurological conditions ranked 11th.

Figure 10.3.5: Leading causes of non-fatal burden (proportion of YLD %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018



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 S10.20.

Fatal burden

Table 10.3.5 shows relative and absolute differences in rates of fatal burden, comparing the most and least disadvantaged areas by disease group for Indigenous Australians in 2018.

The most disadvantaged areas experienced greater fatal burden than the least disadvantaged areas in almost every disease group, indicated by a rate ratio higher than 1.0 (the exception was mental & substance use disorders with a rate ratio of 0.6). A gradient of increasing fatal burden with increasing socioeconomic disadvantage was observed in most disease groups.

The greatest relative difference was for kidney & urinary diseases (the most disadvantaged quintile had 9.2 times the rate of the least disadvantaged quintile), followed by skin disorders (5.2) and endocrine disorders (including diabetes) (4.5).

The greatest absolute differences were for cardiovascular diseases (a difference of 38 YLL per 1,000 people) followed by injuries, cancer & other neoplasms and kidney & urinary diseases (differences of 33, 20, and 14 YLL per 1,000 between the most and least disadvantaged quintiles, respectively).

Table 10.3.5: Crude fatal (YLL) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018

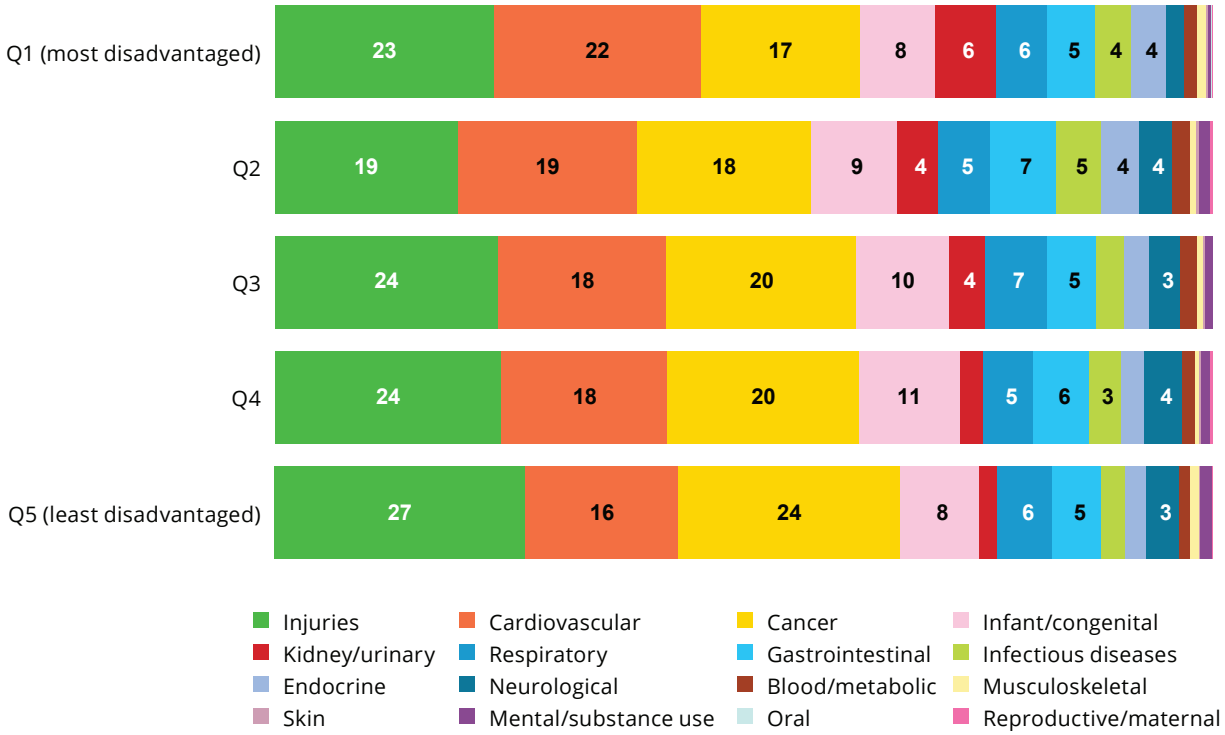
	Q1 (most disadvantaged)	Q2	Q3	Q4	Q5 (least disadvantaged)	Rate ratio	Rate difference
Injuries	56.0	35.7	32.9	24.1	23.5	2.4	32.5
Cardiovascular	52.6	35.1	24.7	17.7	14.4	3.7	38.2
Cancer	40.7	33.8	28.0	20.3	20.7	2.0	19.9
Infant/congenital	19.0	16.8	13.6	10.7	7.4	2.6	11.6
Kidney/urinary	15.5	8.1	5.3	2.5	1.7	9.2	13.8
Respiratory	13.2	10.0	9.1	5.3	5.2	2.5	8.0
Gastrointestinal	12.0	12.9	7.3	5.9	4.5	2.6	7.5
Infectious diseases	9.3	8.8	4.1	3.4	2.3	4.0	7.0
Endocrine	8.9	7.3	3.7	2.5	2.0	4.5	6.9
Neurological	4.5	6.5	4.6	4.0	3.0	1.5	1.5
Blood/metabolic	3.4	3.6	2.4	1.3	1.1	3.1	2.3
Musculoskeletal	2.1	1.1	0.9	0.4	0.8	2.7	1.3
Skin	0.7	0.5	0.4	0.3	0.1	5.2	0.6
Mental/substance use	0.7	2.3	1.1	0.9	1.2	0.6	–0.5
Oral	0.4	—	—	—	—	. .	0.4
Reproductive/maternal	—	0.5	—	0.3	—	. .	—
Total	**239.1**	**182.9**	**138.0**	**99.7**	**88.0**	**2.7**	**151.1**

Notes
1. Hearing & vision disorders are excluded as they did not cause any fatal burden.
2. The numbers may not add to total for all columns due to rounding.
3. Rate ratios calculated as the most disadvantaged quintile (Q1) rate divided by the least disadvantaged quintile (Q5) rate.
4. Rate differences calculated as the most disadvantaged quintile (Q1) rate minus by the least disadvantaged quintile (Q5) rate.
5. Analysis excludes records with unknown IRSEO index quintile.

Figure 10.3.6 presents the proportional contribution of disease groups to fatal burden for Indigenous Australians for each of the 5 socioeconomic disadvantage quintiles:

- Injuries, cardiovascular disease and cancer & other neoplasms 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.
- In general, kidney & urinary diseases were ranked higher in the more disadvantaged quintiles, compared with the least disadvantaged quintiles (ranked fifth in the most disadvantaged quintile, seventh in the middle quintile and 10th in the least disadvantaged quintile).

Figure 10.3.6: Leading causes of fatal burden (proportion of YLL %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018



Notes
1. Per cent labels are not shown for disease groups contributing less than 3% of burden.
2. Hearing & vision disorders are excluded as they did not cause any fatal burden.
Source: This figure is based on data in a supplementary table available online—Table S10.21.

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 Socio-Economic Indexes for Areas (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 quintile. This assumes there are no differences in Indigenous identification between Indigenous Australians 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 fatal burden estimates presented by socioeconomic disadvantage in this report.

Data quality for non-fatal burden estimates by level of socioeconomic disadvantage is considered reasonably low and should be interpreted with caution. This is because Statistical Area Level 2 (SA2) 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 non-fatal burden 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.

11

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 the ABDS 2018 Aboriginal and Torres Strait Islander study, as well as on the estimates themselves. These include issues relating to identification of Indigenous people in key data sources, the availability of detailed information about the prevalence of individual 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.

11.1 Data gaps and limitations

Burden of disease estimates for the Aboriginal and Torres Strait Islander population produced as part of the ABDS 2018 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 3.3% of the total Australian population in 2016. 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, as well as when making comparisons between the Indigenous and non-Indigenous populations.

Fatal burden estimates

For Indigenous Australian 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. Analysis by the AIHW suggests that up to 15% of Indigenous deaths may not be recorded as Indigenous in mortality records (AIHW 2019c). 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 (ABS 2013, 2018c; AIHW 2017f). However, uncertainty still exists around the true level of mortality among Indigenous Australians, and therefore also about Indigenous life expectancy. The lack of suitable adjustment factors for some jurisdictions also means that estimates of Indigenous fatal burden (and therefore total burden) were only able to be made for 4 jurisdictions. 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 is not currently used to assign the fatal burden (except for some cases where the underlying cause is not appropriate for use in burden of disease analysis, as described in 'Appendix A: Methods overview'). The current method assigns the entire burden to one cause of death, and therefore cannot take account of the more complex situation where multiple causes contribute to the death, or where one disease is a risk factor for another. It also relies on accurate allocation of the underlying cause of death. For example, chronic kidney disease 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 (such as that noted in Section 11.3) 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 Australian 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. These methods included the use of ratios 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 Indigenous 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:** there is good quality data (although now several years old) to estimate the burden of mental health conditions in the total Australian population available from national diagnostic surveys; however, equivalent data for the Indigenous population are lacking. Although self-reported information on mental health diagnoses is available from the NATSIHS, expert advice was that this was less reliable than data obtained from specific diagnostic surveys. An Indigenous-specific survey focused on mental health is needed to fill this information gap. Similarly, while national surveys provide good quality data on substance use in the general population, the sample size is not sufficient to directly produce estimates of burden in the Indigenous population.
- **Chronic obstructive pulmonary disease (COPD):** here, the clinical study providing Indigenous estimates of the prevalence of COPD (Cooksley et al. 2015) is based on a small sample of Indigenous Australians in the Kimberley region of Western Australia and lacks sufficient information on breakdowns of COPD by age and sex. The study recruited respondents between 2008 and 2012, and therefore results are becoming out-dated. Estimates of COPD would be improved with updated data from new studies comprising data from a larger national Indigenous sample.

- **Oral disorders:** for these, prevalence estimates for Indigenous adults and children are based on out-dated surveys with relatively small Indigenous samples (for example, the 2004–06 National Survey of Adult Oral Health (NSAOH) and the 2009 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 3 small epidemiological studies of Indigenous Australians. A larger national study of dementia in the Indigenous population is needed.
- **Injuries:** data for injury prevalence are fragmented. Admitted cases were sourced from the national hospital admissions data collection (and adjusted for under-identification). A national data source was used for assessing non-admitted (emergency care) cases of injury (also adjusted for under-identification), however, prior to 2016–17 not all data were usable due to the use of different classifications to describe injury diagnoses.
- There are also a small number of conditions for which little, or no Australian data are available for national estimates or estimates for Indigenous Australians. Such conditions include atrial fibrillation, inflammatory bowel disease and some neurological conditions. There are also conditions that are rare in Indigenous Australians (for example, sarcoidosis or cystic fibrosis). Further investigation into these areas to provide broader, Australian-specific, and Indigenous-specific results, would increase the reliability of estimates of the burden of these conditions. Further information on the quality of estimates is provided in Appendix B of this report and in the interactive data visualisations available at www.aihw.gov.au/burden-of-disease.

For severity distributions (which represent the proportion of people with a given disease by levels of severity) used in calculating Indigenous YLD estimates, the ABDS 2018 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. The ABDS 2018 national estimates 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 (for example, for coronary heart disease and stroke).

More detailed information on the methods and sources used for these estimates is provided in the ABDS 2018 methods report (AIHW 2021c).

The disability weights used in this study are sourced from the GBD 2013, and 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 Indigenous risk factor estimates, only those risk factors that had strong evidence of causal 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, bullying victimisation and racism) 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 2016 were sourced from developing countries and related to infectious diseases only.

The ABDS 2018 adopted relative risks used in the GBD 2017, GBD 2019 or the AIHW's review of the literature (AIHW 2017c, 2017d, 2018b; GBD 2017 Risk Factors Collaborators 2018; GBD 2019 Risk Factors Collaborators 2020), 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 Australian Health Survey (AHS) 2011–12.
- **Occupational exposures:** for work-related injuries, Indigenous status was not available from data published by Safe Work Australia. Instead, sex-specific Indigenous to non-Indigenous hospitalisation rate ratios of all injuries with the ICD-10-AM activity code U73 (*While working for income*) were 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 NATSIHS 2018–19 were adjusted by the same correction factors that are used nationally.
- **Limited data to inform trends:** the quality of exposure estimates on dietary risks and on risks derived from blood measurements (such as high blood plasma glucose and high cholesterol), is limited by a lack of time series data. At present, the 2012–13 AATSIHS biomedical survey (ABS 2014) provides the only national data on these risk factors for Indigenous Australians. For ABDS 2018, trends were estimated based on evidence from self-reported data, or by assuming the same trends as in the general Australian population. Data from the forthcoming biomedical component of the ABS Intergenerational Health and Mental Health Survey will be a valuable source of information for future burden of disease studies.

More detailed information on the methods and sources used for risk factor estimates is provided in the ABDS 2018 methods report (AIHW 2021c).

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 2018 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 2018 due to the extensive body of work that would be required (such as developing appropriate definitions directly related to health) and a lack of research quantifying 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 analyses 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 fully take into account known features of 'real-world' epidemiology such as mediation between risk factors, correlations between exposures, or effect modification. For some risk factors, mediation factors taken from the GBD 2019 were applied to account for known interactions; however, these do not include all known associations between risk factors (for example, associations between diet and overweight). 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. These 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)
- 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, 2011 and 2018 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, there are a number of reasons why changes over time may not be accurately assessed. Specific to Indigenous estimates, changes in Indigenous identification over time, inconsistencies in identification in the numerator and denominators used for some 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 populations used for 2003 and 2011 estimates in the current study are based on the 2016 Census. This provides a consistent denominator time series for calculating rates. This is different to the populations used for the ABDS 2011, which were based on the 2011 Census. As the ABS currently recasts the Indigenous population based on each Census, the 2003, 2011 and 2018 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 (ERP).

11.2 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 Indigenous Reference Group (IRG), to address issues affecting Indigenous burden of disease estimates in the study. 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 2003, 2011 and 2018 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, 2011 and 2018; determining 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 individual 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 and 2011 estimates to ensure consistency with 2018 estimates. 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, sensitivity analyses undertaken for the ABDS 2011 study showed no difference in the ranking of diseases in terms of both Indigenous YLL and the 'gap' in fatal burden (see 'Appendix A: Methods overview' 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 2003, 2011 and 2018 Indigenous deaths to correct Indigenous under-identification in mortality data, with the exception of estimates by remoteness in 2003 and 2011, for which AIHW adjustment factors were used due to limitations with the available ABS remoteness adjustment factors (as they combined data for *Outer regional*, *Remote* and *Very remote* areas)
- 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 since ABDS 2011 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, limit analysis to only those jurisdictions considered to have adequate Indigenous data quality for the relevant 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 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 individual 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, 2011 and 2018 Indigenous population estimates based on the 2016 Census for rate calculations, which provides consistency in Indigenous identification levels between the 3 denominators.

Uncertainty bounds have not been included in this study for a number of reasons. 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 requires a combination of assumptions, models and judgements. 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: How reliable are the estimates?'), covering all aspects affecting quality, so that users of ABDS 2018 can make judgements 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 A: Methods overview', and in an accompanying technical methods report for the ABDS 2018 (AIHW 2021c).

11.3 Opportunities to further use and improve the estimates

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, within the national context and within the Indigenous Australian context. The use of Australian data sources and adaptation of global methods to suit Australian circumstances means that the resulting estimates are directly relevant for Australian policy, planning and research purposes. The ABDS could be further used and its usefulness enhanced in a variety of ways.

Using the existing data

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 potentially policy-relevant analyses that could be undertaken using the results from ABDS 2018. There are further opportunities to explore the estimates for Indigenous population health monitoring, including:

- exploring morbidity estimates in more depth (for example, analysis in relation to chronic conditions using sequela-level information that distinguishes acute and chronic effects)
- considering the causes of variation across age/sex/subnational groups
- answering specific research questions (for example, burden in the last year of life for cancer)
- contributing 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).

Extending previous analysis to look at Indigenous Australians

Post the ABDS 2011, the AIHW undertook further work which featured more in-depth analysis for selected diseases and risk factors. This work included examining:

- the burden of disease of intimate partner violence against women (Ayre et al. 2016)
- the burden of cancer in Australia (AIHW 2017a)
- the impact of overweight (including obesity) as a risk factor for chronic conditions (AIHW 2017c)
- the impact of alcohol and illicit drug use on the burden of disease and injury in Australia (AIHW 2018b)
- diabetes and chronic kidney disease as risks for other diseases (AIHW 2016c)
- the burden of vaccine preventable diseases in Australia (AIHW 2019d)
- the first year of COVID-19 in Australia (AIHW 2021d).

These projects showcased some of the possibilities in extended work from the ABDS, and in some cases revised methods have been incorporated into the ABDS 2018; however, most did not include results for Indigenous Australians. Further work could be undertaken to explore individual diseases (including alternative disease groupings, or causes not currently reported on in the ABDS, such as septicaemia), risk factors (including diseases as risks) and combinations of risk factors, for Indigenous Australians.

Following ABDS 2015, disease expenditure estimates mapped to burden of disease causes were published for the total Australian population (AIHW 2018a). Updated estimates for the Australian population were released along with the ABDS 2018 study (see AIHW 2021e), and methods for determining expenditure estimates for the Indigenous population are being investigated. These estimates could be used to guide resource allocation or cost-effectiveness analysis.

Potential new analyses and improvements to methods

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.

Burden of disease methods are constantly evolving and improving to take advantage of new data sources, new techniques and new disease-specific information. The AIHW will continue to enhance the ABDS methods in line with international developments, and where possible make more granular data available for use by others. There are several specific areas where improvements may be made:

- **Exploring fatal burden for smaller geographic areas:** subnational estimates of Indigenous burden in the ABDS 2018 were limited by the availability of reliable prevalence data, as well as by the lack of suitable mortality adjustment factors for some jurisdictions. However, in those jurisdictions where mortality adjustment factors are available, there is scope to examine fatal burden at a lower geographic level. More granular analysis of fatal burden, particularly in relation to preventable deaths, would provide valuable information to inform prevention policies and programs.
- **Examining diseases as risks:** the ABDS 2018 quantifies the indirect impact of specific diseases (for example, diabetes and chronic kidney disease) by including them as risk factors as well as causes. Work could be undertaken to extend this approach to other disease pairs which have known associations, such as depression and cardiovascular disease.
- **Estimating the burden of COVID-19:** along with the addition of acute COVID-19 as a cause in future burden of disease studies, if data are available then work could also be undertaken to examine the longer-term impacts of COVID-19 and the indirect health effects associated with the pandemic response (for example, reductions in diseases and injuries such as influenza, road transport accidents and sporting injuries).
- **Incorporating multiple causes of death (MCoD) into fatal burden calculations:** an opportunity may exist with results from current work undertaken by the Australian National University Research School of Population Health (ANU 2021). This project's goals include the development and testing of statistical methods for MCoD quantification, quantifying the impact of using MCoD versus conventional methods, and developing a framework and toolkit for implementation of MCoDs in practice.

- **Making use of linked data assets:** the National Integrated Health Services Information Analysis Asset (NIHSI AA) is an enduring linked data asset managed under the custodianship of the AIHW, available for approved projects and analysts from the AIHW and participating jurisdictions. It contains linked data from admitted patient care services (in public and private hospitals where available), ED services and outpatient services in public hospitals for all participating states and territories, along with Medicare Benefits Schedule (MBS) data, Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS) data, Residential Aged Care Services (RACS) data and National Deaths Index (NDI) data. Components of this data set were used extensively by the ABDS 2018 national analysis team; however, at the time of the ABDS 2018, the version of the NIHSI AA (v0.5) to which the analysis team had access only included hospitals data from 4 jurisdictions (New South Wales, Victoria, South Australia and Tasmania). Data from these jurisdictions were not considered by the analysis team to adequately represent the Indigenous Australian population for the purposes of estimating prevalence of diseases. However, with continued improvements to the NIHSI AA, and expansion to cover more jurisdictions, this is expected to be possible in the near future.

Filling data gaps

The ABDS 2018 analysis phase highlighted a number of data gaps, particularly in the prevalence of diseases (for example, diseases mainly treated in primary health care), exposure for some risk factors, and for Indigenous-specific severity distributions. The development of new data sources may help to fill some of these gaps over time.

There are also various areas where current ABDS methods would benefit from further development (for example, validating comorbidity adjustment, and uncertainty estimation). Such developments would require considerable resources and were out of scope for ABDS 2018.

The non-inclusion of social determinants of health (such as income/poverty, education and employment) as risk factors is a gap common to both Australian and international burden of disease studies. Although some of the effect of social determinants on burden is already indirectly taken into account through the prevalence and risk factor exposure estimates (both of which are affected by social determinants), as well as through comparing burden estimates across socioeconomic groups (as in Chapter 10), this does not quantify the effect of individual determinants. Examining social determinants for Aboriginal and Torres Strait Islander people in a way that could potentially be incorporated into burden of disease risk factor analysis would require linkage of Indigenous health survey data with administrative data. Although not currently undertaken, such linkage 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.

Appendix A: Methods overview

This Appendix summarises the methodological approach of the ABDS 2018, 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 2018: methods and supplementary material* (AIHW 2021c).

A1. 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 below.

Disease and injury (condition) list

The disease and injury list details the individual diseases and causes of injury for which estimates were made. An Australian disease and injury list was developed specifically for the Australian Burden of Disease Study (ABDS) to reflect the Australian context. It is a hierarchical classification which comprises 2 levels. The highest level contains 17 disease groups under which 219 diseases and injuries are classified. The condition list used for the ABDS is included in Appendix Table A1. Definitions for each disease by ICD-10 for mortality or ICD-10-AM (where relevant) for morbidity are available in additional online tables.

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 choice of reference life table will affect burden of disease estimates. Other things being equal, a reference life table with longer potential life expectancies at all or most ages will result in greater YLL. Applying the same reference life table across multiple settings enables comparison between population groups and across time.

Indigenous Australians experience a lower life expectancy than non-Indigenous Australians, with a life expectancy at birth of 71.6 years for Indigenous males and 75.6 years for Indigenous females born in 2015–2017, compared with 80.2 and 83.4 years for non-Indigenous males and females, respectively. To maintain comparability across populations, however, in the ABDS 2018 the same reference life table was used for Indigenous, non-Indigenous and total population estimates.

The ABDS 2018 uses the standard reference life table developed in the GBD 2010 study (Murray and Ezzati et al. 2012). 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 life expectancy at birth to be 86.0 years for both males and females. The reference life table used in this study is included in Appendix Table A2.

The most recent global estimates of YLL are based on a newer life table—the theoretical minimum risk life table (TMRLT) (GBD 2016 Causes of Death Collaborators 2017). This life table is based on the lowest observed age-specific mortality rates from locations with total populations greater than 5 million. From this life table, life expectancy at birth is 86.6 years, 1.6 years at age 105 (the limit of the standard reference life table) and 1.4 years at age 110.

When preparing this report, the TMRLT was only available in an abridged format; that is, where life expectancy is reported for 5-year age groups. YLL estimates are best made using a life table that describes life expectancy at each single year of age. Using an abridged version results in less accurate YLL (unpublished AIHW analysis of the NMD), therefore the standard reference life table was used for calculating YLL in the ABDS 2018.

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 NMD. In this study, Indigenous deaths have been adjusted for under-identification in mortality data (see Section A3 for further information).

The data quality statements underpinning the AIHW NMD can be found in the ABS's quality declaration summary for *Deaths, Australia* and *Causes of death, Australia*.

Redistribution of unspecified deaths

Some ICD-10 codes are not appropriate or valid causes of death for burden of disease analysis, either because they are implausible underlying causes (for example, hypertension), they are intermediate causes that have a precipitating cause (for example, septicaemia) or occur in the final stages of dying (for example, cardiac arrest), or they are recoded as 'ill-defined'. The burden of disease method reassigns deaths coded to these causes to one or more 'target diseases' that are more probable underlying causes of death. This is referred to as 'redistribution', and ensures that all deaths are counted in calculating YLL.

A list of the ICD-10 codes used to identify deaths for redistribution in the ABDS 2018 is included in the accompanying technical methods report for the study (AIHW 2021c). In order to maintain comparability, the same redistribution methods and algorithms used to redistribute total Australian deaths in the ABDS 2018 have been used to redistribute Indigenous deaths.

For the 3 reference years combined, a total of 804 Indigenous deaths (9%) were identified for redistribution in the 2018 ABDS. 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 cause(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, 90% were redistributed using empirical evidence (direct evidence, indirect multiple causes of death or a mix of both) and 10% were redistributed using proportional redistribution.

The ABDS 2018 has used the same approach to redistribution as in the ABDS 2011, however, there were some updates to the redistribution algorithms for this cycle, including:

- assignment of deaths with an underlying cause of C26.0 (*Malignant neoplasm; Intestinal tract, part unspecified*) to bowel cancer, instead of being redistributed as part of the ABDS algorithm for ill-defined digestive cancers. This aligns with AIHW cancer mortality reporting and cause of death coding practice by the ABS
- updated algorithms for ill-defined digestive cancers (ICD-10 code C26 excluding C26.0) and cancers of ill-defined, secondary and unspecified sites (ICD-10 codes C76–C80). The WA cancer registry provided updated weightings to inform these redistributions
- refinement of the way deaths due to septicaemia are redistributed. Internationally, there have been changes to the selection rules for coding causes of death which has allowed more chronic conditions, such as cancers, coded to Part 2 of the death certificate (associated causes), to be selected as the underlying cause of death when sepsis appears in Part 1 (underlying cause) of the death certificate. For ABDS 2018, with advice from the ABS, we have taken these coding rules into account, with the result that deaths with septicaemia as the underlying cause are not redistributed to chronic conditions. This aligns more closely to the way septicaemia deaths are redistributed in the GBD
- refinement of the redistribution of ICD-10 code X59 (*Exposure to unspecified factor*). Previously these were redistributed proportionately across injuries. Using similar methods to those applied in AIHW injury reports, we used associated causes of death (fracture codes) to identify deaths with the underlying cause of X59 that were likely to be the result of falls. This accounted for around three-quarters of X59 deaths overall, resulting in fewer X59 deaths needing to be redistributed

- assignment of deaths with an underlying cause of E14 (*Unspecified diabetes mellitus*, excluding E14.2 *Unspecified diabetes mellitus with renal complications*). This algorithm was introduced for the ABDS 2015, as a result of dividing the single cause of 'Diabetes' (used in previous ABDS) to 3 new causes, 'Diabetes type 1', 'Diabetes type 2' and 'Other diabetes'. Deaths with an underlying cause of unspecified diabetes are distributed using proportions of diabetes by type, from the Fremantle Diabetes Study 2 (https://www.uwa.edu.au/schools/research/fremantle-diabetes-study).

For further details on the ABDS 2018 redistribution methodology see the accompanying technical methods report for the study (AIHW 2021c).

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 YLD measure 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

For conditions that are not present for the full year, prevalence is calculated as incidence (the number of cases occurring) multiplied by duration (as a proportion of 1 year).

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.

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 were not available for the Indigenous population, indirect methods were used to derive Indigenous prevalence and morbidity estimates (see Section A3 below 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 B 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 one or more disability weights via corresponding health states. A health state reflects a combination of signs and symptoms that result in a certain amount of health loss, and is not necessarily specific to one particular disease.

As in the ABDS 2011 and the ABDS 2015, the health states and disability weights used in the ABDS 2018 were drawn from the GBD 2013 (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), 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), modelling done for ABDS 2015 using DisMod II (https://www.epigear.com/index_files/dismod_ii.html) and adapted to suit the available data for Indigenous Australians 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 one condition gives rise to another condition.

Comorbidity poses a challenge for burden of disease analysis. Simply summing YLD estimates (derived from the prevalence 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'. Consider the case of Jane, who experiences metastatic cancer (DW = 0.451), episodic migraine headache (DW = 0.441) and severe epilepsy (DW = 0.552). If we trace though a case-counting approach to estimating prevalence and computing YLD estimates (that is, ignoring comorbidity), Jane would contribute 1.444 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.

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 prevalence 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 the accompanying technical methods report for the study (AIHW 2021c).

Comorbidity bias in burden of disease studies

In an ideal data environment, we might have a complete health record for every person in the population, showing what combination of conditions they experienced in the reference period, and a complete set of disability weights associated with every observed combination of conditions. We would then estimate overall YLD by summing all the health losses implied by the observed pattern of comorbidity. To calculate YLD estimates for individual conditions, we would need to somehow distribute the results for each combination back to its component conditions.

This situation, however, does not reflect either the data we have available about population health, or the disability weights that have been calculated for GBD or other burden of disease studies.

In the absence of comprehensive data sets, adjustment for comorbidity bias in burden of disease estimation has relied on modelling both the prevalence and the disability weights for comorbid conditions. The modelled data are then used to compute a re-scaled (comorbidity-adjusted) disability weight each for condition, and it is from these adjusted weights (but the original prevalence) that comorbidity-adjusted YLD estimates are derived.

Comorbidity bias adjustment in this study

A modelling strategy as outlined above was adopted to adjust for comorbidity in the ABDS 2018, with the same strategy applied for both the Indigenous and total Australian estimates. 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 data set envisaged earlier.

- For prevalence, the ABDS 2018 assumed independent ('multiplicative') comorbidity—that is, the probability of having a specific combination of conditions is simply the product of the probabilities of experiencing each of the constituent conditions. In reality, the pattern of comorbidities is likely to be more complex, but there is evidence that this assumption provides an approximation acceptable for the purposes of burden of disease estimation (Vos et al. 2012).
- For disability weights, the ABDS 2018 assumed a multiplicative relationship between the health loss suffered by a person with specific combinations of sequelae and the losses associated with the constituent sequelae. The combined disability weight for a comorbid combination of conditions is equal to:

$$1 - \prod\{1 - DW_c\}$$

  where DW_c is the disability weight for each constituent sequela and $\prod$ means the product of all factors.

  This assumption puts a maximum value of 1 on the disability weight that can arise from any combination of conditions.

Assumptions of these kinds have been used for the GBD and other recent burden of disease studies.

Because disease prevalence is known to vary by age and sex (and to support results to be broken down), the procedure was undertaken at the sequela level for each age and sex. To account for known differences in disease prevalence in the Indigenous population at points in time, comorbidity bias adjustment was undertaken separately for each of the reference years—2003, 2011 and 2018—using the prevalence data specific to those years.

Assembling the simulated population entailed the following steps.

- The available data on single-condition prevalence (and the independence assumption) were used to simulate a population that shows all possible combinations of 1, 2, 3 or 4 comorbid conditions selected from the ABDS 2018 list of sequelae. The frequency of a given combination within the simulated population depends on the probabilities (taken as the per-capita prevalence) of individual conditions. In reality, a person may experience 5 or more conditions, but the approximation error from capping the number of conditions in the synthetic population at 4 is negligible. The probability (expected prevalence) associated with a combination of conditions shrinks rapidly toward zero as the number of co present sequelae increases. For example, the impact of any change on the calculated YLD of the fifth co present sequelae is minimal, because the comorbidity-bias-adjusted disability weight is stable to the fifth decimal point. Any change in the fifth decimal place will only affect the YLD calculated for prevalence estimates greater than 100,000 in a particular age–sex cohort.
- The available data on single-condition disability weights (and the multiplicative assumption) was used to attach an adjusted disability weight to each combination of comorbid conditions, and, from there, to each population age and sex group.

The adjusted YLD that result from applying adjusted disability weights derived from the simulation are expected to be a reasonable approximation to the ideal aggregate YLD (and comorbidity-adjusted YLD for individual conditions) described earlier. The closeness of the approximation and whether an adjusted YLD has over-compensated or under-compensated for comorbidity bias depends on the assumptions regarding independence. Validation studies by the GBD and the New Zealand Ministry of Health suggest that the approximations using a multiplicative model appear reasonable at the aggregate level (NZMOH 2012; Vos et al. 2012). Further validation or improvement of the methods await the availability of richer data sets.

Total burden of disease (DALY)

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

Health-adjusted life expectancy (HALE)

Life expectancy measures the average number of years a person can expect to live, without taking into account how healthy those years of life are. During their lifetime, a person spends time in different states of health. Health-adjusted life expectancy (HALE) extends the concept of life expectancy by considering the time spent living with ill health from disease and injury. It reflects the average length of time a person at a specific age lived in full health. HALE is measured using the morbidity and mortality experienced by the population for a particular reference year. Both life expectancy and HALE are summary measures based on experiences of the population.

HALE is typically reported:

- at birth: describing the average number of healthy years that a baby born in a particular year could expect to live, if they experienced the mortality rates and morbidity rates for that year
- at age 65: describing the average number of healthy years that a person at this age could expect during their remaining expected lifetime.

HALE, as described here, differs from disability-free life expectancy in that HALE includes the full experience of ill health and the impact of the health-related consequences; disability-free life expectancy as reported by the AIHW (AIHW 2017e) encompasses a broader scope of functional limitations of disability and selected long-term conditions. For a more detailed description of the differences, see AIHW 2017b.

In the ABDS 2018, HALE is estimated using Sullivan's method (described by Jagger et al. 2014). This method requires age-specific proportions of time spent in different states of health (in this report, full heath and ill health) and age-specific mortality information from a life table.

To estimate HALE, Indigenous Australian life table data were adjusted in proportion to the average health of the population in each age group.

YLD is a measure of the years of what could have been healthy life that were instead spent in states of ill health. They represent durations of time spent living with illness, weighted for the severity of the illness, reflecting an equivalent severity weighted duration of health loss. These amounts, summed for all causes of illness, adjusted for comorbidity and averaged for the population, represent the average YLD per person (that is, the average time, per person, lived with disability). Accordingly, the complement of the average time spent in ill health is the average time spent in full health.

Applying the average level of full health per person to the total person-years lived (from a life table) results in the total person-years lived in full health. Subsequent application of life table methods results in a corresponding adjusted life expectancy—the health-adjusted life expectancy, or HALE.

Sullivan's method is used by many countries for estimating HALE. More detail on HALE calculations are described in the methods report (AIHW 2021c).

HALE is used elsewhere as a standard measure of population health. The WHO estimates HALE for member countries with Sullivan's method using the GBD estimates of YLD rates for each country. The European Union also computes and monitors HALE for European Union countries on an annual basis. HALE has been used elsewhere in policy application: in the United Kingdom for monitoring the quality of life and social exclusion of older people, and in Canada to compare health status across provinces (Steifel et al. 2010).

Risk factors

Quantification of the impact of risk factors assists in making evidence-based decisions about where to direct efforts to improve population health and prevent disease and injury. The comparative risk assessment method has become standard global practice in burden of disease risk factor analysis (Ezzati et al. 2004).

The basic steps to estimate risk factor attributable burden are:

1. Select risk factors
2. Select linked diseases for which there is convincing or probable evidence in the literature that the risk factor has a causal association with increased prevalence or mortality
3. Define the exposure to the risk factor that is not associated with increased risk of disease (the TMRED or the counterfactual)
4. Estimate the PAFs by either the direct method or the comparative risk assessment method
   - if PAFs appropriate to the disease and population in question are available from a comprehensive data source (such as a disease register), they are estimated directly from this data source (named a 'direct PAF' in this report) and do not require the following steps
   - if not, PAFs are created using the comparative risk assessment method, which involves steps 5, 6 and 7
5. Define the amount of increased risk (relative risk) of linked disease morbidity or mortality due to exposure to the risk factor
6. Estimate exposure to each risk factor in the population
7. Use these inputs to calculate the PAF.

This section describes the method used to quantify the impact of risk factors in the ABDS 2018.

Risk factor list

Burden of disease studies 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, and are particularly relevant in the Indigenous Australian context. 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.

There are 39 risk factors included in the ABDS 2018 for the Indigenous component of the study (see Appendix Table A3 for a list). The same risk factor list was used for ABDS estimates for the total Australian population with 3 exceptions: unsafe sanitation, which was included for Indigenous estimates only; and high sun exposure and bullying victimisation, which were included for total population estimates only.

Linked diseases

A linked disease is a condition in the disease list with a known risk factor for that condition. For example, high fasting blood plasma glucose is a risk factor for type 2 diabetes, ischaemic heart disease (also called coronary heart disease), stroke and chronic kidney disease. In this report, such associations are described as diseases or injuries being 'linked to' that risk factor. Thus, these diseases are linked to the risk factor high blood plasma glucose.

Convincing or probable evidence is used to identify linked diseases as defined according to criteria set by the World Cancer Research Fund (WCRF & AICR 2007). The criterion is broken down into 'convincing', 'probable', 'possible' and 'insufficient' evidence. Linked diseases are categorised as convincing or probable based on the robustness and volume of studies showing a relationship. The lists of risk factors, linked diseases and the size of the association (relative risk) changes between successive burden of disease studies as more research evidence becomes available. The risk factors selected for inclusion in this study are shown in Table 5.1.

For those risk factors selected for inclusion in this study, the ABDS 2018 adopted the available relevant linked diseases used in the GBD 2019 (GBD 2019 Risk Factors Collaborators 2020) and those identified by the AIHW from literature reviews undertaken for selected risk factors as part of extension projects (AIHW 2017c, 2017d, 2018b).

The linked diseases were spread across 16 disease groups. Some risk factors were linked to a single disease only, while others had many outcomes within these disease groups.

Theoretical minimum risk exposure distribution

The estimated contribution of a risk factor to disease burden is calculated by comparing the observed risk factor distribution with an alternative, hypothetical distribution (the counterfactual scenario). This scenario could be an increase or decrease in levels of exposure or changes in behaviour compared with what is currently observed in the population. In the ABDS 2018, as in previous burden of disease studies, a TMRED (theoretical minimum risk exposure distribution) scenario was adopted. This involved determining the hypothetical exposure distribution that would lead to the lowest conceivable disease burden.

For some risk factors, the choice of the TMRED is obvious, as it involves no exposure to risk—for example, all people are lifelong non-smokers, or all people are highly active. However, for many risk factors, no exposure is not appropriate, either because it is physiologically impossible (for example, blood pressure or body mass index), or because there are lower limits beyond which exposure cannot feasibly be reduced (for example, air pollution). In these cases, epidemiological evidence is used to determine the optimal level of exposure, which reflects either the lowest level at which a dose–response relationship can be observed within a meta-analysis of cohort studies, or the lowest risk factor exposure distribution observed globally (GBD 2019 Risk Factors Collaborators 2020).

The counterfactual then becomes a narrow distribution around the optimal level. For example, based on a meta-analysis of global studies, the counterfactual distribution for high body mass index is based on a population mean of a body mass index of 20–25 kg/m^2 with a standard deviation of 1.

The TMRED may not be achievable, feasible or economically viable in the Australian population; for example, no unsafe sex.

Where the TMRED is a range, exposure to risk is not dichotomous (that is, at risk or not at risk). In this situation, the measure of attributable burden cannot be estimated by simply comparing each level of exposure in the population with the endpoints. Instead, to determine how much burden each exposure level contributes compared with the TMRED, the relative position in the range of the level of exposure is compared with its relative position in the range of the TMRED. The appropriate TMRED value for each category of exposure depends on the placement of their category within the risk factor exposure distribution of the population, starting at the lowest TMRED possible.

Direct population attributable fractions

For some risk–outcome pairs, direct evidence is used to calculate the PAFs. This is used:

- for linked diseases where there is evidence from high-quality data sources to attribute a disease outcome to a risk factor in Australia. It is important that the estimate captures all cases of the disease outcome in Australia. An example is the HIV register which collects data on the risk factor exposures that cause HIV (unsafe sex and/or drug use). The direct PAF is calculated as the proportion of the outcome caused by the risk factor
- when exposure to the risk factor is necessary to have the outcome—for example, all of the disease outcome 'alcohol use disorders' is attributable to the risk factor 'alcohol use'. In this case, the PAF is 1, where all of the disease outcome is attributed to the risk factor.

Population distribution of exposure

To estimate the PAF using comparative risk assessment, the population distribution of exposure needs to be estimated.

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 2018, the definitions of risk factor exposures have been adopted where possible from the GBD 2019 (GBD 2019 Risk Factors Collaborators 2020) and the AIHW's review of the literature (AIHW 2017c, 2017d, 2018b).

Estimates of Indigenous population distributions of risk factor exposure by age and sex have been based on a variety of sources. The 2012–13 Aboriginal and Torres Strait Islander Health Survey and the 2018–19 National Aboriginal and Torres Strait Islander Health Survey were the primary data sources for most risk factor exposure estimates. This was complemented by administrative data sets such as the exposure type recorded on disease notifications to the National Notifiable Diseases Surveillance System (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)

Comparative risk assessment estimates use relative risks to measure the strength of causal association between risk factors and the linked disease outcomes. The ABDS 2018 has adopted relative risks released by the GBD 2017, GBD 2019 or the AIHW's review of the literature (AIHW 2017c, 2017d, 2018b; GBD 2017 Risk Factors Collaborators 2018; GBD 2019 Risk Factors Collaborators 2020). The GBD relative risks used were deemed appropriate to be used globally, in different countries and for different ethnicities.

Effect sizes used were adjusted for confounders ('parallel' risk factors) but not for factors that occur successively along the causal pathway. For example, relative risk of coronary heart disease due to physical inactivity was not adjusted for high blood plasma glucose as these risk factors occur along the same causal pathway. This means that their effects cannot be added together.

Where categories of relative risk did not correspond to an equivalent exposure category, the relevant relative risk to apply to each exposure category was determined as the relative risk for the median survey response of that category. For example, for the proportion of the population who ate 80–120 g of fruit, the relative risk for the median, which was 111 g in this example, was applied. When the exposure category included an open-ended range, the median in this range was also used.

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). PAFs were calculated for each linked disease by year, sex and age group. 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 $\sum_c$ is the sum over all categories, c is an index for category, *P* = prevalence and *RR* = relative risk.

For selected risk factors, the PAF calculation formula was changed based on GBD 2019.
The following formula allows the relative risks to be protective and therefore less than 1:

$$PAF = \frac{\sum_c RR_c P_c - RR_{TMRED}}{\sum_c RR_c P_c} \times 100$$

where $\sum_c$ is the sum over all categories, *c* is an index for category, *P* = prevalence and *RR* = relative risk.

Combined risk factor analysis

To combine risk factors the following formula was used:

$$PAF_i = 1 - \prod_r (1 - PAF_{ir})$$

where PAF_i is the PAF of burden attributable to a particular disease from those risk factors being combined (such as all risk factors or all dietary risk factors), *i* is the linked disease, *r* is the individual risk factor for a linked disease being combined, PAF_{ir} is the PAF for risk factor '*r*' and linked disease *i*, and $\prod$ is the product over all risk factors.

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 account for risk factors on the same causal pathway, attenuation factors were used to attenuate the PAF of the risk factor second to the other factor in the same causal pathway. The attenuation factors were sourced from GBD 2019 (GBD 2019 Risk Factors Collaborators 2020).

A2. Overarching methodologies /choices

Reference year

The reference year for the estimates is 2018. This is the latest year of data available at the time of analysis for the majority of data sources used to produce burden of disease estimates. Where data were not available for the reference year from a particular data source, modelling techniques were used to adjust the counts or rates to the reference year.

While overarching methods for estimating disease burden remained unchanged from the ABDS 2011, revision of some disease-specific methods in ABDS 2015 and ABDS 2018 led to estimates that differed considerably from the ABDS 2011. Therefore, revision of 2011 and 2003 estimates were required to provide comparable Indigenous burden of disease estimates to assess changes over time. These revisions reduce the risk of users making erroneous comparisons between previous 2003 and 2011 Indigenous estimates and those produced in ABDS 2018.

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 for 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 A3 for more detail).

Geography

Analysis by geographical areas was carried out for selected states and territories, remoteness and socioeconomic group based on area of usual residence. See Section A3 for further information on Indigenous subnational estimates presented in this report.

Reference populations

Aboriginal and Torres Strait Islander population estimates as at 30 June 2018 (based on the 2016 Census) were used to calculate Indigenous rates presented in this report. See Section A3 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 2016, 2017 and 2018). These estimates were calculated based on the ABS's 2016 Census ERP for the Aboriginal and Torres Strait Islander population. The ABS has released the 2018 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 2016 Aboriginal and Torres Strait Islander ERP at Statistical Area Level 2 (SA2) was used.

The Australian 2001 standard population (published 20 June 2013) is used for all age-standardisation as per AIHW and ABS standards.

A3. Indigenous-specific methods/data quality issues

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 below.

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 individual disease, and for subnational estimates).

Indigenous mortality and YLL estimates presented in this report were based on the annual average of 3 years of deaths data. For the 2018 reference year, deaths were averaged from deaths occurring in 2016, 2017 and 2018; for the 2011 reference year, deaths were averaged from 2010, 2011 and 2012; and for the 2003 reference year, deaths were averaged from 2002, 2003 and 2004.

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; 25–44; 45–64; 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 individual diseases

Of the 17 disease groups included in the ABDS 2018 disease and injury list, for YLL estimates, often a reduced number of disease groups, and the top 20 individual 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 along with the top 20 individual diseases.

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 2018c). 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.

National and state/territory data linkage studies undertaken to ascertain levels of Indigenous under-identification in death registration records have each produced adjustment factors. These studies include the ABS Census Data Enhancement Study (CDE) Indigenous Mortality Study (ABS 2013, 2018c) and the AIHW Enhanced Mortality Database (EMD) study (AIHW 2012, 2017f).

The ABS's CDE Indigenous Mortality Study linked Census records with death registration records and produced subnational mortality correction factors for 2010–2012 (2011 Census based) and 2015–2017 (2016 Census based) (ABS 2013, 2018c). The AIHW's Enhanced Indigenous Mortality Data Collection (EIMDC) links registered deaths with Indigenous death records from administrative data sources including residential aged care data, hospital data and perinatal data. 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). Remoteness adjustment factors from the most recent ABS study are available for 3 combined categories of remoteness: *Major cities*, *Inner/Outer regional* combined and *Remote/Very remote* combined.

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. These analyses showed only modest differences, and, at the national level, the age patterns and disease rankings remained consistent using either set of adjustment factors. Therefore, the ABDS 2018 used adjustment factors from the ABS 2016 CDE study to adjust Indigenous deaths for YLL estimates and gap measures at both the national and state/territory levels. The ABS adjustment factors 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. The ABS adjustment factors are also the official estimates of Indigenous mortality coverage in Australia. This approach also provides consistency in methods between the Indigenous components of the ABDS 2011 and the ABDS 2018.

The exception to this approach was for estimates by remoteness for the 2011 and 2003 reference years, for which AIHW adjustment factors were used due to limitations with the available ABS remoteness adjustment factors. The combined adjustment factor for *Outer regional/Remote/Very remote* produced from the earlier ABS study was 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 mask any mortality disparities by remoteness.

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 Enhanced Mortality Data Linkage study.

The mortality adjustment factors used in the ABDS 2018 can be found in Appendix Table A4.

Adjusting for Indigenous under-identification in hospitals data

Indigenous Australians are under-identified in hospitals data to varying degrees across state and territory, remoteness areas and over time. This results in an underestimate of hospitalisations of Indigenous Australians.

The AIHW has undertaken 2 national studies (2007–08 and 2011–12 hospital audits) to assess the level of Indigenous under-identification in hospitalisations data (AIHW 2010, 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, in order to produce correction factors for Indigenous under-identification in hospitalisations data. Adjustment factors were produced from these studies at varying levels (national, state/territory, and remoteness, and remoteness within state/territory for the 2011–12 audit only).

For the ABDS 2011, the AIHW undertook a series of sensitivity analyses of hospitalisations data to determine which set of adjustment factors was the most appropriate to apply to Indigenous hospitalisations for the purpose of burden of disease analysis. As a result of this analysis, it was agreed with the ABDS 2011 IRG that the AIHW's state/territory by remoteness adjustment factors from the 2011–12 hospital audit would be applied to hospitalisations data for calculating Indigenous burden of disease estimates for 2011, and the AIHW's remoteness adjustment factors from the 2007–08 hospital audit would be applied to hospitalisations data for calculating Indigenous burden of disease estimates for 2003.

For ABDS 2018, the same methods were used to adjust hospitalisations data for the 2003 and 2011 reference years. For the 2018 reference year, however, no more recent evidence could be found by which the level of Indigenous under-identification in hospitalisations data could be quantified. The AIHW therefore undertook a series of analyses to determine the effect that increases or decreases in identification over time in different geographic areas would have on burden of disease estimates derived from hospitalisations data. These analyses suggested that modest changes in identification levels (on a scale similar to the changes observed between the 2007–08 and 2011–12 hospital audits) would have minimal impact on burden of disease estimates. As a result of this analysis, it was agreed with the ABDS 2018 IRG that the state/territory by remoteness adjustment factors from the 2011–12 hospital audit would be applied to hospitalisations data for calculating Indigenous burden of disease estimates for 2018.

The hospital adjustment factors used in the ABDS 2018 can be found in Appendix tables A5 and A6.

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 to the estimates produced.

Measuring the gap between Indigenous and non-Indigenous Australians

Direct age-standardisation was used to compare rates between Indigenous and non-Indigenous Australians, and to measure the gap in burden between the 2 populations. The direct method was chosen, following a series of sensitivity analyses previously undertaken by the AIHW, which looked at the impact and robustness of using the direct method compared with the indirect method on resulting Indigenous YLL estimates (see AIHW 2015 for more information). The direct method enables multiple comparisons (for example, disease 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 it is applied to a small number of deaths and prevalent cases; this should be kept in mind when interpreting gap results for less common diseases and conditions.

Age-standardised rate differences and rate ratios were reported as measures of the gap. Rate differences provide a measure of the absolute gap between 2 populations, while rate ratios are a measure of the relative gap between 2 populations.

For the most accurate estimate 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 should not be added together to estimate burden in the total Australian population. Refer to the AIHW report *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2018* (AIHW 2021a) for burden of disease estimates for the total Australian population.

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 2018 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:

- applying Indigenous: total hospitalisation rate ratios to the total population prevalence
- applying Indigenous: total rate ratios from other relevant data sources (for example, mortality data, health surveys, health services data, epidemiological studies) to the total population prevalence
- sourcing data from international literature on disease prevalence in other indigenous populations (for example, applying Māori: non Māori prevalence rate ratios or assuming Māori prevalence rates)
- using the total population prevalence estimate for the Indigenous population estimate (assuming 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 (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 61 diseases across 10 disease groups where indirect methods were used to derive Indigenous prevalence for either the whole or part of the disease. Of these, 32 (52%) used hospitalisation rate ratios, 28 (46%) used rate ratios from other data sources, and 1 (<0.5%) used Māori prevalence rates. A list of these diseases and sequela and the indirect methods used can be found in Appendix Table A7. Infectious diseases represented the largest proportion (47%) of Indigenous YLD produced based on indirect methods (and accounted for 30 of the diseases).

A further 10 diseases used national prevalence rates to derive Indigenous prevalence for the whole disease, and 10 diseases used national ratios to derive Indigenous prevalence for particular sequelae (applied to Indigenous hospitalisations or cancer incidence rates), together representing 13% of total Indigenous YLD in 2018 (Appendix Table A8).

Indigenous subnational estimates

Indigenous subnational estimates are reported for selected states and territories (New South Wales, Queensland, Western Australia and the Northern Territory), remoteness categories and socioeconomic quintiles. Estimates were calculated at the disease group level only (not at the individual disease 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, that individual mortality adjustment factors are not available from the ABS for these jurisdictions, and that the use of a combined adjustment factor produced by the ABS for these 4 jurisdictions 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 2016 Indigenous Relative Socioeconomic Outcomes (IRSEO) index is used to examine variation in the burden of disease for the Indigenous population in 2018 by level of socioeconomic disadvantage (Biddle & Markham 2017). The index incorporates 9 variables from the 2016 Census of Population and Housing that measure employment, occupation, education, income and housing. The IRSEO index was originally calculated at Indigenous Area level and has been converted to 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 the Socio-Economic Indexes for Areas (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 Indigenous-specific health survey data to disaggregate the national-level Indigenous YLD estimates for each disease group. Hospitalisation data was used for 10 disease groups and health survey data was used for 6 disease groups for state/territory and remoteness estimates. The subnational Indigenous population structure was used for one disease group (skin disorders). For estimates by socioeconomic quintile, hospitalisation data was used for all disease groups as SA2 data were available from this data collection, which was required to calculate the IRSEO index.

The data source used for each disease group to disaggregate Indigenous YLD into subnational categories can be found in Appendix Table A9; and the subnational proportions used to disaggregate Indigenous YLD estimates for each disease group can be found in Appendix tables A10–A12.

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 above was used to produce subnational estimates for the non-Indigenous population, with the general health surveys used as the data source to determine proportional splits in place of the Indigenous-specific surveys. 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 2018* (AIHW 2021a). This is because different methods and/or data sources may have been used to calculate these estimates.

Assessment of changes over time and population denominator issues

The population denominators used to calculate rates for 2003, 2011 and 2018 Indigenous burden of disease estimates are the ABS Aboriginal and Torres Strait Islander population estimates as at 30 June for 2003, 2011 and 2018, respectively, based on the 2016 Census (ABS 2019b). This is consistent with other AIHW reporting relating to Indigenous Australians, and with the decision made by the National Indigenous Reform Agreement Performance Information Management Group (NIRA PIMG) in relation to national reporting.

Using the 2016 Census backcast population estimates and projections provides consistency between the denominators used for 2003, 2011 and 2018 Indigenous burden of disease estimates, which is very important for assessing rate changes over time. However, this choice inherently applies the Indigenous identification level in 2016 to all years in the series.

Disease occurrence in 2003, 2011 and 2018 may not always follow the same identification as population measurements in 2016 and so it is important to note that some Indigenous burden of disease rates, which have not had any adjustments made for under-identification, may be affected by numerator/denominator inconsistencies. This should be kept in mind when interpreting any changes over time in Indigenous burden of disease estimates reported.

While 2003, 2011 and 2018 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 3 points (additional data points are needed in order to accurately track changes over time).

The Indigenous populations used for the 2003 and 2011 estimates in the ABDS 2018 are different to the populations used for the same reference years in the ABDS 2011 (which used the 2003/2011 Indigenous populations based on the 2011 Census). The populations used in the current study do not reflect the population of people who would have identified as Indigenous in 2003 or 2011.

Table A1: Disease and injury list

Infectious diseases	Infectious diseases (continued)	Cancer & other neoplasms (continued)
Barmah Forest virus	Other sexually transmitted infections	Lip & oral cavity cancer
Campylobacteriosis	Other infections	Liver cancer
Chlamydia	**Infant & congenital conditions**	Lung cancer
Dengue	Birth trauma & asphyxia	Melanoma of the skin
Diphtheria	Brain malformations	Mesothelioma
Gonorrhoea	Cardiovascular defects	Myeloma
HIV/AIDS	Cerebral palsy	Nasopharyngeal cancer
Haemophilus influenzae type-b	Cleft lip and/or palate	Non-Hodgkin lymphoma
Hepatitis A	Down syndrome	Non-melanoma skin cancers
Hepatitis B (acute)	Gastrointestinal malformations	Oesophageal cancer
Hepatitis C (acute)	Neonatal infections	Ovarian cancer
Herpes-zoster	Neural tube defects	Pancreatic cancer
Influenza	Pre-term birth & low birthweight complications	Prostate cancer
Lower respiratory infections	Sudden infant death syndrome	Stomach cancer
Malaria	Urogenital malformations	Testicular cancer
Measles	Other chromosomal abnormalities	Thyroid cancer
Meningococcal disease	Other congenital conditions	Unknown primary
Mumps	Other disorders of infancy	Uterine cancer
Otitis media	**Cancer & other neoplasms**	Other blood cancers
Pertussis	Acute lymphoblastic leukaemia (ALL)	Other leukaemias
Pneumococcal disease	Acute myeloid leukaemia (AML)	Other oral cavity & pharynx cancers
Ross River virus	Benign & uncertain brain tumours	Other benign, in situ & uncertain neoplasms
Rotavirus	Bladder cancer	Other malignant neoplasms (cancers)
Rubella	Bowel cancer	**Cardiovascular diseases**
Salmonellosis	Brain & central nervous system cancer	Aortic aneurysm
Syphilis	Breast cancer	Atrial fibrillation & flutter
Tetanus	Cervical cancer	Cardiomyopathy
Trachoma	Chronic lymphocytic leukaemia (CLL)	Coronary heart disease
Tuberculosis	Chronic myeloid leukaemia (CML)	Hypertensive heart disease
Upper respiratory infections	Ductal carcinoma in situ (DCIS) (breast)	Inflammatory heart disease
Urinary tract infections	Gallbladder cancer	Non-rheumatic valvular disease
Varicella	Hodgkin lymphoma	Peripheral vascular disease
Other gastrointestinal infections	Kidney cancer	Rheumatic heart disease (including acute rheumatic fever)
Other meningitis & encephalitis	Laryngeal cancer	Stroke

(continued)

Table A1 (continued): Disease and injury list

Cardiovascular diseases (continued)	Mental & substance use disorders (continued)	Musculoskeletal conditions
Other cardiovascular diseases	Anxiety disorders	Back pain & problems
Respiratory diseases	Attention deficit hyperactivity disorder (ADHD)	Gout
Asbestosis	Autism spectrum disorders	Osteoarthritis
Asthma	Bipolar affective disorder	Rheumatoid arthritis
Chronic obstructive pulmonary disease (COPD)	Conduct disorder	Other musculoskeletal conditions
Interstitial lung disease	Depressive disorders	**Hearing & vision disorders**
Sarcoidosis	Drug use disorders (excluding alcohol)	Age-related macular degeneration
Silicosis	Eating disorders	Cataract & other lens disorders
Upper respiratory conditions	Intellectual disability	Glaucoma
Other pneumoconiosis	Schizophrenia	Hearing loss
Other respiratory diseases	Other mental & substance use disorders	Refractive errors
Gastrointestinal disorders	**Endocrine disorders**	Other hearing & vestibular disorders
Abdominal wall hernia	Type 1 diabetes mellitus	Other vision disorders
Appendicitis	Type 2 diabetes mellitus	Skin disorders
Chronic liver disease	Other diabetes mellitus	Acne
Diverticulitis	Other endocrine disorders	Dermatitis & eczema
Functional gastrointestinal disorders (FGID)	**Kidney & urinary diseases**	Psoriasis
Gallbladder & bile duct disease	Chronic kidney disease	Scabies
Gastro oesophageal reflux disease (GORD)	Enlarged prostate	Skin infections (including cellulitis)
Gastroduodenal disorders	Interstitial nephritis	Ulcers
Inflammatory bowel disease (IBD)	Kidney stones	Other skin disorders
Intestinal obstruction (without hernia)	Other kidney & urinary diseases	**Oral disorders**
Pancreatitis	**Reproductive & maternal conditions**	Dental caries
Vascular disorders of intestine	Early pregnancy loss	Periodontal disease
Other gastrointestinal diseases	Endometriosis	Severe tooth loss
Neurological conditions	Genital prolapse	Other oral disorders
Dementia	Gestational diabetes	**Blood & metabolic disorders**
Epilepsy	Hypertensive disorders of pregnancy	Cystic fibrosis
Guillain-Barré syndrome (GBS)	Infertility	Haemolytic anaemias
Migraine	Maternal haemorrhage	Haemophilia
Motor neurone disease	Maternal infections	Iron-deficiency anaemia
Multiple sclerosis	Obstructed labour	Protein-energy deficiency
Parkinson disease	Polycystic ovarian syndrome	Other blood & metabolic disorders
Other neurological conditions	Uterine fibroids	
Mental & substance use disorders	Other maternal conditions	
Alcohol use disorders	Other reproductive conditions	

(continued)

Table A1 (continued): Disease and injury list

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

Table A2: 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 and Ezzati et al. 2012.

Table A3: Risk factor list used for Indigenous estimates in the ABDS 2018

Risk factor/ cluster	Components
Air pollution	Air pollution
Alcohol use	Alcohol use
Child abuse and neglect	Child abuse and neglect
Dietary risks	Diet low in fish and seafood Diet low in fruit Diet low in legumes Diet low in milk Diet low in nuts and seeds Diet low in polyunsaturated fat Diet high in processed meat Diet high in red meat Diet high in sodium Diet high in sugar-sweetened beverages Diet low in vegetables Diet low in whole grains and high-fibre cereal
High blood pressure	High blood pressure
High blood plasma glucose	Intermediate hyperglycaemia Diabetes
High cholesterol	High cholesterol
Illicit drug use	Cannabis use Amphetamine use Other illicit drug use Unsafe injecting practices Opioid use Cocaine use
Impaired kidney function	Chronic kidney disease stage 1–3 Chronic kidney disease stage 4–5
Intimate partner violence	Intimate partner violence
Iron deficiency	Iron deficiency
Low birthweight and short gestation	Low birthweight and short gestation
Low bone mineral density	Low bone mineral density
Occupational exposures and hazards	Occupational exposures and hazards
Overweight (including obesity)	Overweight but not obese Obesity
Physical inactivity	Physical inactivity
Tobacco use	Tobacco use Second-hand smoke
Unsafe sanitation	Unsafe sanitation
Unsafe sex	Unsafe sex

Table A4: Mortality adjustment factors used for Indigenous national and subnational YLL estimates

	ABS 2010–2012 CDE study adjustment factor	ABS 2015–2017 CDE study adjustment factor	AIHW EMD study adjustment factor
2018 Indigenous national and 2018 Indigenous socioeconomic group estimates			
0–14 years	. .	1.19	. .
15–59 years	. .	1.07	. .
60 years and over	. .	1.09	. .
Total	. .	1.08	. .
2003 and 2011 Indigenous national and 2011 Indigenous socioeconomic group estimates			
0–14 years	1.21	. .	. .
15–59 years	1.12	. .	. .
60 years and over	1.29	. .	. .
Total	1.21	. .	. .
2018 Indigenous state/territory estimates			
New South Wales	. .	1.46	. .
Queensland	. .	0.97	. .
Western Australia	. .	1.06	. .
Northern Territory	. .	0.96	. .
2011 Indigenous state/territory estimates			
New South Wales	1.42	. .	. .
Queensland	1.24	. .	. .
Western Australia	1.14	. .	. .
Northern Territory	0.96	. .	. .
2018 Indigenous remoteness estimates			
Major cities	. .	1.33	. .
Inner regional	. .	1.3	. .
Outer regional	. .	1.3	. .
Remote	. .	1.05	. .
Very remote	. .	1.05	. .
2011 Indigenous remoteness estimates			
Major cities		. .	1.25
Inner regional		. .	1.22
Outer regional		. .	1.12
Remote		. .	1.04
Very remote		. .	1.02

CDE Census Data Enhancement; EMD Enhanced Mortality Database.
Sources: ABS 2013, 2018c; AIHW 2012, 2017f.

Table A5: Hospitalisation adjustment factors used for 2018 and 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**

ACT Australian Capital Territory; NSW New South Wales; NT Northern Territory; SA South Australia; WA Western Australia.

Table A6: 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 A7: Diseases for which Indigenous prevalence estimates were derived using indirect methods

Disease[a]	Data source and indirect method
Cancer & other neoplasms	
Non-melanoma skin cancer[b]	Diagnosis and primary therapy of simple non-melanoma skin cancer: applied Indigenous-to-national ratio of complex non-melanoma skin cancer
Ductal carcinoma in situ[b] (DCIS)	Mastectomy due to DCIS: applied ratio of Indigenous-to-national diagnosed breast cancer of less than 2cm to national DCIS incidence
Cardiovascular diseases	
Atrial fibrillation and flutter	Applied the New Zealand Māori rates to the Indigenous population to estimate total cases
Gastrointestinal disorders	
Chronic liver disease	Liver transplant: Indigenous-to-non-Indigenous ratios from National Hospital Mortality Database (NHMD)
	Decompensated cirrhosis person:separations ratios from National Integrated Health Services Information Analysis Asset (NIHSI) AA v0.5 and age-specific ratios from Western Australia (WA)
	Terminal chronic liver disease person:separations ratios from NIHSI AA v0.5 and age-specific ratios from WA
Infant and congenital conditions	
Pre-term birth and low birthweight complications	Neurodevelopment impairment due to pre-term and low birthweight complications: age-specific rate ratios (Indigenous-to-non-Indigenous) from WA IDEA (Intellectual Disability Exploring Answers) database
Birth trauma and asphyxia	Age-specific rate ratios (Indigenous-to-non-Indigenous) from WA IDEA database
Cerebral palsy	Sex-specific rate ratios (Indigenous-to-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	Acute complications due to gastrointestinal malformations: applied Indigenous birth prevalence rate obtained from WARDA to national estimates.
	Incontinence due to anorectal atresia: sex-specific hospital separation rate ratios (Indigenous-to-non-Indigenous)
Urogenital malformations	Applied Indigenous birth prevalence rate obtained from WARDA to national estimates
Down syndrome	Age-specific rate ratios (Indigenous-to-non-Indigenous) from WA IDEA database
Brain malformations	Age-specific rate ratios (Indigenous-to-non-Indigenous) from WA IDEA database

(continued)

Table A7 (continued): Diseases for which Indigenous prevalence estimates were derived using indirect methods

Disease[a]	Data source and indirect method
Infectious diseases	
HIV	Indigenous proportion derived from Kirby Institute modelling and applied to national estimates
Tuberculosis	Sex-specific hospitalisation separation rate ratios (Indigenous-to-national)
Syphilis	Age- and sex-specific hospital separation and notification rate ratios (Indigenous: national)
Chlamydia	Sex-specific hospitalisation separation rate ratios (Indigenous-to-national)
Gonorrhoea	Sex-specific hospitalisation separation rate ratios (Indigenous-to-national)
Other sexually transmitted infections[a]	Sex-specific hospitalisation separation rate ratios (Indigenous-to-national)
Hepatitis A	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Hepatitis B (acute)	Age- and sex-specific notification rate ratios (Indigenous-to-national)
Hepatitis C (acute)	Age- and sex-specific notification rate ratios (Indigenous-to-national)
Upper respiratory tract infections	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Otitis media	Age- and sex-specific rate ratios (Indigenous-to-national) of self-reported chronic otitis media in children (NATSIHS 2018–19)
Lower respiratory tract infections	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Influenza	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Pertussis	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Measles	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Pneumococcal disease	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Meningococcal disease	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Other meningitis and encephalitis	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Dengue	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Ross River virus	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Barmah forest virus	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Malaria	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Campylobacteriosis	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Salmonellosis	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Rotavirus	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Other gastrointestinal infections	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Varicella	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Herpes zoster (shingles)	Age- and sex-specific hospital separation rate ratios (Indigenous-to-national)
Mumps	Sex-specific hospital separation rate ratios (Indigenous-to-national)
Disease[a]	**Data source and indirect method**
Urinary tract infections	Sex-specific hospital separation rate ratios (Indigenous-to-national)

(continued)

Table A7 (continued): Diseases for which Indigenous prevalence estimates 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 Queensland (Qld) linked mental health-care data
	Dysthymia: sex-specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
Anxiety disorders	Age- and sex- specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
Bipolar affective disorder	Age- and sex-specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
Alcohol use disorders	Asymptomatic/Very mild/mild: age- and sex-specific hospitalisation rate ratios (Indigenous-to- national)
	Moderate/Severe: age- and sex-specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
Drug use disorders	Cannabis dependence: age- and sex- specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
	Amphetamine dependence and opioid dependence: sex-specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
	Cocaine dependence: sex-specific rate ratios (Indigenous-to-non-Indigenous) from national drug strategy survey data
	Other drug dependence: sex-specific hospitalisation rate ratios (Indigenous-to-national)
Schizophrenia	Age- and sex- specific rate ratios (Indigenous-to-national) based on Qld linked mental health-care data
Attention deficit hyperactivity disorder (ADHD)	Average of age-specific rate ratios (Indigenous-to-non-Indigenous) based on the Longitudinal Study of Indigenous Children (LSIC) and Qld linked mental health-care data
Conduct disorder	Average of age-specific rate ratios (Indigenous-to-non-Indigenous) based on LSIC and Qld linked mental health-care data
Intellectual disability	Age-specific rate ratios (Indigenous-to-non-Indigenous) from WA IDEA database
Neurological conditions	
Parkinsons disease	National prevalence rates and severity distribution were applied to the Indigenous population, and then adjusted using ratios from New Zealand
Multiple sclerosis (MS)	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, and then adjusted using ratios from New Zealand.
Guillain-Barré Syndrome (GBS)	The national persons: separation ratio was applied to the count of Indigenous GBS hospital separations

(continued)

Table A7 (continued): Diseases for which Indigenous prevalence estimates were derived using indirect methods

Disease[(a)]	Data source and indirect method
Oral disorders	
Dental caries and pulpitis	Indigenous: national rate ratios from the National Survey of Adult Oral Health (NSAOH) 2004–06 (≥15 years) and Child Dental Health Survey 2009 (<15 years) were applied to national age and sex distributions
Periodontal disease	Indigenous: national rate ratios from the NSAOH 2004–06 and Child Dental Health Survey 2009 were applied to national age and sex distributions
Reproductive & maternal	
Early pregnancy loss	Indigenous-to-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-to-national rate ratios from hospital separations for genital prolapse applied to national rate
Skin disorders	
Ulcers	Other chronic skin ulcers: used hospital rate ratio to determine prevalence start point, then applied national pattern of prevalence by age and sex 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 A8: Diseases for which national rates or ratios were assumed to derive Indigenous prevalence estimates

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)] (DCIS)	Mastectomy due to DCIS: applied ratio of Indigenous: national diagnosed breast cancer of less than 2 cm to national DCIS incidence
Benign and uncertain brain tumours[(a)]	Brain injury due to benign and uncertain brain tumours: national rates assumed
Endocrine disorders	
Type 1 diabetes mellitus	National age- and sex-specific rates applied in people aged 30 and over
Gastrointestinal disorders	
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
Mental & substance use disorders	
Eating disorders	Assume same prevalence rate as national
Autism spectrum disorders	Assume same prevalence rate as national

(continued)

Table A8 (continued): Diseases for which national rates or ratios were assumed to derive Indigenous prevalence estimates

Disease	Data source and indirect method
Reproductive & maternal	
Endometriosis	Assumed 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	Assumed same prevalence rate as national (including all sequelae of the infertility envelope)
Other reproductive conditions	Assumed same prevalence as total Australian population for other reproductive conditions
Polycystic ovarian syndrome	Assumed same prevalence as total Australian population for polycystic ovarian syndrome
Skin disorders	
Acne	Assume same prevalence rate as national
Dermatitis and eczema	Assume same prevalence rate as national

(a) Applicable to listed sequelae only.

Table A9: Data source used for subnational distribution of Indigenous non–fatal burden estimates

	State/territory	Remoteness	Socioeconomic quintile
Infections	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	2018–19 NATSIHS	2018–19 NATSIHS	Adjusted hospitalisations
Gastrointestinal	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Neurological	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Mental & substance use	2018–19 NATSIHS	2018–19 NATSIHS	Adjusted hospitalisations
Endocrine	2012–13 AATSIHS	2012–13 AATSIHS	Adjusted hospitalisations
Kidney/urinary	2012–13 AATSIHS & ANZDATA	2012–13 AATSIHS & ANZDATA	Adjusted hospitalisations
Reproductive/maternal	Adjusted hospitalisations	Adjusted hospitalisations	Adjusted hospitalisations
Musculoskeletal	2018–19 NATSIHS	2018–19 NATSIHS	Adjusted hospitalisations
Hearing/vision	2018–19 NATSIHS	2018–19 NATSIHS	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 A10: 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
Infections	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	38.0	26.2	10.9	3.8	29.3	19.7	9.9	0.5
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	32.7	26.9	12.7	8.3	31.2	19.6	9.6	0.6
Endocrine	32.8	25.0	17.2	14.8	35.6	21.7	9.6	0.9
Kidney/urinary	16.1	24.6	17.2	27.4	56.7	3.4	1.5	1.5
Reproductive/maternal	27.8	29.7	13.5	12.4	30.3	21.3	10.6	1.0
Musculoskeletal	37.6	25.1	10.5	5.0	31.8	19.4	9.9	0.5
Hearing/vision	33.4	27.9	10.8	6.8	31.3	20.2	10.0	0.6
Skin	33.2	27.8	12.6	9.2	31.9	19.8	10.3	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, musculoskeletal conditions, mental & substance use disorders and hearing & vision disorders calculated from the 2018–19 NATSIHS (Indigenous) and 2017–18 NHS (non-Indigenous). Proportions for endocrine disorders and kidney & urinary diseases calculated from the AATSIHS 2012–13 (Indigenous) and AHS 2011–12 (non-Indigenous). ANZDATA for 2018 contributed to the calculations for kidney & urinary. Proportions for skin disorders based on the Indigenous and non–Indigenous population distributions. All other disease group proportions calculated from the NHMD.

Table A11: 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
Infections	26.4	17.4	20.3	14.0	21.9	69.7	19.9	8.9	1.1	0.4
Infant/congenital	37.5	26.1	19.9	6.5	10.0	74.1	17.6	7.1	1.0	0.3
Cancer	37.5	26.4	20.4	6.7	9.0	68.3	21.6	8.9	0.9	0.3
Cardiovascular	29.0	20.0	23.0	10.9	17.1	67.2	22.1	9.3	1.0	0.4
Respiratory	44.6	27.3	18.5	4.5	5.1	72.2	18.2	7.8	1.2	0.5
Gastrointestinal	32.6	24.5	23.5	8.8	10.6	69.6	20.6	8.5	0.9	0.4
Neurological	38.4	26.1	18.5	8.3	8.7	71.6	20.0	7.4	0.7	0.3
Mental/substance use	35.7	27.0	19.6	6.3	11.2	71.6	18.0	9.0	0.9	0.3
Endocrine	27.3	16.4	17.2	11.7	28.1	64.8	22.2	11.1	1.4	0.5
Kidney/urinary	9.2	11.2	35.6	22.3	21.7	77.0	12.1	10.7	0.1	0.05
Reproductive/maternal	35.0	22.6	23.2	7.5	11.8	74.6	15.8	8.2	1.1	0.4
Musculoskeletal	41.7	24.8	20.6	6.0	7.1	68.4	20.9	8.9	1.4	0.5
Hearing/vision	40.9	25.2	18.8	6.1	9.0	70.8	19.2	8.2	1.3	0.5
Skin	37.7	23.9	20.2	6.6	11.6	73.2	17.6	7.8	1.0	0.4
Oral	34.4	22.7	19.9	8.7	14.4	72.2	18.6	8.0	0.9	0.3
Blood/metabolic	28.0	19.7	20.2	11.2	20.9	70.4	19.5	8.8	1.0	0.3
Injuries	30.7	18.9	20.4	11.4	18.6	69.6	19.9	8.9	1.1	0.5

Note: Proportions for respiratory disease, musculoskeletal conditions, mental & substance use disorders and hearing & vision disorders calculated from the 2018–19 NATSIHS (Indigenous) and 2017–18 NHS (non-Indigenous). Proportions for endocrine disorders and kidney & urinary diseases calculated from the AATSIHS 2012–13 (Indigenous) and AHS 2011–12 (non-Indigenous). ANZDATA for 2018 contributed to the calculations for kidney & urinary. Proportions for skin disorders based on the Indigenous and non–Indigenous population distributions. All other disease group proportions calculated from the NHMD.

Table A12: 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)
Infections	15.9	20.5	24.1	19.0	20.5
Infant/congenital	21.9	27.3	27.7	14.9	8.3
Cancer	25.5	27.6	25.0	14.5	7.4
Cardiovascular	18.6	21.9	25.3	18.9	15.4
Respiratory	19.3	23.7	25.6	18.5	12.9
Gastrointestinal	22.4	25.3	26.0	17.5	8.9
Neurological	26.8	25.6	25.3	14.9	7.5
Mental/substance use	27.7	24.0	23.8	15.1	9.4
Endocrine	17.3	22.8	23.9	19.2	16.8
Kidney/urinary	22.6	24.4	25.0	16.3	11.8
Reproductive/maternal	20.6	26.4	27.2	15.9	10.0
Musculoskeletal	27.2	26.5	23.1	14.1	9.2
Hearing/vision	21.0	24.5	22.6	17.4	14.5
Skin	15.6	21.2	22.9	20.5	19.8
Oral	23.1	25.8	23.9	16.5	10.6
Blood/metabolic	19.2	20.0	24.9	16.9	19.0
Injuries	20.4	22.5	22.8	17.4	16.9

Note: All proportions calculated from the NHMD.

Appendix B: How reliable are the estimates?

All estimates within ABDS 2018 were produced using the best possible data that were available within the scope and time frame of the study.

A number of actions were undertaken to ensure the accuracy and relevance of the estimates in the ABDS:

- All standard inputs (such as the standard life table, disability weights and relative risks) were reviewed and assessed as appropriate by the study's Expert Advisory Group (EAG) for relevance and applicability in the Australian context.
- All data used in the ABDS had to meet strict inclusion criteria via protocols endorsed by the study's EAG.
- All models and inputs used in YLL and YLD estimates were reviewed by disease-specific experts and other experts to ensure their appropriateness for Australia. For YLD estimates, models reviewed as part of the ABDS 2015 were used, and where new diseases or models were developed in the ABDS 2018 these were reviewed by disease specific experts. Methods for particular risk factors were also reviewed by experts.
- The quality index used in ABDS 2018 was used to interpret the reliability of estimates within this framework.

ABDS 2018 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. Confidence intervals (CIs) are not straightforward to quantify and were 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:

1. The relevance and quality of the source data
2. The methods used to transform those 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 2018 Indigenous 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.

Generally, the higher the index, the more relevant and accurate the estimate. The ratings are interpreted as follows:

- **A–B: highly relevant/accurate**—estimate is derived from comprehensive and highly relevant data / little data transformation was required. The estimates can be considered to be highly indicative of the health loss incurred from these diseases or risk factors.
- **C–D: moderately relevant/accurate**—estimate is derived from reasonably comprehensive and relevant data / moderate transformations required, taking into account known trends in the underlying data (such as over time or age-distributions). These estimates can be considered to be moderately indicative of the health loss experienced by Indigenous Australians in 2018 due to these conditions or risk factors.
- **E: questionable relevance/accuracy**—estimate is derived from less comprehensive or relevant data / moderate transformations required with trends unknown or unaccounted for. These estimates are to be considered as possibly indicative of the health loss in Indigenous Australians in 2018 and should be used with some caution.

More detailed information on the ABDS Quality Index, and the criteria and methods used, are provided in the *Australian Burden of Disease Study 2018: methods and supplementary material* (AIHW 2021c).

Fatal burden estimates

Using the ABDS Quality Index, all mortality data, and hence all YLL estimates, are considered relevant and accurate, and highly indicative of the years of life lost due to these diseases. One exception to this is fatal injury burden by nature of injury, as injury-related deaths are classified by the external cause; subsequent mapping is required to estimate fatal burden by nature of injury.

Fatal estimates account for around 47% of total DALY for Indigenous Australians.

Non-fatal burden estimates

YLD estimates, which account for around 53% of total DALY for Indigenous Australians, vary in quality as there is no single comprehensive and reliable source of data on the incidence, prevalence, severity and duration of all non-fatal health conditions. The currency, generalisability and specificity of the data also varied, depending on the source.

YLD estimates for most of the major individual causes are considered relevant and accurate.

Relevance and quality of data sources

Almost half (48%) of diseases (accounting for 31% of YLD) predominantly derived YLD from diagnostically confirmed disease registers, administrative data or national surveys that were either fully enumerated (or with known gaps in coverage), current and specific to both the disease (or sequela) in question and the population. This includes most cancer, cardiovascular, musculoskeletal, injuries, gastrointestinal, and blood & metabolic estimates, as well as estimates for a large number of infectious diseases and kidney & urinary diseases.

A further 32% of diseases (accounting for 16% of YLD) predominantly derived YLD either from:

- diagnostically confirmed disease registers, administrative data or national surveys of medium currency/coverage and/or specificity to both the disease (or sequela) in question and the population
- systematic and generalisable meta-analyses of Australian data
- small-area Australian (or generalisable international) studies with good sampling.

The diseases that predominantly derived YLD by these means included type 2 diabetes, reproductive & maternal conditions, infant & congenital conditions, the majority of mental & substance use disorders and most of the remaining infectious diseases.

Only 4.1% of diseases (4.2% of total YLD) were predominantly derived from data that were of questionable quality. This included small Australian studies more than 5 years old, or international studies of questionable generalisability to the Australian context; or indirectly from secondary data sources. Diseases meeting these criteria included dermatitis & eczema, eating disorders and benign & uncertain brain tumours.

Methods of transformation to overcome data shortcomings

Around 37% of the diseases estimated (accounting for 24% of YLD) could be derived with no transformation required, or using accepted adjustment factors (for example, for Indigenous under-identification). A further 39% (accounting for 58% of YLD) were derived from data where there were known issues with Indigenous under-identification, but no evidence of a difference between the Indigenous and national populations. A fifth (21% of diseases, accounting for 16% of YLD) relied on deriving prevalence based on other epidemiological measures, or indirect methods from other (related) data sources. Only 3.1% of diseases (1.6% of YLD) relied on indirect modelling methods or inferences of distributions from other (unrelated) data sources or expert advice (Table B1).

Table B1: Rating of data relevance, quality and transformation methods for YLD estimates, 2018 reference year

	Data relevance and quality		Method of transformation	
Rating	% of diseases	% of YLD	% of diseases	% of YLD
A	18.7	2.2	3.1	0.1
B	29.0	28.8	33.7	24.2
C	32.1	15.5	38.9	57.9
D	16.1	49.3	21.2	16.2
E	4.1	4.2	3.1	1.6

Note: The proportions may not add up to 100% due to rounding.

Risk factor estimates

It is possible to assess only the quality of data used to estimate exposure to the risk factors in Australia, rather than the other inputs used to calculate attributable burden. The other inputs for this work, such as the relative risk data and the TMREDs, were adopted from the GBD 2019 and the AIHW's review of the literature, which independently and systematically reviewed and calculated appropriate relative risks and TMREDs.

Where the linked diseases were 100% attributable (such as alcohol use disorders attributable to alcohol use) or the exposure to the risk factor was estimated by the prevalence of a cause in the ABDS 2018 study, the quality of the causes was used to estimate the quality of exposure to the risk factor. Quality was assessed for each data source for exposure and weighted by the amount of attributable burden to give a score for each risk factor.

For 2011 estimates, risk factor exposure was estimated using robust national measured (or good quality self-reported) survey data for the majority of risk factors. However, for many of these risk factors no new measured data were available for 2018. Trends for risk factors with no new good quality data for 2018 were estimated either using lower quality self-reported information or by assuming similar change as was seen in the general Australian population.

For 16% of risk factors in 2018 (accounting for 6% of attributable DALY), exposure was able to be derived with no transformation required, or using known trends (Table B2). For the majority of the remaining risk factors (accounting for 92% of attributable DALY), estimation of exposure required moderate transformations.

It is important to note that the quality of the attributable DALY for each risk factor also depends on the quality of the estimate of the linked diseases, and of the proportion attributable to YLL or YLD.

Table B2: Rating of data relevance, quality and transformation methods for risk factor estimates, 2018 reference year

	Data relevance and quality		Method of transformation	
Rating	% of risk factors	% of attributable DALY	% of risk factors	% of attributable DALY
A	15.8	7.9	—	—
B	31.6	52.4	15.8	6.0
C	26.3	27.1	73.7	91.8
D	40.0	12.4	10.5	2.2
E	5.3	0.3	—	—

Note: The proportions may not add up to 100% due to rounding.

Older age groups

Care should be taken when comparing disease level information in age groups 75 years and older. Data for Indigenous Australians of this age are often limited, leading to greater variability.

Appendix C: Understanding and using burden of disease estimates

This appendix provides guidance on using and interpreting estimates published in this report.

C1. Different types of estimates presented in this report

There are a number of different estimates produced by a burden of disease study, which are useful for different purposes.

- DALY, YLD and YLL estimates provide a measure of the health impact from disease and injury and describe the overall disease burden in the population being analysed. They are useful for summarising the health of that population at a point in time, and for assessing health-care needs and planning health services.
- Crude rates of DALY, YLL and YLD provide a measure of disease burden against the size of the population, but without taking any other features of the population into account. These are useful for measuring the relative impact in one age group compared with another by describing the amount of disease burden relative to the size of the age group. They are also useful for assessing health-care needs and planning health services.
- The ASRs of DALY, YLL and YLD also provide a measure of the disease burden against the size of the population but take into account the age structure of the population. ASRs 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 2018).

As with many other statistics, it is comparisons (between diseases, across population groups, across time), rather than single estimates, that are the most useful. Comparisons are often done using rate ratios and rate differences. A rate ratio shows how many times the rate of burden is relative to another, while a rate difference shows the difference between one rate and another. For example, when analysing age-standardised DALY rates of males compared with females, a rate ratio of 1.0 indicates that the burden in males and females is the same; a rate higher than 1.0, that the burden is higher among males; and a rate lower than 1.0, that the burden is lower among males. For example, a rate ratio of 1.6 means that the age standardised DALY rate for males is 1.6 times or 60% higher than that for females.

Both rate ratios and rate differences are useful and have complementary value.

Levels of reporting and alternative reporting categories

Estimates in this study are calculated for individual conditions (for example, lung cancer, anxiety, chronic kidney disease, epilepsy, hip fracture). For some aspects of reporting, conditions that have a similar aetiology, outcomes or treatment are grouped together—generally according to ICD-10 classifications—into 17 *disease groups*. For ease of recognition in this publication, each disease group has been allocated a colour—these are used consistently throughout each overview chapter to identify a disease grouping, and shown in Appendix D Box D1.

Diseases are grouped in this study to reflect the Australian health context (that is, to meet health reporting and monitoring needs) while also informing policy setting, health planning and research. These groupings may not suit all users. Alternative groupings of individual diseases are possible—these are not included in this report but can be the subject of future analyses.

It is important to be aware that some disease groups—such as injuries, infectious diseases and cancer & other neoplasms—are made up of a large number of separate diseases or injuries, while others—such as endocrine and oral disorders—include only a few specific conditions. Ranking by disease group and ranking by individual conditions may present different stories. For example, mental & substance use disorders is the disease group causing the most burden among Indigenous Australians, but coronary heart disease (within the cardiovascular disease group) is the individual disease causing the most burden. This reflects the level of reporting and the choice as to how the disease group level is constructed. It is important to use the level of reporting that is most suited to a specific purpose.

In this report, YLL, YLD and DALY estimates are presented at 3 levels, each having a different purpose and audience:

1. **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.
2. **Disease group level:** for understanding the broad patterns in the types of diseases causing health loss in the population. The collective impact of diseases of broadly similar cause assists in identifying large interrelated areas of health loss that might otherwise go unquantified (especially for the rarer and less prevalent diseases—such as blood & metabolic disorders). This is important for broad policy and research setting as well as for advocacy. There are 17 disease groups in the ABDS 2018.
3. **Disease level:** for a more detailed picture of the diseases and injuries that give rise to burden. These represent individual diseases (such as appendicitis, Parkinson disease), or finer aggregations of related diseases (such as gastrointestinal infections—which include salmonella and campylobacter—or dementia—which includes Alzheimer disease, as well as other dementias). Diseases at this level have been chosen to be as policy-relevant as possible, subject to the constraints of data availability. Disease-level estimates are useful for detailed policy setting and research. Burden was estimated for 219 diseases.

Comparing life lost in burden of disease studies with other measures of premature mortality

Different measures are used to highlight the impact of dying prematurely; however, the notion of 'premature' in relation to mortality can be arbitrary. Two of the most commonly used summary measures to describe premature mortality are YLL (as used in burden of disease studies) and potential YLL.

YLL in burden of disease studies assume a potential number of remaining years according to a *life table* (see Appendix Table A2). A life table specifies, for each age, a number of years that, on average, a person could potentially live—the life expectancy. For example, the standard life table from the GBD 2010 and 2013 studies (as used in this study) specifies that a person aged under 1 could potentially live 86.0 more years; a person aged 65, 23.3 more years; and a person aged 100, 2.2 more years. YLL is calculated by summing the number of deaths at each age multiplied by the remaining life expectancy for that age. In this measure, all deaths in a population are counted and accrue some lost years of life.

Potential years of life lost (PYLL), a simpler measure, specifies an *arbitrary age cut-off* to identify early deaths; that is, deaths occurring before the specified age are considered premature. For example, an AIHW report describes PYLL for deaths occurring before age 75 (AIHW 2015). Using this parameter, death of an infant (aged under 1) loses 75 years of life; death of a person aged 65, 10 years. The death of a person aged over 75 would not be counted in this measure.

Both summary measures provide a means of assessing premature death. YLL, based on all deaths in a population, describes early death according to the life expectancy at each age of death. It uses the same metric as the YLD—a count of the number of years lost. In burden of disease studies, this enables combining measures of fatal and non-fatal effects into a summary measure of health, the DALY. PYLL, on the other hand, considers deaths only within a population younger than the specified age cut-off. In contrast to YLL, it tends to more strongly reflect the magnitude and causes of death that typically affect the younger population.

C2. Interpreting estimates

There are many factors that should be taken into account when interpreting or comparing burden of disease estimates. Box C1 lists some general rules.

Box C1: Dos and don'ts of using burden of disease estimates in this study

Do

- Use estimates to compare health loss between different diseases, groups of diseases, risk factors or population groups in this study.
- Look beyond the ranking to understand the level of impact of a disease.
- Look beyond the DALY estimate to YLL and YLD to understand the estimate better.
- Be careful comparing groups of diseases with individual diseases.
- Make sure you understand what is being measured and the assumptions that have been used.

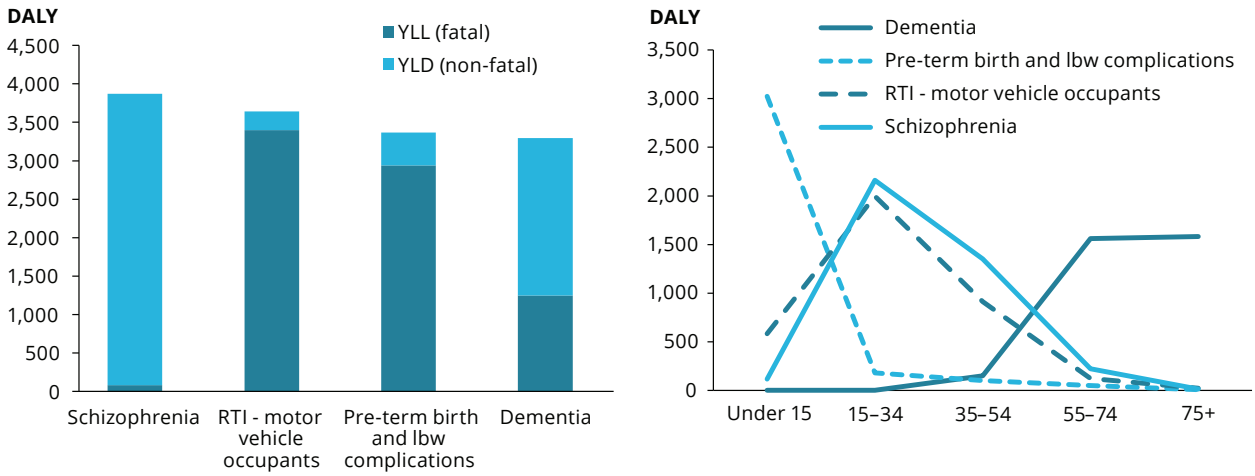
Don't

- Compare YLL, YLD, DALY estimates from different burden of disease studies.
- Add together the unadjusted attributable YLL, YLD and DALY estimates across risk factors.
- Compare measures of *mortality* in this study with measures reported elsewhere, as burden of disease methods and grouping of causes are different from those used in other studies.

Interpreting and comparing DALY estimates

When interpreting DALY estimates, it is often useful to look at the relative contribution of each condition to the overall health loss, or the relative contributions of fatal and non-fatal health loss for a given condition, to gain a picture of a population's health. As a DALY is made up of YLL and YLD, diseases can have very similar DALY estimates, but tell very different stories about the relative contribution of YLL and YLD. For example, schizophrenia, road traffic injuries for motor vehicle occupants, pre-term birth and low birthweight complications, and dementia all have a similar number of DALY—but the contribution of fatal and non-fatal burden are quite different, as are the ages at which these diseases affect people (see Figure C1).

Figure C1: Example of different DALY stories



RTI road traffic injuries; lbw low birthweight.

Interpreting and comparing risk factor estimates

Risk factor analysis allows us to estimate how much the disease burden could be reduced if exposure to the risk factor were at or below the theoretical minimum level. Exposure to harmful levels of a risk factor can contribute to deaths and/or ill health resulting from one or more diseases. The estimates are presented in the following forms:

- the number of DALY that can be attributed to exposure to each risk factor. This 'attributable burden' is useful for gauging the contribution of each risk factor
- the proportion of disease DALY, disease group DALY or total DALY that can be attributed to the risk factor. This is a useful way of relating the contribution of each risk factor to the burden of the linked diseases, disease groups or to the total burden
- the age-specific rate of DALY attributable to a risk factor. Such a rate is used to compare the relative contribution of the risk in one age group with that of another, by depicting the amount of health loss relative to the size of each age group
- the ASR attributable to a risk factor. Such a rate also provides a relative measure of the health loss against the size of the population but takes into account the age structure of the population. This allows comparison of estimates between 2003, 2011 and 2018.

Exposure to some risk factors is known to cause both ill health *and* death while exposure to other risk factors may be associated only with ill health *or* death. This affects the patterns of attributable YLL and YLD across the risk factors and linked diseases.

DALY attributable to a risk factor may also vary by age and sex. These variations may be caused by age and sex differences in:

- amounts of exposure to the risk factor
- the degree of increased risk of the linked disease due to exposure to the risk factor (relative risk)
- patterns of DALY, YLL and YLD for the linked diseases.

Estimates of attributable burden for the different risk factors cannot be simply added together without further analysis, due to complex pathways and interactions between them. This analysis has been undertaken for all risk factors included in this report combined, and it underpins, for example, estimates of combined burden attributable to disease groups.

Interpreting rankings

Rankings are often used to tell the story of which disease or injury causes the biggest burden. However, rankings do not provide the reader with context of the size of each estimate, nor of the difference between adjacent estimates. For example, rankings may give the impression that a disease or injury has increased, but the age-standardised rates can show the opposite. It is important to look at the trend in the age-standardised rate to determine how a disease has changed over time as the rankings also reflect the movement of other diseases and injuries.

Further, the rankings in this report are specific to the level of reporting, as reporting rankings at different levels can be misperceived. For example, as a group, cancer ranks ahead of cardiovascular conditions in causing burden for Indigenous females. This is because the cancer group is made up of many different cancer types, some of which have a very high burden. At the individual disease level, however, coronary heart disease (part of the cardiovascular disease group) ranks ahead of breast cancer and lung cancer in causing burden for Indigenous females. Therefore, rankings should be interpreted with care.

Groups of residual conditions (for example, 'Other infections') have been excluded from rankings in most of the ABDS tables and tilemaps. This is because these categories are often made up of several causes and, as a group, are difficult to interpret. Table C1 lists residual conditions excluded from rankings in the main ABDS 2018 outputs.

Alternative versions of some tilemaps that include the other residual causes are presented in 'Appendix D: Additional tables and figures'. In addition, the supplementary tables to the online data visualisations include the residual causes.

Table C1: Residual causes excluded from rankings

Cause name
Other infections
Other disorders of infancy
Other chromosomal abnormalities
Other congenital conditions
Other benign, in situ and uncertain neoplasms
Other cardiovascular diseases
Other respiratory disease
Other gastrointestinal diseases
Other neurological conditions
Other mental and substance use disorders
Other endocrine disorders
Other kidney and urinary diseases
Other maternal conditions
Other reproductive conditions
Other musculoskeletal conditions
Other hearing and vestibular disorders
Other skin disorders
Other oral disorders
Other blood and metabolic disorders
All other external causes of injury
Other injuries

Comparing with estimates from other studies

As a general rule, due to the large variety of data sources, possible disease models, assumptions and concepts of 'ideal health', the DALY, YLL and YLD estimates from different studies should not be compared.

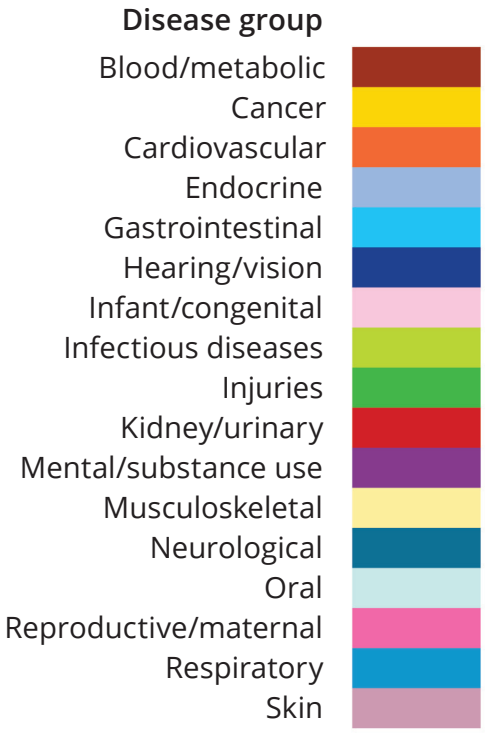
For comparing the Australian burden with the burden of other countries, the AIHW recommends using the Australian estimates reported in either the most recent GBD (for example, GBD 2019 Diseases and Injuries Collaborators 2020) or the Global Health Estimates produced by the WHO (for example, WHO 2021).

Which estimate is 'right'? Interpreting multiple results

There are a number of current burden of disease estimates for Australia. As DALY are the final output of a complex set of models and assumptions, there is no 'right' answer. Global studies are designed to enable comparisons across countries and need to account for a large variation in the data availability and quality across countries. Country-based studies (such as the ABDS) are more likely to be designed to meet local needs and use detailed local data. When faced with more than one set of estimates, it is important to understand the data sources and assumptions behind the estimates and use the set that most closely matches its purpose and user needs.

Appendix D: Additional tables and figures

Box D1: ABDS 2018 disease group colours



Box D2: ABDS 2018 risk factor colours

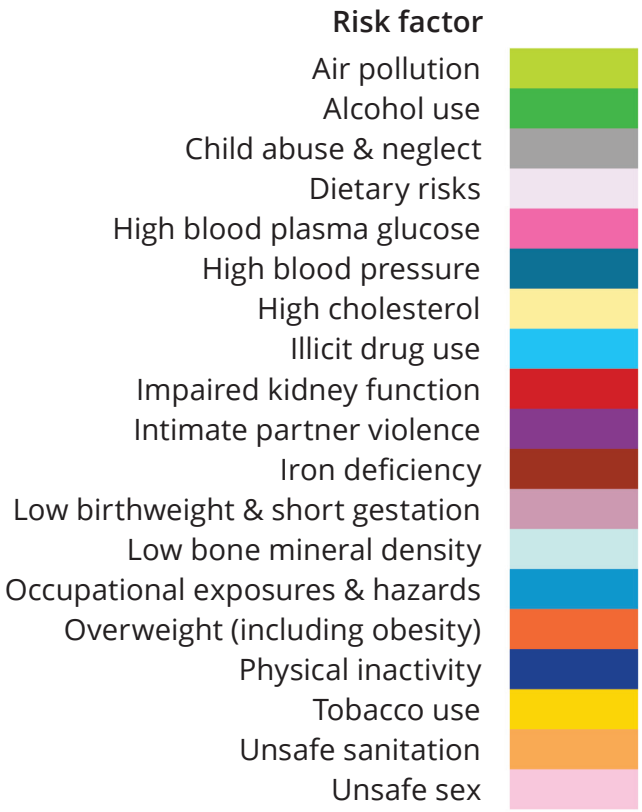


Figure D1: Leading causes of total burden (DALY; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,784; 19%)	Conduct disorder (1,127; 16%)	Other injuries (4,343; 27%)	Other injuries (5,344; 14%)	Coronary heart disease (5,270; 13%)	Coronary heart disease (1,322; 12%)	Dementia (611; 11%)
2nd	Other disorders of infancy (990; 11%)	Anxiety disorders (899; 13%)	Alcohol use disorders (1,996; 12%)	Alcohol use disorders (4,656; 12%)	COPD (2,211; 5.5%)	COPD (1,026; 9.1%)	COPD (570; 10%)
3rd	Other injuries (723; 7.8%)	Asthma (662; 9.3%)	Anxiety disorders (851; 5.2%)	Poisoning (2,629; 6.8%)	Lung cancer (2,038; 5.0%)	Lung cancer (760; 6.7%)	Coronary heart disease (510; 9.2%)
4th	Birth trauma/ asphyxia (635; 6.9%)	Other injuries (516; 7.2%)	Depressive disorders (794; 4.9%)	Anxiety disorders (2,209; 5.7%)	Chronic liver disease (1,923; 4.8%)	Type 2 diabetes (678; 6.0%)	Lung cancer (260; 4.7%)
5th	Protein-energy deficiency (557; 6.0%)	ADHD (366; 5.1%)	Drug use disorders (794; 4.9%)	Depressive disorders (2,078; 5.4%)	Type 2 diabetes (1,844; 4.6%)	Chronic kidney disease (571; 5.0%)	Type 2 diabetes (252; 4.5%)
6th	SIDS (475; 5.1%)	Depressive disorders (344; 4.8%)	Schizophrenia (609; 3.8%)	Coronary heart disease (1,915; 4.9%)	Other injuries (1,507; 3.7%)	Dementia (498; 4.4%)	Stroke (228; 4.1%)
7th	Cardiovascular defects (403; 4.4%)	Autism spectrum disorders (309; 4.3%)	Asthma (507; 3.1%)	Schizophrenia (1,634; 4.2%)	Back pain and problems (1,316; 3.3%)	Other musculoskeletal (313; 2.8%)	Rheumatoid arthritis (220; 4.0%)
8th	Neonatal infections (320; 3.5%)	Dental caries (258; 3.6%)	Dental caries (389; 2.4%)	Drug use disorders (1,599; 4.1%)	Chronic kidney disease (1,242; 3.1%)	Stroke (301; 2.7%)	Prostate cancer (213; 3.8%)
9th	Asthma (297; 3.2%)	Epilepsy (210; 2.9%)	Other musculoskeletal (360; 2.2%)	Back pain and problems (1,117; 2.9%)	Alcohol use disorders (1,158; 2.9%)	Rheumatoid arthritis (286; 2.5%)	Chronic kidney disease (191; 3.5%)
10th	LRI incl influenza & pneumonia (287; 3.1%)	Other musculoskeletal (199; 2.8%)	Traumatic brain injury (358; 2.2%)	Other musculoskeletal (884; 2.3%)	Hearing loss (1,078; 2.7%)	Hearing loss (285; 2.5%)	Other musculoskeletal (140; 2.5%)
	Top 10 (6,471; 70%)	Top 10 (4,890; 68%)	Top 10 (11,001; 68%)	Top 10 (24,065; 62%)	Top 10 (19,588; 48%)	Top 10 (6,041; 53%)	Top 10 (3,195; 58%)

lbw low birthweight; SIDS sudden infant death syndrome; LRI lower respiratory infections; ADHD attention deficit hyperactivity disorder; COPD chronic obstructive pulmonary disease.
Notes: This figure reports injuries by nature of injury—for external cause of injury see Figure 2.9; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D2: Leading causes of total burden (DALY; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,179; 15%)	Anxiety disorders (738; 13%)	Other injuries (1,639; 13%)	Anxiety disorders (3,342; 11%)	Coronary heart disease (2,574; 7.1%)	COPD (1,097; 9.7%)	Dementia (971; 13%)
2nd	Other disorders of infancy (872; 11%)	Conduct disorder (684; 12%)	Anxiety disorders (1,612; 13%)	Depressive disorders (2,757; 9.1%)	COPD (2,150; 6.0%)	Coronary heart disease (919; 8.1%)	Coronary heart disease (603; 8.3%)
3rd	Birth trauma/ asphyxia (869; 11%)	Depressive disorders (458; 8.1%)	Depressive disorders (1,265; 9.8%)	Other injuries (1,892; 6.2%)	Type 2 diabetes (1,933; 5.4%)	Chronic kidney disease (783; 6.9%)	COPD (546; 7.5%)
4th	Protein-energy deficiency (533; 6.9%)	Asthma (458; 8.1%)	Alcohol use disorders (879; 6.8%)	Asthma (1,483; 4.9%)	Chronic kidney disease (1,785; 5.0%)	Lung cancer (722; 6.4%)	Chronic kidney disease (407; 5.6%)
5th	Other injuries (494; 6.4%)	Back pain and problems (323; 5.7%)	Drug use disorders (605; 4.7%)	Back pain and problems (1,298; 4.3%)	Anxiety disorders (1,654; 4.6%)	Type 2 diabetes (631; 5.6%)	Rheumatoid arthritis (402; 5.5%)
6th	Cardiovascular defects (436; 5.6%)	Other injuries (291; 5.1%)	Asthma (545; 4.2%)	Poisoning (1,153; 3.8%)	Lung cancer (1,581; 4.4%)	Dementia (541; 4.8%)	Stroke (378; 5.2%)
7th	SIDS (434; 5.6%)	Dental caries (247; 4.4%)	Bipolar affective disorder (481; 3.7%)	Alcohol use disorders (1,118; 3.7%)	Asthma (1,555; 4.3%)	Other musculoskeletal (497; 4.4%)	Type 2 diabetes (319; 4.4%)
8th	Other infections (233; 3.0%)	Epilepsy (184; 3.2%)	Back pain and problems (479; 3.7%)	Drug use disorders (1,103; 3.6%)	Other musculoskeletal (1,517; 4.2%)	Rheumatoid arthritis (439; 3.9%)	Other musculoskeletal (283; 3.9%)
9th	Other congenital conditions (230; 3.0%)	Acne (161; 2.8%)	Eating disorders (443; 3.4%)	Other musculoskeletal (833; 2.8%)	Depressive disorders (1,488; 4.1%)	Asthma (373; 3.3%)	Lung cancer (194; 2.7%)
10th	Other neurological conditions (230; 3.0%)	ADHD (153; 2.7%)	Dental caries (329; 2.6%)	Coronary heart disease (797; 2.6%)	Back pain and problems (1,304; 3.6%)	Osteoarthritis (355; 3.1%)	Hearing loss (177; 2.4%)
	Top 10 (5,511; 71%)	Top 10 (3,697; 65%)	Top 10 (8,278; 64%)	Top 10 (15,776; 52%)	Top 10 (17,541; 49%)	Top 10 (6,359; 56%)	Top 10 (4,279; 59%)

lbw low birthweight; SIDS sudden infant death syndrome; ADHD attention deficit hyperactivity disorder; COPD chronic obstructive pulmonary disease.
Notes: This figure reports injuries by nature of injury—for external cause of injury see Figure 2.10; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D3: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Protein-energy deficiency (557; 27%)	Conduct disorder (1,127; 19%)	Alcohol use disorders (1,996; 20%)	Alcohol use disorders (4,528; 21%)	Back pain and problems (1,315; 8.3%)	COPD (438; 10%)	Dementia (338; 16%)
2nd	Asthma (292; 14%)	Anxiety disorders (899; 15%)	Anxiety disorders (851; 8.3%)	Anxiety disorders (2,209; 10%)	Type 2 diabetes (1,092; 6.9%)	Dementia (357; 8.5%)	Rheumatoid arthritis (220; 10%)
3rd	Other gastro-intestinal inf. (202; 9.9%)	Asthma (600; 10%)	Depressive disorders (794; 7.8%)	Depressive disorders (2,078; 9.4%)	Hearing loss (1,078; 6.8%)	Type 2 diabetes (316; 7.5%)	COPD (197; 9.1%)
4th	Conduct disorder (114; 5.6%)	ADHD (366; 6.2%)	Drug use disorders (793; 7.8%)	Schizophrenia (1,585; 7.2%)	Anxiety disorders (1,072; 6.8%)	Other musculoskeletal (296; 7.0%)	Hearing loss (136; 6.3%)
5th	Anxiety disorders (98; 4.8%)	Depressive disorders (344; 5.8%)	Schizophrenia (609; 6.0%)	Drug use disorders (1,559; 7.1%)	Other musculoskeletal (953; 6.0%)	Hearing loss (285; 6.8%)	Other musculoskeletal (124; 5.7%)
6th	Intellectual disability (89; 4.3%)	Autism spectrum disorders (309; 5.2%)	Asthma (482; 4.7%)	Back pain and problems (1,117; 5.1%)	COPD (909; 5.7%)	Rheumatoid arthritis (280; 6.7%)	Type 2 diabetes (99; 4.6%)
7th	Dermatitis and eczema (60; 2.9%)	Dental caries (258; 4.4%)	Dental caries (389; 3.8%)	Other musculoskeletal (863; 3.9%)	Alcohol use disorders (850; 5.4%)	Back pain and problems (248; 5.9%)	Back pain and problems (80; 3.7%)
8th	LRI incl influenza & pneumonia (53; 2.6%)	Epilepsy (208; 3.5%)	Other musculoskeletal (337; 3.3%)	Hearing loss (725; 3.3%)	Depressive disorders (794; 5.0%)	Osteoarthritis (167; 4.0%)	Coronary heart disease (75; 3.5%)
9th	Other musculoskeletal (47; 2.3%)	Other musculoskeletal (199; 3.4%)	Conduct disorder (312; 3.1%)	Asthma (702; 3.2%)	Asthma (667; 4.2%)	Coronary heart disease (159; 3.8%)	Atrial fibrillation (66; 3.1%)
10th	Autism spectrum disorders (44; 2.1%)	Intellectual disability (177; 3.0%)	Bipolar affective disorder (303; 3.0%)	Bipolar affective disorder (600; 2.7%)	Rheumatoid arthritis (528; 3.3%)	Asthma (144; 3.4%)	Chronic kidney disease (60; 2.8%)
	Top 10 (1,556; 76%)	Top 10 (4,487; 76%)	Top 10 (6,867; 67%)	Top 10 (15,966; 73%)	Top 10 (9,259; 58%)	Top 10 (2,689; 64%)	Top 10 (1,393; 65%)

LRI lower respiratory infections; ADHD attention deficit hyperactivity disorder; COPD chronic obstructive pulmonary disease.
Notes: Estimates for anxiety disorders and conduct disorder in children under 5 relate to children aged 4 years only; This figure reports injuries by nature of injury—for external cause of injury see Figure 3.6; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D4: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	Protein-energy deficiency (533; 29%)	Anxiety disorders (738; 16%)	Anxiety disorders (1,612; 16%)	Anxiety disorders (3,342; 16%)	Anxiety disorders (1,654; 8.9%)	Other musculoskeletal (464; 9.2%)	Dementia (494; 16%)
2nd	Other gastro-intestinal inf. (193; 10%)	Conduct disorder (684; 14%)	Depressive disorders (1,265; 12%)	Depressive disorders (2,756; 13%)	Depressive disorders (1,488; 8.0%)	COPD (411; 8.2%)	Rheumatoid arthritis (386; 12%)
3rd	Asthma (192; 10%)	Depressive disorders (458; 9.7%)	Alcohol use disorders (857; 8.4%)	Back pain and problems (1,298; 6.3%)	Asthma (1,383; 7.5%)	Rheumatoid arthritis (409; 8.1%)	Other musculoskeletal (257; 8.3%)
4th	Other infections (108; 5.8%)	Asthma (427; 9.0%)	Drug use disorders (605; 6.0%)	Asthma (1,280; 6.2%)	Back pain and problems (1,293; 7.0%)	Dementia (401; 8.0%)	Hearing loss (177; 5.7%)
5th	Other neurological conditions (92; 5.0%)	Back pain and problems (323; 6.8%)	Asthma (520; 5.1%)	Alcohol use disorders (1,080; 5.2%)	Other musculoskeletal (1,270; 6.9%)	Type 2 diabetes (375; 7.4%)	COPD (173; 5.6%)
6th	Anxiety disorders (70; 3.8%)	Dental caries (247; 5.2%)	Bipolar affective disorder (481; 4.7%)	Drug use disorders (1,045; 5.1%)	Type 2 diabetes (1,121; 6.1%)	Osteoarthritis (355; 7.0%)	Type 2 diabetes (126; 4.1%)
7th	Conduct disorder (70; 3.7%)	Epilepsy (184; 3.9%)	Back pain and problems (479; 4.7%)	Hearing loss (760; 3.7%)	Hearing loss (987; 5.3%)	Asthma (335; 6.7%)	Osteoarthritis (114; 3.7%)
8th	Dermatitis and eczema (57; 3.1%)	Acne (161; 3.4%)	Eating disorders (443; 4.4%)	Bipolar affective disorder (759; 3.7%)	COPD (981; 5.3%)	Hearing loss (297; 5.9%)	Chronic kidney disease (112; 3.6%)
9th	LRI incl influenza & pneumonia (50; 2.7%)	ADHD (153; 3.2%)	Dental caries (329; 3.2%)	Other musculoskeletal (729; 3.5%)	Osteoarthritis (888; 4.8%)	Chronic kidney disease (236; 4.7%)	Asthma (102; 3.3%)
10th	Intellectual disability (44; 2.4%)	Other musculoskeletal (116; 2.5%)	Polycystic ovarian syndrome (257; 2.5%)	Schizophrenia (591; 2.9%)	Rheumatoid arthritis (761; 4.1%)	Back pain and problems (200; 4.0%)	Coronary heart disease (91; 2.9%)
	Top 10 (1,410; 76%)	Top 10 (3,491; 74%)	Top 10 (6,849; 67%)	Top 10 (13,639; 66%)	Top 10 (11,824; 64%)	Top 10 (3,484; 69%)	Top 10 (2,033; 66%)

LRI lower respiratory infections; ADHD attention deficit hyperactivity disorder; COPD chronic obstructive pulmonary disease.
Notes: Estimates for anxiety disorders and conduct disorder in children under 5 relate to children aged 4 years only; This figure reports injuries by nature of injury—for external cause of injury see Figure 3.7; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D5: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 1	1–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,754; 28%)	Other injuries (833; 37%)	Other injuries (4,323; 72%)	Other injuries (5,304; 32%)	Coronary heart disease (4,816; 20%)	Coronary heart disease (1,164; 16%)	Coronary heart disease (435; 13%)
2nd	Other disorders of infancy (926; 15%)	Other blood/ metabolic dis.* (104; 4.7%)	Poisoning* (351; 5.8%)	Poisoning (2,628; 16%)	Lung cancer (2,016; 8.2%)	Lung cancer (744; 10%)	COPD (374; 11%)
3rd	Birth trauma/ asphyxia* (628; 10%)	Drowning/ submersion* (101; 4.5%)	Traumatic brain injury* (168; 2.8%)	Coronary heart disease (1,805; 11%)	Chronic liver disease (1,920; 7.8%)	COPD (588; 8.3%)	Dementia (274; 8.1%)
4th	SIDS* (434; 7.0%)	LRI incl influenza & pneumonia* (99; 4.5%)	Drowning/ submersion* (102; 1.7%)	Chronic liver disease (739; 4.4%)	Other injuries (1,491; 6.1%)	Chronic kidney disease (461; 6.5%)	Lung cancer (248; 7.3%)
5th	Other injuries* (395; 6.4%)	Brain/CNS cancer* (99; 4.4%)	Other congenital conditions* (92; 1.5%)	Chronic kidney disease* (421; 2.5%)	COPD (1,302; 5.3%)	Type 2 diabetes (362; 5.1%)	Stroke (200; 5.9%)
	Top 5 (66.7%)	Top 5 (55.4%)	Top 5 (83.6%)	Top 5 (64.8%)	Top 5 (47.1%)	Top 5 (46.7%)	Top 5 (45.2%)

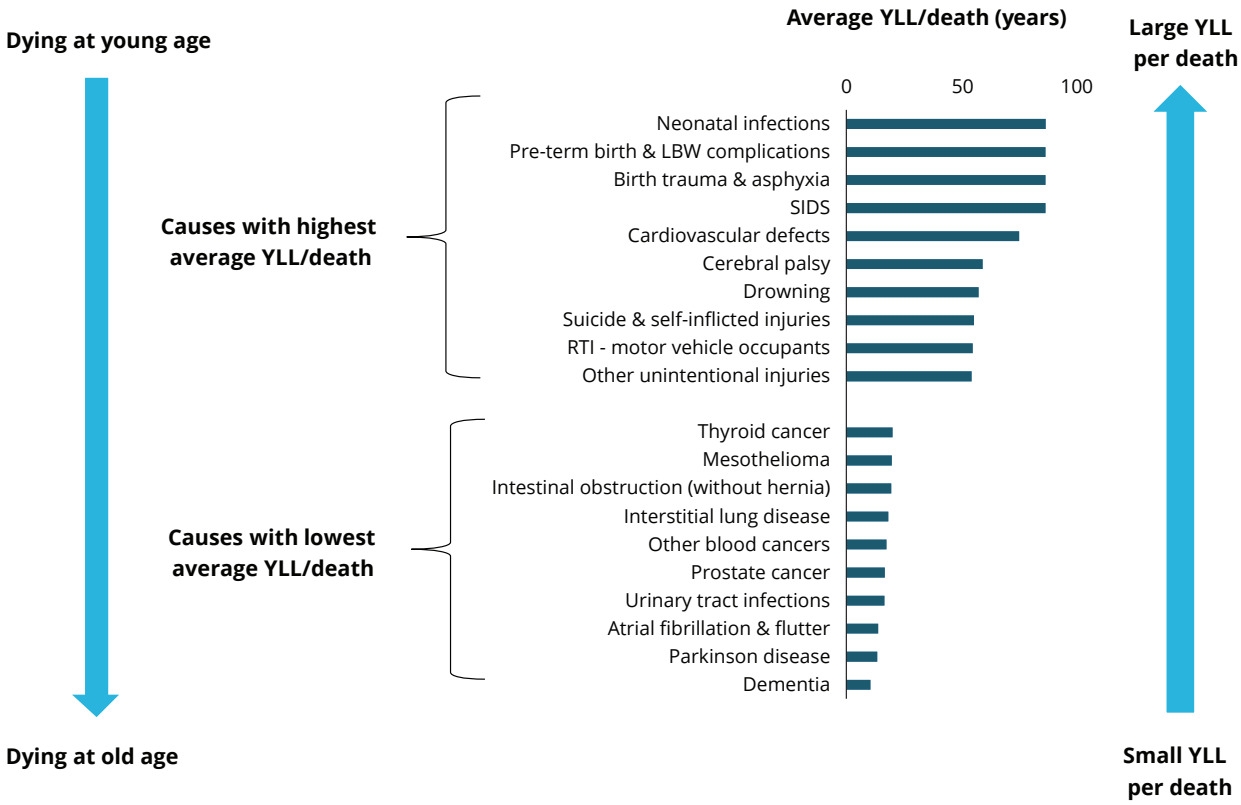
* Number of Indigenous deaths used in YLL calculations is fewer than 10.
lbw low birthweight; SIDS sudden infant death syndrome; CNS central nervous system; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.
Notes: This figure reports injuries by nature of injury—for external cause of injury see Figure 4.7; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D6: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes

Rank	Age group (years)						
	Under 1	1–14	15–24	25–44	45–64	65–74	75+
1st	Pre-term/lbw complications (1,160; 23%)	Other injuries* (517; 30%)	Other injuries (1,627; 61%)	Other injuries (1,874; 19%)	Coronary heart disease (2,222; 13%)	Coronary heart disease (785; 12%)	Coronary heart disease (512; 12%)
2nd	Other disorders of infancy* (848; 17%)	Cerebal palsy* (110; 6.4%)	Poisoning* (208; 7.8%)	Poisoning (1,152; 12%)	Lung cancer (1,561; 8.9%)	Lung cancer (708; 11%)	Dementia (476; 11%)
3rd	Birth trauma/ asphyxia* (833; 16%)	LRI incl influenza & pneumonia* (101; 5.9%)	Traumatic brain injury* (100; 3.7%)	Coronary heart disease (710; 7.4%)	Chronic kidney disease (1,281; 7.3%)	COPD (686; 11%)	COPD (372; 8.9%)
4th	SIDS* (434; 8.5%)	Poisoning* (90; 5.3%)	Epilepsy* (75; 2.8%)	Chronic liver disease (605; 6.3%)	COPD (1,169; 6.7%)	Chronic kidney disease (547; 8.7%)	Stroke (332; 8.0%)
5th	Cardiovascular defects* (356; 6.9%)	Cardiovascular defects* (74; 4.3%)	Cerebal palsy* (70; 2.6%)	Chronic kidney disease* (352; 3.6%)	Chronic liver disease (911; 5.2%)	Type 2 diabetes (256; 4.1%)	Chronic kidney disease (295; 7.1%)
	Top 5 (70.7%)	Top 5 (52.1%)	Top 5 (77.6%)	Top 5 (48.7%)	Top 5 (40.8%)	Top 5 (47.3%)	Top 5 (47.6%)

* Number of Indigenous deaths used in YLL calculations is fewer than 10.
lbw low birthweight; SIDS sudden infant death syndrome; LRI lower respiratory infections; COPD chronic obstructive pulmonary disease.
Notes: This figure reports injuries by nature of injury—for external cause of injury see Figure 4.8; Disease rankings include 'other' residual conditions from each disease group; for example, 'other musculoskeletal conditions'.

Figure D7: Causes with the highest and lowest average years of life lost (YLL) per death, Indigenous Australians, 2018



LBW low birthweight; SIDS sudden infant death syndrome; RTI road traffic injuries.

Notes

1. Excludes diseases with fewer than 5 deaths and residual ('other') diseases.
2. Average YLL is standardised to the GBD standard reference life table (Murray and Ezzati et al. 2012) with a maximum life expectancy of 86.02 years at birth and a life table cap at age 105 years with a life expectancy of 1.63 years.

Figure D8: Leading risk factor contribution to non-fatal burden (YLD; proportion %) for Indigenous males, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	LBW/short gestation (19; 0.9%)	Child abuse/neglect (131; 2.2%)	Alcohol (2,183; 21.4%)	Alcohol (4,957; 22.5%)	Overweight/obesity (1,968; 12.4%)	Overweight/obesity (610; 14.5%)	Tobacco (262; 12.2%)
2nd	Unsafe sanitation (14; 0.7%)	Overweight/obesity (100; 1.7%)	Illicit drug use (1,167; 11.4%)	Illicit drug use (2,222; 10.1%)	Tobacco (1,889; 11.9%)	Tobacco (590; 14.0%)	Overweight/obesity (257; 11.9%)
3rd	Iron deficiency (12; 0.6%)	Alcohol (59; 1.0%)	Child abuse/neglect (384; 3.8%)	Child abuse/neglect (995; 4.5%)	Blood glucose (1,398; 8.8%)	Blood glucose (455; 10.8%)	Blood glucose (190; 8.8%)
4th		LBW/short gestation (33; 0.6%)	Occupational (197; 1.9%)	Overweight/obesity (882; 4.0%)	Alcohol (1,205; 7.6%)	Diet (227; 5.4%)	Kidney function (135; 6.3%)
5th		Iron deficiency (26; 0.4%)	Overweight/obesity (164; 1.6%)	Occupational (671; 3.0%)	Diet (823; 5.2%)	Kidney function (198; 4.7%)	Blood pressure (104; 4.8%)
6th		Blood glucose (13; 0.2%)	LBW/short gestation (64; 0.6%)	Tobacco (630; 2.9%)	Occupational (684; 4.3%)	Blood pressure (198; 4.7%)	Diet (91; 4.2%)
7th			Blood glucose (49; 0.5%)	Blood glucose (538; 2.4%)	Kidney function (593; 3.7%)	Physical inactivity (161; 3.8%)	Physical inactivity (87; 4.0%)
8th				Diet (250; 1.1%)	Illicit drug use (504; 3.2%)	Alcohol (94; 2.2%)	Alcohol (36; 1.7%)
9th				Kidney function (117; 0.5%)	Blood pressure (446; 2.8%)	Air pollution (68; 1.6%)	Air pollution (28; 1.3%)
10th				Physical inactivity (108; 0.5%)	Child abuse/neglect (396; 2.5%)	Cholesterol (52; 1.2%)	Cholesterol (27; 1.3%)

LBW low birthweight.

Figure D9: Leading risk factor contribution to non-fatal burden (YLD; proportion %) for Indigenous females, by age group, 2018

Rank	Under 5	5–14	15–24	25–44	45–64	65–74	75+
			Age group (years)				
1st	LBW/short gestation (14; 0.7%)	Child abuse/neglect (264; 5.6%)	Child abuse/neglect (1,292; 12.7%)	Child abuse/neglect (2,825; 13.7%)	Overweight/obesity (2,520; 13.6%)	Overweight/obesity (897; 17.8%)	Overweight/obesity (395; 12.7%)
2nd	Unsafe sanitation (13; 0.7%)	Overweight/obesity (77; 1.6%)	Alcohol (920; 9.0%)	Partner violence (1,962; 9.5%)	Tobacco (1,981; 10.7%)	Tobacco (619; 12.3%)	Tobacco (264; 8.5%)
3rd	Iron deficiency (5; 0.3%)	Iron deficiency (43; 0.9%)	Illicit drug use (888; 8.7%)	Illicit drug use (1,372; 6.6%)	Blood glucose (1,424; 7.7%)	Blood glucose (562; 11.2%)	Blood glucose (258; 8.3%)
4th		Blood glucose (26; 0.6%)	Partner violence (408; 4.0%)	Alcohol (1,293; 6.3%)	Child abuse/neglect (1,348; 7.3%)	Kidney function (328; 6.5%)	Kidney function (194; 6.2%)
5th		Alcohol (25; 0.5%)	Overweight/obesity (227; 2.2%)	Overweight/obesity (1,288; 6.2%)	Partner violence (1,144; 6.2%)	Diet (227; 4.5%)	Blood pressure (135; 4.4%)
6th		LBW/short gestation (21; 0.4%)	Occupational (151; 1.5%)	Tobacco (725; 3.5%)	Alcohol (790; 4.3%)	Blood pressure (212; 4.2%)	Physical inactivity (126; 4.1%)
7th			Iron deficiency (132; 1.3%)	Blood glucose (528; 2.6%)	Diet (678; 3.7%)	Physical inactivity (189; 3.8%)	Diet (116; 3.7%)
8th			Blood glucose (68; 0.7%)	Occupational (464; 2.2%)	Kidney function (654; 3.5%)	Air pollution (68; 1.4%)	Alcohol (42; 1.3%)
9th			LBW/short gestation (36; 0.4%)	Diet (241; 1.2%)	Occupational (430; 2.3%)	Alcohol (57; 1.1%)	Bone density (41; 1.3%)
10th			Unsafe sex (23; 0.2%)	Iron deficiency (178; 0.9%)	Physical inactivity (411; 2.2%)	Child abuse/neglect (46; 0.9%)	Cholesterol (34; 1.1%)

LBW low birthweight

Figure D10: Leading risk factor contribution to fatal burden (YLL; proportion %) for Indigenous males, by age group, 2018

Rank	Under 5	5–14	15–24	25–44	45–64	65–74	75+
	Age group (years)						
1st	LBW/short gestation (2,949; 41.0%)	Child abuse/neglect (31; 2.5%)	Alcohol (2,101; 34.9%)	Illicit drug use (4,102; 24.4%)	Tobacco (7,759; 31.6%)	Tobacco (2,045; 28.8%)	Tobacco (812; 24.0%)
2nd	Kidney function (39; 0.5%)	Blood glucose (28; 2.3%)	Illicit drug use (1,181; 19.6%)	Alcohol (4,088; 24.3%)	Diet (4,575; 18.7%)	Overweight/obesity (1,256; 17.7%)	Overweight/obesity (431; 12.7%)
3rd		Overweight/obesity (13; 1.0%)	Child abuse/neglect (1,178; 19.6%)	Diet (1,880; 11.2%)	Overweight/obesity (4,229; 17.2%)	Diet (1,038; 14.6%)	Blood glucose (412; 12.2%)
4th		Kidney function (8; 0.7%)	Overweight/obesity (68; 1.1%)	Tobacco (1,841; 10.9%)	Alcohol (3,012; 12.3%)	Blood glucose (1,019; 14.3%)	Diet (385; 11.4%)
5th		LBW/short gestation (7; 0.6%)	Occupational (18; 0.3%)	Overweight/obesity (1,706; 10.1%)	Blood pressure (2,973; 12.1%)	Kidney function (957; 13.5%)	Blood pressure (341; 10.1%)
6th				Child abuse/neglect (1,481; 8.8%)	Kidney function (2,912; 11.9%)	Blood pressure (901; 12.7%)	Kidney function (306; 9.0%)
7th				Blood pressure (1,241; 7.4%)	Cholesterol (2,494; 10.2%)	Alcohol (571; 8.0%)	Physical inactivity (205; 6.1%)
8th				Cholesterol (1,188; 7.1%)	Blood glucose (2,353; 9.6%)	Physical inactivity (419; 5.9%)	Alcohol (179; 5.3%)
9th				Kidney function (868; 5.2%)	Illicit drug use (1,664; 6.8%)	Cholesterol (388; 5.5%)	Cholesterol (162; 4.8%)
10th				Blood glucose (696; 4.1%)	Physical inactivity (1,332; 5.4%)	Air pollution (217; 3.1%)	Air pollution (92; 2.7%)

LBW low birthweight

Figure D11: Leading risk factor contribution to fatal burden (YLL; proportion %) for Indigenous females, by age group, 2018

Rank	Age group (years)						
	Under 5	5–14	15–24	25–44	45–64	65–74	75+
1st	LBW/short gestation (2,152; 36.5%)	Child abuse/neglect (54; 5.7%)	Child abuse/neglect (764; 28.5%)	Illicit drug use (1,495; 15.5%)	Tobacco (5,110; 29.2%)	Tobacco (1,991; 31.6%)	Tobacco (806; 19.3%)
2nd		Overweight/obesity (7; 0.8%)	Alcohol (559; 20.8%)	Tobacco (1,164; 12.1%)	Overweight/obesity (3,275; 18.7%)	Overweight/obesity (1,153; 18.3%)	Overweight/obesity (660; 15.8%)
3rd			Illicit drug use (462; 17.2%)	Overweight/obesity (1,131; 11.7%)	Diet (2,363; 13.5%)	Kidney function (993; 15.8%)	Kidney function (553; 13.2%)
4th			Partner violence (365; 13.6%)	Alcohol (1,116; 11.6%)	Kidney function (2,170; 12.4%)	Blood glucose (870; 13.8%)	Blood glucose (546; 13.1%)
5th			Overweight/obesity (25; 0.9%)	Partner violence (874; 9.1%)	Blood glucose (2,062; 11.8%)	Diet (718; 11.4%)	Blood pressure (486; 11.6%)
6th			Kidney function (22; 0.8%)	Diet (853; 8.8%)	Blood pressure (1,652; 9.4%)	Blood pressure (698; 11.1%)	Diet (475; 11.4%)
7th			Blood glucose (7; 0.3%)	Kidney function (651; 6.7%)	Alcohol (1,354; 7.7%)	Physical inactivity (345; 5.5%)	Physical inactivity (302; 7.2%)
8th				Child abuse/neglect (589; 6.1%)	Cholesterol (1,211; 6.9%)	Alcohol (286; 4.5%)	Cholesterol (205; 4.9%)
9th				Cholesterol (520; 5.4%)	Illicit drug use (960; 5.5%)	Cholesterol (265; 4.2%)	Alcohol (157; 3.8%)
10th				Blood glucose (488; 5.1%)	Physical inactivity (892; 5.1%)	Air pollution (178; 2.8%)	Air pollution (108; 2.6%)

LBW low birthweight

Table D1: Number and percentage of YLL and deaths, by age group and sex, Indigenous Australians, 2018

	Males				Females				People			
Age group (years)	Deaths (number)	Deaths (%)	YLL (number)	YLL (%)	Deaths (number)	Deaths (%)	YLL (number)	YLL (%)	Deaths (number)	Deaths (%)	YLL (number)	YLL (%)
Under 1	72	3.6	6,199	9.4	60	3.6	5,132	10.9	132	3.6	11,331	10.0
1–4	12	0.6	995	1.5	9	0.6	768	1.6	21	0.6	1,764	1.6
5–9	8	0.4	640	1.0	6	0.4	477	1.0	14	0.4	1,117	1.0
10–14	8	0.4	596	0.9	6	0.4	466	1.0	14	0.4	1,062	0.9
15–19	36	1.8	2,456	3.7	19	1.1	1,297	2.8	54	1.5	3,753	3.3
20–24	55	2.8	3,568	5.4	22	1.3	1,385	2.9	77	2.1	4,953	4.4
25–29	61	3.1	3,649	5.5	29	1.8	1,705	3.6	90	2.5	5,354	4.7
30–34	74	3.7	4,031	6.1	43	2.6	2,324	4.9	117	3.2	6,355	5.6
35–39	85	4.3	4,189	6.3	50	3.1	2,493	5.3	135	3.7	6,683	5.9
40–44	111	5.6	4,945	7.5	70	4.3	3,122	6.6	181	5.0	8,067	7.1
45–49	165	8.3	6,612	10.0	103	6.3	4,107	8.7	268	7.4	10,718	9.5
50–54	184	9.3	6,475	9.8	136	8.3	4,773	10.1	320	8.9	11,248	9.9
55–59	191	9.7	5,849	8.8	154	9.4	4,685	9.9	345	9.5	10,534	9.3
60–64	215	10.9	5,587	8.4	151	9.2	3,952	8.4	366	10.1	9,540	8.4
65–69	187	9.5	4,046	6.1	180	11.0	3,852	8.2	367	10.1	7,898	7.0
70–74	177	9.0	3,067	4.6	141	8.6	2,447	5.2	319	8.8	5,514	4.9
75–79	134	6.8	1,800	2.7	142	8.7	1,890	4.0	276	7.6	3,690	3.3
80–84	105	5.3	1,016	1.5	129	7.8	1,248	2.7	234	6.5	2,265	2.0
85+	97	4.9	566	0.9	191	11.6	1,036	2.2	288	8.0	1,602	1.4
Total	**1,978**	**100.0**	**66,285**	**100.0**	**1,641**	**100.0**	**47,160**	**100.0**	**3,619**	**100.0**	**113,445**	**100.0**

Note: Numbers and percentages for age groups may not add up to the total due to rounding.

Table D2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, males, 2018

	DALY per 1,000[(a)]				
Disease group	Indigenous	Non-Indigenous	Rate ratio	Rate difference	Contribution to the health gap (% of total rate difference)
Mental/substance use	75.8	25.3	3.0	50.5	20.8
Cardiovascular	62.1	27.9	2.2	34.2	14.1
Injuries	53.4	22.5	2.4	30.9	12.7
Cancer	57.8	34.9	1.7	22.9	9.5
Respiratory	33.6	12.8	2.6	20.9	8.6
Endocrine	17.4	5.4	3.2	11.9	4.9
Neurological	23.6	12.0	2.0	11.6	4.8
Musculoskeletal	32.9	21.9	1.5	11.1	4.6
Gastrointestinal	16.4	6.6	2.5	9.7	4.0
Kidney/urinary	12.8	3.0	4.2	9.7	4.0
Hearing/vision	12.0	3.9	3.1	8.1	3.3
Infectious diseases	10.6	3.7	2.9	6.9	2.9
Infant/congenital	10.6	4.9	2.2	5.7	2.4
Oral	8.5	4.7	1.8	3.7	1.5
Blood/metabolic	5.3	1.8	2.9	3.4	1.4
Skin	4.3	3.4	1.3	0.9	0.4
Reproductive/maternal	0.2	0.2	1.1	—	—
Total all diseases	**437.4**	**195.0**	**2.2**	**242.4**	**100.0**

(a) Rates are directly age-standardised to the 2011 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Notes

1. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
2. The numbers may not add to total for all columns due to rounding.

Table D3: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, females, 2018

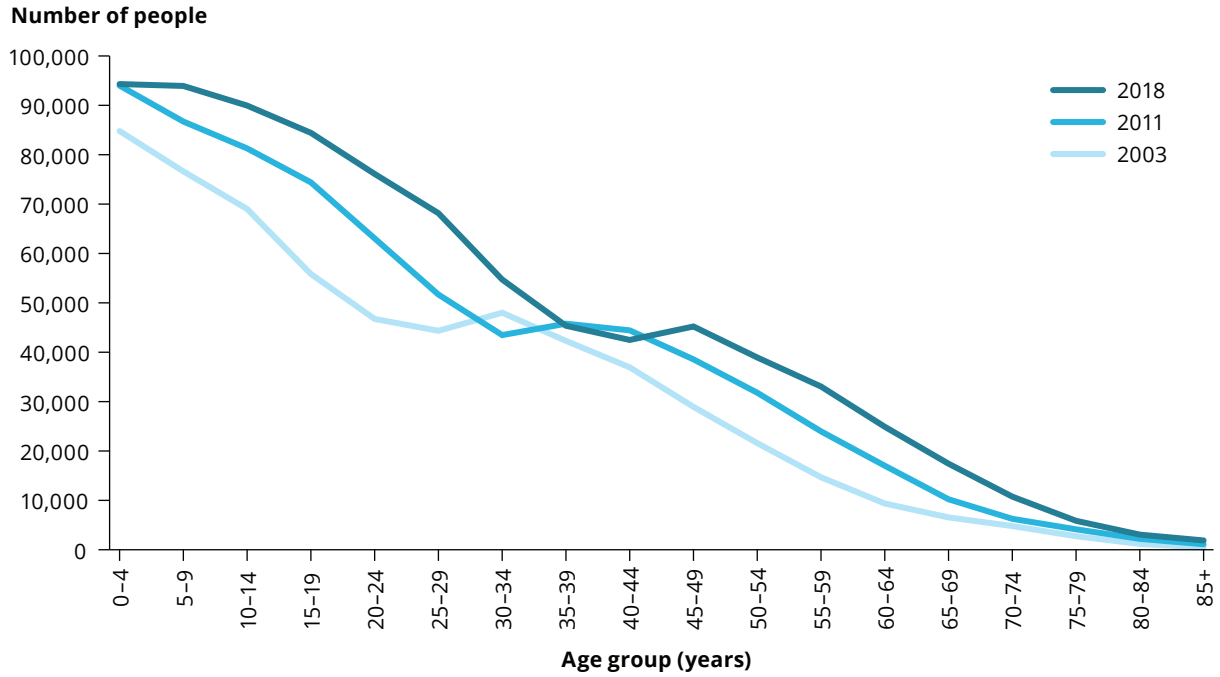
	DALY per 1,000[(a)]				
Disease group	Indigenous	Non-Indigenous	Rate ratio	Rate difference	Contribution to the health gap (% of total rate difference)
Mental/substance use	63.6	23.8	2.7	39.8	19.6
Cardiovascular	41.8	15.6	2.7	26.2	12.9
Respiratory	35.0	12.8	2.7	22.3	10.9
Cancer	43.8	25.5	1.7	18.3	9.0
Injuries	24.4	9.2	2.6	15.2	7.5
Musculoskeletal	39.2	25.4	1.5	13.8	6.8
Kidney/urinary	15.1	1.5	10.1	13.6	6.7
Endocrine	15.2	3.6	4.2	11.6	5.7
Neurological	23.1	14.2	1.6	8.9	4.4
Hearing/vision	11.1	3.2	3.5	7.9	3.9
Gastrointestinal	12.5	5.0	2.5	7.4	3.7
Infectious diseases	9.9	3.1	3.2	6.9	3.4
Infant/congenital	8.8	3.8	2.3	5.1	2.5
Oral	7.3	4.1	1.8	3.2	1.6
Blood/metabolic	5.6	2.5	2.3	3.2	1.5
Skin	4.4	3.6	1.2	0.8	0.4
Reproductive/maternal	3.6	4.0	0.9	–0.5	–0.2
Total all diseases	**364.4**	**160.9**	**2.3**	**203.5**	**100.0**

(a) Rates are directly age-standardised to the 2011 Australian ERP as at 30 June 2001 (based on the 2001 Census).

Notes

1. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.
2. The numbers may not add to total for all columns due to rounding.

Figure D12: Indigenous estimated resident population (ERP), by age group, 2003, 2011 and 2018



Source: ABS 2019b.

Table D4: Indigenous estimated resident population (ERP) (number and %), by age group, 2003, 2011 and 2018

	2003		2011		2018	
Age group (years)	Number	%	Number	%	Number	%
0–4	84,794	14.3	93,994	13.1	94,308	11.4
5–9	76,625	12.9	86,716	12.0	93,926	11.3
10–14	69,007	11.6	81,277	11.3	89,950	10.8
15–19	55,843	9.4	74,400	10.3	84,428	10.2
20–24	46,741	7.9	63,051	8.8	76,108	9.2
25–29	44,340	7.5	51,681	7.2	68,160	8.2
30–34	48,001	8.1	43,475	6.0	54,722	6.6
35–39	42,304	7.1	45,776	6.4	45,361	5.5
40–44	36,940	6.2	44,429	6.2	42,485	5.1
45–49	28,941	4.9	38,557	5.4	45,213	5.4
50–54	21,591	3.6	31,800	4.4	38,938	4.7
55–59	14,679	2.5	23,973	3.3	33,054	4.0
60–64	9,364	1.6	17,014	2.4	24,904	3.0
65–69	6,551	1.1	10,220	1.4	17,425	2.1
70–74	4,800	0.8	6,267	0.9	10,756	1.3
75–79	2,740	0.5	4,137	0.6	5,859	0.7
80–84	1,177	0.2	2,208	0.3	3,061	0.4
85+	484	0.1	1,118	0.2	1,884	0.2
Total	**594,922**	**100.0**	**720,093**	**100.0**	**830,542**	**100.0**

Source: ABS 2019b.

Table D5: Changes in total attributable burden between 2003 and 2018, by risk factor exposure subcategories

Risk factor exposure	2003 attributable DALY	2018 attributable DALY	Change in attributable DALY	Change in attributable DALY (%)	2003 attributable DALY ASR	2018 attributable DALY ASR	Change in ASR	Rate ratio 2018:2003
Overweight (including obesity)								
Overweight but not obese	4,943	6,135	1,192	24.1	19.7	12.4	–7.3	0.6
Obesity	8,551	17,202	8,651	101.2	32.7	34.5	1.8	1.1
Dietary risks								
Diet low in legumes	3,670	3,577	–92	–2.5	13.0	6.9	–6.0	0.5
Diet low in whole grains & high fibre cereal	2,306	2,509	203	8.8	8.2	5.0	–3.2	0.6
Diet high in sodium	1,643	3,235	1,593	96.9	6.2	6.4	0.2	1.0
Diet high in red meat	2,447	2,562	115	4.7	8.7	5.1	–3.6	0.6
Diet low in fruit	2,327	2,592	264	11.4	8.8	5.2	–3.6	0.6
Diet low in nuts & seeds	2,595	2,531	–63	–2.4	9.2	4.9	–4.3	0.5
Diet low in vegetables	1,624	1,674	50	3.1	5.7	3.3	–2.4	0.6
Diet high in processed meat	1,334	1,384	50	3.8	4.5	2.6	–1.9	0.6
Diet low in polyunsaturated fats	350	343	–8	–2.2	1.2	0.7	–0.6	0.5
Diet low in fish	19	19	–1	–2.9	0.1	—	—	0.5
Diet high in sugar sweetened beverages	536	528	–8	–1.4	1.7	1.0	–0.7	0.6
Diet low in milk	71	127	56	79.4	0.3	0.3	—	1.0

(continued)

Table D5 (continued): Changes in total attributable burden between 2003 and 2018, by risk factor exposure subcategories

Risk factor exposure	2003 attributable DALY	2018 attributable DALY	Change in attributable DALY	Change in attributable DALY (%)	2003 attributable DALY ASR	2018 attributable DALY ASR	Change in ASR	Rate ratio 2018:2003
Illicit drug use								
Opioid use	2,115	5,207	3,093	146.3	3.6	7.5	3.9	2.1
Amphetamine use	1,333	4,487	3,154	236.6	2.1	5.7	3.7	2.8
Cannabis use	1,978	3,934	1,956	98.9	3.3	4.8	1.5	1.5
Cocaine use	561	1,058	497	88.6	0.9	1.2	0.3	1.4
Other illicit drug use	394	233	–161	–40.8	0.7	0.3	–0.4	0.4
Unsafe injecting practices	850	1,725	875	103.0	2.3	3.1	0.8	1.4
Impaired kidney function								
Chronic kidney disease stage 1–3	2,762	4,000	1,238	44.8	12.7	8.6	–4.0	0.7
Chronic kidney disease stage 4–5	3,953	7,944	3,991	101.0	17.1	17.3	0.3	1.0

Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 population.
2. Rate ratios divide 2018 ASRs by corresponding 2003 ASRs.
3. Rate differences subtract 2018 ASRs from the corresponding 2003 ASRs.

Table D6: 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 2018

	Indigenous age-standardised rate	Non-Indigenous age-standardised rate	ASR rate ratio	ASR rate difference
Males				
Total burden (DALY)				
2003	530.9	232.3	2.3	298.6
2018	437.4	195.0	2.2	242.4
Non-fatal burden (YLD)				
2003	194.6	95.1	2.0	99.5
2018	199.0	93.4	2.1	105.6
Fatal burden (YLL)				
2003	336.3	137.2	2.5	199.1
2018	238.4	101.6	2.3	136.7
Females				
Total burden (DALY)				
2003	412.2	179.3	2.3	232.8
2018	364.4	160.9	2.3	203.5
Non-fatal burden (YLD)				
2003	191.0	97.2	2.0	93.8
2018	197.9	97.5	2.0	100.5
Fatal burden (YLL)				
2003	221.2	82.2	2.7	139.0
2018	166.5	63.4	2.6	103.1

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 people.
2. ASR rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. ASR rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Table D7: 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 2018

	Indigenous DALY ASR		Non-Indigenous DALY ASR		Rate ratio		Rate difference	
	2003	2018	2003	2018	2003	2018	2003	2018
Males								
Mental/substance use	65.4	75.8	24.4	25.3	2.7	3.0	41.1	50.5
Cardiovascular	113.3	62.1	46.4	27.9	2.4	2.2	66.9	34.2
Injuries	56.1	53.4	25.5	22.5	2.2	2.4	30.6	30.9
Cancer	64.9	57.8	45.7	34.9	1.4	1.7	19.1	22.9
Respiratory	40.4	33.6	14.0	12.8	2.9	2.6	26.4	20.9
Endocrine	30.1	17.4	5.7	5.4	5.2	3.2	24.3	11.9
Neurological	24.3	23.6	10.7	12.0	2.3	2.0	13.6	11.6
Musculoskeletal	41.2	32.9	24.3	21.9	1.7	1.5	16.9	11.1
Gastrointestinal	22.0	16.4	7.3	6.6	3.0	2.5	14.8	9.7
Kidney/urinary	11.2	12.8	3.2	3.0	3.5	4.2	8.1	9.7
Hearing/vision	15.8	12.0	3.1	3.9	5.0	3.1	12.7	8.1
Infectious diseases	17.8	10.6	5.0	3.7	3.5	2.9	12.7	6.9
Infant/congenital	12.2	10.6	6.8	4.9	1.8	2.2	5.4	5.7
Oral	7.5	8.5	4.5	4.7	1.7	1.8	3.0	3.7
Blood/metabolic	4.5	5.3	2.1	1.8	2.2	2.9	2.5	3.4
Skin	4.1	4.3	3.4	3.4	1.2	1.3	0.7	0.9
Reproductive/maternal	0.2	0.2	0.2	0.2	1.0	1.1	—	—
Females								
Mental/substance use	50.1	63.6	23.1	23.8	2.2	2.7	27.0	39.8
Cardiovascular	73.5	41.8	26.0	15.6	2.8	2.7	47.5	26.2
Respiratory	36.8	35.0	13.4	12.8	2.7	2.7	23.4	22.3
Cancer	46.2	43.8	32.1	25.5	1.4	1.7	14.1	18.3
Injuries	24.2	24.4	9.6	9.2	2.5	2.6	14.5	15.2
Musculoskeletal	47.2	39.2	25.9	25.4	1.8	1.5	21.3	13.8
Kidney/urinary	12.5	15.1	1.4	1.5	8.7	10.1	11.1	13.6
Endocrine	27.4	15.2	3.7	3.6	7.4	4.2	23.7	11.6
Neurological	21.0	23.1	13.1	14.2	1.6	1.6	8.0	8.9
Hearing/vision	14.1	11.1	3.1	3.2	4.6	3.5	11.0	7.9
Gastrointestinal	14.6	12.5	5.3	5.0	2.8	2.5	9.3	7.4
Infectious diseases	14.7	9.9	3.7	3.1	4.0	3.2	11.0	6.9
Infant/congenital	9.5	8.8	5.4	3.8	1.8	2.3	4.1	5.1
Oral	6.1	7.3	4.0	4.1	1.5	1.8	2.1	3.2
Blood/metabolic	6.4	5.6	2.3	2.5	2.8	2.3	4.2	3.2
Skin	4.8	4.4	3.5	3.6	1.4	1.2	1.3	0.8
Reproductive/maternal	3.1	3.6	3.8	4.0	0.8	0.9	-0.7	-0.5

Notes
1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 population.
2. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Table D8: 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 2018

	Indigenous YLD ASR		Non-Indigenous YLD ASR		Rate ratio		Rate difference	
	2003	2018	2003	2018	2003	2018	2003	2018
Males								
Mental/substance use	59.5	73.1	23.3	24.7	2.6	3.0	36.1	48.4
Musculoskeletal	39.6	32.0	23.7	21.3	1.7	1.5	15.9	10.7
Respiratory	17.9	17.3	7.3	7.6	2.5	2.3	10.6	9.7
Hearing/vision	15.8	12.0	3.1	3.9	5.0	3.1	12.7	8.1
Neurological	12.7	13.0	5.7	5.6	2.2	2.3	7.1	7.4
Endocrine	8.3	8.9	2.7	3.3	3.1	2.7	5.6	5.7
Oral	7.3	8.4	4.5	4.7	1.6	1.8	2.9	3.7
Kidney/urinary	3.3	3.8	1.6	1.4	2.1	2.7	1.7	2.4
Injuries	3.4	5.3	3.4	3.3	1.0	1.6	—	2.0
Infectious diseases	3.2	2.9	1.2	1.1	2.5	2.6	1.9	1.8
Cardiovascular	9.9	8.3	8.5	6.5	1.2	1.3	1.3	1.7
Infant/congenital	2.2	2.4	1.1	1.0	2.0	2.4	1.1	1.4
Blood/metabolic	2.1	1.8	0.5	0.4	4.6	4.1	1.7	1.4
Cancer	3.4	3.9	2.7	2.8	1.2	1.4	0.7	1.2
Skin	3.5	3.5	3.2	3.2	1.1	1.1	0.3	0.4
Reproductive/maternal	0.2	0.2	0.2	0.2	1.1	1.0	—	—
Gastrointestinal	2.3	2.2	2.4	2.4	1.0	0.9	–0.1	–0.1
Females								
Mental/substance use	48.1	62.5	22.7	23.5	2.1	2.7	25.5	39.0
Musculoskeletal	44.2	37.2	25.1	24.8	1.8	1.5	19.0	12.4
Respiratory	21.6	20.7	9.3	9.1	2.3	2.3	12.3	11.6
Hearing/vision	14.1	11.1	3.1	3.2	4.6	3.5	11.0	7.9
Endocrine	8.2	8.3	2.0	2.4	4.2	3.4	6.3	5.9
Neurological	14.5	14.3	9.0	8.8	1.6	1.6	5.5	5.5
Kidney/urinary	3.1	4.2	0.4	0.4	7.8	10.2	2.7	3.8
Oral	6.1	7.3	4.0	4.0	1.5	1.8	2.1	3.2
Cardiovascular	8.7	7.1	5.1	4.0	1.7	1.8	3.5	3.1
Infectious diseases	4.1	3.9	1.3	1.1	3.2	3.4	2.8	2.7
Injuries	2.6	4.0	2.0	2.2	1.3	1.8	0.6	1.8
Cancer	2.7	3.6	2.0	2.0	1.4	1.8	0.7	1.6
Blood/metabolic	3.1	3.0	1.1	1.5	2.8	2.0	2.0	1.5
Infant/congenital	1.4	1.4	0.7	0.6	2.0	2.4	0.7	0.8
Skin	3.7	3.8	3.3	3.4	1.1	1.1	0.3	0.4
Gastrointestinal	2.2	2.4	2.5	2.5	0.9	1.0	–0.3	–0.1
Reproductive/maternal	2.7	3.2	3.7	4.0	0.7	0.8	–1.0	–0.7

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 population.
2. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Table D9: 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 2018

	Indigenous YLL ASR		Non-Indigenous YLL ASR		Rate ratio		Rate difference	
	2003	2018	2003	2018	2003	2018	2003	2018
Males								
Cardiovascular	103.5	53.8	37.9	21.3	2.7	2.5	65.6	32.5
Injuries	52.7	48.1	22.1	19.2	2.4	2.5	30.6	28.8
Cancer	61.5	53.9	43.0	32.1	1.4	1.7	18.5	21.8
Respiratory	22.5	16.3	6.7	5.1	3.4	3.2	15.8	11.2
Gastrointestinal	19.7	14.2	4.9	4.3	4.1	3.3	14.9	9.9
Kidney/urinary	7.9	9.0	1.6	1.7	5.0	5.4	6.3	7.3
Endocrine	21.8	8.4	3.0	2.2	7.2	3.9	18.8	6.3
Infectious diseases	14.6	7.7	3.8	2.6	3.8	3.0	10.8	5.1
Infant/congenital	10.0	8.2	5.7	3.9	1.8	2.1	4.4	4.3
Neurological	11.5	10.6	5.0	6.4	2.3	1.7	6.5	4.3
Mental/substance use	6.0	2.7	1.1	0.6	5.6	4.5	4.9	2.1
Blood/metabolic	2.4	3.5	1.6	1.4	1.5	2.5	0.8	2.1
Skin	0.6	0.8	0.2	0.2	2.5	3.2	0.3	0.5
Musculoskeletal	1.5	0.9	0.6	0.5	2.5	1.7	0.9	0.4
Oral	0.1	0.1	—	—	. .	. .	0.1	0.1
Reproductive/maternal	—	—	—	—	. .	. .	—	—
Hearing/vision	—	—	—	—	. .	. .	—	—
Females								
Cardiovascular	64.8	34.6	20.8	11.6	3.1	3.0	44.0	23.0
Cancer	43.6	40.3	30.1	23.5	1.4	1.7	13.4	16.7
Injuries	21.5	20.4	7.6	7.0	2.8	2.9	13.9	13.4
Respiratory	15.2	14.3	4.0	3.6	3.7	4.0	11.1	10.7
Kidney/urinary	9.4	10.9	1.1	1.1	9.0	10.0	8.4	9.8
Gastrointestinal	12.3	10.1	2.8	2.6	4.4	4.0	9.5	7.6
Endocrine	19.2	6.8	1.8	1.2	10.9	5.7	17.4	5.6
Infant/congenital	8.1	7.4	4.7	3.2	1.7	2.3	3.4	4.2
Infectious diseases	10.6	6.1	2.4	1.9	4.3	3.1	8.1	4.1
Neurological	6.6	8.8	4.1	5.4	1.6	1.6	2.5	3.4
Blood/metabolic	3.3	2.6	1.2	1.0	2.9	2.7	2.2	1.7
Musculoskeletal	3.0	2.1	0.8	0.7	3.8	3.1	2.2	1.4
Mental/substance use	2.0	1.1	0.4	0.3	4.4	3.3	1.5	0.8
Skin	1.1	0.6	0.2	0.2	5.7	3.2	0.9	0.4
Reproductive/maternal	0.4	0.3	0.1	0.1	5.3	5.7	0.3	0.3
Oral	—	—	—	—	. .	. .	—	—
Hearing/vision	—	—	—	—	. .	. .	—	—

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population and expressed per 1,000 population.
2. Rate ratio is calculated as Indigenous ASR divided by non-Indigenous ASR.
3. Rate difference is calculated as Indigenous ASR minus non-Indigenous ASR.
4. Rate ratios and rate differences are calculated using unrounded rates and may differ to those calculated using the rounded rates presented in the table.

Table D10: Age-standardised Indigenous and non–Indigenous DALY rates (per 1,000 people) attributed to selected risk factors, 2003, 2011 and 2018

	2003		2011		2018	
Risk factor	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous	Indigenous	Non-Indigenous
Tobacco use	65.8	20.8	73.1	16.6	58.8	13.8
Overweight (including obesity)	52.5	14.7	52.2	13.7	47.0	13.9
Alcohol use	37.1	8.8	37.0	8.3	36.8	9.8
Dietary risks	49.4	15.3	37.3	11.1	30.2	8.8
Impaired kidney function	29.6	3.6	25.5	3.2	25.9	2.8
Illicit drug use	12.9	4.2	15.2	4.7	22.8	6.2
High blood pressure	41.4	16.0	27.6	10.4	22.6	8.1
Child abuse & neglect	12.7	4.0	13.1	3.9	15.6	4.0
High cholesterol	27.9	9.7	21.6	6.3	13.9	4.5
Physical inactivity	24.5	5.9	17.4	4.8	13.3	3.9
Intimate partner violence[(a)]	6.3	1.2	5.8	1.2	7.2	1.6
Occupational exposures & hazards	6.2	4.0	6.3	3.7	5.8	7.6
Low bone mineral density	3.0	1.2	2.2	1.2	2.8	7.5
Unsafe sex	1.6	0.6	1.6	0.5	1.4	0.4
Iron deficiency	1.5	0.5	1.4	0.5	1.1	0.7

(a) The attributable burden from intimate partner violence is measured for females only.
Note: Rates are directly age-standardised to the 2001 Australian standard population as at 30 June 2001 and expressed per 1,000 people.

Table D11: Life expectancy, HALE and HALE (%), at birth and age 65, by sex, state/territory (NSW, Qld, WA and the NT), and remoteness area, Indigenous Australians, 2018

	At birth						At age 65[a]					
	Males			Females			Males			Females		
	LE (years)[b]	HALE (years)	LE in full health (%)	LE (years)[b]	HALE (years)	LE in full health (%)	LE (years)[b]	HALE (years)	LE in full health (%)	LE (years)[b]	HALE (years)	LE in full health (%)
State/territory												
New South Wales	70.9	57.3	80.9	75.9	60.5	79.7	15.4	10.3	66.9	16.8	10.5	62.5
Queensland	72.0	57.2	79.4	76.4	60.2	78.7	15.2	8.7	57.5	17.2	9.8	56.8
Western Australia	66.9	53.3	79.6	71.8	56.7	78.9	13.8	7.1	51.3	15.7	8.5	54.4
Northern Territory	66.6	54.3	81.5	69.9	56.6	81.0	13.4	7.1	53.2	15.0	8.5	56.8
Remoteness area												
Major cities	72.1	57.1	79.1	76.5	60.1	78.6	16.1	9.2	57.4	17.3	9.9	57.3
Inner and outer regional	70.0	56.1	80.1	74.8	58.9	78.8	14.8	9.6	65.0	16.4	10.0	61.0
Remote and very remote	65.9	53.1	80.5	69.6	55.7	80.0	13.0	7.0	54.2	14.5	7.7	52.9
Australia	**70.0**	**56.0**	**80.0**	**74.4**	**58.8**	**79.1**	**14.9**	**9.1**	**60.8**	**16.3**	**9.5**	**58.4**

(a) Measures for age 65 refer to the age group 65–69.
(b) Life expectancy (LE) from ABS 2018c.
Sources: AIHW analysis of ABDS 2018 database; ABS 2018c.

Table D12: Life expectancy(a), HALE and percentage of life expectancy in full health, at selected ages, by sex, Indigenous Australians, 2018

	Males			Females		
Age (years)	LE (years)[(a)]	HALE (years)	LE in full health (%)	LE (years)[(a)]	HALE (years)	LE in full health (%)
0	70.0	56.0	80.0	74.4	58.8	79.1
1	69.5	55.4	79.8	74.0	58.3	78.8
5	65.6	51.7	78.8	70.0	54.5	77.9
10	60.6	47.0	77.6	65.1	49.7	76.4
15	55.7	42.4	76.1	60.1	45.1	75.0
20	50.9	38.2	75.0	55.3	40.8	73.8
25	46.3	34.1	73.6	50.5	36.7	72.6
30	41.8	30.3	72.5	45.7	32.7	71.5
35	37.5	26.8	71.4	41.1	28.9	70.4
40	33.2	23.5	70.7	36.6	25.3	69.2
45	29.2	20.5	70.2	32.2	21.9	68.0
50	25.5	17.5	68.5	28.0	18.5	66.2
55	21.8	14.6	66.9	24.0	15.4	64.1
60	18.2	11.7	64.2	20.0	12.3	61.7
65	14.9	9.1	60.8	16.3	9.5	58.4
70	11.7	6.6	56.6	12.9	7.0	54.4
75	9.0	4.6	50.8	9.8	4.9	49.9
80	6.7	2.9	43.7	7.1	3.2	45.1
85	4.3	1.6	37.2	4.5	1.8	39.1

(a) Life expectancy (LE) from ABS 2018c.
Sources: AIHW analysis of ABDS 2018 database; ABS 2018c.

Table D13: Life expectancy and HALE by Indigenous status and sex, selected ages, 2018

	Indigenous			Non-Indigenous			Gap	
Age (years)	LE (years)[(a)]	HALE (years)	LE in full health (%)	LE (years)[(a)]	HALE (years)	LE in full health (%)	LE (years)	HALE (years)
Males								
0	70.0	56.0	80.0	80.2	71.5	89.1	10.2	15.5
25	46.3	34.1	73.6	55.9	48.1	86.2	9.6	14.0
45	29.2	20.5	70.2	36.7	30.5	83.1	7.5	10.0
65	14.9	9.1	60.8	19.0	14.6	76.8	4.1	5.5
85	4.3	1.6	37.2	4.7	2.9	62.7	0.4	1.3
Females								
0	74.4	58.8	79.1	83.5	73.5	88.1	9.1	14.7
25	50.5	36.7	72.6	58.9	50.0	84.9	8.4	13.3
45	32.2	21.9	68.0	39.4	32.1	81.6	7.2	10.2
65	16.3	9.5	58.4	20.8	15.7	75.4	4.5	6.2
85	4.5	1.8	39.1	4.8	2.8	58.5	0.3	1.0

(a) Life expectancy (LE) from ABS 2018c.
Sources: AIHW analysis of ABDS 2018 database; ABS 2018c.

Acknowledgments

The Australian Burden of Disease Study 2018 Aboriginal and Torres Strait Islander component was undertaken by members of the Indigenous Burden of Disease Unit of the AIHW: Eleanor Bateman, Ilona Brockway, Tracy Dixon, Robin Kagie, Kalijah Madsen-Guarini, Nick Mann, Lucas Mills and Nancy Stace-Winkles.

Fadwa Al-Yaman, Senior Executive of the Indigenous Group, AIHW, provided valuable guidance and advice throughout the project. The support of the ABDS 2018 national team, under the leadership of Michelle Gourley, is also gratefully acknowledged.

The authors thank members of the ABDS 2018 Indigenous Reference Group for their advice and guidance throughout the project, including review of this report and other materials. Members comprised Debra Reid (Chair), Anthony Barnes, John Bryant, Daniel Christensen, Steven Guthridge, Wendy Hoy, Laura Kirkland, Timothy Saunders, M. Shahidullah, Len Smith, Tomoko Sugiura, Daniel Williamson and Yuejen Zhao. We are also thankful for contributions provided by Lucy Stanley and Megan Campbell.

Helpful comments on drafts of this report and other ABDS 2018 materials were provided by members of the Australian Government Department of Health and the National Indigenous Australians Agency.

Funding for the study was provided by the Australian Government Department of Health.

Abbreviations

AATSIHS	Australian Aboriginal and Torres Strait Islander Health Survey
ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACPR	Australian Cerebral Palsy Register
ACT	Australian Capital Territory
ADHD	attention deficit hyperactivity disorder
AHS	Australian Health Survey
AICR	American Institute for Cancer Research
AIHW	Australian Institute of Health and Welfare
ALL	acute lymphoblastic leukaemia
AML	acute myeloid leukaemia
ANU	Australian National University
ANZDATA	Australian and New Zealand Dialysis and Transplant Registry
ASR	age-standardised rate
CDC	Centers for Disease Control and Prevention
CDE	Census Data Enhancement
CHD	coronary heart disease
CI	confidence interval
CKD	chronic kidney disease
CLD	chronic liver disease
CLL	chronic lymphocytic leukaemia
CML	chronic myeloid leukaemia
CNS	central nervous system
COPD	chronic obstructive pulmonary disease
CVD	cardiovascular disease
DALY	disability-adjusted life years
DCIS	ductal carcinoma in situ
DisMod II	Disease Modelling II
DW	disability weight
EAG	Expert Advisory Group
ED	emergency department
EIMDC	Enhanced Indigenous Mortality Data Collection
EMD	Enhanced Mortality Database
ERP	estimated resident population
FGID	functional gastrointestinal disorders

GBD	Global Burden of Disease Study
GBS	Guillain-Barré syndrome
GORD	gastro-oesophageal reflux disease
HALE	health-adjusted life expectancy
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
IBD	inflammatory bowel disease
ICD	International Statistical Classification of Diseases and Related Health Problems
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification
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
kg/m^2	kilogram per square metre
LBW	low birthweight
LDL	low-density lipoprotein
LE	life expectancy
LRI	lower respiratory infections
LSIC	Longitudinal Study of Indigenous Children
MBS	Medicare Benefits Schedule
MCoD	multiple causes of death
METeOR	Metadata Online Registry
MS	Multiple sclerosis
NATSIHS	National Aboriginal and Torres Strait Islander Health Survey
NDI	National Death Index
NHMD	National Hospital Morbidity Database
NHS	National Health Survey
NIHSI AA	National Integrated Health Services Information Analysis Asset
NIRA PIMG	National Indigenous Reform Agreement Performance Information Management Group
NMD	National Mortality Database
NNDSS	National Notifiable Diseases Surveillance System
NSAOH	National Survey of Adult Oral Health
NSW	New South Wales

NT	Northern Territory
PAF	population attributable fraction
PBS	Pharmaceutical Benefits Scheme
PYLL	potential years of life lost
Qld	Queensland
RACS	Residential Aged Care Services
RPBS	Repatriation Pharmaceutical Benefits Scheme
RTI	road traffic injuries
RR	relative risks
SA	South Australia
SA2	Statistical Area Level 2
SEIFA	Socio-Economic Indexes for Areas
SIDS	sudden infant death syndrome
STI	sexually transmitted infections
Tas	Tasmania
TBI	traumatic brain injury
TMRED	theoretical minimum risk exposure distribution
TMRLT	theoretical minimum risk life table
Vic	Victoria
WA	Western Australia
WARDA	Western Australian Registry of Developmental Anomalies
WCRF	World Cancer Research Fund
WHO	World Health Organization
YLD	years lived with disability
YLL	years of life lost

Symbols

>	greater than
≥	greater than and/or equal to
<	less than
—	nil or rounded to zero
. .	not applicable
n.a.	not available
∏	product of
∑	sum of

Glossary

Aboriginal or Torres Strait Islander: A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Indigenous**.

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: A rate that takes into account the age structure of the population.

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

burden of disease (and injury): 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.

chronic: A term meaning persistent and long-lasting.

chronic condition: A health condition that is persistent and long lasting.

comorbidity: The existence of more than one disease or injury in an individual at the same time.

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

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): Measure (in years) of healthy life lost, either through premature death, defined as dying before the expected life span at the age of death (**YLL**), or, equivalently, through living with ill health due to illness or injury (**YLD**). It is often used synonymously with 'health loss'.

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

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

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

external cause: The environmental event, circumstance or condition that causes injury, poisoning and other adverse effects. METeOR identifier: 514295.

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

health-adjusted life expectancy (HALE): The number of healthy years a person of a particular age can expect to live.

health burden/health loss: The total number of healthy years lost from living with disease/injury (**YLD**) and the total number of years lost from dying early from disease/injury (**YLL**). It is often used synonymously with **DALY**.

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

hospitalisation: Synonymous with admission and separation; that is, an episode of hospital care that starts with the formal admission process and ends with the formal separation process.

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

Indigenous: A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Aboriginal or Torres Strait Islander**.

Indigenous Relative Socioeconomic Outcomes (IRSEO) index: The IRSEO index is used to examine variation in the burden of disease for the Indigenous population by level of socioeconomic disadvantage. The 2016 index incorporates 9 variables from the 2016 Census of Population and Housing that measure employment, occupation, education, income and housing. 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 the Socio-Economic Indexes for Areas (**SEIFA**).

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.

life expectancy: The number of years a person of a particular age can expect to live.

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

morbidity: Ill health in an individual, and levels of ill health in a population or group.

mortality: Death.

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

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

premature death: Deaths that occur at a younger age than a selected cut-off.

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

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health-care establishment. METeOR identifier: 514273.

rate: One number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age standardised) are generally multiplied by a number such as 100,000 to create whole numbers.

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 corresponds to the maximum life expectancy for an individual in good health.

relative risk (RR): The risk of an event relative to exposure, calculated as the ratio of the probability of the event's occurring in the exposed group to the probability of its occurring in the non-exposed group. A relative risk of 1 implies no difference in risk; RR <1 implies the event is less likely to occur in the exposed group; RR >1 implies the event is more likely to occur in the exposed group.

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

Socio-Economic Indexes for Areas (SEIFA): A set of indexes, created from Census data, that aim to represent the socioeconomic position of Australian communities and identify areas of advantage and disadvantage. The index value reflects the overall or average level of disadvantage of the population of an area; it does not show how individuals living in the same area differ from each other in their socioeconomic group.

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

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

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

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

References

ABS (Australian Bureau of Statistics) 2013. Life tables for Aboriginal and Torres Strait Islander Australians, 2010-2012. ABS cat. no. 3302.0.55.003. Canberra: ABS. 8 December 2020, <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3302.0.55.003Main+Features12010-2012?OpenDocument>.

ABS 2014. Australian Aboriginal and Torres Strait Islander Health Survey: biomedical results 2012–13. ABS cat. no. 4727.0.55.003. Canberra: ABS.

ABS 2018a. Census of Population and Housing: understanding the increase in Aboriginal and Torres Strait Islander counts. Canberra: ABS. Viewed 8 December 2020, <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/census-population-and-housing-understanding-increase-aboriginal-and-torres-strait-islander-counts/2016>.

ABS 2018b. Estimates of Aboriginal and Torres Strait Islander Australians, June 2016. 3238.0.55.001. Canberra: ABS. Viewed 8 December 2020, <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-aboriginal-and-torres-strait-islander-australians/latest-release#data-download>.

ABS 2018c. Life tables for Aboriginal and Torres Strait Islander Australians, 2015–2017. ABS cat. no. 3302.0.55.003. Canberra: ABS.

ABS 2019a. Australian demographic statistics, June 2019. 3101.0. Canberra: ABS. Viewed 14 July 2020, <https://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/3101.0Main%20Features1Jun%202019?opendocument&tabname=Summary&prodno=3101.0&issue=Jun%202019&num=&view=>.

ABS 2019b. Estimates and projections, Aboriginal and Torres Strait Islander Australians 2006–2031. Viewed 14 July 2020, <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-and-projections-aboriginal-and-torres-strait-islander-australians/latest-release#acknowledgements>.

AIHW (Australian Institute of Health and Welfare) 2010. Indigenous identification in hospital separations data—quality report. Health Services Series no. 35. Cat. no. HSE 85. Canberra: AIHW.

AIHW 2011. Chronic kidney disease in Aboriginal and Torres Strait Islander people 2011. Cat. no. PHE 151. Canberra: AIHW.

AIHW 2012. An enhanced mortality database for estimating Indigenous life expectancy: a feasibility study. Cat. no. IHW 75. Canberra: AIHW.

AIHW 2013a. Indigenous identification in hospital separations data—quality report. Cat. no. IHW 90. Canberra: AIHW.

AIHW 2014a. Assessment of Global Burden of Disease 2010 methods for the Australian context: Australian Burden of Disease Study. Working paper no. 1. Canberra: AIHW.

AIHW 2014b. Australia's health 2014. Australia's health series no. 14. Cat. no. AUS 178. Canberra: Australia.

AIHW 2015. Australian Burden of Disease Study: fatal burden of disease in Aboriginal and Torres Strait Islander people 2010. Cat. no. BOD 2. Canberra: AIHW.

AIHW 2016a. Australian Burden of Disease Study 2011: impact and causes of illness and death in Aboriginal and Torres Strait Islander people. Australian Burden of Disease Study series no. 6. Cat. no. BOD 7. Canberra: AIHW.

AIHW 2016b. Australian Burden of Disease Study 2011: impact and causes of illness and death in Australia. Australian Burden of Disease Study series no. 3. Cat. no. BOD 4. Canberra: AIHW.

AIHW 2016c. Diabetes and chronic kidney disease as risks for other diseases: Australian Burden of Disease Study 2011. Australian Burden of Disease Study series no. 8. Cat. no. BOD 9. Canberra: AIHW.

AIHW 2017a. Burden of cancer in Australia: Australian Burden of Disease Study 2011. Australian Burden of Disease Study series no. 12. Cat. no. BOD 13. Canberra: AIHW.

AIHW 2017b. Health-adjusted life expectancy in Australia: expected years lived in full health 2011. Australian Burden of Disease Study series no. 16. Cat. no. BOD 17. Canberra: AIHW.

AIHW 2017c. Impact of overweight and obesity as a risk factor for chronic conditions: Australian Burden of Disease Study. Australian Burden of Disease Study series no. 11. Cat. no. BOD 12. Canberra: AIHW.

AIHW 2017d. Impact of physical inactivity as a risk factor for chronic conditions: Australian Burden of Disease Study. Australian Burden of Disease Study series no. 15. Cat. no. BOD 16. Canberra: AIHW.

AIHW 2017e. Life expectancy and disability in Australia: expected years living with and without disability. Cat. no. DIS 66. Canberra: AIHW.

AIHW 2017f. Trends in Indigenous mortality and life expectancy, 2001–2015: evidence from the Enhanced Mortality Database. Cat. no. IHW 174. Canberra: AIHW.

AIHW 2018a. Disease expenditure in Australia Cat. No. HWE 76. Canberra: AIHW. Viewed 20 September 2021, <https://www.aihw.gov.au/reports/health-welfare-expenditure/disease-expenditure-in-australia/contents/summary>.

AIHW 2018b. Impact of alcohol and illicit drug use on the burden of disease and injury in Australia: Australian Burden of Disease Study 2011. Australian Burden of Disease Study series no. 17. Cat. no. BOD 19. Canberra: AIHW.

AIHW 2019a. Australian Burden of Disease Study: impact and causes of illness and death in Australia 2015. Australian Burden of Disease series no. 19. Cat. no. BOD 22. Canberra: AIHW.

AIHW 2019b. Cervical screening in Australia 2019. Cancer series no. 123. Cat. no. CAN 124. Canberra: AIHW.

AIHW 2019c. Improving Indigenous identification in mortality estimates. Cat. no. IHW 215. Canberra: AIHW.

AIHW 2019d. The burden of vaccine preventable diseases in Australia. Cat. no. PHE 263. Canberra: AIHW.

AIHW 2020. Aboriginal and Torres Strait Islander Health Performance Framework 2020 summary report. Cat. no. IHPF 2. Canberra: AIHW.

AIHW 2021a. Australian Burden of Disease Study: impact and causes and death in Australia 2018. Australian Burden of Disease series no. 23. Cat. no. BOD 29. Canberra: AIHW.

AIHW 2021b. Australian Burden of Disease Study 2018: key findings for Aboriginal and Torres Strait Islander people. Cat. no. BOD 28. Canberra: AIHW.

AIHW 2021c. Australian Burden of Disease Study 2018: methods and supplementary material. Australian Burden of Disease series no. Cat. no. BOD 26. Canberra: AIHW.

AIHW 2021d. The first year of COVID-19 in Australia: direct and indirect health effects. Cat. no. PHE 287. Canberra: AIHW.

AIHW 2021e. Disease expenditure in Australia 2018–19. Cat. no. HWE 81. Canberra: AIHW.

ANU (Australian National University) 2021. Quantifying mortality incorporating multiple causes of death: optimising data for policy and practice. Viewed 30 September 2021.

Ayre J, Lum On M, Webster K & Moon L 2016. Examination of the burden of disease of intimate partner violence against women in 2011: final report. Sydney: Australian National Research Organisation for Women's Safety.

Begg S, Vos T, Barker B, Stevenson C, Stanley L & Lopez A 2007. The burden of disease and injury in Australia 2003. Cat. no. PHE 82. Canberra: AIHW.

Biddle N & Markham F 2017. Area level socioeconomic outcomes for Aboriginal and Torres Strait Islander Australians, 2016. Austaxpolicy: Tax and Transfer Policy Blog, viewed December 2020.

Cooksley NAJB, Atkinson D, Marks GB, Toelle BG, Reeve D, Johns DP, Abramson MJ, Burton DL, James AL, Wood-Baker R, Walters EH, Buist AS & Maguire GP. 2015. Prevalence of airflow obstruction and reduced forced vital capacity in an Aboriginal Australian population: The cross-sectional BOLD study. Respirology 20(5):766–74.

Cunningham J, Rumbold AR, Zhang X & Condon JR 2008. Incidence, aetiology and outcomes of cancer in Indigenous peoples in Australia. The Lancet Oncology 9:585–95.

Ehrlich JR, Ramke J, Macleod D, Burn H, Lee CN, Zhang JH, Waldock W, Swenor BK, Gordon I, Congdon N, Burton M & Evans JR 2021. Association between vision impairment and mortality: a systematic review and meta-analysis. The Lancet Global Health 9(4):E418–E430, doi:10.1016/S2214-109X(20)30549-0.

Ezzati M, Lopez AD, Rodgers AA & Murray CJL 2004. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva: World Health Organization.

GBD (Global Burden of Disease) 2015 DALYs and HALE Collaborators 2016. Global, regional, and national disability adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet 388:1603–58.

GBD 2016 Causes of Death Collaborators 2017. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet 390(10100): 1151–210.

GBD 2016 DALYs and HALE Collaborators 2017. Global, regional, and national disability adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet 390(10100):1260–344.

GBD 2017 DALYs and HALE Collaborators 2018. Global, regional, and national disability adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392(10159):1859–922.

GBD 2017 Risk Factors Collaborators 2018. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet 392(10159):1923–94.

GBD 2019 Diseases and Injuries Collaborators 2020. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet 396(10258):1204–22.

GBD 2019 Risk Factors Collaborators 2020. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet 396(10258):1223–49.

Hoy WE, Mathews JD, McCredie DA, Pugsley DJ, Hayhurst BG, Rees M, Kile E, Walker KA & Wang Z 1998. The multidimensional nature of renal disease: rates and associations of albuminuria in an Australian Aboriginal community. Kidney International 54:1296–1304.

Jagger C, van Oyen H & Robine J 2014. Health expectancy calculation by the Sullivan method: a practical guide (4th edition). Newcastle, United Kingdom: Institute for Ageing, Newcastle University. Viewed 27 February 2017.

Joint Council on Closing the Gap 2020. National Agreement on Closing the Gap.

Lopez A, Mathers C, Ezzati M, Jamison DT & Murray CJL (eds) 2006. Global burden of disease and risk factors. Washington DC: World Bank.

Mathers C, Vos T & Stevenson C 1999. The burden of disease and injury in Australia (1996). Cat. no. PHE 17. Canberra: AIHW.

Murray CJ & Lopez A 1996. The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Boston: Harvard School of Public Health.

Murray CJ, Ezzati M, Flaxman AD, Lim S, Lozano R, Michaud C, Naghavi M, Salomon JA, Shibuya K, Vos T, Wikler D & Lopez AD 2012. GBD 2010: design, definitions, and metrics. The Lancet 380:2063–6.

Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C et al. 2012. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380:2197–223.

Murray CJ, Barber RM, Foreman KJ, Abbasoglu Ozgoren A, Abd-Allah F, Abera SF et al. 2015. Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition. Lancet 386:2145–91.

NZMOH (New Zealand Ministry of Health) 2012. Ways and means: a report on methodology from the New Zealand Burden of Diseases, Injuries and Risk Factors Study, 2006–2016. Wellington: New Zealand Ministry of Health.

Rehm J, Kehoe T, Gmel G, Stinson F, Grant B & Gmel G 2010. Statistical modelling of volume of alcohol exposure for epidemiological studies of population health: the US example. Population Health Metrics 8(3):1–12, doi:10.1186/1478-7954-8-3.

Salomon JA 2010. New disability weights for the global burden of disease. Bulletin of the World Health Organization 88:879.

Salomon JA, Vos T, Hogan DR, Gagnon M, Naghavi M, Mokdad A et al. 2012. Common values in assessing health outcomes from disease and injury: disability weights measurement study for the Global Burden of Disease Study 2010. The Lancet 15;380(9859):2129–43. doi:10.1016/S0140-6736(12)61680-8.

Salomon JA, Haagsma JA, Davis A, de Noordhout CM, Polinder S, Havelaar AH, Cassini A, Devleesschauwer B, Kretzschmar M, Speybroeck N, Murray CJL & Vos T 2015. Disability weights for the Global Burden of Disease 2013 study. The Lancet Global Health 3:e712–e23.

Stiefel MC, Perla RJ & Zell BI 2010. A healthy bottom line: healthy life expectancy as an outcome measure for health improvement efforts. The Milbank Quarterly 88(1):35–53.

US DHHS (United States Department of Health and Human Services) 2020. Smoking cessation: a report of the Surgeon General. Atlanta, GA: Centers for Disease Control and Prevention, Office on Smoking and Health.

Vos T, Barker B, Stanley L & Lopez A 2007. The burden of disease and injury in Aboriginal and Torres Strait Islander peoples 2003. Brisbane: University of Queensland.

Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M et al. 2012. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380:2163–96.

Vos T, Barber RM, Bell B, Bertozzi-Villa A, Biryukov S, Bolliger I et al. 2015. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet 386(9995):743–800, doi:10.1016/S0140-6736(15)60692-4.

WCRF & AICR (World Cancer Research Fund & American Institute for Cancer Research) 2007. Food, nutrition, physical activity, and the prevention of cancer: a global perspective. Washington DC: AICR.

WHO (World Health Organization) 2009. Disease, injury and causes of death (country), 2004. Geneva: WHO. Viewed 11 December 2018, <https://www.who.int/healthinfo/global_burden_disease/estimates_country_2004_2008/en/>.

WHO 2014. Disease and injury regional estimates, 2000–2011. Geneva: WHO. Viewed 14 December 2018, <http://www.who.int/healthinfo/global_burden_disease/estimates_regional_2000_2011/en/>.

WHO 2015. Respiratory tract diseases. Geneva: WHO. Viewed 10 February 2016, <http://www.who.int/topics/respiratory_tract_diseases/en/>.

WHO 2016. International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10). Geneva: WHO. Viewed 11 December 2018, <http://apps.who.int/classifications/icd10/browse/2016/en>.

WHO 2017. Disease, injury and causes of death (country), 2000–2015. Geneva: WHO. Viewed 11 December 2018, <https://www.who.int/healthinfo/global_burden_disease/estimates_country_2000_2015/en/>.

WHO 2018. Disease, injury and causes of death (country), 2000–2016. Geneva: WHO. Viewed 11 December 2018, <https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html>.

WHO 2021. Global health estimates. Geneva: WHO. Viewed 2 November 2021, <https://www.who.int/data/global-health-estimates>.

List of tables

Summary of total burden and 5 leading disease groups, Indigenous Australians, 2018 v

Table 1.1: Summary of global and Australian burden of disease studies 9

Table 1.2: ABDS 2018 Disease groups 10

Table 2.1: Total burden (DALY, DALY %, DALY age-standardised rates (ASRs)), by disease group and sex, Indigenous Australians, 2018. 25

Table 2.2: Comparison of DALY rate ratios and rate differences of age-standardised rates (ASRs): Indigenous males: Indigenous females, Australia, 2018 29

Table 2.3: Leading 20 causes of total burden (DALY) for Indigenous Australians, by sex, 2018 . 30

Table 3.1: Non-fatal burden (YLD, YLD %, YLD age-standardised rates (ASRs)), by disease group and sex, Indigenous Australians, 2018. 46

Table 3.2: Comparison of YLD rate ratios and rate differences of age-standardised rates (ASRs): Indigenous males: Indigenous females, Australia, 2018 47

Table 3.3: Leading 20 causes of non-fatal burden (YLD) for Indigenous Australians, by sex, 2018 49

Table 4.1: Comparison of deaths and fatal burden (YLL, YLL%, YLL ASR), by disease group and sex, Indigenous Australians, 2018 66

Table 4.2: Comparison of YLL age-standardised rates, rate differences and rate ratios, Indigenous males: Indigenous females, Australia, 2018 67

Table 4.3: Leading 20 causes of fatal burden (YLL) for Indigenous Australians, by sex, 2018 . . . 69

Table 5.1: Proportion (%) of total burden attributable to each risk factor, Indigenous Australians, 2018 83

Table 5.2: Number and proportion (%) of deaths, fatal (YLL) and non-fatal (YLD) burden attributable to each risk factor, Indigenous Australians, 2018 84

Table 5.3: Proportion (%) of total burden (DALY) attributable to risk factors for selected disease groups in Indigenous Australians, 2018 86

Table 5.4: Number and proportion (%) of total burden (DALY) from homicide and violence, by sex and perpetrator type, Indigenous Australians 87

Table 6.1: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and sex, 2018 96

Table 6.2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, 2018 98

Table 6.3: Leading 20 diseases contributing to the gap in total burden (DALY) for Indigenous males and females, 2018 102

Table 6.4: Age-standardised DALY rates (per 1,000 people) for Indigenous and non-Indigenous Australians attributed to selected risk factors, rate ratios and rate differences, 2018 104
Table 7.1: Change in total burden (DALY) between 2003 and 2018, by disease group, Indigenous Australians 112
Table 7.2: Change in non-fatal burden (YLD) between 2003 and 2018, by disease group, Indigenous Australians 115
Table 7.3: Change in leading causes of non-fatal burden (YLD) between 2003 and 2018, Indigenous Australians 116
Table 7.4: Change in fatal burden (YLL) between 2003 and 2018, by disease group, Indigenous Australians 119
Table 7.5: Change in leading causes of fatal burden (YLL) between 2003 and 2018, Indigenous Australians 120
Table 7.6: Change in total attributable burden between 2003 and 2018, by risk factor 123
Table 7.7: Change in attributable non-fatal burden between 2003 and 2018, by risk factor 127
Table 7.8: Change in attributable fatal burden between 2003 and 2018, by risk factor 128
Table 7.9: Age-standardised DALY, YLL and YLD rates (per 1,000 people), rate ratios and rate differences, by Indigenous status, 2003 and 2018 129
Table 7.10: Gap measures of total burden (DALY rate ratios and rate differences per 1,000 people) by disease group, 2003 and 2018 131
Table 7.11: 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), 2003 and 2018 133
Table 8.1: HALE and gap in HALE at birth and at age 65, selected states and territories, Indigenous and non-Indigenous Australians, 2018 141
Table 8.2: HALE and gap in HALE at birth and at age 65, by remoteness area, Indigenous and non-Indigenous Australians, 2018 143
Table 9.2.1: ABDS 2018 Disease list for injuries, by nature and external cause of injury 149
Table 9.12.1: Age-standardised rates of total burden (DALY per 1,000 people) for kidney & urinary diseases, by Indigenous status & disease, 2018 185
Table 10.1.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden by state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018 205
Table 10.1.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts and age-standardised rates (per 1,000 people[(a)]), by state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018 206

Table 10.1.3: Age-standardised total burden (DALY) rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018. 209

Table 10.1.4: Age-standardised non-fatal (YLD) burden rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018. 211

Table 10.1.5: Age-standardised fatal (YLL) burden rates (per 1,000 people), by disease group, state/territory (NSW, Qld, WA and the NT) and Australia, Indigenous Australians, 2018. 213

Table 10.1.6: Age-standardised total burden (DALY) rates (per 1,000 people), rate ratios and rate differences by Indigenous status, state/territory (NSW, Qld, WA and the NT) and Australia, 2018 215

Table 10.2.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden, by remoteness, Indigenous Australians, 2018. 219

Table 10.2.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts and age-standardised rates (per 1,000 people[(a)]), by remoteness, Indigenous Australians, 2018. 220

Table 10.2.3: Age-standardised total burden (DALY) rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018 222

Table 10.2.4: Age-standardised non-fatal (YLD) burden rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018. 224

Table 10.2.5: Age-standardised fatal (YLL) burden rates (per 1,000 people), by disease group and remoteness, Indigenous Australians, 2018 226

Table 10.2.6: Age-standardised total burden (DALY) rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and remoteness, 2018. 227

Table 10.3.1: Number and proportion of population, total (DALY), non-fatal (YLD) and fatal (YLL) burden, by socioeconomic disadvantage quintile, Indigenous Australians, 2018 233

Table 10.3.2: Total (DALY), non-fatal (YLD) and fatal (YLL) burden counts, proportions and crude rates (per 1,000 people), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018. 233

Table 10.3.3: Crude total (DALY) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018 236

Table 10.3.4: Crude non-fatal (YLD) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018 238

Table 10.3.5: Crude fatal (YLL) burden rates (per 1,000 people), by disease group and socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018 240
Table A1: Disease and injury list 277
Table A2: Standard life table: life expectancy (years) at age of death for all persons 280
Table A3: Risk factor list used for Indigenous estimates in the ABDS 2018 281
Table A4: Mortality adjustment factors used for Indigenous national and subnational YLL estimates 282
Table A5: Hospitalisation adjustment factors used for 2018 and 2011 Indigenous YLD estimates (from AIHW 2011–12 Indigenous identification in hospital separations data quality study) 283
Table A6: Hospitalisation adjustment factors used for 2003 Indigenous YLD estimates (from AIHW 2007–08 Indigenous identification in hospital separations data quality study) 283
Table A7: Diseases for which Indigenous prevalence estimates were derived using indirect methods 284
Table A8: Diseases for which national rates or ratios were assumed to derive Indigenous prevalence estimates 288
Table A9: Data source used for subnational distribution of Indigenous non–fatal burden estimates 290
Table A10: Subnational proportions used for distribution of non–fatal burden estimates by state/territory, by Indigenous status 291
Table A11: Subnational proportions used for distribution of non–fatal burden by remoteness, by Indigenous status 292
Table A12: Subnational proportions used for distribution of non–fatal burden by socioeconomic quintile, Indigenous Australians 293
Table B1: Rating of data relevance, quality and transformation methods for YLD estimates, 2018 reference year 296
Table B2: Rating of data relevance, quality and transformation methods for risk factor estimates, 2018 reference year 297
Table C1: Residual causes excluded from rankings 303
Table D1: Number and percentage of YLL and deaths, by age group and sex, Indigenous Australians, 2018 318
Table D2: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, males, 2018 319
Table D3: Age-standardised DALY rates (per 1,000 people), rate ratios and rate differences, by Indigenous status and disease group, females, 2018 320

Table D4: Indigenous estimated resident population (ERP) (number and %), by age group, 2003, 2011 and 2018 322
Table D5: Changes in total attributable burden between 2003 and 2018, by risk factor exposure subcategories 323
Table D6: 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 2018 325
Table D7: 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 2018 326
Table D8: 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 2018 327
Table D9: 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 2018 328
Table D10: Age-standardised Indigenous and non–Indigenous DALY rates (per 1,000 people) attributed to selected risk factors, 2003, 2011 and 2018 329
Table D11: Life expectancy, HALE and HALE (%), at birth and age 65, by sex, state/territory (NSW, Qld, WA and the NT), and remoteness area, Indigenous Australians, 2018 330
Table D12: Life expectancy[(a)], HALE and percentage of life expectancy in full health, at selected ages, by sex, Indigenous Australians, 2018 331
Table D13: Life expectancy and HALE by Indigenous status and sex, selected ages, 2018 332

List of figures

Figure 2.1: Fatal (YLL) and non-fatal (YLD) composition of the total burden (DALY) for Indigenous Australians, by age group, 2018. 22

Figure 2.2: Number and rates of total burden (DALY), by age group and sex, Indigenous Australians, 2018 23

Figure 2.3: Proportion (%) of total burden (DALY), by disease group and sex, Indigenous Australians, 2018 25

Figure 2.4: Fatal (YLL) and non-fatal (YLD) proportion of total burden, by disease group, Indigenous Australians, 2018 26

Figure 2.5: Proportion of total burden (DALY) by sex, by disease group for Indigenous Australians, 2018. 27

Figure 2.6: Total burden (number of DALY), by disease group and age group, Indigenous males and females, 2018 33

Figure 2.7: Relative proportion of total burden (DALY), by disease group and age group, Indigenous males and females, 2018 34

Figure 2.8: Proportion of Indigenous population and total burden (DALY), by age group, Indigenous Australians, 2018 35

Figure 2.9: Leading causes of total burden (DALY; proportion of total %) for Indigenous males, by age group, 2018. 38

Figure 2.10: Leading causes of total burden (DALY; proportion of total %) for Indigenous females, by age group, 2018 39

Figure 2.11: Leading causes of total burden (DALY; proportion of total %) for Indigenous Australians, by age group, 2018 40

Figure 3.1: Number and rate of years lived with disability (YLD), by age group and sex, Indigenous Australians, 2018 44

Figure 3.2: Proportion of non-fatal burden (YLD) by disease groups and sex, Indigenous Australians, 2018. 45

Figure 3.3: Number of non-fatal burden (YLD), by disease group and age group, Indigenous males and females, 2018 52

Figure 3.4: Relative proportion of non-fatal burden (YLD), by disease group and age group, Indigenous males and females, 2018 53

Figure 3.5: Proportion of Indigenous population and non-fatal burden (YLD), by age group, Indigenous Australians, 2018 54

Figure 3.6: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous males, by age group, 2018 56

Figure 3.7: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous females, by age group, 2018. 57
Figure 3.8: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous Australians, by age group, 2018. 58
Figure 4.1: Proportion of fatal burden (YLL) and deaths for Indigenous Australians, by age group, 2018 62
Figure 4.2: Numbers and rates of fatal burden (YLL, YLL per 1,000 people) for Indigenous Australians, by age group and sex, 2018 64
Figure 4.3: Percentage contribution (%) of the top 10 leading causes of fatal burden (YLL) in Indigenous Australians, by disease group and sex, 2018. 65
Figure 4.4: Number of YLL (fatal burden), by disease group and age group, Indigenous males and females, 2018. 72
Figure 4.5: Relative proportion of fatal burden (YLL), by disease group and age group, Indigenous males and females, 2018 73
Figure 4.6: Proportion of Indigenous population and fatal burden (YLL), by age, Indigenous Australians, 2018 74
Figure 4.7: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous males, by age group, 2018. 76
Figure 4.8: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous females, by age group, 2018 77
Figure 4.9: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous Australians, by age group, 2018 78
Figure 5.1: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous males, by age group, 2018 91
Figure 5.2: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous females, by age group, 2018. 92
Figure 5.3: Leading risk factor contribution to total burden (DALY; proportion %) for Indigenous Australians, by age group, 2018. 93
Figure 6.1: Age-specific DALY rates (per 1,000 people) and rate ratios, by age group, Indigenous and non-Indigenous Australians, 2018. 97
Figure 6.2: DALY rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group, 2018 99
Figure 6.3: Percentage contribution (%) of leading disease groups to the gap in total (DALY), fatal (YLL) and non-fatal burden (YLD), 2018 100
Figure 6.4: Percentage contribution (%) of leading disease groups to the gap in total disease burden (DALY), by sex, 2018 101

Figure 6.5: Percentage contribution (%) to the health gap (based on DALY rate difference) between Indigenous and non-Indigenous Australians, by age and disease group, 2018 103
Figure 6.6: Leading risk factors contributing to the gap in the attributable burden for males and females, 2018 (proportion (%) of the gap in total DALY due to each risk factor) 105
Figure 7.1: Number and rate of total burden (DALY per 1,000 people), by age, Indigenous Australians, 2003 and 2018 111
Figure 7.2: Change in disease ranking and age-standardised DALY rate (DALY per 1,000 people), Indigenous Australians, 2003 and 2018 113
Figure 7.3: Number and rate of non-fatal burden (YLD per 1,000 people), by age, Indigenous Australians, 2003 and 2018 114
Figure 7.4: Number and rate of fatal burden (YLL per 1,000 people), by age, Indigenous Australians, 2003 and 2018 118
Figure 7.5: Risk factor rankings by age-standardised attributable burden rate (per 1,000 people), 2003 and 2018. 124
Figure 7.6: 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 2018 132
Figure 8.1: Percentage of remaining life expectancy in full health and ill health at each age, by sex, Indigenous Australians, 2018. 137
Figure 8.2: Life expectancy at birth as years lived in full health (HALE) and years lived in ill health, by sex and Indigenous status, 2018 138
Figure 8.3: Life expectancy at age 65 as years lived in full health (HALE) and years lived in ill health, by sex and Indigenous status, 2018 138
Figure 8.4: Life expectancy at birth in full health (HALE) and ill health, by sex and state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018 139
Figure 8.5: Life expectancy at age 65 in full health (HALE) and ill health, by sex and state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018 140
Figure 8.6: Life expectancy at birth in full health (HALE) and ill health, by sex and remoteness area, Indigenous Australians, 2018 142
Figure 8.7: Life expectancy at age 65 in full health (HALE) and ill health, by sex and remoteness area, Indigenous Australians, 2018 142
Figure 9.1.1: Contribution of individual causes to mental & substance use disorders total burden (DALY), Indigenous Australians, 2018. 146
Figure 9.1.2: Mental & substance use disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 147

Figure 9.1.3: Mental & substance use disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 148
Figure 9.2.1: Injury total burden (DALY), by nature of injury, Indigenous Australians, 2018 150
Figure 9.2.2: Injury total burden (DALY), contribution of external causes of injury, Indigenous Australians, 2018 151
Figure 9.2.3: Injury burden (DALY), by external cause of injury, Indigenous Australians, 2018 152
Figure 9.2.4: Injury age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by external cause of injury, 2018 153
Figure 9.3.1: Contribution of individual diseases to cardiovascular disease total burden (DALY), Indigenous Australians, 2018 154
Figure 9.3.2: Cardiovascular disease burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 155
Figure 9.3.3: Cardiovascular diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 156
Figure 9.4.1: Contribution of individual cancers to cancer & other neoplasms total burden (DALY), Indigenous Australians, 2018 157
Figure 9.4.2: Cancer & other neoplasms burden (DALY), cancers by burden type and sex, Indigenous Australians, 2018 158
Figure 9.4.3: Cancer & other neoplasms age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by cancer, 2018 159
Figure 9.5.1: Contribution of individual conditions to musculoskeletal conditions total burden (DALY), Indigenous Australians, 2018 161
Figure 9.5.2: Musculoskeletal burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018. 162
Figure 9.5.3: Musculoskeletal conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 163
Figure 9.6.1: Contribution of individual diseases to respiratory diseases total burden (DALY), Indigenous Australians, 2018 164
Figure 9.6.2: Respiratory burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018. 165

Figure 9.6.3: Respiratory diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 166
Figure 9.7.1: Contribution of individual conditions to infant & congenital conditions total burden (DALY), Indigenous Australians, 2018 167
Figure 9.7.2: Infant & congenital burden (DALY), proportion due to fatal and non-fatal outcomes, Indigenous Australians, 2018 168
Figure 9.7.3: Infant & congenital burden age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 169
Figure 9.8.1: Contribution of individual conditions to neurological conditions total burden (DALY), Indigenous Australians, 2018 170
Figure 9.8.2: Neurological conditions burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 171
Figure 9.8.3: Neurological conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 172
Figure 9.9.1: Contribution of individual disorders to endocrine disorders total burden (DALY), Indigenous Australians, 2018 173
Figure 9.9.2: Endocrine disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 174
Figure 9.9.3: Endocrine disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 175
Figure 9.10.1: Contribution of individual disorders to gastrointestinal disorders total burden (DALY), Indigenous Australians, 2018 176
Figure 9.10.2: Gastrointestinal disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 177
Figure 9.10.3: Gastrointestinal disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 178
Figure 9.11.1: Contribution of individual diseases to infectious diseases total burden (DALY), Indigenous Australians, 2018 179
Figure 9.11.2: Infectious diseases burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 180
Figure 9.11.3: Infectious diseases age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 181

Figure 9.12.1: Contribution of individual diseases to kidney & urinary diseases total burden (DALY), Indigenous Australians, 2018 183
Figure 9.12.2: Kidney & urinary disease non-fatal (YLD) burden, contribution of sequelae, Indigenous Australians, 2018 184
Figure 9.13.1: Contribution of individual disorders to hearing & vision disorders total burden (DALY), Indigenous Australians, 2018 186
Figure 9.13.2: Hearing & vision disorders burden (DALY), by disease: proportion for males and females, Indigenous Australians, 2018 187
Figure 9.13.3: Hearing & vision disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 188
Figure 9.14.1: Contribution of individual conditions to oral disorders total burden (DALY), Indigenous Australians, 2018 189
Figure 9.14.2: Oral disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018. 190
Figure 9.14.3: Oral disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 191
Figure 9.15.1: Contribution of individual conditions to blood & metabolic disorders total burden (DALY), Indigenous Australians, 2018 192
Figure 9.15.2: Blood & metabolic disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 193
Figure 9.15.3: Blood & metabolic disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 194
Figure 9.16.1: Contribution of individual conditions to skin disorders total burden (DALY), Indigenous Australians, 2018 195
Figure 9.16.2: Skin disorders burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 196
Figure 9.16.3: Skin disorders age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 197
Figure 9.17.1: Contribution of individual conditions to reproductive & maternal conditions total burden (DALY), Indigenous Australians, 2018 198
Figure 9.17.2: Reproductive & maternal burden (DALY), diseases by burden type and sex, Indigenous Australians, 2018 199

Figure 9.17.3: Reproductive & maternal conditions age-standardised total burden rates (DALY per 1,000 people) and rate ratios, Indigenous and non-Indigenous Australians, by disease, 2018 200
Figure 10.1.1: Age-standardised total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by sex and state/territory (NSW, Qld, WA and the NT), 2018 207
Figure 10.1.2: Proportion of total burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and state/territory (NSW, Qld, WA and the NT), 2018 207
Figure 10.1.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and state/territory (NSW, Qld, WA and the NT), 2018. 208
Figure 10.1.4: Leading causes of total burden (proportion of DALY %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018 210
Figure 10.1.5: Leading causes of non-fatal burden (proportion of YLD %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018 212
Figure 10.1.6: Leading causes of fatal burden (proportion of YLL %), by state/territory (NSW, Qld, WA and the NT), Indigenous Australians, 2018 214
Figure 10.1.7: Age-standardised rates of non-fatal (YLD) and fatal (YLL) burden, by Indigenous status, and the non-fatal (YLD) and fatal (YLL) gap by state/territory (NSW, Qld, WA and the NT), 2018. 215
Figure 10.1.8: 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), 2018. 216
Figure 10.2.1: Age-standardised total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by sex and remoteness, 2018. 220
Figure 10.2.2: Proportion of total burden (DALY) for Indigenous Australians, by sex and by fatal/non-fatal burden and remoteness, 2018 221
Figure 10.2.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and remoteness, 2018 221
Figure 10.2.4: Leading causes of total burden (proportion of DALY %), by remoteness, Indigenous Australians, 2018 223
Figure 10.2.5: Leading causes of non-fatal burden (proportion of YLD %), by remoteness, Indigenous Australians, 2018 224
Figure 10.2.6: Leading causes of fatal burden (proportion of YLL %), by remoteness, Indigenous Australians, 2018 226
Figure 10.2.7: Age-standardised rates of non-fatal (YLD) and fatal (YLL) burden, by Indigenous status, and the non-fatal (YLD) and fatal (YLL) gap by remoteness, 2018 228

Figure 10.2.8: Percentage contribution (%) of leading causes of the gap in total burden between Indigenous and non-Indigenous Australians (based on DALY rate difference), by remoteness, 2018 229
Figure 10.2.9: Total burden (DALY) rate ratios and rate differences between Indigenous and non-Indigenous Australians, by disease group and remoteness, 2018 230
Figure 10.3.1: Total burden (DALY) rates (per 1,000 people) for Indigenous Australians, by socioeconomic disadvantage quintile (IRSEO index), 2018. 234
Figure 10.3.2: Proportion of total burden (DALY) for Indigenous Australians, by fatal/non-fatal burden and socioeconomic disadvantage quintile (IRSEO index), 2018 234
Figure 10.3.3: Age-specific total burden (DALY) rates for Indigenous Australians, by age and socioeconomic disadvantage quintile (IRSEO index), 2018 235
Figure 10.3.4: Leading causes of total burden (proportion of DALY %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018. 237
Figure 10.3.5: Leading causes of non-fatal burden (proportion of YLD %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018. 239
Figure 10.3.6: Leading causes of fatal burden (proportion of YLL %), by socioeconomic disadvantage quintile (IRSEO index), Indigenous Australians, 2018. 241
Figure C1: Example of different DALY stories 301
Figure D1: Leading causes of total burden (DALY; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes 307
Figure D2: Leading causes of total burden (DALY; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes 308
Figure D3: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes 309
Figure D4: Leading causes of non-fatal burden (YLD; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes 310
Figure D5: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous males, by age group, 2018—nature of injury, including other causes 311
Figure D6: Leading causes of fatal burden (YLL; proportion of total %) for Indigenous females, by age group, 2018—nature of injury, including other causes 312
Figure D7: Causes with the highest and lowest average years of life lost (YLL) per death, Indigenous Australians, 2018 313

Figure D8: Leading risk factor contribution to non-fatal burden (YLD; proportion %) for Indigenous males, by age group, 2018 314
Figure D9: Leading risk factor contribution to non-fatal burden (YLD; proportion %) for Indigenous females, by age group, 2018. 315
Figure D10: Leading risk factor contribution to fatal burden (YLL; proportion %) for Indigenous males, by age group, 2018 316
Figure D11: Leading risk factor contribution to fatal burden (YLL; proportion %) for Indigenous females, by age group, 2018. 317
Figure D12: Indigenous estimated resident population (ERP), by age group, 2003, 2011 and 2018 321

List of boxes

Box 1.1: Key burden of disease terms 4
Box 1.2: Disability weights 7
Box 1.3: Example of calculating disability-adjusted life years 7
Box 1.4: Key developments since the 2011 Aboriginal and Torres Strait Islander burden of disease study 12
Box 1.5: Different types of estimates presented in this report 17
Box 2.1: How are diseases and disease groups assigned in the Australian Burden of Disease Study 2018? 24
Box 2.2: Age-standardised rates (ASRs) 28
Box 3.1: How is years lived with disability calculated? 43
Box 5.1: How is attributable burden measured? 81
Box 5.2: Why risk factor estimates cannot be added together 85
Box 5.3: Homicide and violence perpetrators 87
Box 7.1: Data gaps in non-fatal health loss over time 117
Box 7.2: Death data coding changes for poisoning impacting on trends 121
Box C1: Dos and don'ts of using burden of disease estimates in this study 301
Box D1: ABDS 2018 disease group colours 305
Box D2: ABDS 2018 risk factor colours 306

Related publications

AIHW 2021. Australian Burden of Disease Study 2018: impact and causes of illness and death in Australia. Australian Burden of Disease Study series no. 23. Cat. no. BOD 29. Canberra: AIHW.

AIHW 2021. Australian Burden of Disease Study 2018: impact and causes of illness and death in Australia—summary report. Australian Burden of Disease Study series no. 22. Cat. no. BOD 27. Canberra: AIHW.

AIHW 2021. Australian Burden of Disease Study 2018: key findings. Australian Burden of Disease Study series no. 24. Cat. no. BOD 30. Canberra: AIHW.

AIHW 2021. Australian Burden of Disease Study 2018: key findings for Aboriginal and Torres Strait Islander people. Australian Burden of Disease Study. Cat. no. BOD 28. Canberra: AIHW.

AIHW 2021. Australian Burden of Disease Study 2018: methods and supplementary material. Australian Burden of Disease Study series no. 21. Cat. no. BOD 26. Canberra: AIHW.

AIHW 2022. Australian Burden of Disease Study 2018: impact and causes of illness and death for Aboriginal and Torres Strait Islander people—summary report. Australian Burden of Disease Study series no. 27. Cat. no. BOD 33. Canberra: AIHW.

This report describes the impact of 219 diseases and injuries among Aboriginal and Torres Strait Islander people in terms of living with illness (non-fatal burden) and premature death (fatal burden). It finds that:

- the burden rate fell by 15% between 2003 and 2018, driven by a substantial drop in fatal burden
- injuries and chronic diseases (such as mental & substance use disorders, cardiovascular diseases, cancers and musculoskeletal conditions) caused most of the burden in 2018.

aihw.gov.au

AIHW

Stronger evidence,
better decisions,
improved health and welfare