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Burden of cancer in Australia

Australian Burden of Disease Study 2011

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Authoritative information and statistics to promote better health and wellbeing

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Abbreviations

ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACD	Australian Cancer Database
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ASR	age-standardised rate
DALY	disability-adjusted life years
GBD	Global Burden of Disease Study
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth revision
MET	metabolic equivalent of tasks
NHMD	National Hospital Morbidity Database
NMSC	non-melanoma skin cancer
NSW	New South Wales
NT	Northern Territory
PAF	population attributable fraction
Qld	Queensland
SA	South Australia
Tas	Tasmania
TMRED	theoretical minimum risk exposure distribution
Vic	Victoria
WA	Western Australia
YLD	years lived with disability
YLL	years of life lost

Symbols

. .	not applicable
n.a.	not available
n.p.	not published due to small numbers
<	less than
>	greater than
≥	greater than or equal to
+	and over

Summary

Burden of disease analysis measures the combined impact of dying prematurely, as well as living with disease. More than merely counting deaths or disease incidence and prevalence, burden of disease analysis takes into account age at death and severity of disease for all diseases, conditions and injuries, in a consistent and comparable way. This report presents detailed findings on the burden due to cancer in Australia using results from the Australian Burden of Disease Study 2011.

Cancer burden greatest of all disease groups but improving

Cancer was the greatest cause of health burden in Australia in 2011, accounting for around one-fifth (19%) of the total disease burden. Cancer was ranked ahead of cardiovascular diseases (15%) despite having fewer deaths and lower disease prevalence. This is mainly the result of people dying earlier from cancer than cardiovascular diseases. Most (94%) of the burden from cancer was due to dying prematurely, with only a small proportion due to living with a cancer diagnosis.

Almost half (48%) of the total cancer burden in 2011 is from 5 cancers—lung, bowel, breast, prostate and pancreatic cancers—and almost one-quarter (22%) of the total cancer burden can be attributed to tobacco use.

The cancer burden has improved since 2003, with a 10% decline in age-standardised rates of overall burden. Improvements are evident across most cancer types (except liver and thyroid cancer), with the bulk of the improvement due to a decline in the fatal burden of lung, breast and bowel cancers through a shift towards dying at older ages.

These improvements are generally expected to continue to 2020 with expected falling mortality rates; however, both the fatal and non-fatal burden of lung cancer in females and liver cancer in both sexes is expected to increase with increasing incidence and mortality.

Higher cancer burden in Indigenous Australians

Indigenous Australians experienced 1.7 times the cancer burden of non-Indigenous Australians. In particular, Indigenous males experience 2.3 times the lung cancer burden of non-Indigenous males, and Indigenous females 2.6 times the lung cancer burden of non-Indigenous females.

The improvements observed in cancer burden nationally were not reflected in the Indigenous population, with a small increase in the age-standardised rates of overall cancer burden between 2003 and 2011.

Burden increases with increasing remoteness and decreasing socioeconomic position

The burden of lung, bowel, prostate and pancreatic cancers increased with increasing remoteness. The rate of cancer burden increased with decreasing socioeconomic position, with people in the lowest socioeconomic group experiencing 1.4 times the cancer burden of people in the highest group. In particular, the rate of lung cancer burden in the lowest group is almost twice the rate in the highest group.

1 Introduction

Cancer is a major cause of illness in Australia and has a substantial social and economic impact on individuals, families and the community. In 2011, cancer and other (non-malignant) neoplasms caused the greatest disease burden compared with all other major disease groups, accounting for almost one-fifth of the total disease burden (AIHW 2016b). In 2017, it is estimated that there will be around 134,000 new cases of cancer diagnosed and around 47,750 people will die from cancer (AIHW 2017a). Breast, bowel, prostate and lung cancer account for 4 of the 5 most commonly diagnosed cancers in Australia; and lung, bowel, prostate, breast and pancreatic cancer are the 5 most common causes of death from cancer (AIHW 2017a).

Burden of disease analysis measures the combined impact of dying prematurely, as well as living with disease. More than merely counting deaths or disease incidence and prevalence, burden of disease analysis takes into account age at death and severity of disease for all diseases, conditions and injuries, in a consistent and comparable way. As well as describing the disease burden, burden of disease analysis also estimates the contribution of various risk factors (termed 'attributable burden') to this health loss. The estimates produced from a burden of disease study remain the best summary measure of a population's health (Richardson 2002).

The Australian Burden of Disease Study (ABDS) 2011 estimated the burden for 200 specific diseases and attributable burden for 30 risk factors for the Australian and Aboriginal and Torres Strait Islander populations, for 2011 and 2003. The 2 major reports generated from this study (AIHW 2016a, 2016b) provide a comprehensive picture of the overall disease burden in 2011 for both populations, and how this burden has changed since 2003, as well as the differences in burden experience by states and territories, remoteness areas and socioeconomic groups across Australia.

These reports showed that while there have been improvements in cancer survival, the burden from cancer is predominantly still due to early death. As a result, cancer was found to be the overall major contributor to fatal burden in Australia, with around 1.5 times the fatal burden of cardiovascular diseases and more than double the fatal burden of injuries (AIHW 2016b).

This report, using data from the ABDS 2011, explores in greater detail the burden of cancer and other neoplasms in 2011. It presents the fatal and non-fatal burden of the various types of cancer for the total Australian and Aboriginal and Torres Strait Islander populations and analyses the burden by states and territories, remoteness areas and socioeconomic groups. Additionally, this report compares the cancer burden to the burden in 2003 to provide context of how the cancer burden has changed, and looks at the potential burden in 2020 for select cancer types using projected estimates of cancer incidence and mortality.

What is burden of disease?

Burden of disease analysis is a technique used to assess and compare the impact of different diseases, conditions or injuries and risk factors on a population. It uses information from a range of sources to quantify the fatal (for example, dying from cancer) and non-fatal

(for example, living with cancer) effects of these diseases in a consistent manner so that they can then be combined into a summary measure of health called disability-adjusted life years, or DALY. Put simply, a DALY combines the impact of dying early and living with illness. It combines the estimates of years of life lost due to premature death (YLL) and years lived in ill health or with disability (YLD) to count the total years of healthy life lost from disease and injury. These and other key terms are defined in Box 1.1.

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

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

Box 1.1: Key terms used in this report

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2 Methods summary

This chapter summarises the methods for measuring the burden of cancer in relation to all diseases as part of the ABDS 2011. For more detailed information on methods for measuring the burden of cancer, see Appendix A of this report. For more detailed information on the ABDS 2011 generally, please refer to the separate report *Australian Burden of Disease Study 2011: methods and supplementary tables* (AIHW 2016c).

Definition of cancer in ABDS 2011

The ABDS 2011 is divided into 17 separate disease groups, based approximately on the groupings in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10). One of these disease groups covers malignant and non-malignant neoplasms, grouped together as 'Cancer and other neoplasms'. Although this broad group encompasses non-malignant neoplasms, they did not contribute a substantial amount to the overall burden, and so for brevity, the group was referred to simply as 'Cancer' in the ABDS 2011, and forms the basis of this report.

The list of diseases and injuries in the ABDS 2011 were compiled to suit the Australian and Indigenous contexts using defined criteria, confirmed by the study's Expert Advisory Group, and were designed to be both mutually exclusive and collectively exhaustive. On the advice of the Cancer Monitoring Advisory Group (advisory group to the AIHW's National Cancer Monitoring Centre), specific cancer types and definitions were designed to align with local policy and current Australian coding practice.

Based on this advice, and ICD-10 allocation from previous burden of disease studies, the individual cancers and ICD-10 allocations defined for the ABDS 2011 are listed in Table A.1. This includes for the first time in burden of disease studies separate estimates for cancer of unknown primary site called 'Unknown primary', and breast ductal carcinoma in situ. Uterine fibroids were not included in this group—instead their burden was counted separately under 'Reproductive and maternal conditions'.

Malignant brain tumours are included in the category 'brain and central nervous system cancer' (referred to as 'brain cancers' for brevity). Brain tumours that are non-malignant or of uncertain nature are grouped together as 'brain tumours'.

Those cancer types with low incidence counts each year are grouped together into residual categories referred to as 'other cancers' for malignant neoplasms, and 'other non-malignant neoplasms' for those neoplasms with a benign or uncertain nature. As these are heterogeneous groups of cancers, they are not included in rankings of specific cancer types.

Cancer of unknown primary site

In previous global and Australian burden of disease studies it has been assumed that cases and deaths were coded to cancer of unknown primary cancers due to insufficient information about the original cancer available at the time of coding. Mortality has been traditionally redistributed across other cancer sites and morbidity included in 'other malignant neoplasms'. However, cancer of unknown primary site is now a well-recognised clinical syndrome by the International Agency for Research on Cancer, and new cases

are recorded in Australian cancer registries consistent with international coding recommendations. With around 3,000 new cancer cases and more than 2,000 cancer deaths per year in Australia (AIHW & AACR 2012), it was agreed by the cancer expert panel that it was important to separately identify the burden of unknown primary cancer in the ABDS 2011.

Ductal carcinoma in situ

Similarly, due to the non-fatal nature of ductal carcinoma in situ, the burden has previously been included in the more generic 'other non-malignant neoplasms'. However, with the widespread use of mammographic screening for breast cancer, there were over 1,800 new cases of ductal carcinoma in situ diagnosed in 2010 in Australia (AIHW 2016d). This makes the non-fatal burden of ductal carcinoma in situ of interest to the monitoring of organised screening for breast cancer.

How is the burden of cancer measured?

Using burden of disease methodology, the burden of cancer is measured in DALY, as the sum of the non-fatal burden and the fatal burden of cancer.

$$DALY = YLD + YLL$$

YLD measure the number of healthy years of life lost due to disease in the year. For cancer, this is calculated by estimating the amount of time in the year spent in each phase of the cancer journey (including long-term effects), multiplied by a *disability weight* indicating the severity of the health loss experienced in that phase. Total YLD are influenced by the number of people with each cancer type, the time spent in each phase and the disability weights defined for each phase. The disability weights used in this study are drawn from the Global Burden of Disease Study (GBD) 2013 and represent the health loss caused by the consequences of each disease.

YLL measure the years lost between the age at which a person dies and an *ideal life span*. In this study, the ideal remaining expectancy varies at each age but starts as a life expectancy at birth of 86.0 years for both men and women (see Table A.4 for the full standard life expectancy table.) This ideal life span is drawn from the GBD 2010 and is based on the lowest observed death rates at each age group from multiple countries (Murray et al. 2012). Total YLL are influenced by both the total number of deaths, and the ages at which those deaths occur.

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

How is the contribution of risk factors measured?

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

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

Where do the data for cancer burden come from?

Data to develop the ABDS estimates for cancer 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 administrative sources including the Australian Cancer Database, the National Mortality Database, the National Hospital Morbidity Database and Medicare Benefits Schedule claims data, as well as a number of epidemiological studies. Data for risk factor exposure were sourced primarily from the Australian Health Survey 2011–12 and the National Drug Strategy Household Surveys 2007 and 2010.

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

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

Further details on the various data sources and standard inputs are available in Appendix A and in *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c).

Quality of cancer burden of disease estimates

All estimates within the ABDS 2011 were produced using the best possible data available within the scope and time frame of the study.

While uncertainty (or confidence) intervals used to describe the reliability of estimates in some burden of disease studies were not produced as part of the ABDS 2011, a 2-dimensional quality index (based on the relevance and quality of the source data, and the methods used to transform that data into a form required for analysis) were provided to help users understand the quality and limitations of the estimates.

As the cancer mortality data were comprehensive and relevant, with little or no transformation required other than the redistribution of a small proportion of deaths that were not considered appropriate for burden of disease analyses, the fatal burden estimates are considered to be highly indicative of the YLL due to these diseases for all populations analysed.

As data for all non-fatal estimates of malignant neoplasms and breast ductal carcinoma in situ were sourced from the Australian Cancer Database, the National Mortality Database and the National Hospital Morbidity Database, the majority of national cancer estimates are considered highly reliable.

Indigenous estimates are also considered relevant and accurate; however, as information on Indigenous status on the Australian Cancer Database was only considered to be of sufficient completeness for reporting for New South Wales, Victoria (post 2008), Queensland, Western Australia and the Northern Territory; this should be borne in mind when interpreting results.

It should be noted that incidence and prevalence data were available only to 2009 for New South Wales and the Australian Capital Territory (as opposed to 2011 for other jurisdictions); however, due to the stable nature of cancer estimates, and the combination of these data with other data sources to estimate burden, this was assessed as having little impact on the accuracy of the national estimates. Nonetheless, this should be borne in mind when interpreting estimates by state and territory.

Non-fatal estimates for non-melanoma skin cancer were modelled from a combination of Medicare Benefits Schedule claims data, admitted hospital data and mortality data. As Medicare Benefits Schedule claims data are administrative data, they are not a direct measure of incidence or prevalence of non-melanoma skin cancer; however, they provide a reasonable indication of the level of health loss incurred by this disease.

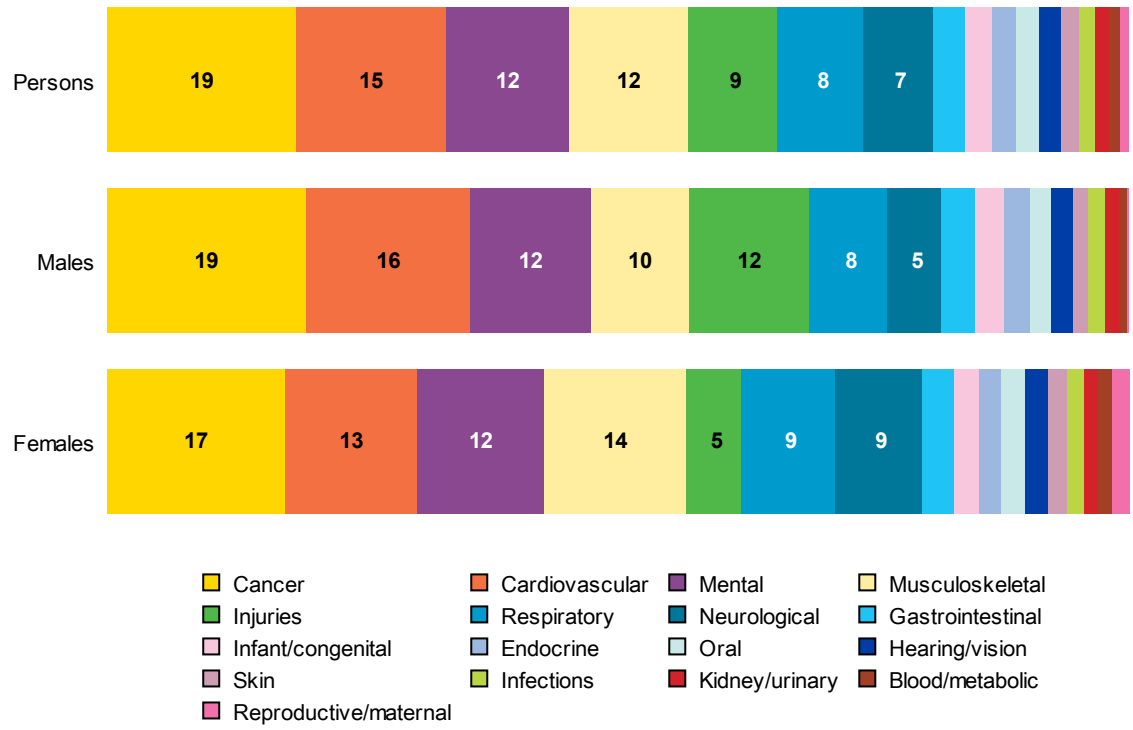
Non-fatal estimates for benign and uncertain brain tumours and other non-malignant neoplasms were estimated from national mortality data, admitted hospital data and incidence data from Western Australia, Queensland and Victoria only. While these estimates are reliable for these states, the resulting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

A full description of the quality index for each cancer type, for both the Australian and Indigenous populations, is available in Appendix F of the report *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c).

3 Cancer burden in 2011

Cancer burden in context of other disease groups

Collectively, cancer and other neoplasms caused the greatest burden in Australia in 2011, responsible for an estimated 833,250 DALY. It accounted for 19% (20% males; 17% females) of the total burden of disease, compared with 15% from cardiovascular diseases, and 12% each from mental and substance use disorders and musculoskeletal disorders (Figure 3.1).

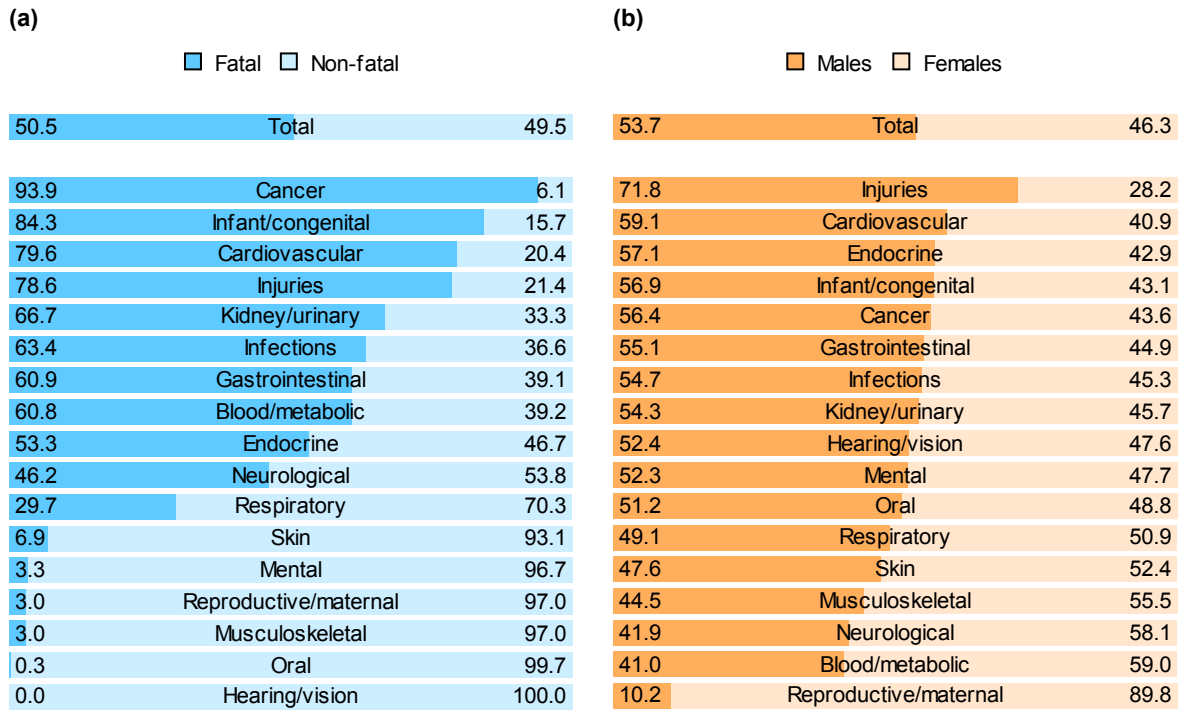


Source: AIHW 2016b.

Figure 3.1 : Proportion (%) of total burden (DALY), by disease groups and sex, 2012

While there were fewer deaths from cancer compared with cardiovascular diseases, and lower disease prevalence, the overall burden due to cancer was higher than for cardiovascular diseases. This was predominantly due to people dying earlier from cancer: on average, cancer deaths occurred at younger ages than those from cardiovascular diseases. In addition, only 6% of the total cancer burden was due to non-fatal health loss, compared with 20% of cardiovascular burden (Figure 3.2a).

Like many disease groups, males experienced the greater share (56.4%) of the cancer burden (Figure 3.2b).

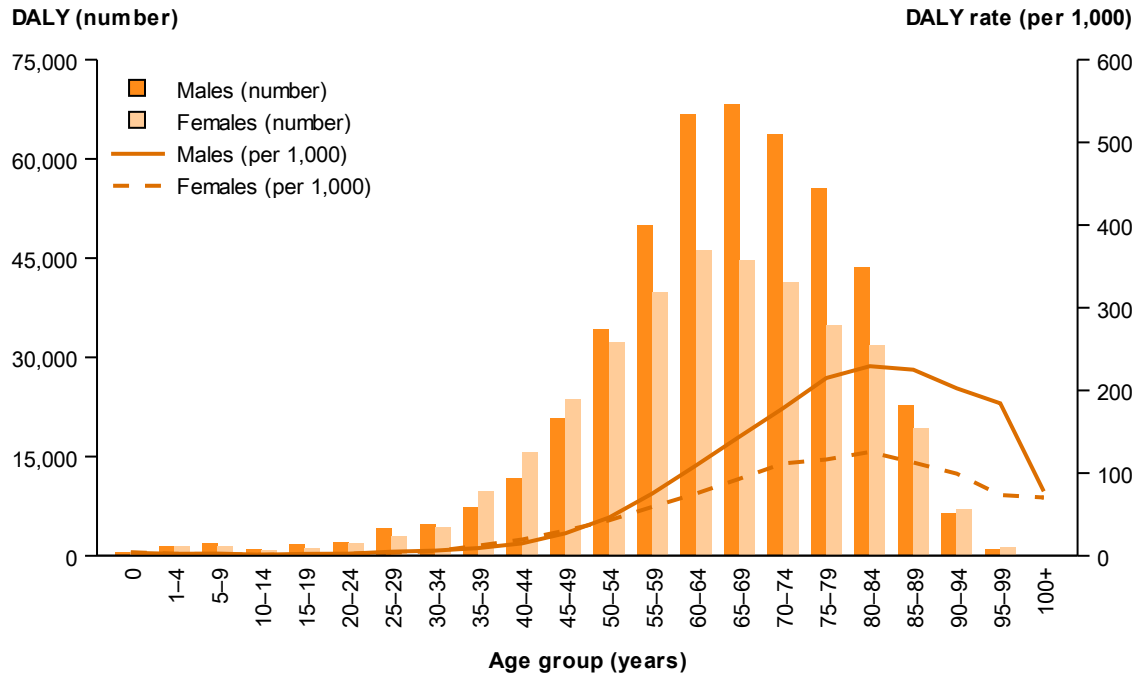


Source: AIHW 2016b.

Figure 3.2: Proportion (%) of total burden (DALY) by fatal versus non-fatal (a) and sex (b), by disease group, 2011

Overview of cancer burden

The cancer burden was mostly experienced by people aged 40 and over. Up to age 50, there was little difference in the rate of burden for males and females. However, after 50, males experienced a far greater rate of burden, to almost double the female rate between the ages of 75 and 99 (Figure 3.3). The drivers of this difference are discussed in the following sections.

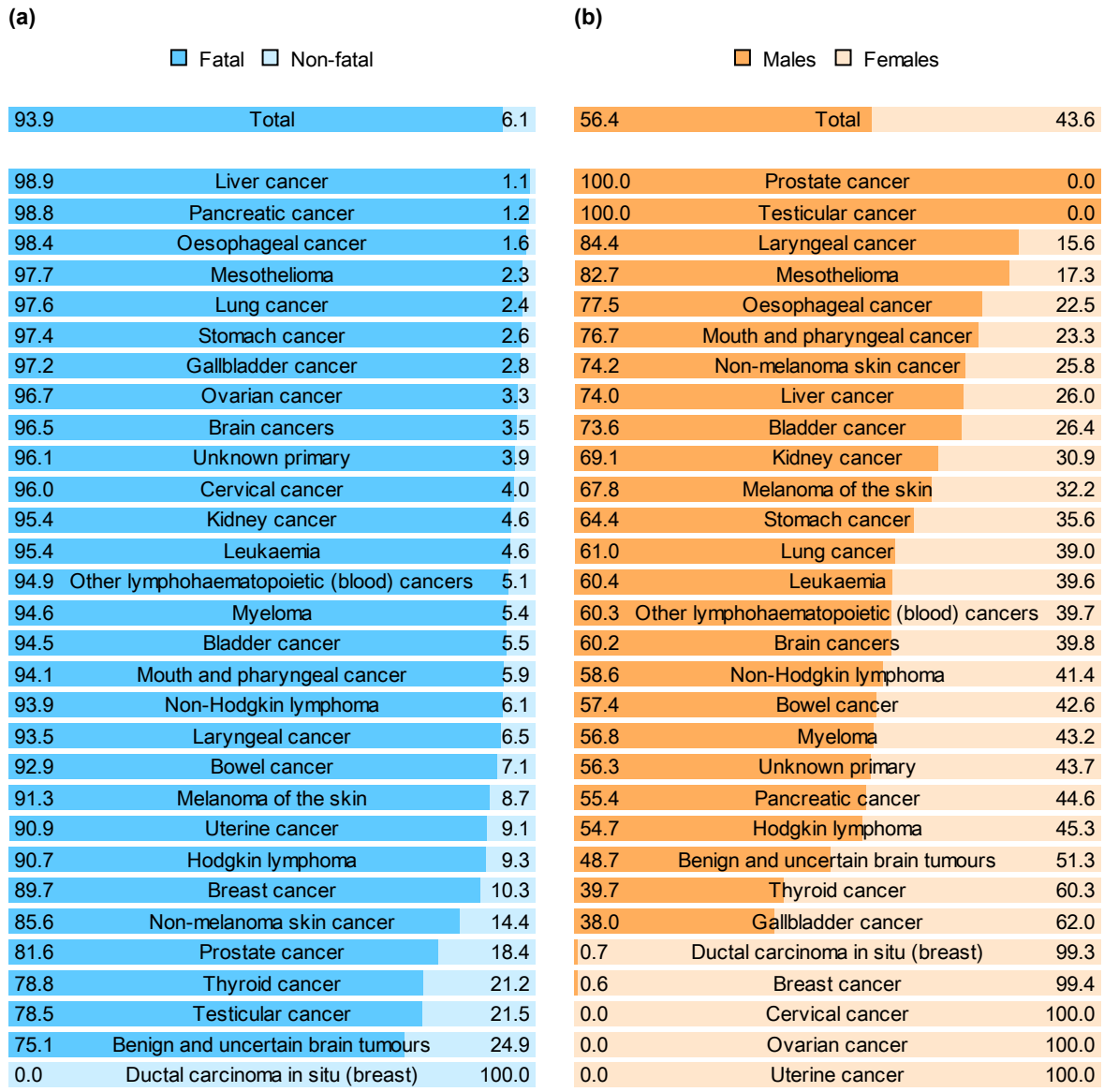


Source: AIHW burden of disease database 2011.

Figure 3.3: Numbers and rates of cancer-related disability-adjusted life years (DALY), by age and sex, 2011

While the cancer burden was almost entirely due to dying prematurely, with only 6% of the burden due to living with cancer, the proportion of fatal to non-fatal burden varied by cancer type (Figure 3.4a). This is explored further in the sections on fatal and non-fatal burden.

The proportion of burden by sex varied by cancer type: apart from the sex-specific cancers, males experienced a large percentage of the burden from laryngeal cancer (84.4%), mesothelioma (82.7%), oesophageal cancer (77.5%), mouth and pharyngeal cancer (76.7%) and non-melanoma skin cancer (74.2%); whereas females experienced a larger proportion of burden from gallbladder cancer (62.0%) and thyroid cancer (60.3%) (Figure 3.4b).



Source: AIHW burden of disease database 2011.

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

Burden by age, sex and cancer type

Table 3.1 presents the leading 10 causes of cancer burden for males, females and persons. A more detailed table, including DALY and age-standardised rates (ASR) of all cancer types, is in Table B.1.

Lung, bowel, prostate and pancreatic cancers and melanoma of the skin caused the most burden in males, accounting for 52.1% of the cancer burden in males. Breast, lung, bowel, pancreatic and ovarian cancers caused the most burden in females, accounting for 57.6% of the cancer burden in females (Table 3.1).

Table 3.1: Leading causes of cancer burden (by % of total cancer burden), by sex, 2011

Rank	Males	% of DALY	Females	% of DALY	Persons	% of DALY
1	Lung cancer	20.1	Breast cancer	19.4	Lung cancer	18.6
2	Bowel cancer	11.3	Lung cancer	16.6	Bowel cancer	11.1
3	Prostate cancer	10.5	Bowel cancer	10.8	Breast cancer	8.5
4	Pancreatic cancer	5.2	Pancreatic cancer	5.5	Prostate cancer	5.9
5	Melanoma of the skin	5.0	Ovarian cancer	5.3	Pancreatic cancer	5.3
6	Liver cancer	4.6	Unknown primary	4.3	Brain cancers	4.3
7	Brain cancers	4.6	Brain cancers	3.9	Unknown primary	4.3
8	Unknown primary	4.3	Leukaemia	3.3	Melanoma of the skin	4.2
9	Leukaemia	3.9	Melanoma of the skin	3.1	Leukaemia	3.7
10	Oesophageal cancer	3.9	Non-Hodgkin lymphoma	2.9	Liver cancer	3.5
	Leading 10 cancers	**73.4**	**Leading 10 cancers**	**75.1**	**Leading 10 cancers**	**69.3**
	All other cancers	*26.6*	*All other cancers*	*24.9*	*All other cancers*	*30.7*
	Total	**100.0**	**Total**	**100.0**	**Total**	**100.0**

Note: Columns may not add to total due to rounding.

Source: AIHW burden of disease database 2011.

Many of the cancer types with higher burden in males are related to tobacco use and occupational risk factors (this is discussed further in the section 'Burden attributable to specific risk factors'). Figures 3.5 and 3.6 show the 10 most burdensome cancers for males and females, respectively, by key age groups. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.

Children and young adults

In children and young adults (aged 0–24), the burden is dominated by brain cancers, blood cancers (leukaemia, Hodgkin and non-Hodgkin lymphoma), and benign and uncertain neoplasms.

In young males aged 15–24, testicular cancer also contributed to the cancer burden, while ovarian cancer caused considerable burden in girls and young women aged 5–24, and cervical cancer in women aged 15–24.

Adults aged 25–64

Males

Brain cancers (14%), bowel cancer (13%) and melanoma (12%) caused the most burden in males aged 25–44. From 45–64, lung cancer became the greatest cause of burden (22%), followed by digestive cancers (bowel, liver and pancreatic cancers) and melanoma.

Females

Breast cancer was responsible for one-quarter of the burden in the 25–44 age group, followed by bowel cancer, melanoma and lung cancer. Cervical and ovarian cancers also caused considerable burden in this age group.

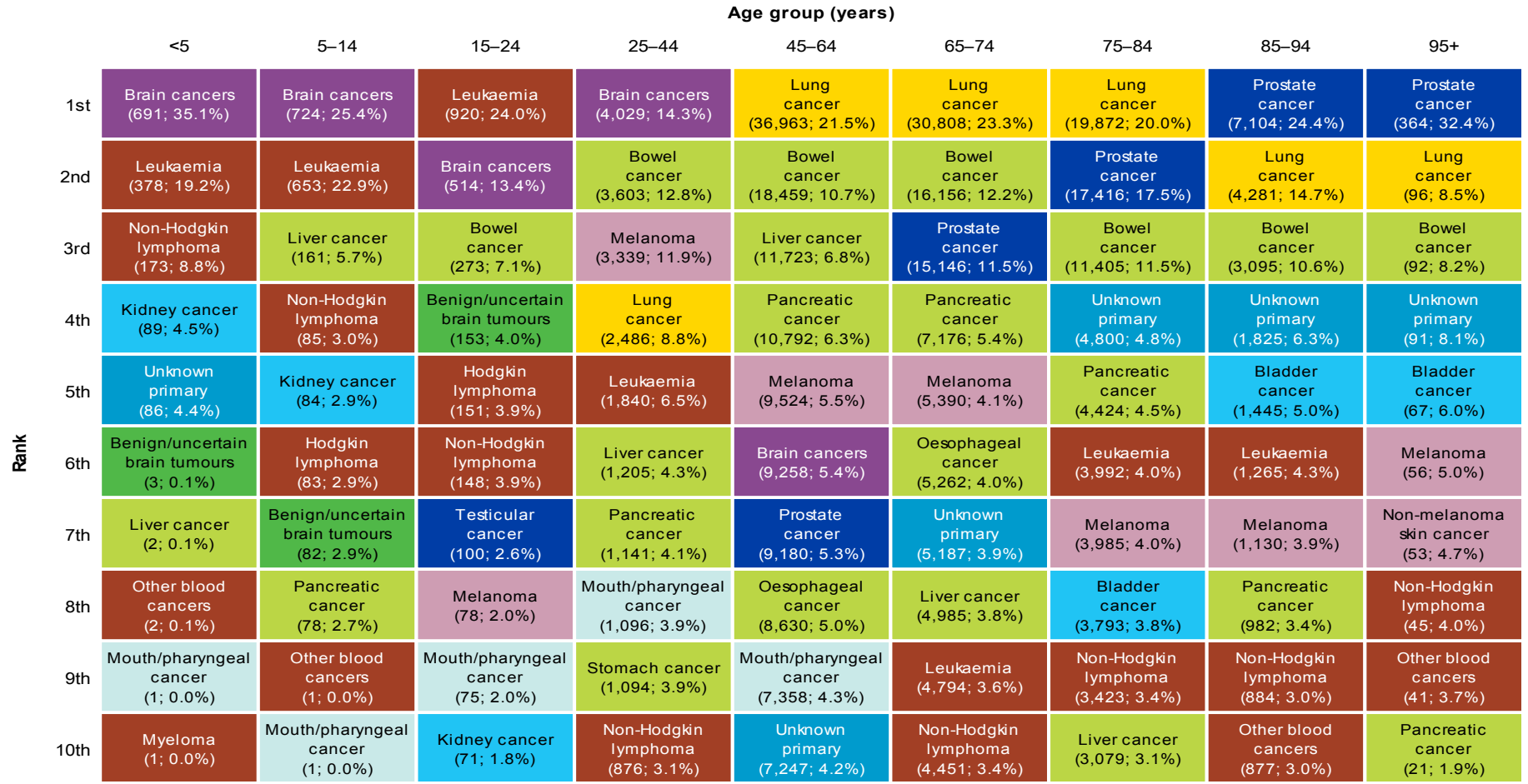
Adults aged 65–84

In males, the cancer burden in this group was dominated by lung cancer, prostate cancer and digestive cancers (bowel, pancreatic and liver cancers), while in females, it was lung cancer, breast cancer and digestive cancers (bowel, pancreatic and liver cancers).

Older Australians aged 85 and over

Prostate cancer caused the most burden in older males, accounting for one-quarter to one-third of the burden in this group. This was followed by lung cancer, bowel cancer, cancer of unknown primary site and bladder cancer.

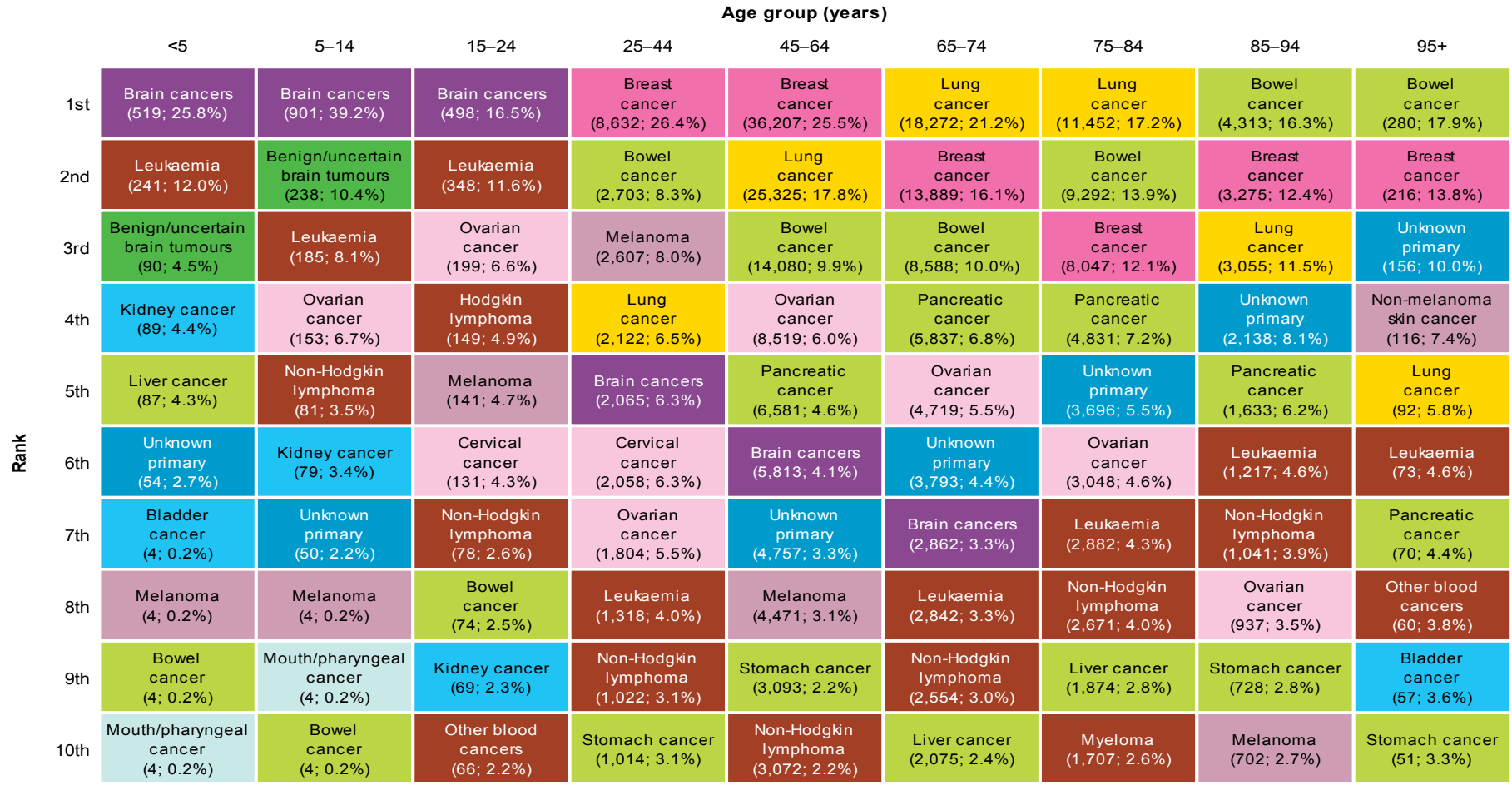
Bowel cancer caused the most burden in older females, followed by breast cancer. Lung cancer and cancer of unknown primary site also were responsible for burden in this group.



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.5: Leading causes of total cancer burden (DALY, %) for males, by age group, 2011



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.6: Leading causes of total cancer burden (DALY, %) for females, by age group, 2011

Fatal burden of cancer

Dying prematurely accounted for 94% of the burden of cancers and other neoplasms, with 782,349 YLL. The age-standardised rate was 32.1 YLL per 1,000 persons. Males accounted for more than half this burden (56.5%).

This high fatal burden means that cancer and other neoplasms accounted for the most fatal burden of all disease groups in the ABDS 2011—33% of fatal burden in males, and 36% in females (AIHW 2016b).

Lung cancer was responsible for almost one-fifth (19.3%) of the fatal cancer burden. Together, bowel and breast cancer accounted for the next 19.1% (11.0% and 8.1%, respectively). Pancreatic (5.6%) and prostate cancers (5.1%) round out the top 5 (Table 3.2).

While lung cancer caused the most fatal burden for males (20.9%), breast cancer caused the most fatal burden in females (18.5%), closely followed by lung cancer (17.3%) (Table 3.2).

Table 3.2: Leading causes of fatal cancer burden (by % of cancer fatal burden), by sex, 2011

Rank	Males	% of total YLL	Females	% of total YLL	Persons	% of total YLL
1	Lung cancer	20.9	Breast cancer	18.5	Lung cancer	19.3
2	Bowel cancer	11.2	Lung cancer	17.3	Bowel cancer	11.0
3	Prostate cancer	9.1	Bowel cancer	10.7	Breast cancer	8.1
4	Pancreatic cancer	5.5	Pancreatic cancer	5.7	Pancreatic cancer	5.6
5	Melanoma of the skin	4.9	Ovarian cancer	5.5	Prostate cancer	5.1
6	Liver cancer	4.9	Unknown primary	4.4	Brain cancers	4.4
7	Brain cancers	4.7	Brain cancers	4.0	Unknown primary	4.4
8	Unknown primary	4.4	Leukaemia	3.4	Melanoma of the skin	4.0
9	Oesophageal cancer	4.1	Melanoma of the skin	2.9	Leukaemia	3.7
10	Leukaemia	4.0	Non-Hodgkin lymphoma	2.9	Liver cancer	3.7
	Leading 10 cancers	**73.6**	**Leading 10 cancers**	**75.4**	**Leading 10 cancers**	**69.4**
	All other cancers	*26.4*	*All other cancers*	*24.6*	*All other cancers*	*30.6*
	Total	**100.0**	**Total**	**100.0**	**Total**	**100.0**

Note: Columns may not add to total due to rounding.

Source: AIHW burden of disease database 2011.

Fatal burden by age and sex

Figure 3.7 shows that the rate of fatal burden for the top 3 cancers peaked in those over 70. The greatest YLL for lung cancer were in those aged 75 to 79 in males and females. The YLL for bowel cancer peaked for males aged 75 to 79 and for females aged 80 to 84. YLL for prostate cancer peaked for males aged 70–84 and breast cancer for females aged 45–64.

Figures 3.8 and 3.9 show the 10 cancers with the highest fatal burden for males and females by key age groups. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same. Because of the high proportion of fatal burden, these graphs show similar patterns to overall burden.

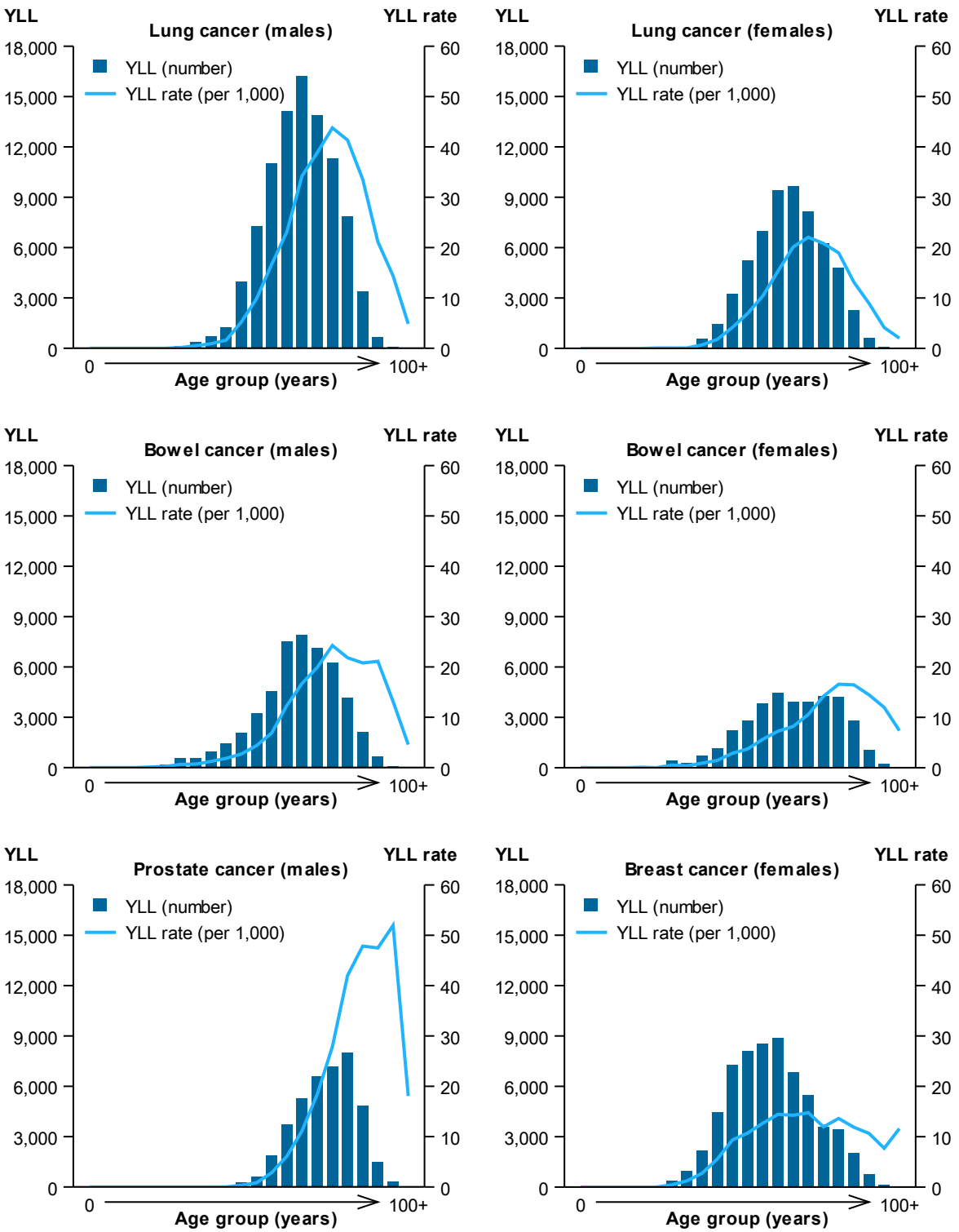
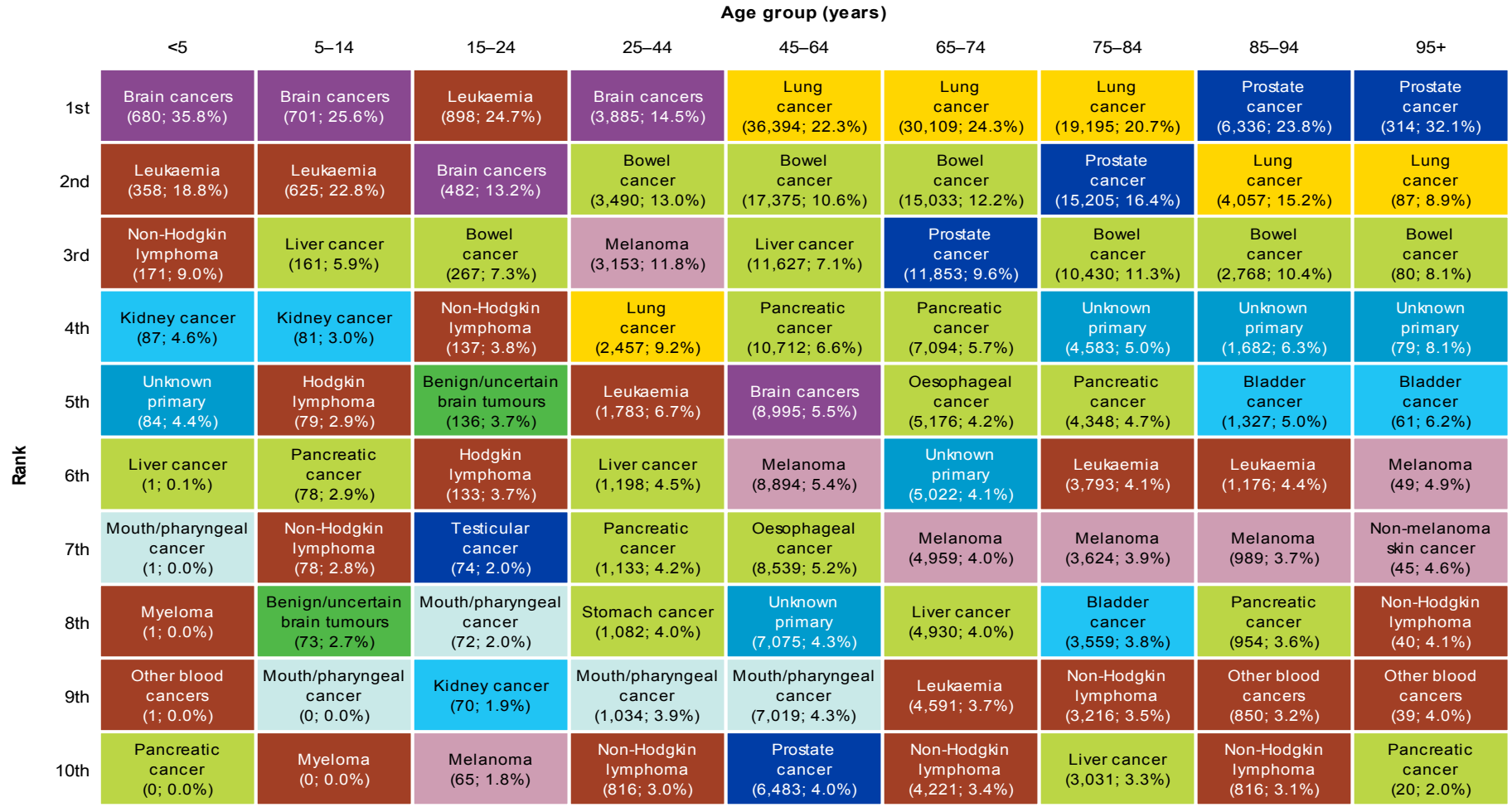


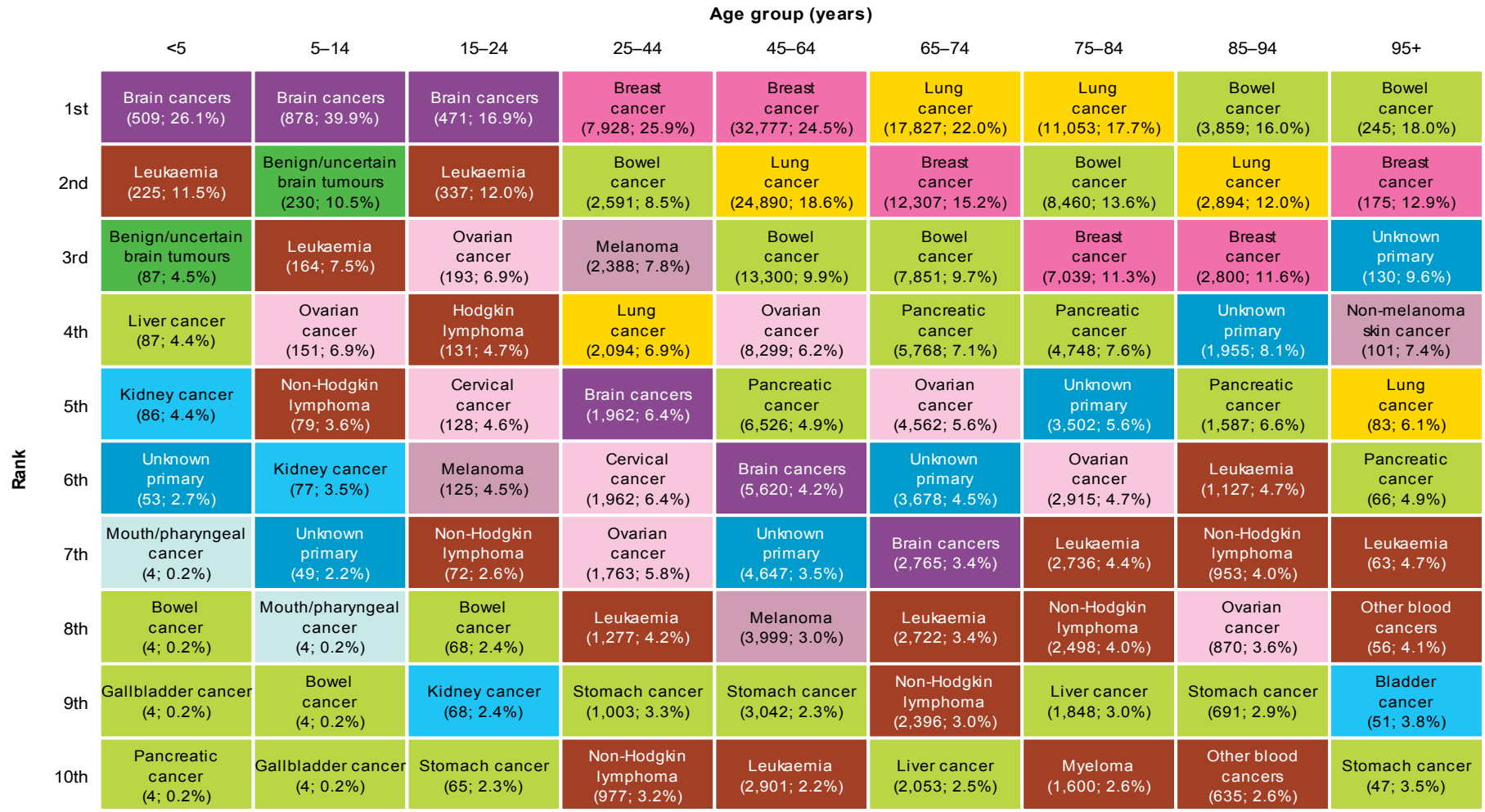
Figure 3.7: Fatal cancer burden (YLL, age-specific YLL rate per 1,000 persons), by age: top 3 cancers for each sex, 2011



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.8: Leading causes of fatal cancer burden (YLL, %) for males, by age group, 2011



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.9: Leading causes of fatal cancer burden (YLL, %) for females, by age group, 2011

Non-fatal burden of cancer

The non-fatal burden in 2011 only accounted for 6.1% of the total cancer burden.

Survival rates of individual cancers strongly influence the relative contributions of fatal and non-fatal burden. Testicular, thyroid, prostate, non-melanoma skin and breast cancers had the highest proportion of non-fatal burden (Figure 3.4a). These cancers all had 5-year survival rates of 89% or more in 2010, whereas the cancers with the lowest proportion of non-fatal burden (that is, less than 2.5% of the respective cancer burden)—liver, pancreatic and oesophageal cancers, mesothelioma and lung cancer—had 1-year survival rates between 21% and 45%, and 5-year survival rates of 16.0% or less in 2010 (AIHW 2012c).

Table 3.3 shows the leading causes of non-fatal cancer burden in Australia. Almost three-fifths (58.3%) of the non-fatal cancer burden in 2011 was due to the 5 leading causes of cancer in 2011: prostate, breast, bowel and lung cancers, and melanoma of the skin. Of these, prostate, breast and bowel cancers and melanoma have a high prevalence and survival rate, due in part to early detection through testing or organised screening programs.

Prostate cancer accounts for almost one-third (32.4%) of the non-fatal cancer burden in males, while breast cancer accounts for a similar proportion (31.5%) in females. Bowel cancer accounts for around 13% of the non-fatal burden in both males and females, and lung cancer 7.9% and 6.4% in males and females, respectively. While only 2.4% of the lung cancer burden is from living with the disease, the high numbers of cases diagnosed every year, and the number of people dying from lung cancer, mean that it also contributes substantially to the non-fatal burden in Australia.

Table 3.3: Leading causes of non-fatal cancer burden (by % of non-fatal cancer burden), by sex, 2011

Rank	Males	% of YLD	Females	% of YLD	Persons	% of YLD
1	Prostate cancer	32.4	Breast cancer	31.5	Prostate cancer	17.8
2	Bowel cancer	13.1	Bowel cancer	12.8	Breast cancer	14.4
3	Lung cancer	7.9	Lung cancer	6.4	Bowel cancer	13.0
4	Melanoma of the skin	6.4	Melanoma of the skin	5.4	Lung cancer	7.2
5	Non-Hodgkin lymphoma	3.1	Uterine cancer	3.0	Melanoma of the skin	5.9
6	Leukaemia	3.0	Non-Hodgkin lymphoma	2.9	Non-Hodgkin lymphoma	3.0
7	Non-melanoma skin cancer	2.9	Brain tumours	2.9	Brain tumours	2.8
8	Brain tumours	2.7	Unknown primary	2.8	Leukaemia	2.8
9	Mouth and pharyngeal cancer	2.6	Ovarian cancer	2.7	Unknown primary	2.7
10	Unknown primary	2.6	Leukaemia	2.5	Non-melanoma skin cancer	2.6
	Leading 10 cancers	**76.7**	**Leading 10 cancers**	**73.0**	**Leading 10 cancers**	**72.2**
	All other cancers	*23.3*	*All other cancers*	*27.0*	*All other cancers*	*27.8*
	Total	**100.0**	**Total**	**100.0**	**Total**	**100.0**

Note: Columns may not add to total due to rounding.

Source: AIHW burden of disease database, 2011.

Non-fatal burden by age and sex

Figure 3.10 shows the age distribution of non-fatal burden for the top 3 cancers by sex. The rate of non-fatal burden of prostate cancer increased with age after 50, consistent with the increasing number of men diagnosed from this age. The greatest amount of burden was experienced in those aged 60–74.

The rate of non-fatal burden of breast cancer increased with age from 30–69, after which it remained stable. The greatest amount of burden was experienced in women aged 50–69.

Bowel cancer non-fatal burden showed similar patterns between males and females, with the rate increasing from age 40 and peaking in those aged 80 and over.

Although small compared with other cancers, the non-fatal burden rate of lung cancer also peaked in older ages in both males and females.

Figures 3.11 and 3.12 show the 10 cancers with the highest non-fatal burden for males and females by key age groups. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.

Children and young adults

In children and young adults (aged 0–24), the non-fatal burden, though very small, is still dominated by blood cancers (leukaemia, Hodgkin and non-Hodgkin lymphoma), brain cancers, and testicular cancer in young males aged 15–24.

Adults aged 25–64

Males

Melanoma (14%), benign and uncertain brain tumours (12%) and brain cancers (11%) caused the most non-fatal burden in males aged 25–44. From age 45 onwards, prostate cancer became the greatest cause of non-fatal burden (32%), followed by bowel cancer and melanoma.

Females

Breast cancer was responsible for around one-third of the non-fatal burden in both the 25–44 and 45–64 age groups, followed by bowel cancer and melanoma.

Adults aged 65–84

In males, the non-fatal cancer burden in this group was dominated by prostate, bowel and lung cancers, while in females, it was breast, bowel and lung cancers.

Older Australians aged 85 and over

Prostate cancer caused the most non-fatal burden in older males, accounting for around one-third of the non-fatal burden in this group. This was followed by bowel cancer, lung cancer and cancer of unknown primary site.

Breast cancer continued to cause the most non-fatal burden in older females, followed by bowel cancer and cancer of unknown primary site.

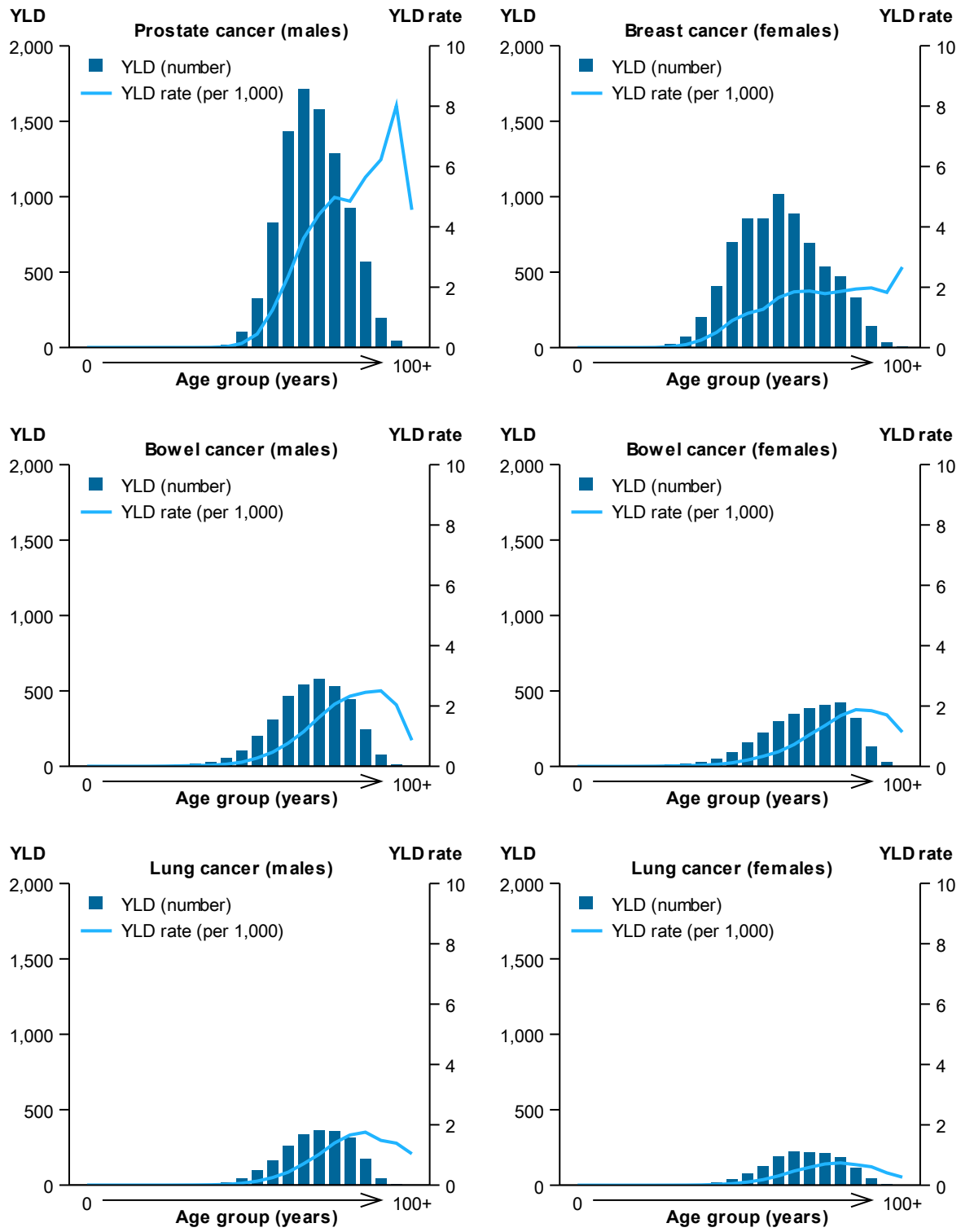
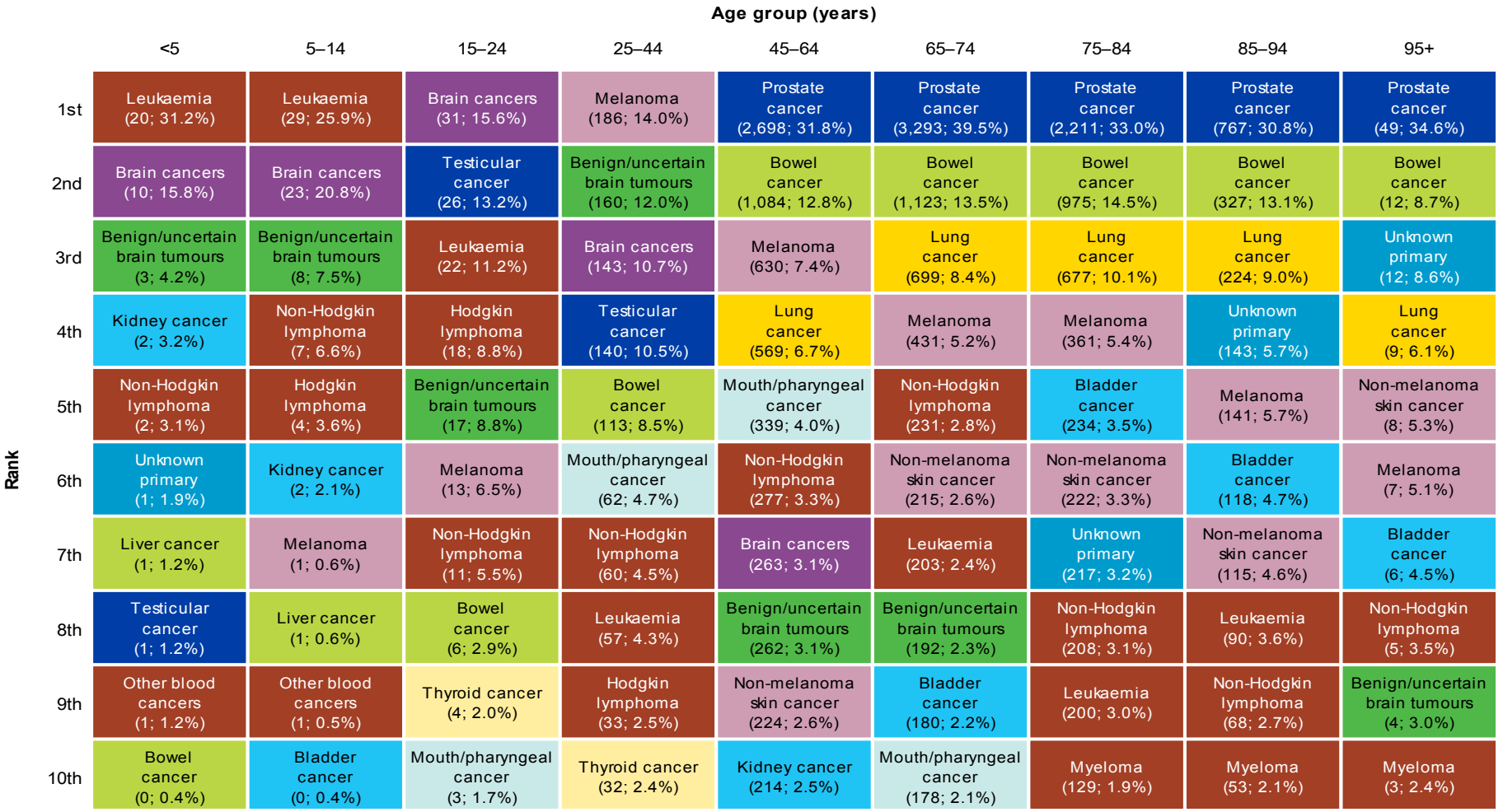


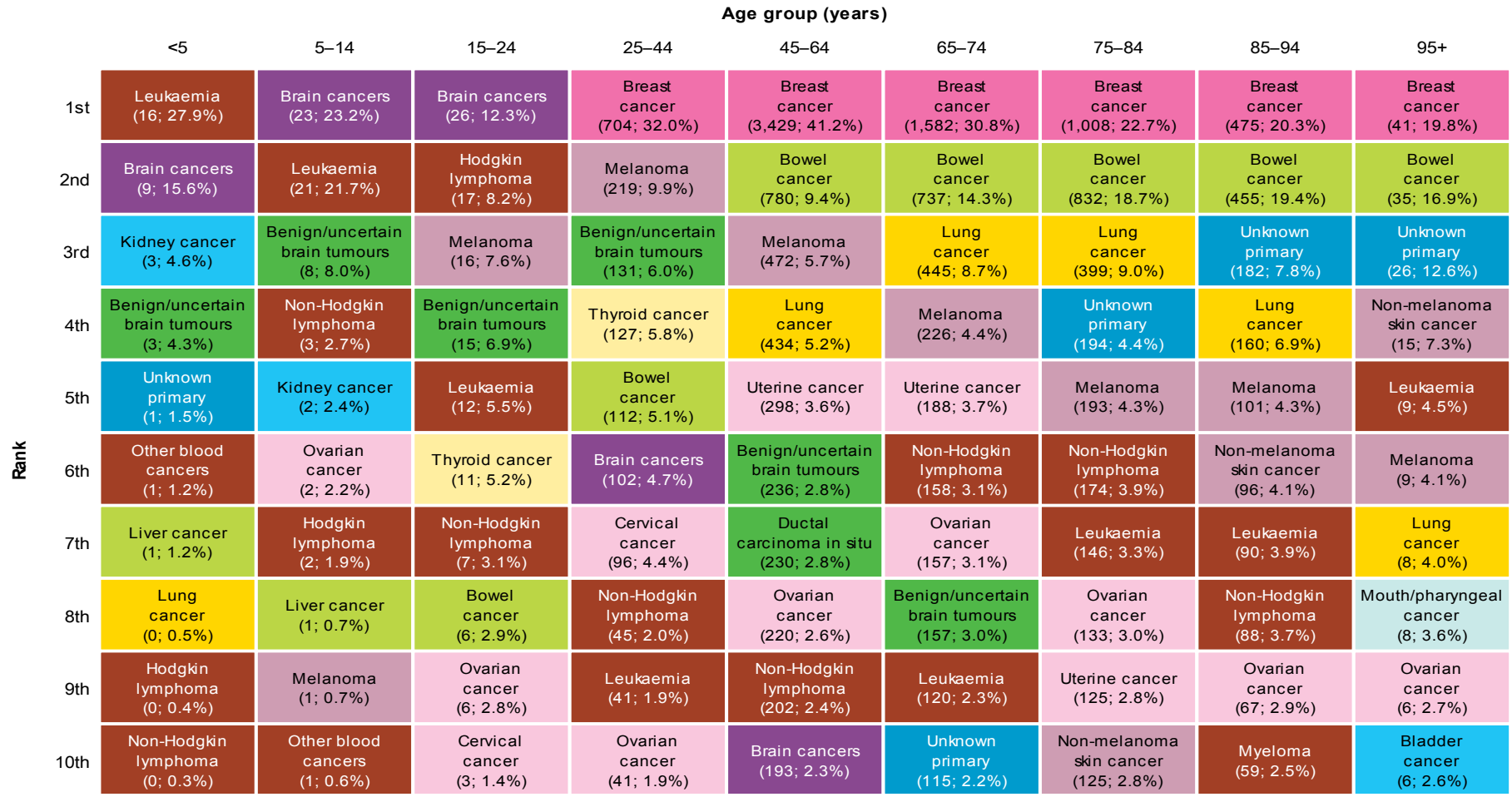
Figure 3.10: Non-fatal cancer burden (YLD, age-specific YLD rate per 1,000 persons), by age: top 3 cancers for each sex, 2011



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.11: Leading causes of non-fatal cancer burden (YLD, %) for males, by age group, 2011



Notes

1. Cancer types within the same ICD-10 grouping (such as digestive cancers) have been coloured the same.
2. This figure excludes 'other cancers' and 'other non-malignant neoplasms' from the rankings.

Figure 3.12: Leading causes of non-fatal cancer burden (YLD, %) for females, by age group, 2011

Burden of the different phases of the cancer journey

To estimate the non-fatal burden from cancer, separate weights were assigned to the health loss caused by different consequences of the disease. The values assigned to these weights were derived by the Global Burden of Disease Study 2013 from a large, multinational study (GBD 2013 Collaborators 2015) and are described fully in Chapter 5 of *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c).

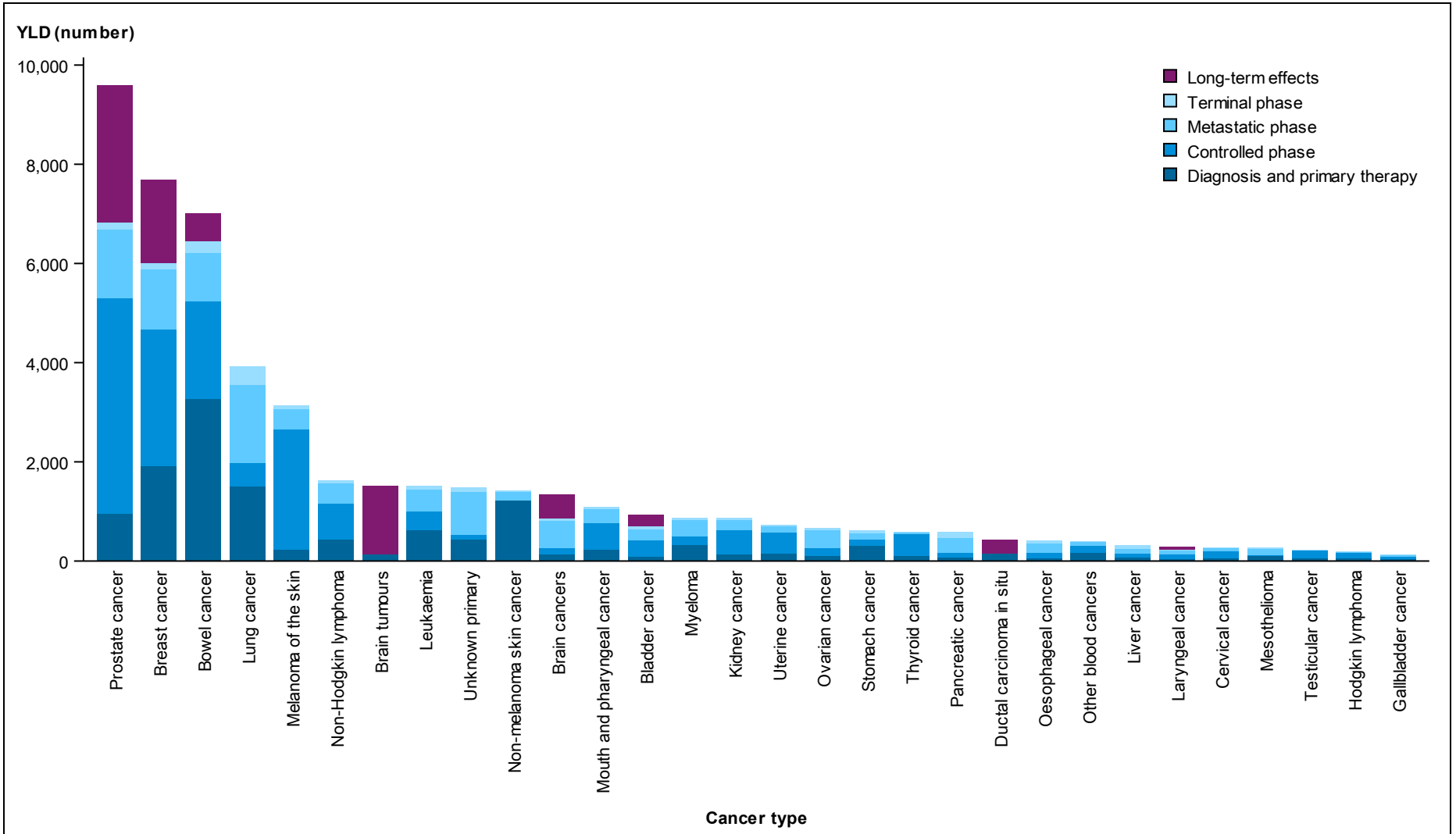
All malignant neoplasms were weighted for the 4 main phases experienced by cancer patients:

- Diagnosis and primary therapy—the weighting for this phase included the health loss suffered directly from the illness as well as from the various processes that needed to be carried out (such as biopsies) to obtain a definitive diagnosis, worry caused by the diagnosis and short-term effects of curative treatment, including chemotherapy, radiotherapy and surgery. All patients diagnosed with a new cancer in 2011 were allocated health loss for the time spent in this phase. The length of time assigned for this health loss was based on average experiences, and varied between cancers (Table A.7).
- Controlled phase—this phase refers to the time after primary therapy has finished, and the patient is considered in remission. Health loss, which included general worry and daily medication, was attributed to all patients who had been diagnosed with cancer in the 5 years from 2005 to 2011 who were still alive as at the end of 2011.
- Metastatic phase—health loss includes the health loss from the illness, as well as health loss from various treatment regimens to either control the further spread of the disease and/or to minimise pain. All patients who died from cancer in 2011 were allocated health loss for the time spent in the metastatic phase, which varied between cancer types (Table A.7).
- Terminal phase—the weighting assigned to the terminal phases attempts to capture the health loss in the final weeks before death, and assumes that the patient had access to pain relief. All patients who died from cancer in 2011 were allocated 1 month of health loss.

A small number of cancer types were also assigned health loss to capture the long-term impacts of surgery as a curative treatment (breast, laryngeal, bowel and bladder cancers) or other long-term effects that are caused by the cancer itself (prostate and brain cancers).

At a population level, the total non-fatal burden is therefore impacted by the number of people diagnosed with each type of cancer, the length and type of primary treatment, the likelihood of survival and any long-term effects of treatment. Being able to identify where the greatest burden is experienced within each type of cancer assists in targeting research efforts and policy decisions.

Figure 3.13 shows the variation by cancer type in the amount of non-fatal burden caused by the different phases.



Source: AIHW burden of disease database 2011.

Figure 3.13: Non-fatal cancer burden (YLD), by cancer phase, 2011

The non-fatal burden of prostate cancer in Australian males is predominantly made up of the controlled phase and long-term effects (74%), with only around 10% of the burden from diagnosis and primary therapy, and 16% due to metastases and dying from the disease. This is due to the high incidence and survival rates for prostate cancer resulting in a large number of men living with the effects of prostate cancer.

By way of contrast, almost half (47%) of the non-fatal burden of bowel cancer is from health loss due to diagnosis and primary therapy. This is due to the long average duration of treatment (9 months) which may include bowel resection. The substantial contribution of the controlled phase is due to the high success rate of treatment reflected in the high 5-year survival rate.

For lung cancer, half the non-fatal burden is due to the metastatic and terminal phases (40% and 10% respectively) and 38% of the non-fatal burden in the population is from diagnosis and primary therapy. This reflects the high incidence and poor prognosis of survival for lung cancer.

Around one-third (36%) of burden from brain cancers is due to the long-term impacts of brain injury, while for brain tumours, long-term impacts account for most (91%) of the burden.

Burden attributable to specific risk factors

A risk factor is any determinant that causes (or increases the likelihood of) 1 or more diseases or injuries. 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.

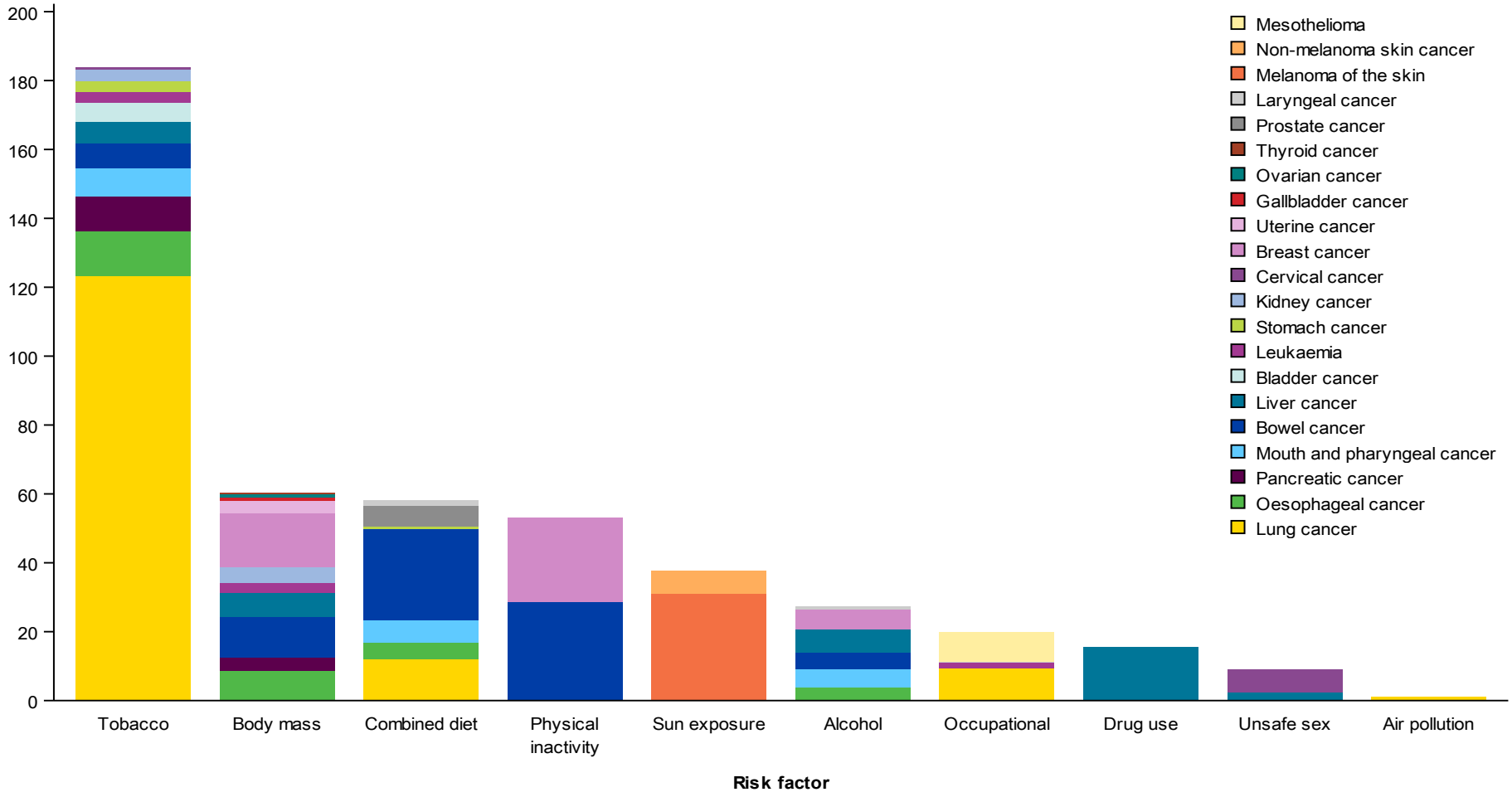
There were 17 risk factors analysed in the ABDS 2011 that contributed to the cancer burden. These risk factors were found to be causally linked to 21 different cancer types. The combined dietary risk and the joint effect are not included in the total number of risk factors analysed in this report. The joint effect of these 17 risk factors accounted for 44% of the cancer burden (364,952 DALY).

Estimates for high body mass (and hence the joint effect) are based on revised methods and enhancements undertaken as part of an extension project undertaken by the AIHW that looked at the impact of overweight and obesity on chronic diseases (AIHW 2017b) and will differ from estimates presented in earlier publications from the ABDS 2011 (AIHW 2016b).

Overall burden

Figure 3.14 and tables B.4a and B.4b show the contribution of the different risk factors to the various cancer types. The cancers were only linked to a risk factor if there was sufficient evidence of a causal association—preferably from a meta-analysis or prospective studies—considered to be at a convincing or probable level. The majority of causal links were assessed and determined by the GBD 2010. The linked cancers for high body mass and sun exposure were assessed and determined by the AIHW.

Note that the attributable burden from individual risk factors cannot be added together (see Box 3.1). The combined attributable burden from all the risk factors is shown as the 'joint effect' and is described in Appendix A.



Note: Dietary risk factors are presented as the joint effect 'Combined diet'.

Source: AIHW burden of disease database 2011; AIHW 2017b.

Figure 3.14: Cancer burden (DALY) attributable to specific risk factors, 2011

Box 3.1: Why risk factor estimates cannot be added together

Most of the risk factors were analysed independently in the ABDS 2011. It is important to note that the separate estimates for different risk factors cannot be added or combined without further analysis, due to complex pathways and interactions between them. For example, the risk factors (sugar-sweetened beverages and high body mass) might be in the same causal pathway or, when combined, the estimate of attributable burden may be more than the total burden of that disease.

Further analysis is needed to combine risk factors. This is referred to as the 'joint effect' (see Appendix A). In this report, the joint effect has been estimated for all the included risk factors to produce an overall estimate 'All risk factors combined' and for the dietary risk factors. The ABDS 2011 did not calculate joint effects for other combinations of these risk factors (for example, for all behavioural risk factors).

Tobacco was by far the largest risk factor, responsible for 183,700 cancer-related DALY in 2011 (22% of the total cancer burden) (Figure 3.14 and Table B.4a). Two-thirds (67%) of the cancer burden from tobacco was from lung cancer, but tobacco also contributed to the burden of oesophageal, pancreatic, mouth and pharyngeal, liver, stomach, kidney, cervical, bowel and bladder cancers as well as leukaemia. As the cancer burden of tobacco is so much greater than any other risk factor included in the ABDS 2011, the burden of tobacco is further explored in the following section.

High body mass contributed around 60,000 DALY (7.2%) to the cancer burden. High body mass was found to be causally related to several cancer types in the ABDS 2011, including bowel, breast, gallbladder, kidney, oesophageal, pancreatic and uterine cancers. The latest evidence suggests high body mass is also causally related to leukaemia, liver, ovarian and thyroid cancers. These cancers were included in enhanced burden estimates due to high body mass recently published (AIHW 2017b) and are included in this estimate.

Dietary risk factors contributed various amounts of burden to different cancer types. These cannot be added together without special analyses because of the high likelihood of inter-relatedness (see Box 3.1). An analysis of the joint effect of diet shows that the various dietary risk factors together accounted for 58,000 DALY (7%) of the cancer burden. Diets low in fruit contributed the most burden (21,000 DALY) across lung, oesophageal, mouth and pharyngeal, and laryngeal cancers (Table B.4a). Diets low in milk or fibre (10,000 and 9,000 DALY, respectively) or high in processed or red meat (7,000 and 3,600 DALY, respectively) contributed to the burden of bowel cancer.

Physical inactivity contributed 53,000 DALY (6.4%) to the cancer burden—this comprised 28,600 DALY from bowel cancer and a further 24,600 DALY from breast cancer.

Sun exposure contributed 37,700 DALY (4.5%) to the cancer burden—this comprised 31,200 DALY from melanoma and 6,600 DALY from non-melanoma skin cancer.

Alcohol use was the other major single risk factor contributing to the cancer burden (27,200 DALY, 3.3%). In the ABDS 2011, alcohol use includes both the impact of average daily alcohol use as well as binge drinking; however, only average daily use was causally linked to cancers. Liver cancer was the cause of the greatest cancer burden from alcohol use, followed by breast and mouth and pharyngeal cancers. Burden from bowel, laryngeal and oesophageal cancer was also attributed to long-term alcohol use.

Occupational exposures (19,800 DALY), drug use (15,500 DALY), unsafe sex (9,100 DALY) and air pollution (1,100 DALY) also contributed to the cancer burden.

The burden of tobacco

In the ABDS 2011, the burden of tobacco was attributed to 11 different types of cancer, and was responsible for almost twice as many cancer DALY in males as females (120,253 DALY compared with 63,476 DALY, respectively). It is estimated to be responsible for more than three-quarters (80%) of the burden of lung cancer (82% in males, 76% in females) and more than half (54%) of the burden of oesophageal cancer (53% in males, 57% in females) (Table 3.4).

The burden from tobacco is predominantly fatal, with 97% of the burden due to dying prematurely. This varies only slightly by the type of cancer (Table 3.5).

Table 3.4: Cancer burden (DALY) attributable to tobacco, by cancer type (ordered by decreasing proportion of burden), by sex, 2011

	Males			Females			Persons		
Cancer type	**Attributable DALY**	**Total DALY**	**% of cancer type**	**Attributable DALY**	**Total DALY**	**% of cancer type**	**Attributable DALY**	**Total DALY**	**% of cancer type**
Lung cancer	77,561	94,508	82.1	45,744	60,382	75.8	123,305	154,890	79.6
Oesophageal cancer	9,746	18,420	52.9	3,070	5,353	57.4	12,816	23,773	53.9
Pancreatic cancer	5,937	24,621	24.1	4,399	19,807	22.2	10,336	44,428	23.3
Mouth and pharyngeal cancer	6,605	13,517	48.9	1,519	4,100	37.0	8,124	17,617	46.1
Bowel cancer	3,466	53,084	6.5	3,747	39,338	9.5	7,213	92,422	7.8
Liver cancer	5,049	21,743	23.2	1,142	7,632	15.0	6,191	29,376	21.1
Bladder cancer	4,221	11,734	36.0	1,255	4,201	29.9	5,476	15,935	34.4
Leukaemia	2,830	18,492	15.3	450	12,137	3.7	3,281	30,629	10.7
Stomach cancer	2,313	14,548	15.9	920	8,035	11.5	3,234	22,583	14.3
Kidney cancer	2,524	12,275	20.6	611	5,498	11.1	3,135	17,774	17.6
Cervical cancer	. .	. .	. .	619	6,555	9.4	619	6,555	9.4
Total	**120,523**	**470,110**	**25.6**	**63,476**	**363,140**	**17.5**	**183,729**	**833,250**	**22.0**

Note: The 'Total DALY' column total includes all cancer types, and not just those listed in the table.

Source: AIHW burden of disease database 2011.

Table 3.5: Cancer burden (DALY) attributable to tobacco (by decreasing burden), by burden type, 2011

	Fatal burden			Non-fatal burden			Proportion fatal burden (%)		
Cancer type	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**	**Males**	**Females**	**Persons**
Lung cancer	75,712	44,594	120,307	1,848	1,150	2,998	97.6	97.5	97.6
Oesophageal cancer	9,588	3,005	12,593	158	66	223	98.4	97.9	98.3
Pancreatic cancer	5,866	4,335	10,201	71	64	135	98.8	98.5	98.7
Mouth and pharyngeal cancer	6,243	1,402	7,645	362	117	479	94.5	92.3	94.1
Bowel cancer	3,210	3,440	6,651	256	307	562	92.6	91.8	92.2
Liver cancer	4,995	1,128	6,123	54	14	69	98.9	98.7	98.9
Bladder cancer	3,975	1,186	5,161	246	68	314	94.2	94.6	94.3
Leukaemia	2,691	427	3,119	139	23	162	95.1	94.9	95.1
Stomach cancer	2,248	892	3,140	65	28	94	97.2	96.9	97.1
Kidney cancer	2,412	577	2,989	113	33	146	95.5	94.5	95.3
Cervical cancer	. .	595	595	. .	24	24	. .	96.1	96.1
Total	**116,941**	**61,582**	**178,522**	**3,312**	**1,894**	**5,207**	**72.5**	**70.2**	**71.7**

Source: AIHW burden of disease database 2011.

4 Cancer burden in key population groups

Cancer burden in Aboriginal and Torres Strait Islander populations

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

Indigenous people are disadvantaged across a range of health-related and socioeconomic indicators compared with other Australians. Many factors contribute to the gap between Indigenous and non-Indigenous health, including social disadvantage, such as lower education and employment rates, as well as higher smoking rates, poor nutrition, physical inactivity and poor access to health services (AIHW 2014).

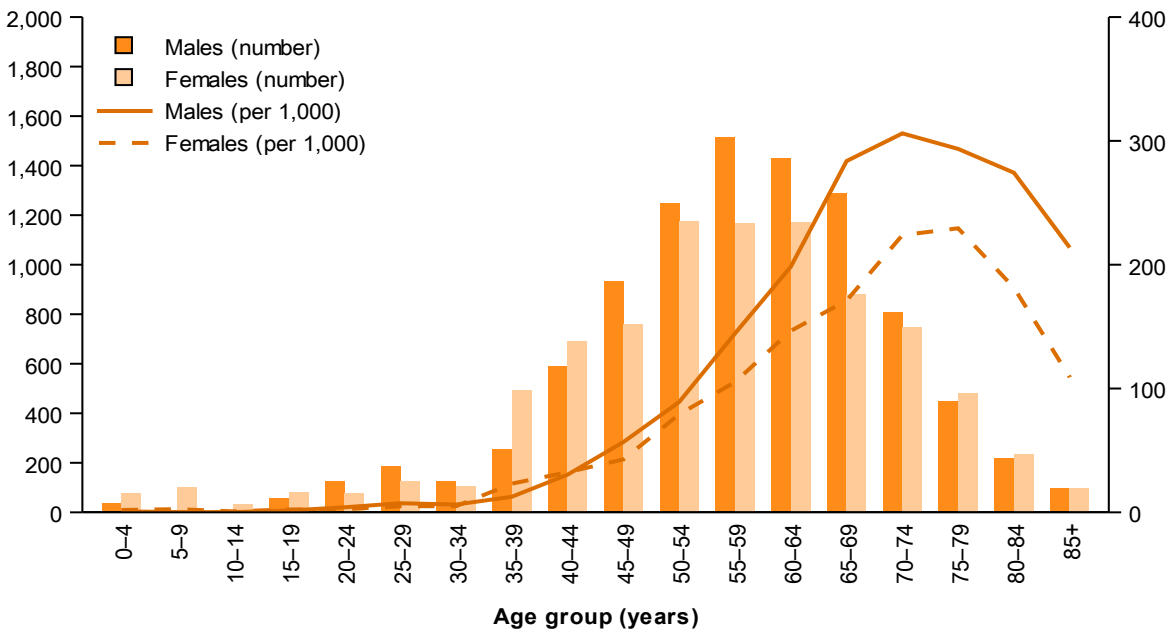
Indigenous Australians are more likely to live in remote areas of Australia than the non-Indigenous population. The Indigenous population also has a younger age structure compared with the non-Indigenous population, with this difference being due to higher birth rates as well as shorter life expectancy. In 2011, the median age of the Indigenous population was 21.8 compared with 37.6 for the non-Indigenous population. The Indigenous population is also ageing (although at a slower rate than the non-Indigenous population) and, in 2011, 3.4% of the Indigenous population were aged 65 and over (compared with 14% of the non-Indigenous population) (AIHW 2015).

To account for differences in the population age structure and size described here, age-standardisation has been used in this report when comparing burden of disease estimates for the Indigenous and non-Indigenous populations.

Total cancer burden in Aboriginal and Torres Strait Islander people

Unlike the national population where cancer was the leading cause of burden (19%), cancer was the fourth leading disease group causing burden in Indigenous people, accounting for only 9.4% of the total disease burden. However, the age-standardised rate of 57.0 DALY per 1,000 persons (compared with 34.2 nationally) indicates that the cancer burden is high in the Indigenous population, and highlights the danger of considering only rankings or proportions of disease burden (AIHW 2016a).

The proportion of cancer burden was slightly higher for Indigenous males (52.5%) compared with Indigenous females (47.5%). Age-specific rates of burden were similar in Indigenous males and females until ages 30–34, higher for females aged 35–39, then increasingly higher for males as age increased (Figure 4.1).



Source: AIHW burden of disease database 2011.

Figure 4.1: Numbers and age-specific rates of cancer-related disability-adjusted life years (DALY) in Indigenous Australians, by age and sex, 2011

Burden from specific cancers

Table 4.1 presents the leading 10 causes of cancer burden for Indigenous males, females and persons. Table B.5 includes more details, including DALY and age-standardised rates of all cancer types. Note that rankings in both tables are determined by the number of DALY. Age-standardised rates may be higher for some lower ranked cancer types due to the impact of age-standardisation on the age distribution of the burden for that cancer type.

Lung cancer was by far the greatest source of cancer burden in Indigenous Australians (4,258 DALY) and accounted for more than 3 times the burden of bowel cancer (1,353 DALY), the next most burdensome cancer. Indigenous males experienced 1.5 times the lung cancer burden rate than Indigenous females (age-standardised rates of 18.0 and 12.1 DALY per 1,000 persons, respectively).

In addition to lung cancer, which caused 2,342 DALY, Indigenous males were also affected by mouth and pharyngeal cancer (917 DALY; 5.5 DALY per 1,000 persons), bowel cancer (799 DALY; 5.6 DALY per 1,000 persons), liver cancer (783 DALY; 5.2 DALY per 1,000 persons) and oesophageal cancer (655 DALY; 3.7 DALY per 1,000 persons). These cancers are all causally associated with tobacco and/or alcohol use, among other risk factors.

Indigenous females also have a high burden from lung (1,916 DALY; 12.1 DALY per 1,000 persons), as well as breast (1,172 DALY; 6.4 DALY per 1,000 persons), bowel (554 DALY; 3.5 DALY per 1,000 persons), cervical (496 DALY; 2.3 DALY per 1,000 persons) and liver (463 DALY; 3.0 DALY per 1,000 persons) cancers. Compared with non-Indigenous women, higher burden of breast and cervical cancers in Indigenous women may be due, in part, to lower participation in the 2 national screening programs (AIHW 2016d, 2016f) in addition to exposure to associated risk factors.

Table 4.1: Leading causes of cancer burden (by % of total cancer burden) in Indigenous Australians, by sex, 2011

Rank	Males	% of DALY	Females	% of DALY	Persons	% of DALY
1	Lung cancer	25.0	Lung cancer	22.6	Lung cancer	23.9
2	Mouth and pharyngeal cancer	9.8	Breast cancer	13.8	Bowel cancer	7.6
3	Bowel cancer	8.5	Bowel cancer	6.5	Liver cancer	7.0
4	Liver cancer	8.4	Cervical cancer	5.8	Breast cancer	6.6
5	Oesophageal cancer	7.0	Liver cancer	5.5	Mouth and pharyngeal cancer	6.3
6	Prostate cancer	4.8	Pancreatic cancer	4.9	Oesophageal cancer	4.8
7	Unknown primary	4.3	Unknown primary	4.9	Unknown primary	4.6
8	Pancreatic cancer	4.1	Leukaemia	4.1	Pancreatic cancer	4.5
9	Stomach cancer	3.4	Ovarian cancer	3.8	Leukaemia	3.5
10	Leukaemia	3.0	Brain cancers	3.0	Cervical cancer	2.8
	Leading 10 cancers	**78.3**	**Leading 10 cancers**	**74.8**	**Leading 10 cancers**	**71.4**
	All other cancers	*21.7*	*All other cancers*	*25.2*	*All other cancers*	*28.4*
	Total	**100.0**	**Total**	**100.0**	**Total**	**100.0**

Note: Columns may not add to total due to rounding.

Source: AIHW burden of disease database, 2011.

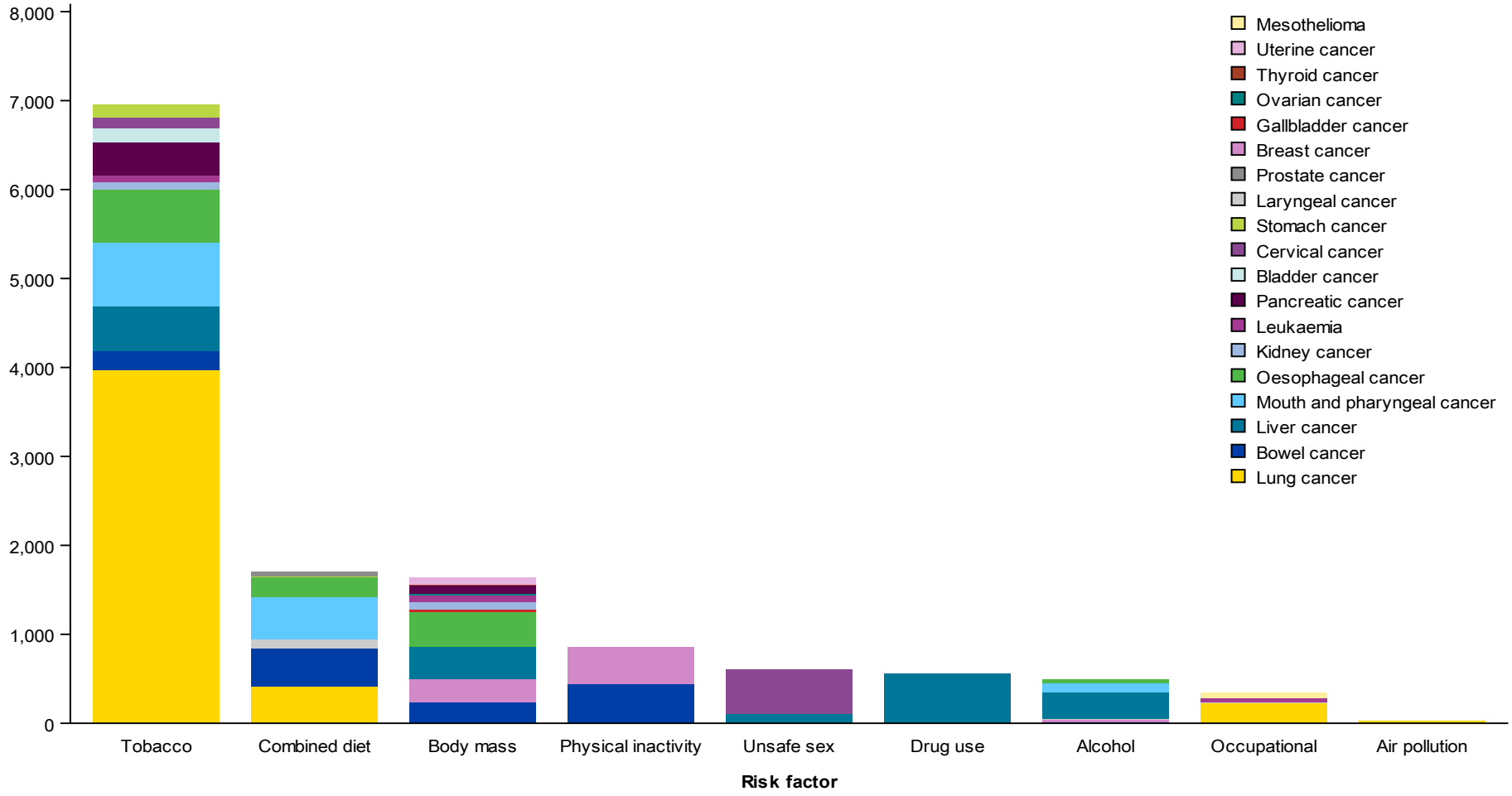
Contribution of risk factors to cancer burden in Aboriginal and Torres Strait Islander people

The attributable burden of sun exposure was not estimated for the Indigenous population as it was not possible to account for the impact of differences in skin melanin levels.

Estimates for high body mass (and hence the joint effect) are based on revised methods (AIHW 2017b) and differ from estimates presented in earlier publications from the ABDS 2011 (AIHW 2016a).

The joint effect of the 16 remaining risk factors that contributed to the Indigenous cancer burden was 54%. Tobacco contributed the most cancer burden (6,956 DALY; 39% of burden) and was responsible for almost 4 times the burden attributable to combined dietary risks (1,709 DALY; 9.6%). This was followed by high body mass (1,638 DALY, 9.2% based on revised methods) and physical inactivity (854 DALY, 4.8%) (Figure 4.2 and Table B.6a).

Diet low in fruit accounted for 980 DALY (5.5% of the Indigenous cancer burden) and diet low in vegetables accounted for 322 DALY (1.8%) (Table B.6b).



Note: Dietary risk factors are presented as the joint effect 'Combined diet'.

Source: AIHW analysis of burden of disease database 2011.

Figure 4.2: Cancer burden (DALY) in Indigenous Australians attributable to specific risk factors, 2011

Comparison of the cancer burden between Indigenous and non-Indigenous people

Measuring the 'gap' in cancer burden between Indigenous and non-Indigenous Australians is of key interest to policy makers. Indigenous and non-Indigenous rates presented in this report have been age-standardised to remove the effect of differences in age structure between the 2 populations.

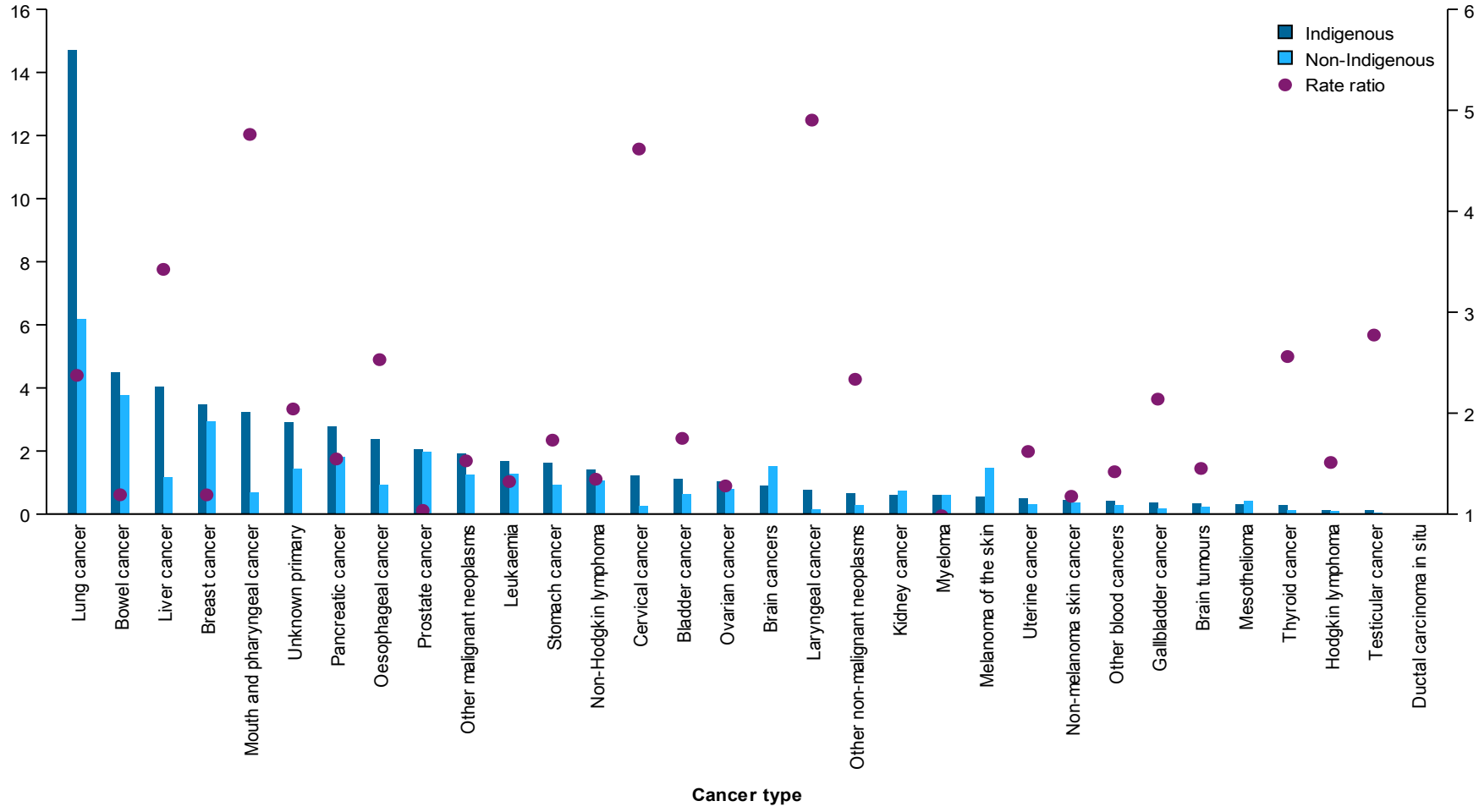
Rate ratios as well as rate differences are presented as measures of the gap in disease burden. Rate ratios provide an indication of the relative differences between the populations. A rate ratio close to 1 indicates that the age-standardised rates are essentially the same. A rate ratio greater than 1 indicates that the age-standardised Indigenous rate is higher, and that the burden is greater in the Indigenous population. A rate ratio less than 1 indicates that the age-standardised Indigenous rate, and hence burden, is lower in the Indigenous population. Rate differences show the absolute size of the gap. Figure 4.3 shows the rates (bars) and rate ratios (points) of age-standardised DALY rates for Indigenous and non-Indigenous Australians.

As the cancer burden estimates for Indigenous Australians are considered relevant and accurate, comparisons between the populations should provide a good indication of the different experiences of cancer burden. Please refer to Table F.3 of the report *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c) for specific comparisons of data quality for each cancer type.

After accounting for differences in age structure, Indigenous Australians experienced 1.7 times the cancer burden of non-Indigenous Australians (Table B.7). While this relative gap was the same for both sexes (1.6 for males and 1.7 for females), the absolute gap in disease burden was slightly greater for males than females (DALY rate differences of 26 per 1,000 compared with 21 per 1,000 respectively). This overall statistic, however, hides greater disparities in particular cancer types.

The largest absolute difference in age-standardised DALY rates between Indigenous and non-Indigenous males was for lung cancer (DALY rate difference of 10.0 per 1,000), followed by mouth and pharyngeal cancer (4.4 per 1,000) and liver cancer (3.4 per 1,000). The largest relative differences in age-standardised DALY rates between Indigenous and non-Indigenous males were for laryngeal cancer (rate ratio of 5.2) and mouth and pharyngeal cancer (rate ratio of 5.1) (Table B.7).

The largest absolute difference in age-standardised cancer DALY rates between Indigenous and non-Indigenous females was also lung cancer (DALY rate difference of 7.5 per 1,000), followed by liver cancer (2.4 per 1,000) and cervical cancer (1.8 per 1,000). The largest relative differences in age-standardised DALY rates between Indigenous and non-Indigenous females were for liver cancer (rate ratio of 5.2) and cervical cancer (rate ratio 4.4) (Table B.7).



Note: Rate ratios not shown on graph if rate is less than 1.

Source: AIHW burden of disease database 2011.

Figure 4.3: Age-standardised DALY rates and rate ratios, Indigenous and non-Indigenous Australians, by cancer and sex, 2011

Cancer burden by state and territory

Variations in patterns of cancer burden across states and territories reflect a complex interaction of many factors such as demographic (including the age structure of the population and the proportion of the population that is Indigenous), socioeconomic and environmental variations (Table 4.2).

For example, the Northern Territory is different from other states and territories. Not only does it have the smallest population, but also its population is younger, less likely to live in or near the capital city and more likely to identify as Aboriginal and Torres Strait Islander Australians compared with other states and territories. By comparison, Tasmania also has a relatively small population; however, the population tends to be older, a larger proportion lives in or near the capital city, and a much smaller proportion identify as Aboriginal and Torres Strait Islander Australians, although this is also relatively high compared with other states and territories, excluding the Northern Territory.

Table 4.2: Demographic characteristics of population, by state and territory, 2011

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

Sources: ABS 2012b, 2012c.

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

Variation of total burden by state and territory

There was only minor variation in the total cancer burden across the different states and territories: the Australian Capital Territory and Western Australia had slightly lower age-standardised rates than nationally (rate ratios less than 1.0), while South Australia, Tasmania and the Northern Territory had slightly higher age-standardised rates than the national rate (Table 4.3).

Table 4.3: Cancer burden (YLL, YLD and DALY) counts, age-standardised rates and rate ratios, by state and territory, 2011

	Fatal burden			Non-fatal burden			Total burden		
Jurisdiction	YLL ('000)	ASR	Rate ratio	YLD ('000)	ASR	Rate ratio	DALY ('000)	ASR	Rate ratio
NSW	265	32.8	1.0	17	2.0	1.0	282	34.8	1.0
Vic	192	31.7	1.0	12	2.0	1.0	205	33.7	1.0
Qld	152	32.4	1.0	10	2.2	1.1	163	34.6	1.0
WA	71	29.8	0.9	5	2.1	1.0	76	31.9	0.9
SA	70	35.8	1.1	4	2.1	1.0	74	37.9	1.1
Tas	22	35.3	1.1	1	2.1	1.0	24	37.4	1.1
ACT	9	26.7	0.8	1	2.0	1.0	10	28.7	0.8
NT	7	40.2	1.3	0	1.8	0.9	7	42.0	1.2
Australia	**782**	**32.1**	**1.0**	**51**	**2.1**	**1.0**	**833**	**34.2**	**1.0**

Notes

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

Source: AIHW analysis of burden of disease database, 2011.

This variation was predominantly driven by the variation in the fatal burden (which accounts for the large proportion of the cancer burden), with only minimal variation in the age-standardised rates of non-fatal burden.

Variation of individual cancer burden by state and territory

The consideration of cancers as a group, however, masks larger variations across the jurisdictions for the different cancer types.

Table 4.4 provides a heat map of age-standardised rates for the different cancers, increasing from light blue (low, less than 1.0 DALY per 1,000) to purple (high, 7.5 DALY or more per 1,000 persons). This provides a simple way to pinpoint those cancers and jurisdictions experiencing greater burden. As confidence intervals were not considered appropriate to be produced in the ABDS 2011 (AIHW 2016c: Section III—'Accounting for quality and accuracy'), the statistical significance of these results is unknown.

Table 4.4 shows that the age-standardised rate of most cancers was less than 3.0 per 1,000 persons in most jurisdictions, with the following exceptions:

- Lung cancer burden was similar across all states and territories, except for the Australian Capital Territory where it was noticeably lower, and the Northern Territory where it was noticeably higher. This result largely reflects the different smoking rates in these jurisdictions (AIHW 2016d).
- Age-standardised bowel cancer burden rates ranged from a low of 3.2 per 1,000 persons in Western Australia to a high of 5.0 per 1,000 in South Australia.
- Breast cancer burden was lowest in the Northern Territory (age-standardised rate of 2.2 per 1,000) and highest in Tasmania (3.4 per 1,000).

- Prostate cancer burden was similar across all states and territories (1.8 to 1.9 per 1,000), except in Tasmania and Queensland where it was higher (2.1 and 2.3 per 1,000, respectively).

Table 4.4: Leading causes of cancer burden (DALY ASR), by state and territory, 2011

Cancer type	NSW	VIC	QLD	WA	SA	TAS	ACT	NT
Lung cancer	6.5	6.0	6.5	5.9	6.1	7.4	4.9	10.1
Bowel cancer	3.8	3.9	3.8	3.2	5.0	4.4	3.4	3.8
Breast cancer	3.1	3.0	2.7	2.6	3.1	3.4	3.2	2.2
Prostate cancer	1.9	1.9	2.3	1.8	1.8	2.1	1.8	1.8
Pancreatic cancer	1.8	1.9	1.8	1.5	1.9	1.9	1.3	2.5
Unknown primary	1.6	1.4	1.4	1.3	2.9	1.7	1.0	1.8
Brain cancers	1.5	1.5	1.5	1.4	1.6	2.0	1.6	1.0
Melanoma of the skin	1.4	1.3	1.8	1.7	1.4	1.2	0.9	1.1
Liver cancer	1.3	1.3	1.0	1.1	1.4	0.8	1.3	3.1
Other cancers	1.3	1.2	1.3	1.1	1.5	1.1	1.1	1.6
Leukaemia	1.2	1.4	1.3	1.3	1.3	1.3	0.5	0.9
Non-Hodgkin lymphoma	1.0	1.1	0.9	0.9	1.4	1.0	1.0	1.3
Oesophageal cancer	1.0	0.9	0.9	0.9	1.1	1.6	1.0	1.3
Stomach cancer	1.0	1.0	0.9	0.9	0.9	1.0	0.8	1.3
Ovarian cancer	0.8	0.9	0.7	0.8	0.8	0.6	0.6	1.6
Mouth and pharyngeal cancer	0.8	0.6	0.8	0.8	0.7	0.9	0.2	1.9
Kidney cancer	0.7	0.7	0.8	0.7	0.8	0.7	0.5	0.2
Bladder cancer	0.6	0.7	0.7	0.6	0.7	0.5	0.4	0.6
Myeloma	0.6	0.7	0.6	0.5	0.5	0.7	0.4	0.0
Mesothelioma	0.4	0.4	0.5	0.7	0.3	0.4	0.8	0.3
Non-melanoma skin cancer	0.4	0.3	0.5	0.4	0.5	0.2	0.1	1.2
Uterine cancer	0.3	0.3	0.3	0.3	0.3	0.1	0.3	0.4
Other blood cancers	0.3	0.2	0.2	0.4	0.3	0.4	0.6	0.3
Cervical cancer	0.3	0.2	0.3	0.3	0.3	0.2	0.1	0.4
Other non-malignant neoplasms	0.3	0.3	0.3	0.3	0.3	0.4	0.2	0.6
Brain tumours	0.3	0.2	0.3	0.2	0.2	0.3	0.4	0.2
Gallbladder cancer	0.2	0.2	0.2	0.1	0.2	0.4	0.2	0.0
Laryngeal cancer	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0
Thyroid cancer	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Hodgkin lymphoma	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.2
Testicular cancer	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.1
Ductal carcinoma in situ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**34.8**	**33.7**	**34.6**	**31.9**	**37.9**	**37.4**	**28.7**	**42.0**

≤1 per 1,000	1 to <2 per 1,000	2 to <5 per 1,000	5 to <7.5 per 1,000	≥7.5 per 1,000

Cancer burden by remoteness

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

There is a range of important demographic, socioeconomic and environmental factors that differ by remoteness which will influence health status, such as:

- Each remoteness area has a different population age structure as well as different population sizes.
- People living in more remote areas are often disadvantaged with regard to educational and employment opportunities, income and access to goods and services. Health behaviours and risks may also differ by remoteness. There are also higher proportions of Aboriginal and Torres Strait Islander people in more remote areas (AIHW 2014).

The key aim of the analysis in this section is to describe the variation in cancer burden across remoteness areas. Results are presented as age-standardised rates, a method that removes the influence of differences in age structure but not those for other demographic, socioeconomic or environmental factors. As *Major cities* are generally considered to experience the best health status overall, age-standardised rates are compared with *Major cities* using rate ratios.

Variation of total burden by remoteness area

As would be expected due to population sizes, the greatest proportion of cancer burden was experienced in *Major cities* and the smallest proportion in *Very remote* areas. Adjustment for population size and age structure shows that there is little difference in the overall rate of cancer burden across the different areas, with the rate in areas outside *Major cities* only slightly higher than in *Major cities*, with rate ratios of 1.1 and 1.2 respectively (Table 4.5).

This variation is driven mostly by variations in fatal burden, with little variation in non-fatal burden, apart from slightly lower burden in *Very remote* areas.

Table 4.5: Cancer burden (YLL, YLD and DALY) counts, age-standardised rates, and rate ratios, by remoteness area, 2011

	Fatal burden			Non-fatal burden			Total burden		
Remoteness area	YLL ('000)	ASR	Rate ratio	YLD ('000)	ASR	Rate ratio	DALY ('000)	ASR	Rate ratio
Major cities	506	30.8	1.0	34	2.0	1.0	539	32.8	1.0
Inner regional	174	34.4	1.1	11	2.1	1.0	185	36.4	1.1
Outer regional	85	35.7	1.2	5	2.1	1.0	90	37.8	1.1
Remote	11	36.7	1.2	1	2.1	1.0	12	38.8	1.2
Very remote	6	35.3	1.1	0	1.9	0.9	6	37.2	1.1

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Rate ratios compare the remoteness area rate of burden with the rate of burden in *Major cities*.

Source: AIHW analysis of burden of disease database, 2011.

Variation of individual cancer burden by remoteness area

Table 4.6 provides a heat map of age-standardised rates for the different cancers, increasing from light blue (low, less than 1.0 DALY per 1,000) to purple (high, 7.5 DALY or more per 1,000 persons). While the overall rate of cancer burden shows little variation across the remoteness areas, with the exception of lower rates in *Major cities*, there is a much greater variation by cancer type:

- Lung cancer burden is much higher in *Remote* and *Very remote* areas (7.8 and 9.2 per 1,000, respectively), while the rate in *Major cities* (5.9 per 1,000) is lower than the national rate of 6.3. The rate of lung cancer burden increases with increasing remoteness, and reflects the pattern of smoking by remoteness areas (AIHW 2016d).
- Bowel cancer burden generally increases with increasing remoteness.
- Breast cancer burden is highest in *Major cities* and *Inner regional* areas, and decreases with increasing remoteness.
- Prostate cancer burden is lowest in *Major cities*, and highest in *Outer regional* areas.

Table 4.6: Leading causes of cancer burden (DALY ASR), by remoteness, 2011

Cancer type	Major cities	Inner regional	Outer regional	Remote	Very remote
Lung cancer	5.9	6.9	7.2	7.8	9.2
Bowel cancer	3.6	4.1	4.2	4.3	4.0
Breast cancer	3.0	3.1	2.6	2.2	1.9
Prostate cancer	1.8	2.2	2.5	2.2	2.3
Pancreatic cancer	1.8	1.8	2.1	2.7	1.7
Brain cancers	1.5	1.7	1.3	1.3	0.6
Unknown primary	1.3	1.5	2.0	2.3	1.9
Leukaemia	1.3	1.3	1.2	1.1	1.0
Melanoma of the skin	1.3	1.8	1.9	1.5	0.7
Liver cancer	1.3	1.0	1.2	1.2	1.2
Other cancers	1.2	1.5	1.5	1.0	1.4
Non-Hodgkin lymphoma	1.0	1.1	1.0	1.6	0.3
Stomach cancer	0.9	0.9	1.0	1.1	0.7
Oesophageal cancer	0.8	1.2	1.2	1.4	1.2
Ovarian cancer	0.8	0.7	0.7	1.0	0.6
Kidney cancer	0.7	0.7	0.8	1.0	0.7
Mouth and pharyngeal cancer	0.7	0.7	1.0	1.0	1.8
Myeloma	0.6	0.7	0.5	0.4	0.3
Bladder cancer	0.6	0.7	0.7	0.5	0.7
Mesothelioma	0.4	0.4	0.4	0.3	0.1
Non-melanoma skin cancer	0.3	0.4	0.5	0.6	0.7
Uterine cancer	0.3	0.3	0.3	0.4	0.4
Other blood cancers	0.3	0.3	0.3	0.2	0.3
Other non-malignant neoplasms	0.3	0.3	0.3	0.3	1.0

(continued)

Table 4.6 (continued): Leading causes of cancer burden (DALY ASR), by remoteness, 2011

Cancer type	Major cities	Inner regional	Outer regional	Remote	Very remote
Cervical cancer	0.3	0.3	0.4	0.4	0.9
Brain tumours	0.2	0.3	0.3	0.3	0.5
Gallbladder cancer	0.2	0.2	0.3	0.2	0.4
Laryngeal cancer	0.1	0.2	0.2	0.3	0.0
Thyroid cancer	0.1	0.1	0.1	0.1	0.2
Hodgkin lymphoma	0.1	0.1	0.1	0.0	0.2
Testicular cancer	0.0	0.1	0.1	0.0	0.2
Ductal carcinoma in situ	0.0	0.0	0.0	0.0	0.0
Total	**32.8**	**36.4**	**37.8**	**38.8**	**37.2**

Source: AIHW analysis of burden of disease database, 2011.

Cancer burden by socioeconomic position

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

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

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

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

Variation of total burden by socioeconomic group

Adjustment for the age structure of each quintile shows that the rate of cancer burden increased with decreasing socioeconomic position, with people in the lowest quintile experiencing 1.4 times the cancer burden of people in the highest quintile (Table 4.7). Most of this variation was driven by the pattern in fatal burden, with only the middle quintile having a slightly lower non-fatal burden.

Table 4.7: Cancer burden (YLL, YLD and DALY) counts, age-standardised rates and rate ratios, by socioeconomic group, 2011

	Fatal burden			Non-fatal burden			Total burden		
Socioeconomic group	YLL ('000)	ASR	Rate ratio	YLD ('000)	ASR	Rate ratio	DALY ('000)	ASR	Rate ratio
Q1 (lowest)	187	38.1	1.4	10	2.1	1.0	197	40.3	1.4
Q2	175	34.6	1.3	10	2.0	1.0	186	36.6	1.3
Q3	161	32.4	1.2	10	1.9	0.9	171	34.3	1.2
Q4	136	29.5	1.1	10	2.1	1.0	145	31.6	1.1
Q5 (highest)	125	26.3	1.0	10	2.1	1.0	135	28.4	1.0

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Rate ratios compare the socioeconomic quintile rate of burden with the rate of burden in the highest quintile.

Source: AIHW analysis of burden of disease database, 2011.

Variation of individual cancer burden by socioeconomic group

Table 4.8 provides a heat map of age-standardised rates for the different cancers across the 5 quintiles, increasing from light blue (low, less than 1.0 DALY per 1,000) to purple (high, 7.5 DALY or more per 1,000 persons). There are noticeable gradients across individual cancer types:

- Lung cancer burden decreases with increasing socioeconomic position, with the rate in the lowest quintile (8.2 per 1,000 persons) almost twice the rate in the highest quintile (4.2 per 1,000 persons). The pattern of lung cancer burden reflects the pattern of smoking by socioeconomic group (AIHW 2016g).
- Bowel cancer burden also decreases with increasing socioeconomic position, with those in the lowest quintile (4.7 per 1,000 persons) having 1.6 times the bowel cancer burden of those in the highest quintile.
- Prostate cancer burden also shows an obvious gradient, decreasing with increasing socioeconomic position, from 2.2 to 1.7 DALY per 1,000 persons.
- There is only minor variation in the breast cancer burden across the different quintiles; however, those in lower quintiles have a slightly higher burden than those in higher quintiles.

Table 4.8: Leading causes of cancer burden (DALY ASR per 1,000), by socioeconomic group, 2011

Cancer type	Q1 (lowest)	Q2	Q3	Q4	Q5 (highest)
Lung cancer	8.2	7.3	6.3	5.3	4.2
Bowel cancer	4.7	3.9	3.8	3.5	3.0
Breast cancer	3.0	3.0	2.9	2.8	2.9
Prostate cancer	2.2	2.1	1.9	1.9	1.7
Pancreatic cancer	2.0	1.9	1.9	1.7	1.6
Brain cancers	1.5	1.5	1.6	1.7	1.4
Melanoma of the skin	1.5	1.7	1.5	1.4	1.2
Leukaemia	1.4	1.4	1.3	1.2	1.2
Unknown primary	1.9	1.7	1.4	1.2	1.1
Other cancers	1.4	1.3	1.3	1.2	1.1
Non-Hodgkin lymphoma	1.2	1.0	1.1	1.0	1.0
Ovarian cancer	0.8	0.8	0.8	0.8	0.8
Liver cancer	1.6	1.4	1.2	1.1	0.8
Stomach cancer	1.0	1.0	0.9	0.9	0.8
Oesophageal cancer	1.2	1.1	1.0	0.8	0.7
Kidney cancer	0.8	0.7	0.8	0.7	0.6
Mouth and pharyngeal cancer	1.0	0.8	0.6	0.6	0.6
Myeloma	0.6	0.6	0.6	0.6	0.5
Bladder cancer	0.9	0.6	0.6	0.6	0.5
Mesothelioma	0.4	0.4	0.5	0.5	0.4
Uterine cancer	0.3	0.3	0.3	0.3	0.3
Other blood cancers	0.3	0.3	0.3	0.3	0.3
Non-melanoma skin cancer	0.4	0.4	0.4	0.3	0.3
Other non-malignant neoplasms	0.3	0.2	0.3	0.3	0.2
Brain tumours	0.3	0.3	0.2	0.2	0.2
Cervical cancer	0.5	0.3	0.2	0.2	0.2
Gallbladder cancer	0.2	0.2	0.2	0.1	0.2
Thyroid cancer	0.1	0.1	0.1	0.1	0.1
Hodgkin lymphoma	0.1	0.1	0.1	0.0	0.1
Laryngeal cancer	0.3	0.2	0.2	0.1	0.1
Testicular cancer	0.0	0.0	0.1	0.0	0.0
Ductal carcinoma in situ	0.0	0.0	0.0	0.0	0.0
Total	**40.3**	**36.6**	**34.3**	**31.6**	**28.4**

Source: AIHW analysis of burden of disease database, 2011.

≤1 per 1,000	1 to <2 per 1,000	2 to <5 per 1,000	5 to <7.5 per 1,000	≥7.5 per 1,000

5 Change in cancer burden since 2003

This chapter compares the cancer burden for 2003 and 2011. Comparisons of burden can only be made where the same methods have been used to produce the non-fatal, fatal and total burden, and the burden attributed to risk factors. The data from 2003 have been analysed using the methods for the ABDS 2011 to produce comparable estimates.

The estimates for 2003 contained here cannot be compared with those estimates for 2003 from the previous Australian study (AIHW: Begg et al. 2007) as they were developed using different methodologies.

As the 2003 estimates are point-in-time estimates, their comparison with the 2011 estimates does not constitute a time-series analysis. Several issues must be addressed before analysing and interpreting time trend data. A key issue is that 2 points in time can provide misleading information—these 2 points might mask variation that exists but is not measured in this analysis, and results must be interpreted with this in mind. In addition, interpretation of changes over time also needs to consider other aspects, such as the impact of confounders over time related to the estimates, and changes in metadata between reference periods. In particular:

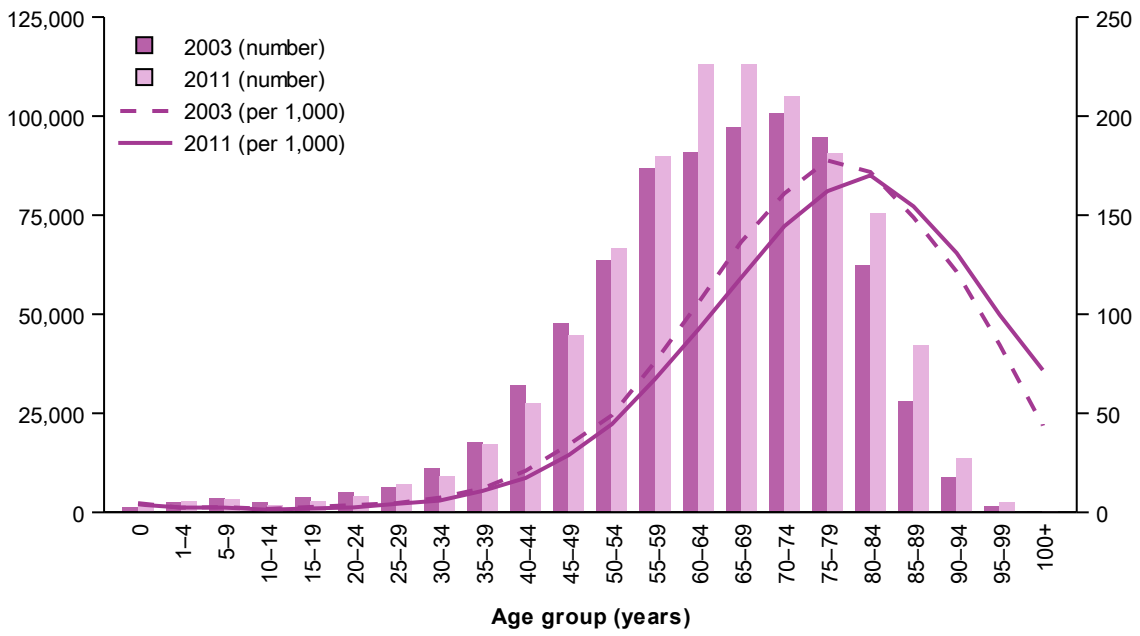
- YLD and YLL may change by differing proportions, thus make differing contributions to the change in DALY. To help interpret the change in disease burden, this section presents changes in DALY, YLD, YLL and attributable burden.
- Unless adjusted for, the impact of population changes (for example, ageing) may mask changes in underlying disease prevalence and/or severity. To account for differences in the population age structure and size, age-standardisation has been used to compare estimates for 2003 and 2011. To understand the various impacts of population increases, population ageing and disease burden, a decomposition of these changes is provided in Appendix B.
- 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.
- Definitional changes (such as coding rules) may impact comparisons. Where possible, adjustments were made for definitional changes between the 2 time points.

Change in total cancer burden

There was an 8.6% increase in total cancer-related DALY counts between 2003 and 2011, from 767,210 to 833,250 DALY. The increase in the DALY counts were mostly in the 60–69 and 80–94 age groups (Figure 5.1).

The crude rate of DALY decreased from 38.9 to 37.3 DALY per 1,000 persons. Age-specific DALY rates were similar in 2003 and 2011 for those aged 0–39; however, for ages 40–84, rates were lower in 2011 than in 2003. From age 85 onward, age-specific rates were higher in 2011. This can be interpreted as delaying the burden by 5 years.

After taking account of the impact of the increasing age of the population, there was a more pronounced decrease in overall burden, with age-standardised rates decreasing from 38.1 to 34.2 DALY per 1,000 persons (Table 5.1).



Source: AIHW burden of disease database, 2011.

Figure 5.1: Numbers and age-specific rates of cancer burden (DALY), by age, 2003 and 2011

The change in burden varied by cancer type (Table 5.1). From 2003 to 2011, the greatest increases in DALY were from lung cancer (16,773 DALY), liver cancer (10,423 DALY) and pancreatic cancer (8,995 DALY); however, the largest proportional increases in DALY were in ductal carcinoma in situ which doubled (98.3% increase), liver cancer (55.0%) and thyroid cancer (51.6%).

A small number of cancers decreased in DALY—non-Hodgkin lymphoma burden was 4,360 DALY lower in 2011 than 2003 (a reduction of 14.6%), bowel cancer burden reduced by 3,616 DALY (3.8%) and gallbladder cancer by 1,471 DALY (25.5%). There were also small reductions in overall burden of leukaemia and cervical, stomach and testicular cancers.

Once the different age structures of the population were taken into account, improvements in total burden were seen in most cancer types—the exceptions were liver cancer and thyroid cancer which in 2011 were 1.3 times the burden in 2003. As liver cancer causes considerable burden at over 29,000 DALY in 2011, this increase is a trend that may warrant closer examination.

Ductal carcinoma in situ also rose substantially (1.6 times the burden in 2003), which may be due to increased detection through mammographic screening; however, as the number of DALY is small, this does not have a great impact the overall cancer burden. Table B.8 and Figure B.1 show the impact of factors contributing to these changes.

Table 5.1: Change in cancer burden (DALY), between 2003 and 2011, by cancer type

Cancer type	2003 DALY	2011 DALY	Change in DALY	Change in DALY (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Lung cancer	138,117	154,890	16,773	12.1	6.8	6.3	–0.6	0.9
Bowel cancer	96,037	92,422	–3,616	–3.8	4.8	3.8	–1.0	0.8
Breast cancer	69,423	70,675	1,252	1.8	3.4	2.9	–0.5	0.9
Prostate cancer	43,204	49,232	6,028	14.0	2.1	2.0	–0.2	0.9
Pancreatic cancer	35,434	44,428	8,995	25.4	1.8	1.8	0.1	1.0
Brain cancers	33,822	35,662	1,839	5.4	1.7	1.5	–0.2	0.9
Unknown primary	32,631	35,585	2,954	9.1	1.6	1.4	–0.2	0.9
Melanoma of the skin	28,439	34,654	6,215	21.9	1.4	1.4	0.0	1.0
Leukaemia	31,222	30,629	–593	–1.9	1.6	1.3	–0.3	0.8
Other cancers	24,164	29,896	5,732	23.7	1.2	1.3	0.1	1.0
Liver cancer	18,953	29,376	10,423	55.0	0.9	1.2	0.3	1.3
Non-Hodgkin lymphoma	29,816	25,456	–4,360	–14.6	1.5	1.1	–0.4	0.7
Oesophageal cancer	22,029	23,773	1,744	7.9	1.1	1.0	–0.1	0.9
Stomach cancer	22,860	22,583	–276	–1.2	1.1	0.9	–0.2	0.8
Ovarian cancer	17,285	19,421	2,136	12.4	0.9	0.8	–0.1	0.9
Kidney cancer	16,681	17,774	1,092	6.5	0.8	0.7	–0.1	0.9
Mouth and pharyngeal cancer	17,229	17,617	387	2.2	0.9	0.7	–0.1	0.8
Bladder cancer	14,401	15,935	1,534	10.7	0.7	0.6	–0.1	0.9
Myeloma	13,287	14,964	1,677	12.6	0.7	0.6	–0.1	0.9
Mesothelioma	9,368	10,476	1,108	11.8	0.5	0.4	0.0	0.9
Non-melanoma skin cancer	7,669	9,369	1,699	22.2	0.4	0.4	0.0	1.0
Uterine cancer	6,199	7,622	1,423	23.0	0.3	0.3	0.0	1.0
Other blood cancers	6,626	7,346	721	10.9	0.3	0.3	0.0	0.9
Other non-malignant neoplasms	5,026	6,771	1,746	34.7	0.2	0.3	0.0	1.1
Cervical cancer	6,646	6,555	–91	–1.4	0.3	0.3	–0.1	0.8
Brain tumours	5,022	5,729	707	14.1	0.3	0.2	0.0	1.0
Gallbladder cancer	5,757	4,287	–1,471	–25.5	0.3	0.2	–0.1	0.6
Laryngeal cancer	4,898	4,070	–828	–16.9	0.2	0.2	–0.1	0.7
Thyroid cancer	1,738	2,634	896	51.6	0.1	0.1	0.0	1.3
Hodgkin lymphoma	1,958	1,999	41	2.1	0.1	0.1	0.0	0.9
Testicular cancer	1,058	1,006	–52	–5.0	0.1	0.0	0.0	0.9
Ductal carcinoma in situ	208	414	205	98.3	0.0	0.0	0.0	1.6
Total	**767,210**	**833,250**	**66,040**	**8.6**	**38.1**	**34.2**	**–3.9**	**0.9**

Notes

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

Source: AIHW analysis of Australian burden of disease database, 2011.

Drivers of the change in cancer burden

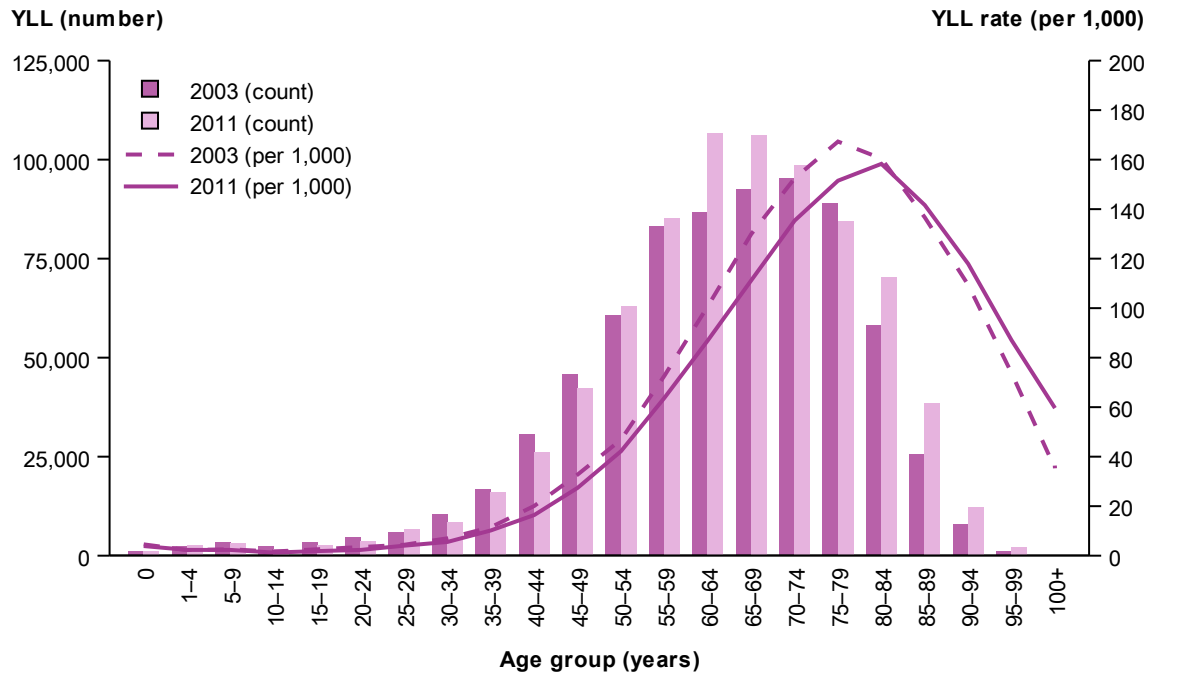
Changes in DALY reflect the changes in the component YLD and YLL; however, the high contribution of fatal burden to the overall cancer burden means that changes to this component will have a large impact on the overall burden.

The relative contributions of fatal burden and non-fatal burden (YLL:YLD) moved slightly from 95:5 in 2003 to 94:6 in 2011, suggesting that the overall cancer burden is gradually shifting towards more non-fatal burden. This may be due to decreasing fatal burden, increasing non-fatal burden, or to shifts in the same direction but at different rates, and differs between cancer types. These scenarios are explored in the following sections.

Changes in fatal burden

Changes in YLL are influenced by both the number of deaths and the ages at which those deaths occur. The number of cancer-related YLL increased by 7.5% between 2003 and 2011, increasing from 727,697 to 782,349 YLL, and is responsible for a large proportion of the increase in overall DALY.

Comparison of the age-specific numbers and rates of YLL (Figure 5.2) shows a similar pattern to the overall DALY. Generally, the higher number of YLL in 2011 in ages 60–84 can be attributed to the increase in the number of deaths in this age group due to increases in the population, as evidenced by the corresponding lower rates. The higher YLL in 2011 in those aged 85 and over is due to a greater number of cancer-related deaths in this age group (as evidenced by the higher corresponding rates), and suggests that the burden due to dying of cancer has been shifted towards the older ages.



Source: AIHW burden of disease database, 2011.

Figure 5.2: Numbers and age-specific rates of fatal cancer burden (YLL), by age, 2003 and 2011

Table 5.2 shows the changes in fatal burden for each cancer type. Like total burden, from 2003 to 2011, the greatest contributors to the increase in fatal burden were due to deaths from lung cancer (increase of 16,107 YLL), liver cancer (10,298) and pancreatic cancer (8,866 YLL), with large proportional increases also for thyroid cancer, melanoma of the skin, non-melanoma skin cancer and uterine cancer.

There were also several cancers that had declines in YLL—fatal burden from bowel cancer fell by more than 5.1% (4,610 YLL) and non-Hodgkin lymphoma by more than 16.1% (4,595 YLL). This was due to a decrease in the actual number of deaths from these cancers between these 2 time points.

After accounting for the increasing and ageing population between 2003 and 2011, all cancer types, except thyroid and liver decreased in fatal burden. The age-standardised rate of fatal liver cancer burden in 2011 was 1.3 times the rate in 2003 and thyroid cancer 1.2 times. The age-standardised rate of pancreatic cancer fatal burden was similar for both years. Table B.9 and Figure B.2 show the various factors contributing to these changes.

Table 5.2: Change in fatal cancer burden (YLL) between 2003 and 2011, by cancer type

Cancer type	2003 YLL	2011 YLL	Change in YLL	Change in YLL (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Lung cancer	135,098	151,205	16,107	11.9	6.7	6.1	–0.6	0.9
Bowel cancer	90,434	85,824	–4,610	–5.1	4.5	3.5	–1.0	0.8
Breast cancer	63,369	63,368	–1	0.0	3.1	2.6	–0.5	0.8
Pancreatic cancer	35,025	43,890	8,866	25.3	1.7	1.8	0.1	1.0
Prostate cancer	37,786	40,191	2,405	6.4	1.9	1.6	–0.3	0.9
Brain cancers	32,813	34,407	1,594	4.9	1.6	1.5	–0.2	0.9
Unknown primary	31,363	34,214	2,852	9.1	1.6	1.4	–0.2	0.9
Melanoma of the skin	26,032	31,647	5,615	21.6	1.3	1.3	0.0	1.0
Leukaemia	30,016	29,210	–806	–2.7	1.5	1.2	–0.3	0.8
Liver cancer	18,769	29,067	10,298	54.9	0.9	1.2	0.3	1.3
Other cancers	23,167	28,482	5,315	22.9	1.2	1.2	0.0	1.0
Non-Hodgkin lymphoma	28,504	23,909	–4,595	–16.1	1.4	1.0	–0.4	0.7
Oesophageal cancer	21,687	23,382	1,695	7.8	1.1	0.9	–0.1	0.9
Stomach cancer	22,316	22,002	–313	–1.4	1.1	0.9	–0.2	0.8
Ovarian cancer	16,738	18,789	2,051	12.3	0.8	0.8	–0.1	0.9
Kidney cancer	16,057	16,954	897	5.6	0.8	0.7	–0.1	0.9
Mouth and pharyngeal cancer	16,309	16,580	272	1.7	0.8	0.7	–0.1	0.8
Bladder cancer	13,604	15,061	1,457	10.7	0.7	0.6	–0.1	0.9
Myeloma	12,638	14,150	1,513	12.0	0.6	0.6	–0.1	0.9
Mesothelioma	9,150	10,232	1,083	11.8	0.5	0.4	0.0	0.9
Non-melanoma skin cancer	6,586	8,022	1,436	21.8	0.3	0.3	0.0	1.0
Other blood cancers	6,265	6,974	709	11.3	0.3	0.3	0.0	0.9
Uterine cancer	5,683	6,930	1,247	22.0	0.3	0.3	0.0	1.0
Cervical cancer	6,390	6,293	–97	–1.5	0.3	0.3	–0.1	0.8
Other non-malignant neoplasms	3,449	4,610	1,161	33.7	0.2	0.2	0.0	1.1
Brain tumours	4,078	4,305	227	5.6	0.2	0.2	0.0	0.9
Gallbladder cancer	5,653	4,167	–1,486	–26.3	0.3	0.2	–0.1	0.6
Laryngeal cancer	4,634	3,806	–828	–17.9	0.2	0.2	–0.1	0.7
Thyroid cancer	1,404	2,076	672	47.9	0.1	0.1	0.0	1.2
Hodgkin lymphoma	1,813	1,813	–0	0.0	0.1	0.1	0.0	0.8
Testicular cancer	872	789	–83	–9.5	0.0	0.0	0.0	0.8
Ductal carcinoma in situ	. .	. .	. .	. .	. .	. .	. .	. .
Total	**727,697**	**782,349**	**54,652**	**7.5**	**36.1**	**32.1**	**–4.0**	**0.9**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Change in YLL is 2011 YLL minus 2003 DALY, expressed as a percentage of 2003 YLL.
3. Change in ASR is 2011 ASR minus 2003 ASR; Rate ratios divide 2011 ASRs by corresponding 2003 ASRs.
4. Ductal carcinoma in situ is non-fatal; therefore, there are no YLL for this disease.

Source: AIHW analysis of Australian burden of disease database, 2011.

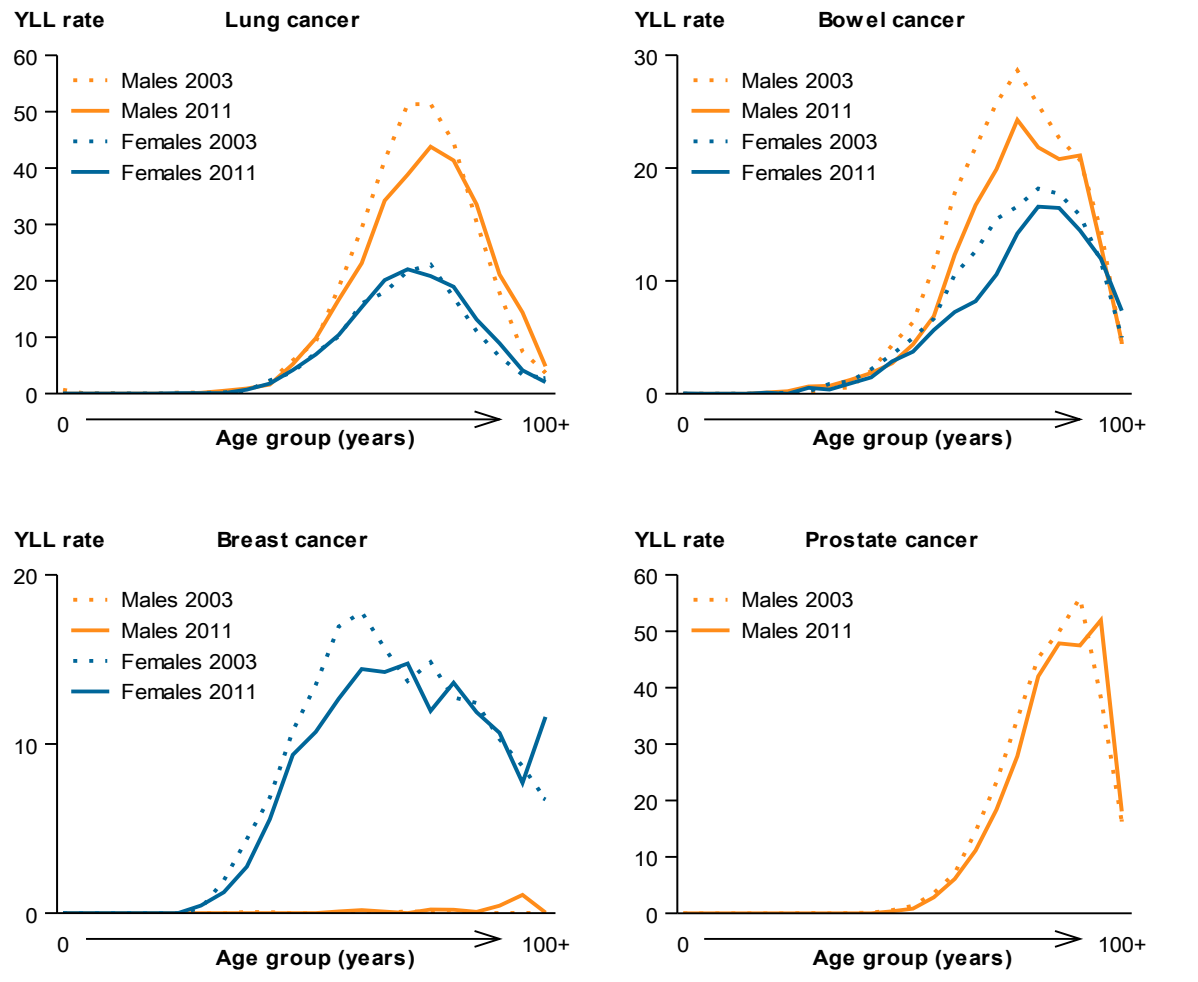
The reduction in ASRs of YLL for lung, bowel, breast and prostate cancers between 2003 and 2011 was primarily due to a shift towards dying at older ages (Figure 5.3).

The reduction in YLL rates of lung cancer was mostly from a reduction for males aged between 55 and 84. In particular, the peak rate at around ages 70–74 has dropped from 51 to 44 YLL per 1,000 persons. There was a less dramatic shift in the YLL rate for lung cancer in females, most apparent in those aged over 80 (Figure 5.3a).

The reduction in YLL rates of bowel cancer was apparent in both males and females, and largest for people aged 60–74, with 2011 rates similar to those in 2003 for people 5 to 10 years younger (Figure 5.3b). This age group is the most likely to have benefited from the introduction of organised screening for 55 and 65 year olds in 2006 and 2007.

The reduction in breast cancer YLL is most noticeable in females aged 40–69. In particular, the peak at ages 60–64 has dropped from 18 to 14 YLL per 1,000 persons. There was a smaller improvement in YLL rates for those aged 20–49 (Figure 5.3c).

In 2011, there was a slight improvement in prostate cancer fatal burden, with a minor shift towards older ages from age 60, with rates peaking at 47 for those aged 95–99 (Figure 5.3d).



Source: AIHW burden of disease database, 2011.

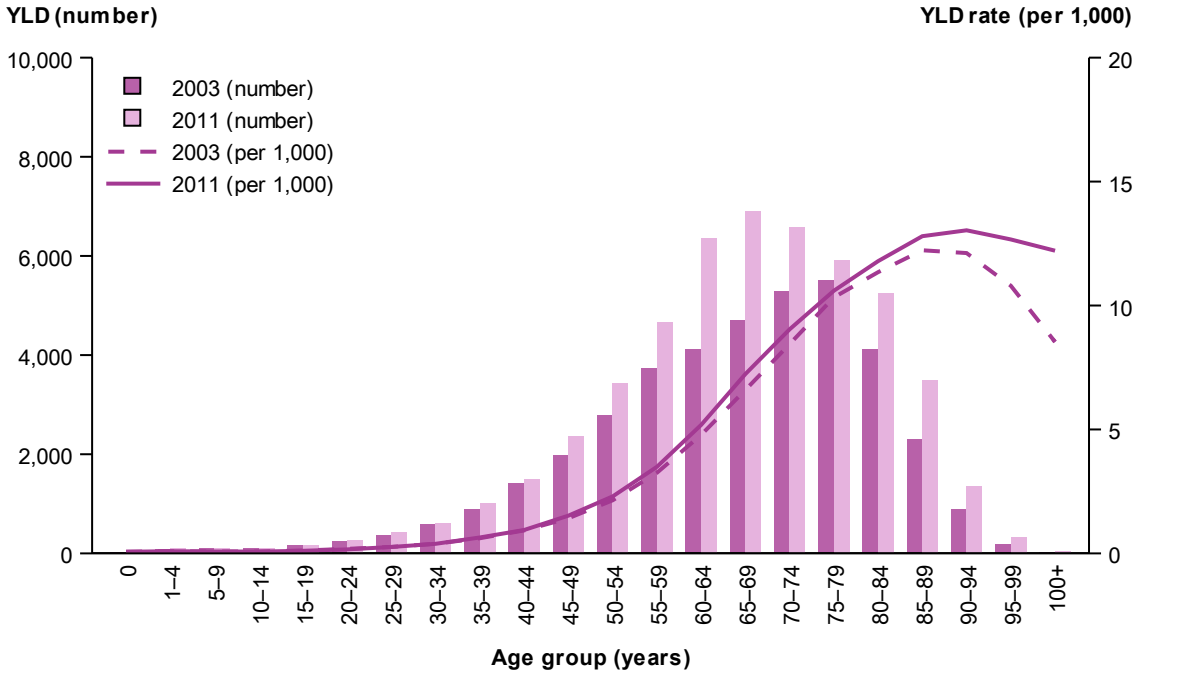
Figure 5.3: Age-specific fatal burden (YLL) rates, lung cancer, bowel cancer, breast cancer and prostate cancer, 2003 and 2011

Changes in non-fatal burden

Changes in YLD rates are influenced by changes in the prevalence and/or the severity of the disease. In the case of cancer, increases in prevalence may be due to increased incidence through increased disease or improved detection, or increased survival through earlier detection and/or improved treatment. Severity of disease may also be impacted as improved detection often diagnoses cancers at an earlier, less advanced stage. Consequently, determining the drivers behind a change in YLD for a specific cancer would be a complex undertaking.

Although the contribution of non-fatal cancer burden to the overall burden is small, the number of cancer-related YLD increased by 28.8% between 2003 and 2011 (from 39,512 to 50,901 YLD) and now makes up a slightly higher proportion of the cancer burden.

Comparison of the age-specific numbers and rates of YLD (Figure 5.4) shows an increase in YLD for all age groups. Age-specific rates of YLD have also increased for each age group, indicating that this increase is due to an increase in prevalence of the disease, rather than an increase in population.



Source: AIHW burden of disease database, 2011.

Figure 5.4: Numbers and age-specific rates of non-fatal cancer burden (YLD), by age, 2003 and 2011

Table 5.3 shows that the changes in non-fatal burden increased for each cancer type. The greatest contributors to the increase in non-fatal burden were prostate cancer (increase of 3,623 YLD), breast cancer (1,253 YLD) and bowel cancer (994 YLD). The large increase in prostate cancer non-fatal burden is most likely due to the increased detection from the prostate-specific antigen testing, which most recently peaked in 2009.

Large proportional increases were seen in most cancer types, but the largest increases were for ductal carcinoma in situ (98.3% increase), liver (67.5%) and thyroid (67.0%) cancers. The increase in non-fatal burden of ductal carcinoma in situ is most likely due to increased

detection through mammographic screening (AIHW 2016d). The increase in liver cancer is most likely due to the large increase in liver cancer incidence between these years.

After accounting for the increasing and ageing population between 2003 and 2011, the non-fatal burden decreased for a small number of cancer types; however, these changes were very small, with rate differences less than 0.1 per 1,000 persons.

Table B.10 and Figure B.3 show the impact of epidemiological and demographic factors contributing to these changes.

Table 5.3: Change in non-fatal cancer burden (YLD) between 2003 and 2011, by cancer type

Cancer type	2003 YLD	2011 YLD	Change in YLD	Change in YLD (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Prostate cancer	5,418	9,041	3,623	66.9	0.3	0.4	0.1	1.3
Breast cancer	6,054	7,307	1,253	20.7	0.3	0.3	<0.1	1.0
Bowel cancer	5,604	6,598	994	17.7	0.3	0.3	<0.1	1.0
Lung cancer	3,019	3,685	666	22.1	0.1	0.1	<0.1	1.0
Melanoma of the skin	2,407	3,007	599	24.9	0.1	0.1	<0.1	1.0
Other non-malignant neoplasms	1,577	2,162	585	37.1	0.1	0.1	<0.1	1.2
Non-Hodgkin lymphoma	1,312	1,547	235	17.9	0.1	0.1	<0.1	1.0
Brain tumours	944	1,424	480	50.9	0.0	0.1	<0.1	1.3
Leukaemia	1,206	1,420	214	17.7	0.1	0.1	<0.1	1.0
Other cancers	997	1,414	417	41.8	0.0	0.1	<0.1	1.2
Unknown primary	1,268	1,370	103	8.1	0.1	0.1	<0.1	0.9
Non-melanoma skin cancer	1,084	1,347	264	24.3	0.1	0.1	<0.1	1.0
Brain cancers	1,010	1,255	245	24.3	0.1	0.1	<0.1	1.1
Mouth and pharyngeal cancer	920	1,036	116	12.6	0.0	0.0	<0.1	0.9
Bladder cancer	797	874	77	9.6	0.0	0.0	<0.1	0.9
Kidney cancer	625	820	195	31.3	0.0	0.0	<0.1	1.1
Myeloma	649	814	164	25.3	0.0	0.0	<0.1	1.0
Uterine cancer	517	692	175	33.9	0.0	0.0	<0.1	1.1
Ovarian cancer	547	631	84	15.4	0.0	0.0	<0.1	0.9
Stomach cancer	544	581	37	6.8	0.0	0.0	<0.1	0.9
Thyroid cancer	334	559	224	67.0	0.0	0.0	<0.1	1.4
Pancreatic cancer	409	538	129	31.4	0.0	0.0	<0.1	1.1
Ductal carcinoma in situ	208	414	205	98.3	0.0	0.0	<0.1	1.6
Oesophageal cancer	342	391	50	14.5	0.0	0.0	<0.1	0.9
Other blood cancers	361	373	12	3.3	0.0	0.0	<0.1	0.8
Liver cancer	184	309	124	67.5	0.0	0.0	<0.1	1.4
Laryngeal cancer	264	265	0	0.0	0.0	0.0	<0.1	0.8
Cervical cancer	256	263	6	2.5	0.0	0.0	<0.1	0.9
Mesothelioma	218	244	25	11.6	0.0	0.0	<0.1	0.9
Testicular cancer	186	216	30	16.3	0.0	0.0	<0.1	1.0
Hodgkin lymphoma	145	186	41	28.6	0.0	0.0	<0.1	1.1
Gallbladder cancer	104	119	15	14.3	0.0	0.0	<0.1	0.9
Total	**39,512**	**50,901**	**11,388**	**28.8**	**2.0**	**2.1**	**0.1**	**1.1**

Notes

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

Source: AIHW analysis of Australian burden of disease database, 2011.

Changes in the non-fatal burden composition

As described in Chapter 3 (section on 'Burden of the different phases of the cancer journey'), the non-fatal burden is comprised of 4 main sequelae in addition to long-term sequelae for a select number of cancer types.

There are many different drivers behind the changes in the burden attributable to each phase, making them difficult to interpret. The following should be borne in mind when interpreting the analyses in this section:

- An increase in the burden of the diagnosis and primary therapy phase may be from a natural increase in incidence, or as a result of increased detection (for example, through organised screening programs as for bowel cancer or changes to detection thresholds as for prostate cancer).
- An increase in the burden of the controlled phase is due to an increase in people living with the disease. This may be due to an increase in diagnosis (including over-diagnosis), down-staging of the cancer at diagnosis and/or improvements in treatment leading to better survival outcomes.
- Changes to the metastatic and terminal phases reflect changes in the underlying mortality for each cancer type.

Despite the overall increase in YLD, most cancer types showed little variation (less than 2.5%) in the proportion each phase contributed to the total non-fatal burden between 2003 and 2011.

On average, the proportions of non-fatal burden from diagnosis and primary treatment, metastatic and terminal phases decreased (by 0.8%, 1.5% and 0.3%, respectively) while the proportion of non-fatal burden from the controlled phase increased on average by 1.9%.

The contributions of the individual phases are examined in Table 5.4 and Figure 5.5 for the 5 cancer types with the highest non-fatal burden.

Prostate cancer

Metastatic cancer contributed a much smaller proportion to the overall burden of prostate cancer in 2011 compared with 2003 (14.3% compared with 20.5%), while the impact of diagnosis and primary therapy and terminal phases was only slightly lower. Conversely, the burden of the controlled phase and long-term effects of impotence and incontinence was higher. This is brought about by the increase in the 5- and 10-year prevalence rates of prostate cancer between these 2 time points (AIHW analysis of Australian Cancer Database data).

Breast cancer

There was very little difference between 2003 and 2011 in the contribution of each sequela to the non-fatal burden of breast cancer. There was a slight decrease in the proportion of the burden due to metastatic disease and dying, with a corresponding increase in living with the long-term impact of mastectomy.

Bowel

Metastatic cancer contributed a noticeably smaller proportion to the overall burden of bowel cancer in 2011 compared with 2003 (13.9% compared with 16.1%), while the impact of the terminal phase and long-term effects was only slightly lower. Conversely, the burden of the controlled phase was slightly higher, brought about by the increase in the 5-year prevalence

rate of bowel cancer between these 2 time points (AIHW analysis of Australian Cancer Database data).

Lung cancer

There was very little difference between 2003 and 2011 in the contribution of each sequela to the non-fatal burden of lung cancer. There was a slight decrease in the proportion of the burden due to metastatic disease and dying, with a corresponding increase in living in the controlled phase of the disease.

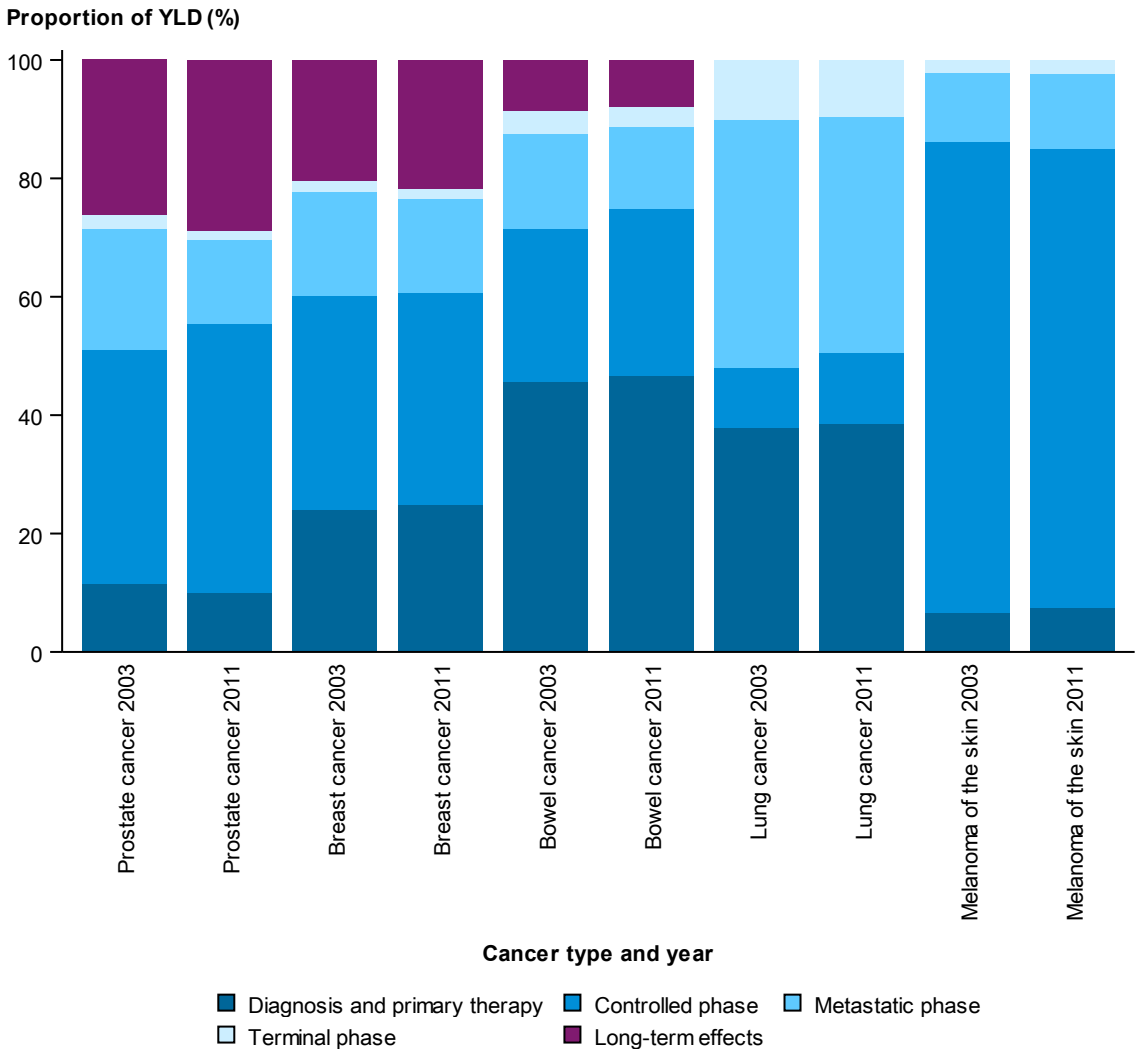
Melanoma of the skin

There was a slight increase between 2003 and 2011 in the proportions of non-fatal burden of melanoma due to diagnosis and primary therapy, metastatic and terminal disease, with a corresponding decrease in the proportion of burden due to controlled disease.

Table 5.4: Comparison of contribution of sequelae to the non-fatal cancer burden (YLD) for top 5 cancers, 2011 and 2003

	Proportion (%) of non-fatal burden contributed by each sequela									
	Diagnosis and primary therapy		Controlled phase		Metastatic phase		Terminal phase		Long-term effects	
Cancer type	2003	2011	2003	2011	2003	2011	2003	2011	2003	2011
Prostate cancer	11.5	10.0	39.5	45.4	20.5	14.3	2.2	1.6	26.2	28.8
Breast cancer	24.1	24.9	36.0	35.8	17.6	15.7	1.9	1.7	20.3	21.8
Bowel cancer	45.6	46.7	25.9	28.2	16.1	13.9	3.8	3.3	8.6	7.9
Lung cancer	37.8	38.5	10.2	11.9	41.9	40.0	10.0	9.6	. .	. .
Melanoma of the skin	6.6	7.4	79.6	77.6	11.7	12.7	2.1	2.3	. .	. .

Source: AIHW analysis of burden of disease database, 2011.



Source: AIHW burden of disease database, 2011.

Figure 5.5: Comparison of non-fatal cancer burden (YLD) for top 5 cancers, by cancer phase, 2011 and 2003

Changes in risk factors for cancer

Analyses of the effects of changes in risk factors are provided only for those risk factors that were included in both the 2003 and the 2011 estimates. The cancer-related risk factors that could not be measured for 2003 were air pollution, dietary risk factors (except fruit and vegetables) and sun exposure. As such, joint effects for 2003 have not been estimated as they are not comparable. Revised methods for high body mass were applied to both 2003 and 2011.

Changes in attributable burden

When interpreting changes in attributable burden, it is important to note these may be due to a variety of reasons:

- There may have been changes in exposure to the risk factors or changes in the age at which exposure occurs.
- There may have been changes to the overall burden of the various diseases attributed to each risk factor—either through a change in disease prevalence, or changes in efficacy of treatments reducing the severity of the disease. Furthermore, as the overall burden is a summary measure of fatal and non-fatal burden, the combined mortality and morbidity effects of risk factor changes on total burden may mask changes when viewed separately; or the period from 2003 to 2011 may be too short a time span to reflect the changes in overall burden.

Possible reasons behind each change are too complex to unpack within the scope of this report; further information on specific disease burden attributable to each risk factor is provided in *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016b).

There was an increase in cancer DALY attributable to all risk factors analysed in both 2003 and 2011 (Table 5.5). Due to the large impact of tobacco on cancer burden, it experienced the largest absolute increase in attributable DALY. This is further explored in the following section.

The largest proportional increase in attributable DALY was for drug use which doubled in males, resulting in an increase of 71.0% overall. Large increases in attributable cancer burden were also observed due to high body mass (19.2% increase).

Once differences between the 2011 and 2003 population size and structure are taken into consideration, the attributable cancer burden from most risk factors are unchanged. However, the cancer burden attributable to drug use increased by 50% (Table 5.6). The increase in drug-related cancer burden is due to a large increase (rate ratio 1.8) of this burden in males.

Table 5.5: Comparison of cancer-related attributable burden (DALY), 2003 and 2011, by risk factor and sex

	Males			Females			Persons		
Risk factor	2003	2011	% change	2003	2011	% change	2003	2011	% change
Tobacco	116,688	120,253	3.1	51,732	63,476	22.7	168,420	183,729	9.1
Body mass	23,400	28,504	21.8	27,188	31,807	17.0	50,587	60,311	19.2
Physical inactivity	14,387	16,057	11.6	33,989	37,069	9.1	48,376	53,126	9.8
Alcohol	13,544	16,077	18.7	11,420	11,168	–2.2	24,964	27,245	9.1
Fruit	13,611	14,756	8.4	5,837	6,517	11.7	19,449	21,273	9.4
Occupational	14,748	16,107	9.2	3,188	3,679	15.4	17,936	19,786	10.3
Drug use	6,143	12,257	99.5	2,905	3,211	10.5	9,048	15,468	71.0
Unsafe sex	1,085	1,794	65.4	7,210	7,313	1.4	8,294	9,107	9.8
Vegetables	3,057	3,499	14.4	1,067	1,032	–3.2	4,124	4,531	9.9

Sources: AIHW analysis of burden of disease database, 2011; AIHW 2017b.

Table 5.6: Comparison of cancer-related attributable burden (age-standardised DALY rates), 2003 and 2011, by risk factor and sex

	Males			Females			Persons		
Risk factor	2003	2011	Rate ratio	2003	2011	Rate ratio	2003	2011	Rate ratio
Tobacco	11.9	10.8	0.9	5.2	5.7	1.1	8.5	8.2	1.0
Body mass	2.4	2.6	1.1	2.7	2.8	1.0	2.6	2.7	1.1
Physical inactivity	1.5	1.4	1.0	3.4	3.3	1.0	2.5	2.4	1.0
Alcohol	1.4	1.4	1.0	1.1	1.0	0.9	1.3	1.2	1.0
Fruit	1.4	1.3	1.0	0.6	0.6	1.0	1.0	1.0	1.0
Occupational	1.5	1.4	1.0	0.3	0.3	1.0	0.9	0.9	1.0
Drug use	0.6	1.1	1.8	0.3	0.3	1.0	0.5	0.7	1.5
Unsafe sex	0.1	0.2	1.5	0.7	0.7	0.9	0.4	0.4	1.0
Vegetables	0.3	0.3	1.0	0.1	0.1	0.9	0.2	0.2	1.0

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Rate ratios compare the 2011 rate of burden with the 2003 rate of burden.

Sources: AIHW analysis of burden of disease database, 2011; AIHW 2017b.

Changes in the burden of tobacco

As for 2011, tobacco use was the principal cause of cancer burden in 2003. Despite falling rates of tobacco use over this period (AIHW 2016g), due to the long lag time between exposure and most cancer outcomes, cancer DALY attributable to tobacco use increased by 9.1% from 2003 to 2011 (Table 5.5).

The increase in attributable tobacco burden was mostly due to an increase in burden in females (22.7%) compared with a much smaller increase in male burden (3.1%), with most of this difference due to trends in lung cancer (Table 5.7). This is consistent with the improvements in lung cancer incidence and mortality in males that have yet to be reflected in females because of different smoking patterns over time (AIHW & CA 2011).

This trend is reflected in the age-standardised rates (Table 5.6) where tobacco-related cancer burden has fallen in males but increased slightly in females, indicating that this trend is not population driven.

Table 5.7: Comparison of cancer-related attributable tobacco burden (DALY), 2003 and 2011, by cancer type and sex

	Males			Females			Persons		
Cancer type	2003	2011	% change	2003	2011	% change	2003	2011	% change
Lung cancer	75,706	77,561	2.4	35,912	45,744	27.4	111,618	123,305	10.5
Oesophageal cancer	9,118	9,746	6.9	3,091	3,070	–0.7	12,210	12,816	5.0
Pancreatic cancer	5,353	5,937	10.9	3,302	4,399	33.2	8,655	10,336	19.4
Mouth and pharyngeal cancer	6,613	6,605	–0.1	1,524	1,519	–0.3	8,136	8,124	–0.2
Bowel cancer	4,255	3,466	–18.5	3,586	3,747	4.5	7,841	7,213	–8.0
Liver cancer	3,497	5,049	44.4	750	1,142	52.4	4,247	6,191	45.8
Bladder cancer	3,972	4,221	6.3	1,189	1,255	5.5	5,161	5,476	6.1
Leukaemia	2,922	2,830	–3.1	340	450	32.6	3,262	3,281	0.6
Stomach cancer	2,584	2,313	–10.5	929	920	–0.9	3,513	3,234	–7.9
Kidney cancer	2,668	2,524	–5.4	563	611	8.4	3,231	3,135	–3.0
Cervical cancer	. .	. .	. .	546	619	13.3	546	619	13.3
Total	**116,688**	**120,253**	**3.1**	**51,732**	**63,476**	**22.7**	**168,420**	**183,729**	**9.1**

Source: AIHW analysis of burden of disease database, 2011.

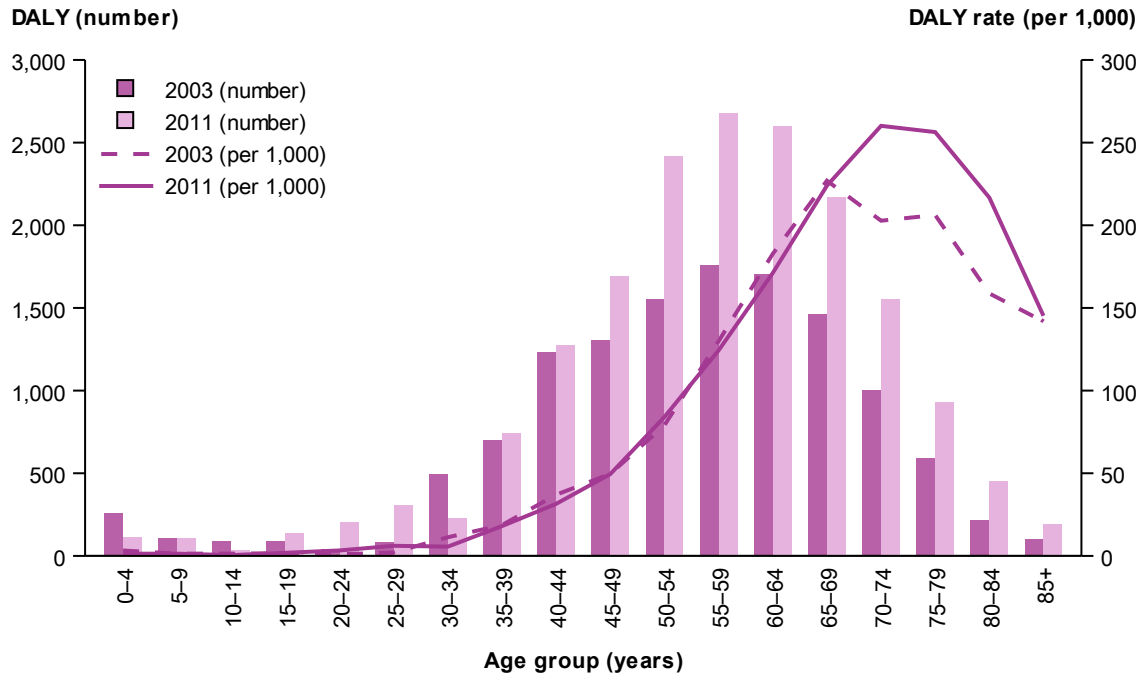
Change in cancer burden in Indigenous Australians

There was a large (39.4%) increase in total cancer-related DALY in Indigenous Australians between 2003 and 2011, from 12,801 to 17,847 DALY. The increase in the DALY counts was across most age groups, with larger increases in those aged 50 to 74 (Figure 5.6).

Unlike the national burden, there was no obvious improvement in crude rates of cancer burden for Indigenous Australians between 2003 and 2011 (which increased from 22.8 to 26.6 per 1,000 persons). There was little difference in age-specific rates between 2003 and 2011 until ages 65 and over where 2011 rates were higher; however, the smaller number of Indigenous Australians in these age groups means these rates should be interpreted with caution.

After removing the impact of the increasing age and size of the Indigenous population, this lack of improvement was confirmed, with age-standardised rates increasing from 53.9 to 57.0 DALY per 1,000 persons (Table 5.8). This was primarily driven by a change in the fatal burden, where age-standardised rates increased from 52.3 to 55.3 YLL per 1,000 persons (Table B.12). The non-fatal burden also increased slightly, from 1.6 to 1.7 YLD per 1,000 persons (Table B.13).

To understand the various impacts of population increases, population ageing and changes in underlying disease burden, a decomposition of these changes is provided by cancer type in Appendix B. Of the overall 39.4% increase in Indigenous DALY counts between 2003 and 2011, 19.4% was due to population growth, 19.1% due to population ageing, and only 0.9% was due to epidemiological changes (Appendix Table B.11, Appendix Figure B.4). Almost one-fifth (19.1%) of the increase in Indigenous DALY counts between 2003 and 2011 was due to the increasing and ageing Indigenous population (Table B.11 and Figure B.4).



Source: AIHW burden of disease database, 2011.

Figure 5.6: Numbers and age-specific DALY rates of cancer burden, by age, Indigenous Australians, 2003 and 2011

Changes in burden of individual cancer types

After taking into account changes in the population, the burden among Indigenous Australians in 2011 was similar to 2003 for most major cancer types (Table 5.8). However, the burden due to liver cancer doubled between 2003 to 2011, while prostate cancer was 1.4 times, and pancreatic cancer 1.3 times the 2003 rate.

There were improvements in the rate of burden of kidney cancer (0.7 times the 2003 rate), oesophageal cancer (0.8), and non-Hodgkin lymphoma, breast and laryngeal cancer (0.9 each) in Indigenous Australians.

The change in burden was driven by an increase in the fatal burden, primarily from liver cancer, where age-standardised rates of fatal burden doubled (2.0 times the 2003 rate), prostate and pancreatic cancers (1.4 and 1.3 times, respectively). Given the high fatal burden of lung cancer in Indigenous Australians, the increase in lung cancer (1.1 times) also contributed substantially to the overall increase in fatal burden (Table B.12).

Table 5.8: Change in cancer burden between 2003 and 2011, Indigenous Australians, by cancer type

Cancer type	2003 DALY	2011 DALY	Change in DALY	Change in DALY (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Lung cancer	2,967	4,258	1,291	43.5	13.4	14.7	1.3	1.1
Bowel cancer	1,021	1,353	333	32.6	4.3	4.5	0.2	1.1
Liver cancer	472	1,246	774	164.1	2.1	4.0	2.0	2.0
Breast cancer	969	1,173	204	21.1	3.8	3.5	–0.3	0.9
Mouth and pharyngeal cancer	735	1,126	391	53.2	2.9	3.2	0.3	1.1
Oesophageal cancer	660	850	190	28.7	2.8	2.4	-0.4	0.8
Unknown primary	693	816	123	17.8	3.2	2.9	-0.3	0.9
Pancreatic cancer	437	802	365	83.5	2.2	2.8	0.6	1.3
Other cancers	604	764	160	26.5	1.9	1.9	0.0	1.0
Leukaemia	500	624	124	24.8	1.8	1.7	–0.1	1.0
Cervical cancer	316	496	181	57.2	1.1	1.2	0.2	1.1
Stomach cancer	350	484	134	38.4	1.6	1.6	0.0	1.0
Brain cancers	396	464	69	17.3	0.9	0.9	0.0	1.0
Prostate cancer	232	445	213	92.0	1.5	2.0	0.6	1.4
Non-Hodgkin lymphoma	336	399	63	18.7	1.5	1.4	–0.1	0.9
Bladder cancer	201	322	121	60.2	1.0	1.1	0.1	1.1
Ovarian cancer	221	319	97	44.0	1.1	1.0	0.0	1.0
Kidney cancer	245	238	–6	–2.6	0.9	0.6	–0.3	0.7
Laryngeal cancer	200	238	38	18.9	0.9	0.8	–0.1	0.9
Other non-malignant neoplasms	196	206	10	5.2	0.6	0.7	0.1	1.2
Melanoma of the skin	114	168	55	48.1	0.5	0.6	0.1	1.2
Myeloma	150	162	12	8.2	0.7	0.6	–0.1	0.9
Brain tumours	84	154	70	83.3	0.3	0.3	0.1	1.2
Uterine cancer	186	139	–47	–25.0	0.9	0.5	–0.4	0.6
Non-melanoma skin cancer	63	133	70	110.8	0.3	0.4	0.2	1.7
Gallbladder cancer	117	111	–6	–5.1	0.7	0.4	–0.4	0.5
Total (all cancers)	**12,801**	**17,847**	**5,046**	**39.4**	**53.9**	**57.0**	**3.1**	**1.1**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Change in DALY is 2011 DALY minus 2003 DALY, expressed as a percentage of 2003 DALY.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASR by corresponding 2003 ASR.
5. Age-standardised rates and changes based on a small number of DALY should be interpreted with caution.
6. Estimates based on DALY less than 100 in 2011 are not included.

Source: AIHW analysis of burden of disease database, 2011.

6 Potential cancer burden in 2020

While the measures of burden in 2003 and 2011 provide insight into the impact of past incidence and mortality, estimates of the potential cancer burden in 2020 can help inform cancer policy planning into the near future.

Due to the availability of a long and consistent time series for cancer data in Australia, the AIHW has published projections of cancer incidence and mortality to 2020 and 2025 respectively (AIHW 2012b, 2016e). These projections are a mathematical extrapolation of past trends (to 2007 for incidence and 2013 for mortality) and assume that the most recent trend will continue into the near future. Although not forecasts (which may take into account changes such as increased detection methods, improvements to treatments and prevalence of risk factors), they do illustrate what the future might reasonably be expected to look like if past trends continue.

These projections form the basis of the future burden estimates. As projections consistent with every cancer type included in the ABDS 2011 are not available, this chapter presents the potential fatal and non-fatal burden for select cancer types, by age and sex. A complete description of methods is included in Appendix A.

Potential fatal burden in 2020

Based on projections of cancer mortality (AIHW 2016e), the number of YLL for most cancer types are expected to increase from 2011 (Table 6.1 and Figure 6.1), with a small number of exceptions.

Of those cancers with the most fatal burden in 2011:

- In 2020, lung cancer YLL are expected to decrease by around 2.9% in males, with an associated drop in age-standardised rates from 7.9 to 6.0 YLL per 1,000 persons (a rate ratio of 0.8). Unfortunately, this improvement is not reflected in female lung cancer burden which is expected to increase by around 26.7%; however, the increase in age-standardised rate is minimal (4.6 to 4.7 YLL per 1,000 persons; rate ratio 1.0) indicating that this increase is due to changes in the population structure. This result is consistent with the continuing decrease in the age-standardised rate of lung cancer deaths seen in males but not females.
- Bowel cancer YLL are expected to continue to decrease in males (by almost 1.8%) with an associated decrease in the age-standardised rate (from 4.3 to 3.3 YLL per 1,000 persons; rate ratio 0.8). However, YLL are expected to increase in females by 18.0%, though age-standardised rates of YLL are expected to remain stable, dropping from 2.8 to 2.7 YLL per 1,000 persons, suggesting this increase in YLL is also due to changes in the population structure. The expected decrease in males is driven by a continued decrease in the number of deaths in the 55–74 age group. This decrease is not reflected in the female projections; however, as the underlying mortality projections are based on data to 2012, expected mortality reductions from population-based bowel screening introduced incrementally from 2006 may not yet be reflected.
- Breast cancer YLL in females and prostate cancer YLL are expected to stay relatively constant, with only small increases of around 2% and 3%, respectively. However, age-standardised rates are expected to decrease, from 5.1 to 4.2 YLL per 1,000 females

for breast cancer (rate ratio of 0.8), and from 3.6 to 2.8 YLL per 1,000 males for prostate cancer (rate ratio of 0.8).

- YLL from liver cancer are expected to increase substantially in both males and females between 2011 and 2020, by 44.5% and 76.4%, respectively. Age-standardised rates are also expected to increase (from 1.8 to 2.1 per 1,000 males and from 0.6 to 0.8 per 1,000 females; rate ratios of 1.2 and 1.4, respectively), indicating that this increase is due to an increase in underlying disease, as well as changes in population.
- Expected increases in YLL from pancreatic cancer are due to changes in population with no change in the expected ASR from 2011 to 2020.
- Increases in YLL from melanoma of the skin and brain cancers are expected to be more modest, with minor decreases in age-standardised rates.

Table 6.1: Expected fatal burden (YLL) in 2020 and percentage change from 2011, by sex, for selected cancers

	Males				Females				Persons			
Cancer type	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011
Lung cancer	89,580	–2.9	6.0	0.8	74,656	26.7	4.7	1.0	164,236	8.6	5.3	0.9
Bowel cancer	48,555	–1.8	3.3	0.8	42,928	18.0	2.7	1.0	91,484	6.6	3.0	0.9
Breast cancer	459	34.3	<0.1	1.1	64,439	2.2	4.2	0.8	64,898	2.4	2.2	0.8
Pancreatic cancer	31,211	28.2	2.1	1.0	24,372	24.7	1.5	1.0	55,583	26.6	1.8	1.0
Liver cancer	31,100	44.5	2.1	1.2	13,307	76.4	0.8	1.4	44,407	52.8	1.5	1.2
Prostate cancer	41,548	3.4	2.8	0.8	. .	. .	. .	. .	41,548	3.4	1.3	0.8
Brain cancers[(a)]	23,027	11.0	1.6	0.9	14,850	8.7	1.0	0.9	37,877	10.1	1.3	0.9
Melanoma of the skin	25,710	18.3	1.8	0.9	11,873	19.7	0.8	1.0	37,583	18.8	1.3	1.0

(a) Estimate of 2020 YLL for brain cancers does not include projected mortality of cancers of the central nervous system; however, the contribution of central nervous system cancers to this grouping is small and not expected to influence this result.

Source: AIHW analysis of burden of disease database, 2011.

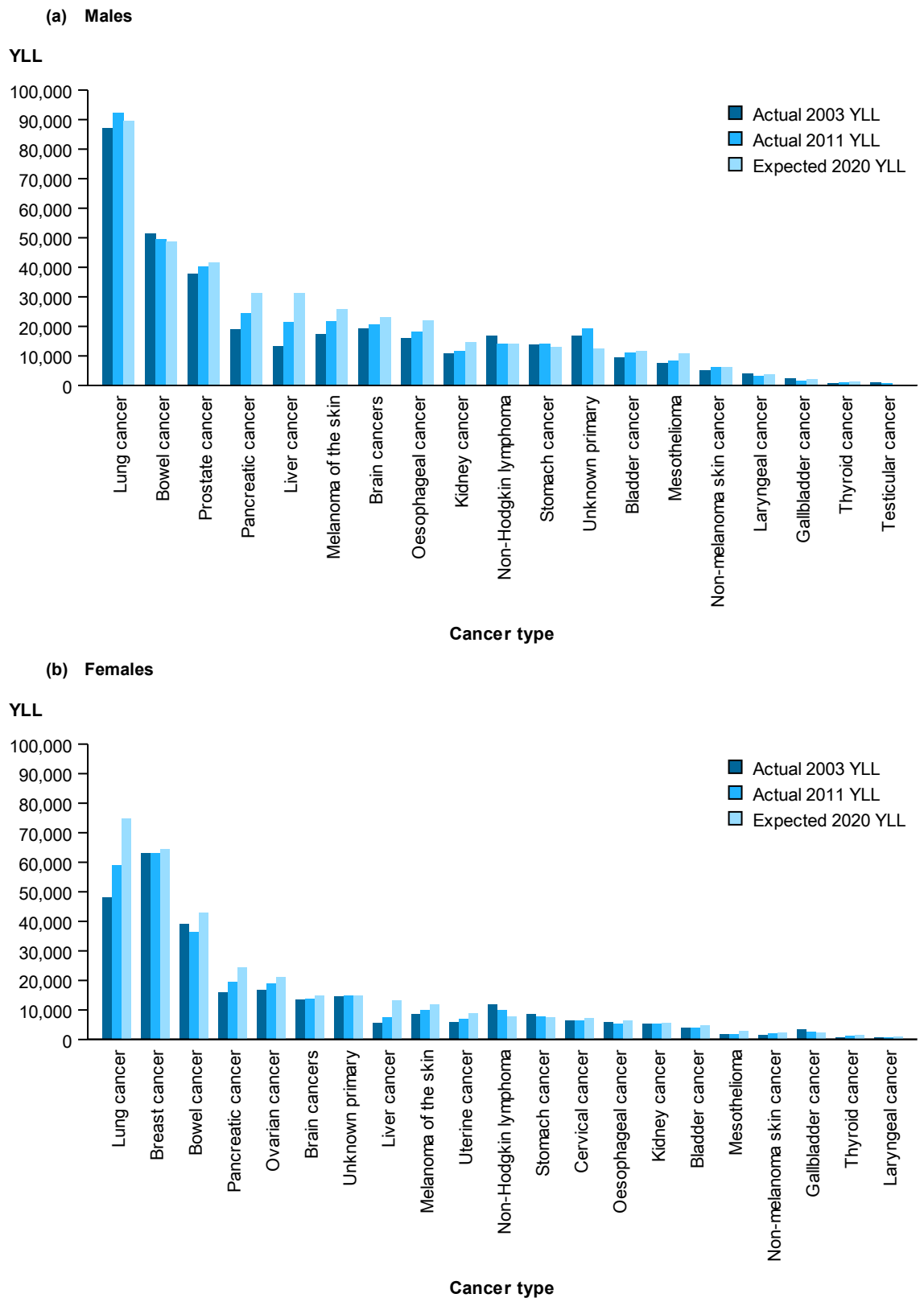


Figure 6.1: Expected fatal burden (YLL) in 2020: males (a) and females (b)

Potential non-fatal burden in 2020

Projections of non-fatal burden in 2020 are based on projections of both cancer incidence and mortality from the most recent trends (to 2007 for incidence and 2013 for mortality), and so attempt to encompass changes in both detection and treatment. However, the underlying projections do not attempt to estimate the impact of interventions (such as the introduction of plain packaging for cigarettes or an expanded bowel screening program) that may not be reflected in current incidence and mortality trends. Variations in trends after these years will impact the future non-fatal burden of each cancer type differently, depending on the contribution of the different phases of the cancer journey (see Chapter 3, section on 'Burden of the different phases of the cancer journey').

Based on these projections, the number of YLD for most cancer types are expected to increase from 2011 or remain constant, with little change in the expected rates of YLD after adjusting for differences in age structure and population increases (Table 6.2 and Figure 6.2).

Of those cancers with the most non-fatal burden in 2011:

- Prostate cancer YLD are expected to increase by 55.5% in 2020, with an associated increase in the age-standardised rate from 0.8 to 0.9 YLD per 1,000 males (rate ratio of 1.2).
- Breast cancer YLD are expected to increase by 22.6% in females; however, the age-standardised rate is expected to remain constant at 0.6 YLD per 1,000 females.
- Bowel cancer YLD are expected to increase in both males and females by 22.6% and 23.0%, respectively; however, the age-standardised rates are again expected to remain constant. However, there have been decreases in the ASRs for bowel cancer incidence in the most recent years (from 75.0 cases per 100,00 males in 2010 to 67.6 per 100,000 in 2013 and from 51.6 cases per 100,000 females in 2010 to 48.8 per 100,000 in 2013) (AIHW 2017a). These recent decreases were not reflected in the underlying incidence projections used for the 2020 estimates because the projections were based on actual incidence data to 2007. As diagnosis and treatment of newly diagnosed cancer contribute a large proportion (47%) to the total YLD for bowel cancer, these estimates should be interpreted with caution.
- Lung cancer YLD are also expected to increase in both males and females by 16.3% and 37.8%, respectively; however, the age-standardised rates are also expected to remain constant despite the large increase in female YLD.
- Although not high, the non-fatal burden of liver cancer is expected to increase in both males and females, with age-standardised rates increasing by 30% and 20%, respectively. This is consistent with the increasing rates of liver cancer incidence over time (AIHW 2017a).

Table 6.2: Expected non-fatal burden (YLD) in 2020 and percentage change from 2011, by sex, for selected cancers

	Males				Females				Persons			
Cancer type	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011	Expected YLL	% increase from 2011	Expected ASR	ASR ratio 2020:2011
Prostate cancer	14,058	55.5	0.9	1.2	. .	. .	. .	. .	. .	. .	. .	. .
Breast cancer[a]	n.a.	n.a.	n.a.	n.a.	8,881	22.6	0.6	1.0	n.a.	n.a.	n.a.	n.a.
Bowel cancer	4,462	22.6	0.3	0.9	3,637	23.0	0.2	1.0	8,100	22.8	0.3	1.0
Lung cancer	2,569	16.3	0.2	0.9	2,034	37.8	0.1	1.1	4,603	24.9	0.1	1.0
Melanoma of the skin	2,409	36.0	0.2	1.1	1,544	25.0	0.1	1.0	3,953	31.5	0.1	1.0
Brain cancers[b]	897	25.0	0.1	1.0	674	25.4	0.0	1.0	1,571	25.2	0.1	1.0
Pancreatic cancer	362	32.2	0.0	1.0	342	29.8	0.0	1.0	704	31.0	0.0	1.0
Liver cancer	350	59.2	0.0	1.3	138	55.4	0.0	1.2	488	58.1	0.0	1.3

(a) Projected estimates of breast cancer YLD in males were not possible due to small numbers.

(b) Estimate of 2020 YLD for brain cancers does not include projected incidence or mortality of cancers of the central nervous system; however, the contribution of central nervous system cancers to this grouping is small and not expected to influence this result.

Source: AIHW analysis of burden of disease database, 2011.

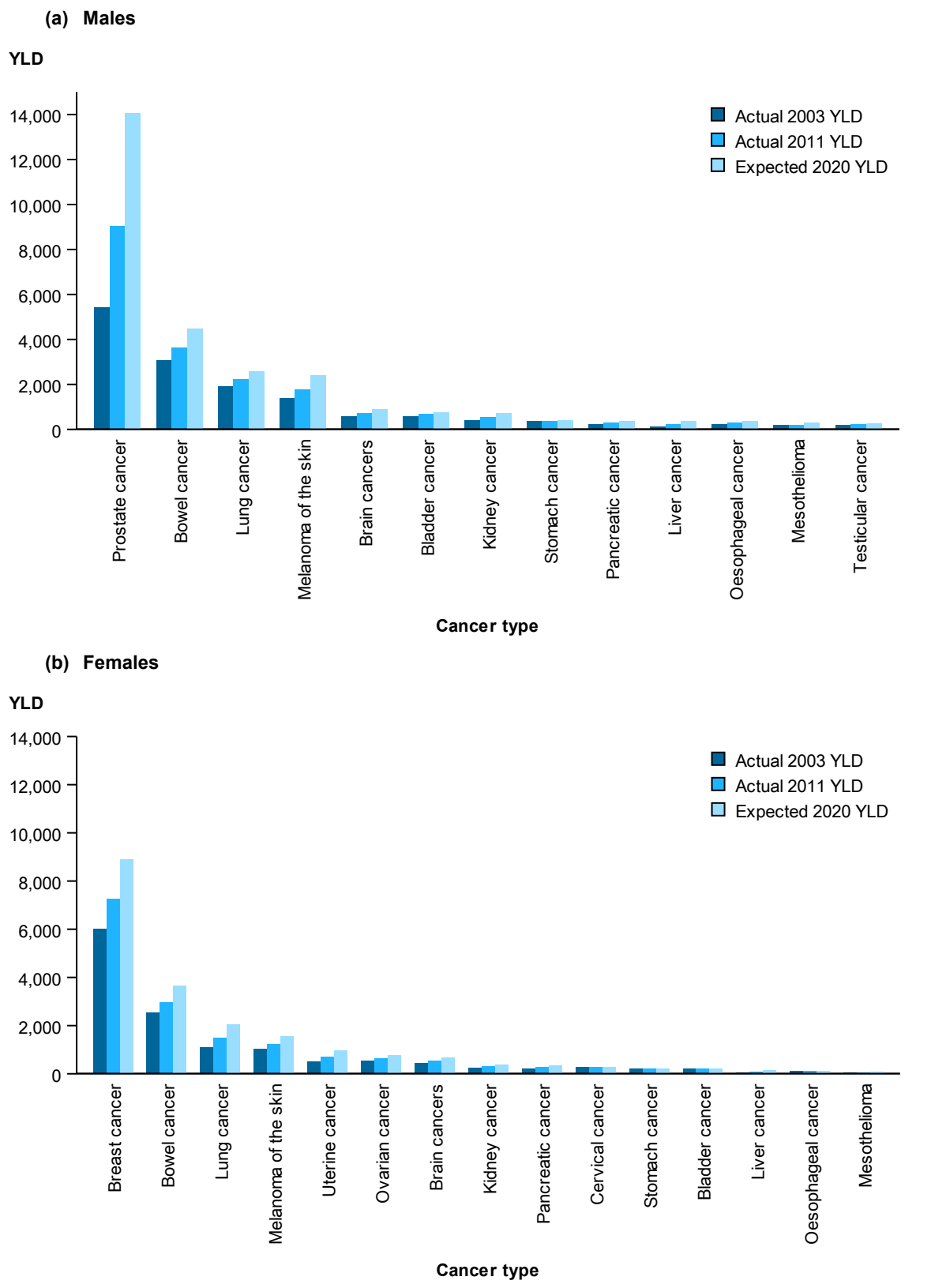


Figure 6.2: Expected non-fatal burden (YLD) in 2020: males (a) and females (b)

Appendix A: Methods

Table A.1: ICD-10 classification of cancer and other neoplasms used in the ABDS 2011

ABDS 2011 cause	ICD-10 codes
Malignant neoplasms	
Bladder cancer	C67
Bowel cancer	C18–C20
Brain and central nervous system cancer	C70–C72
Breast cancer	C50
Cervical cancer	C53
Gallbladder cancer	C23-C24
Hodgkin lymphoma	C81
Kidney cancer	C64
Laryngeal cancer	C32
Leukaemia	C91–C95
Liver cancer	C22
Lung cancer	C33–C34
Melanoma of the skin	C43
Mesothelioma	C45
Mouth and pharyngeal cancers	C00–C14
Myeloma	C90
Non-Hodgkin lymphoma	C82–C85
Non-melanoma skin cancer	C44
Oesophageal cancer	C15
Other lymphohaematopoietic (blood) cancers	C88, C96, D45, D46, D47.1 and D47.3
Other malignant neoplasms (cancers)	C17, C21, C26–31, C37–41, C46–49, C51–52, C57, C58–60, C63, C65–66, C68–69, C74–75.
Ovarian cancer	C56
Pancreatic cancer	C25
Prostate cancer	C61
Stomach cancer	C16
Testicular cancer	C62
Thyroid cancer	C73
Unknown primary	C26(a), C39, C76(a), C77–C79(a), C80(a), C97
Uterine (endometrium) cancer	C54–C55
Benign, in situ and uncertain neoplasms	
Brain tumours (benign and uncertain)	D32–D33, D42–D43
Breast in situ (to be confirmed)	D05
Other benign, in situ and uncertain neoplasms	D00–D04, D06–D31, D34–D48

(a) Some redistribution of mortality required—see 'Appendix A Measuring the fatal burden of cancer'.

Measuring the fatal burden of cancer

The fatal burden from cancer was sourced from deaths registered in the National Mortality Database up to and including 2013, based on the underlying cause of death according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) codes in Table A.1.

Redistribution

There are many ICD-10 codes that are not appropriate for burden of disease analysis for several reasons, including:

- causes that are implausible (such as hearing loss)
- causes that are intermediate (such as septicaemia)
- causes that are immediate (such as heart failure)
- causes that are unspecified (such as unspecified digestive cancer).

As all deaths must be counted, deaths coded to these codes must be reallocated to 1 of the conditions defined in the disease list. The Australian Burden of Disease Study (ABDS) 2011 used 3 methods to reallocate (or redistribute) these deaths, using evidence from alternative sources, or from within the mortality data using patterns of additional causes of death to determine likely causes of death. Chapter 3 of AIHW (2016c) provides more information on these redistribution methods.

Within the 43,663 deaths coded to cancer in 2011, there were 3,689 non-specific cancer deaths identified for redistribution to the specific cancers listed. In addition, a further 1,094 deaths were also attributed to cancer from implausible, intermediate and immediate deaths.

Redistribution of cancer deaths

Deaths coded to other and ill-defined digestive organs (C26) and other and ill-defined cancers, secondary malignant neoplasms and cancers of unknown primary site (C76–C80) were redistributed based on direct evidence from the Western Australian and South Australian cancer registries. The same direct evidence algorithms were also applied to 2003 cancer deaths.

Cancers of unknown primary site

As deaths in the National Mortality Database are coded using information available on the death certificate, deaths coded to unknown primary were assumed to be a mix of the clinical cancer of unknown primary site and deaths coded to unknown primary due to lack of sufficient information. To overcome the potential bias from this lack of distinction, deaths coded to unknown primary were partially redistributed using age–sex proportions derived from a pooled analysis of linked data from the Western Australian and South Australian cancer registries. This process typically assigned between 60.4%–74.9% of deaths to unknown primary, with the remaining deaths redistributed among 22 other cancer types (Table A.2).

Table A.2: Redistribution proportions of ill-defined cancers (C39, C76–C80, C97), by age and sex

	Males				Females			
ABDS 2011 disease	**0–44**	**45–64**	**65–84**	**85+**	**0–44**	**45–64**	**65–84**	**85+**
Unknown primary[(a)]	0.364	0.667	0.604	0.691	0.619	0.695	0.676	0.747
Other malignant neoplasms (cancers)	0.318	0.039	0.051	0.026	0.095	0.061	0.059	0.024
Lung cancer	0.000	0.121	0.094	0.037	0.000	0.053	0.080	0.028
Bowel cancer	0.091	0.014	0.033	0.042	0.048	0.015	0.047	0.059
Mouth and pharyngeal cancer	0.045	0.058	0.038	0.021	0.048	0.008	0.002	0.021
Bladder cancer	0.000	0.034	0.028	0.037	0.048	0.031	0.016	0.007
Pancreatic cancer	0.045	0.014	0.015	0.005	0.048	0.015	0.006	0.003
Non-melanoma skin cancer	0.000	0.029	0.049	0.058	0.000	0.000	0.008	0.035
Gallbladder cancer	0.000	0.000	0.005	0.010	0.048	0.015	0.016	0.007
Melanoma of the skin	0.000	0.005	0.015	0.021	0.048	0.000	0.004	0.014
Breast cancer	0.000	0.000	0.000	0.000	0.000	0.038	0.027	0.014
Kidney cancer	0.045	0.005	0.011	0.000	0.000	0.000	0.002	0.007
Brain and central nervous system cancer	0.045	0.000	0.000	0.005	0.000	0.008	0.002	0.000
Testicular cancer	0.045	0.005	0.003	0.000	0.000	0.000	0.000	0.000
Prostate cancer	0.000	0.005	0.016	0.026	0.000	0.000	0.000	0.000
Liver cancer	0.000	0.000	0.005	0.010	0.000	0.015	0.008	0.003
Ovarian cancer	0.000	0.000	0.000	0.000	0.000	0.015	0.023	0.007
Stomach cancer	0.000	0.000	0.013	0.005	0.000	0.008	0.004	0.010
Oesophageal cancer	0.000	0.005	0.008	0.005	0.000	0.000	0.006	0.000
Leukaemia	0.000	0.000	0.003	0.000	0.000	0.015	0.002	0.000
Uterine cancer	0.000	0.000	0.000	0.000	0.000	0.008	0.002	0.007
Non-Hodgkin lymphoma	0.000	0.000	0.003	0.000	0.000	0.000	0.006	0.003
Laryngeal cancer	0.000	0.000	0.005	0.000	0.000	0.000	0.002	0.003

(a) Assumes that deaths coded to C80 by cancer registries are valid clinical classifications of unknown primary, rather than classified due to insufficient information.

Sources: Pooled Western Australia Cancer Registry data, 2007–2011; South Australia Cancer Registry data, 2007–2011.

Non-specific digestive cancers

Similarly, deaths coded to non-specific digestive cancers were redistributed to specific digestive cancers using age–sex proportions derived from Western Australian and South Australian cancer registries. Typically, 75%–87% of these deaths were reassigned to bowel cancer, with the remaining deaths redistributed to 11 other cancers (Table A.3).

Table A.3: Redistribution proportions of other and ill-defined digestive organs (C26), by age and sex

	Males				Females			
Disease	**0–44**	**45–64**	**65–84**	**85+**	**0–44**	**45–64**	**65–84**	**85+**
Bowel cancer	0.750	0.868	0.860	0.800	1.000	0.862	0.838	0.774
Stomach cancer	0.125	0.017	0.051	0.038	0.000	0.011	0.022	0.019
Pancreatic cancer	0.000	0.000	0.017	0.013	0.000	0.023	0.013	0.026
Liver cancer	0.000	0.017	0.003	0.000	0.000	0.000	0.004	0.000
Bladder cancer	0.000	0.000	0.003	0.013	0.000	0.000	0.000	0.000
Lung cancer	0.000	0.000	0.010	0.000	0.000	0.000	0.013	0.019
Oesophageal cancer	0.000	0.008	0.007	0.000	0.000	0.000	0.009	0.000
Breast cancer	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.013
Ovarian cancer	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.006
Prostate cancer	0.000	0.000	0.007	0.013	0.000	0.000	0.000	0.000
Unknown primary[(a)]	0.125	0.050	0.024	0.100	0.000	0.057	0.035	0.077
Other malignant neoplasms (cancers)	0.000	0.041	0.017	0.025	0.000	0.046	0.048	0.065

(a) Unknown primary (C80) will require further redistribution.

Sources: Pooled Western Australia Cancer Registry data, 2007–2011; South Australia Cancer Registry data, 2007–2011.

Although also a candidate for redistribution, there were insufficient deaths due to other and ill-defined respiratory organs (C39) in the Western Australian and South Australian cancer registries to develop a redistribution algorithm. Deaths coded to C39 were instead assigned to 'unknown primary'.

Similarly, cancers of multiple independent primary sites (C97) could not be redistributed using this method, as a single cancer cannot be assigned by cancer registries. Consequently, deaths coded to C97 were also assigned directly to 'unknown primary'.

Applying the reference life table

Years of life lost (YLL) for each cancer type were then estimated by applying the weightings shown in Table A.4. The ABDS 2011 uses the standard reference life table used in Global Burden of Disease Study (GBD) 2010 and 2013 (Murray et al. 2012) when calculating YLL for the Australian, subnational and Indigenous populations.

Table A.4: YLL, by age at death used in the ABDS 2011

Age at death	YLL	Age at death	YLL	Age at death	YLL	Age at death	YLL
0	86.02	27	59.43	54	33.32	81	10.32
1	85.21	28	58.44	55	32.38	82	9.65
2	84.22	29	57.45	56	31.47	83	8.98
3	83.23	30	56.46	57	30.55	84	8.31
4	82.24	31	55.48	58	29.64	85	7.64
5	81.25	32	54.49	59	28.73	86	7.12
6	80.25	33	53.50	60	27.81	87	6.61
7	79.26	34	52.52	61	26.91	88	6.09
8	78.26	35	51.53	62	26.00	89	5.57
9	77.27	36	50.56	63	25.10	90	5.05
10	76.27	37	49.58	64	24.20	91	4.70
11	75.28	38	48.60	65	23.29	92	4.35
12	74.28	39	47.62	66	22.42	93	4.00
13	73.29	40	46.64	67	21.55	94	3.66
14	72.29	41	45.67	68	20.68	95	3.31
15	71.29	42	44.71	69	19.80	96	3.09
16	70.30	43	43.74	70	18.93	97	2.88
17	69.32	44	42.77	71	18.10	98	2.66
18	68.33	45	41.80	72	17.28	99	2.44
19	67.34	46	40.85	73	16.45	100	2.23
20	66.35	47	39.90	74	15.62	101	2.11
21	65.36	48	38.95	75	14.80	102	1.99
22	64.37	49	38.00	76	14.04	103	1.87
23	63.38	50	37.05	77	13.27	104	1.75
24	62.39	51	36.12	78	12.51	105	1.63
25	61.40	52	35.19	79	11.75		
26	60.41	53	34.25	80	10.99		

Source: Murray et al. 2012.

Measuring Indigenous fatal burden

Due to the much smaller number of Indigenous deaths each year, Indigenous fatal burden is based on the annual average of 3 years of deaths data. For the 2003 reference year, deaths were averaged from deaths occurring in 2002, 2003 and 2004. For the 2011 reference year, deaths were averaged from 2010, 2011 and 2012. This overcomes random fluctuations and instability caused by small numbers, but may mask any real increases or decreases in mortality.

Indigenous deaths are also known to be under-identified in the National Mortality Database (ABS 2013c; AIHW 2012a). This leads to an underestimation of the number of Indigenous deaths (and hence burden) due to cancer. The degree of under-identification can vary by age, by state/territory, by remoteness area and over time. To overcome this bias, the number of deaths recorded is adjusted using adjustment factors derived by the Australian Bureau of Statistics (ABS) and the Australian Institute of Health and Welfare (AIHW) using linked data (AIHW 2016c). While these adjustment factors are specific to the state/territory and/or remoteness area, they are not specific to cancer deaths, and are applied to all deaths regardless of the underlying cause of death.

As there were insufficient data available to form Indigenous-specific redistribution algorithms, the national redistribution algorithms were also applied to Indigenous deaths.

Measuring the non-fatal burden of cancer

Non-fatal cancer burden measures the health loss due to the 4 main phases of the cancer journey: diagnosis and primary treatment; controlled phase; metastatic phase: and terminal phase prior to death. It also measures long-term health loss experienced by people who have undergone permanent surgery as a curative treatment for breast, laryngeal, bowel or bladder cancers as well as other long-term effects for prostate and brain cancers that are caused by the cancer itself.

Tables A.5 and A.6 list the various health states and disability weights used to derive the non-fatal burden.

Table A.5: General cancer-related sequelae and health states

Sequelae	Health state	Disability weight[a]
Diagnosis and primary therapy phase of <*cancer type*>	Cancer: diagnosis and primary therapy	0.288
	Generic uncomplicated disease: anxiety about diagnosis[b]	0.012
Controlled phase of <*cancer type*>[c]	Generic uncomplicated disease: worry and daily medication	0.049
Metastatic phase of <*cancer type*>[d]	Cancer: metastatic	0.451
Terminal phase of <*cancer type*>[e]	Terminal phase: with medication	0.540

(a) Sourced from GBD 2013.

(b) For uncomplicated non-melanoma skin cancer only.

(c) Non-melanoma skin cancer and cancer of unknown primary site models did not include controlled phase health state.

(d) Benign and uncertain brain tumours and breast ductal carcinoma in situ models did not include metastatic phase.

(e) Breast ductal carcinoma in situ models did not include terminal phase.

Table A.6: Long-term cancer sequelae and health states

Disease	Sequelae	Disability weight[(a)]
Laryngeal cancer	Laryngectomy due to laryngeal cancer	0.051
Bowel cancer	Stoma due to bowel cancer	0.095
Breast cancer	Mastectomy due to breast cancer	0.036
Prostate cancer	Impotence due to prostate cancer	0.017
	Urinary incontinence due to prostate cancer	0.139
Bladder cancer	Stoma due to bladder cancer	0.095
	Urinary incontinence due to bladder cancer	0.139
Brain and central nervous system cancer	Mild brain injury due to brain and central nervous system cancer	0.094
	Moderate brain injury due to brain and central nervous system cancer	0.231
	Severe brain injury due to brain and central nervous system cancer	0.637
Benign brain tumours	Mild brain injury due to benign brain tumours	0.094
	Moderate brain injury due to benign brain tumours	0.231
	Severe brain injury due to benign brain tumours	0.637
Ductal carcinoma in situ	Mastectomy due to ductal carcinoma in situ	0.036

(a) Sourced from GBD 2013.

Prevalence estimation

The non-fatal cancer burden was based on the point prevalence of each sequela as at 30 June 2011 (or 2003 as appropriate) using the model in Figure A.1. Point prevalence was primarily derived directly from incidence and prevalence data held in the 2011 version of the Australian Cancer Database (ACD) and deaths registered in the National Mortality Database. Information on long-term effects was derived from the National Hospital Morbidity Database supplemented by epidemiological studies.

As incidence and prevalence data were only available up to 2009 for New South Wales and the Australian Capital Territory, subnational estimates for 2011 were based on the 2009 age-specific rates applied to the 2011 population for these 2 jurisdictions.

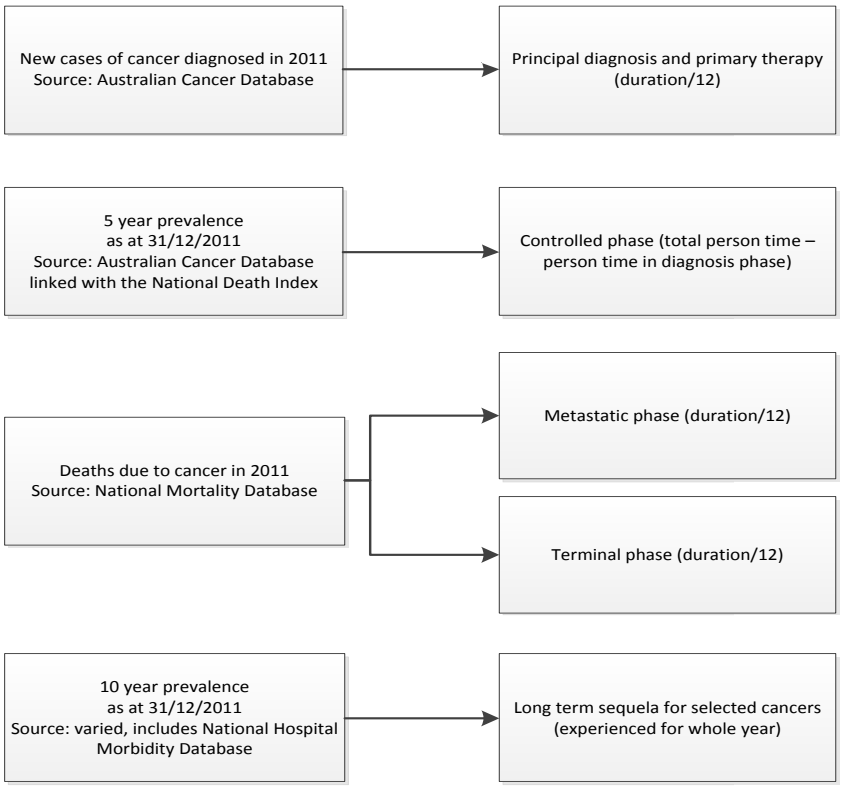


Figure A.1: General model for estimating prevalence of cancer sequelae in 2011

General sequelae

Average durations for each general sequela for the various cancers were primarily taken from the GBD 2010, though a small number were developed specifically for the ABDS 2011 based on expert advice (Table A.7). Durations were applied to the relevant epidemiological measure for each sequela to derive point prevalence.

Table A.7: Average sequelae duration for cancer and other neoplasms

	Sequelae duration (months)			
Cancer type	Diagnosis and primary therapy	Controlled phase	Metastatic phase	Terminal phase
Mouth and pharyngeal cancers[1]	3.0	Remainder of year	9.2	1.0
Laryngeal cancer[1]	3.0	Remainder of year	9.8	1.0
Oesophageal cancer[1]	2.0	Remainder of year	4.2	1.0
Stomach cancer[1]	6.0	Remainder of year	2.7	1.0
Bowel cancer[1]	9.0	Remainder of year	5.0	1.0
Liver cancer[1]	2.0	Remainder of year	1.8	1.0
Gallbladder cancer[1]	2.0	Remainder of year	2.5	1.0
Pancreatic cancer[1]	1.0	Remainder of year	3.1	1.0
Lung cancer[1]	6.0	Remainder of year	5.0	1.0
Mesothelioma[a]	6.0	Remainder of year	5.0	1.0
Melanoma (≤1.00 mm)[3]	0.5	Remainder of year	6.7	1.0
Melanoma (1.01–2.00mm)[3]	0.9	Remainder of year	6.7	1.0
Melanoma (2.01–4.00mm)[3]	1.2	Remainder of year	6.7	1.0
Melanoma (>4.00mm)[3]	1.7	Remainder of year	6.7	1.0
Non-melanoma skin cancer[b]	0.5	0	6.7	1.0
Breast cancer (males)[2]	6.0	Remainder of year	10.8	1.0
Breast cancer (females)[2] (<20 mm)	3.4	Remainder of year	10.8	1.0
Breast cancer (females) (20–50 mm)[2]	6.8	Remainder of year	10.8	1.0
Breast cancer (females) (>50 mm)[2]	8.0	Remainder of year	10.8	1.0
Breast cancer (females) (unknown size)[2]	6.0	Remainder of year	10.8	1.0
Cervical cancer[1]	3.0	Remainder of year	8.2	1.0
Uterine cancer[1]	3.0	Remainder of year	9.0	1.0
Ovarian cancer[1]	3.0	Remainder of year	10.3	1.0
Prostate cancer[1]	2.0	Remainder of year	12.1	1.0
Testicular cancer[1]	3.0	Remainder of year	9.2	1.0
Bladder cancer[1]	1.5	Remainder of year	5.6	1.0
Kidney cancer[1]	2.0	Remainder of year	6.0	1.0
Brain and central nervous system cancer[1]	3.0	Remainder of year	19.0	1.0
Thyroid cancer[1]	2.0	Remainder of year	6.4	1.0
Non-Hodgkin lymphoma[1]	4.0	Remainder of year	7.6	1.0
Hodgkin lymphoma[1]	4.0	Remainder of year	7.5	1.0
Leukaemia[1]	8.0	Remainder of year	7.1	1.0
Myeloma[1]	9.0	Remainder of year	10.6	1.0
Other lymphohaematopoietic (blood) cancers[c]	9.0	Remainder of year	10.6	1.0
Unknown primary cancer[d]	6.0	Remainder of year	0	1.0
Other malignant neoplasms[1]	2.0	Remainder of year	7.5	1.0

(continued)

Table A.7 (continued): Average sequela duration for cancer and other neoplasms

Cancer type	Sequelae duration (months)			
	Diagnosis and primary therapy	Controlled phase	Metastatic phase	Terminal phase
Brain tumours (benign and uncertain)[(e)]	3.0	Remainder of year	. .	1.0
Breast ductal carcinoma in situ[(f)]	3.4	Remainder of year	. .	. .

(a) All phases assumed to be the same as lung cancer.

(b) All phases assumed to be the same as melanoma.

(c) All phases assumed to be the same as myeloma.

(d) Diagnosis and primary therapy phase assumed to be the same as lung cancer. Duration of metastatic phase assumed to be the remainder of the year.

(e) Diagnosis and primary therapy phase and terminal phase assumed to be the same as brain cancer.

(f) Diagnosis and primary therapy phase assumed to be the same as small (<20 mm) breast cancer.

Sources

(1) GBD course notes 2013, Breast cancer case study: Naghavi.

(2) Expert opinion from Dr Catherine Shannon, Senior Medical Oncologist, Mater Cancer Care Centre, and Professor Christobel Saunders, School of Surgery, University of Western Australia.

(3) Melanoma Management Guide for GPs and Melanoma Institute Australia.

Principal diagnosis and primary therapy

Health loss due to diagnosis and treatment of cancer (except non-melanoma skin cancer and ductal carcinoma in situ) was based on incidence data from the 2011 ACD. This assumes that people will undergo primary treatment at the time of diagnosis.

The diagnosis and primary therapy health state for NMSC was divided into 2 severity levels, depending on whether the cancer was treated in community settings (uncomplicated NMSC) or hospital settings (complex NMSC).

Uncomplicated NMSC diagnoses and treatments were sourced from Medicare Benefits Schedule claims for first surgical excision of keratinocyte cancers, and adjusted for histological confirmation. Histological confirmation is based on information from the QSkin Study by QIMR Berghofer Medical Research Institute (Thompson et al. 2014).

Complex NMSC diagnoses and treatments were sourced from separations in the National Hospital Morbidity Database (NHMD) with a principal diagnosis of NMSC in 2011 that underwent a skin-related surgery.

As benign and uncertain tumours of the brain and central nervous system are only reported to cancer registries in Western Australia, Queensland and Victoria, the number of incident cases undergoing diagnosis and primary therapy was not directly obtainable. Instead, the age-specific ratio of benign or uncertain brain tumours in the ACD to separations in the NHMD for Western Australia, Queensland and Victoria was applied to separations from other jurisdictions, to derive national and subnational estimates.

Incident cases for other non-malignant neoplasms were sourced from the NHMD (acknowledging that this will be the more severe end of the spectrum) using principal diagnosis, adjusted for repeat admissions.

Controlled phase

Health loss due to the controlled phase of cancer was based on those people who were alive at the end of 2011 with a diagnosis of cancer in the previous 5 years—this assumes an effective cure rate of 5 years for all cancers.

Health loss is assumed for the full year for each prevalent case, minus the total person-time spent in diagnosis and primary therapy. As prevalent cases must have been alive on 31 December 2011, there is no overlap with people who died in 2011. Prevalence data for 2011 were also sourced from the 2011 ACD, which includes a linkage to the National Death Index to estimate prevalence.

Metastatic and terminal phases

Health loss due to metastatic cancer and terminal cancer in 2011 was based on people who died from cancer in 2011 (regardless of when they were diagnosed). This assumes that the number of people with metastatic and terminal phases who die of something *other* than cancer is small. To ensure that person-time does not exceed 12 months for each death, the duration of health loss in a given year for metastases was capped at 11 months.

Deaths from cancer were sourced directly from the National Mortality Database. To ensure consistency with the fatal component of the study, deaths due to unknown primary and unknown digestive cancers were redistributed before prevalence was estimated.

Long-term sequelae

Long-term sequelae are generally assumed to be lifelong conditions, and ideally would attribute health loss to all cases. However, as the number of people alive in 2011 who had long-term sequelae from cancer was not directly available, health loss due to long-term sequelae was generally based on:

- proportions of cases that had undergone long-term surgery applied to 10-year prevalence (that is, people alive at the end of 2011 diagnosed with cancer in the previous 10 years). This is similar to a 10-year look-back period, and assumes that curative surgery occurs close to diagnosis. A longer look-back period was not considered appropriate due to changes in treatments over time
- proportion of cases known to experience health loss applied to lifetime prevalence (defined for this study as people alive at the end of 2011 diagnosed with cancer any time since 1982, the start of the ACD).

Health loss for long-term sequelae is assumed to apply for the full year.

Laryngectomy due to laryngeal cancer

Prevalence was based on the ratio of the number of partial or total laryngectomies with a principal diagnosis of laryngeal cancer (derived from the NHMD) to new cases of laryngeal cancer in 2011 (derived from the ACD). This was applied to the 10-year prevalence of laryngeal cancer derived from the ACD.

Stoma due to bowel cancer

Prevalence was based on the ratio of hospitalisations for permanent colostomies due to bowel cancer (derived from the NHMD) to new cases of bowel cancer in 2011 (derived from the ACD) applied to 10-year prevalence of bowel cancer.

As individuals cannot be ascertained in the NHMD, it was not possible to determine which stomas were temporary or permanent. Instead, permanent stomas were estimated by applying the overall colostomy closure rate for any disease (derived from the NHMD by dividing the total number of stomas closed by the number of stomas opened in a 12-month period) to the incidence of bowel cancer-related stoma.

The likelihood of permanent stomas in bowel cancer patients increased with increasing remoteness, with patients in *Remote* and *Very remote* areas 70% more likely to have a permanent stoma than patients in major cities. National stoma incidence-hazard rates were adjusted using rate ratios to account for this difference.

Although the number of cases of bowel cancer was higher in the lower socioeconomic groups, the likelihood of permanent stomas decreased with increasing socioeconomic status, with patients in the lowest socioeconomic group 70% more likely to have a permanent stoma than patients in the highest socioeconomic group. National stoma incidence hazard rates were adjusted using rate ratios (based on Quintile 3) to account for this difference.

Mastectomy due to breast cancer or ductal carcinoma in situ

Prevalence of mastectomies due to breast cancer was based on the ratio of the number of mastectomies with a principal diagnosis of breast cancer (derived from the NHMD) to new cases of breast cancer (ACD). Due to the high number of mastectomies and breast cancer cases, age-specific ratios were able to be applied to the 10-year prevalence of breast cancer for females; an overall ratio was applied for males.

The mastectomy incidence-hazard ratio for females increased by increasing remoteness. Rate ratios were applied to the age-specific rates for females to derive mastectomies by remoteness. There were insufficient data to determine a difference by remoteness for males, so the national ratio was used.

There was no difference in the mastectomy incidence-hazard ratio for females between socioeconomic groups. In this case, the ratio was assumed to be the national ratio. There were insufficient data to determine a difference by socioeconomic group for males, so the national ratio was used.

Impotence and urinary incontinence due to prostate cancer

Prevalence was based on the proportions of men diagnosed with localised prostate cancer experiencing impotence and/or urinary incontinence at 3-year follow-up, according to treatment type (Smith et al. 2009) adjusted for background proportion of urinary incontinence and impotence. These were applied to the 10-year prevalence of prostate cancer derived from the ACD.

As radical treatment is not generally offered to men over the age of 70, the proportion of men likely to have undergone different treatments in the previous 10 years was only applied to men aged under 80 in 2011 (to allow for 10 years since treatment). It was also assumed there was no health loss from impotence in males aged under 15. To ensure consistency across the ABDS 2011, urinary incontinence was assumed not to apply to children aged under 5.

As Smith et al. (2009) do not provide breakdowns of treatments and outcomes by remoteness or socioeconomic group, these were assumed to be constant and applied to the prevalence of prostate cancer by remoteness and socioeconomic quintile.

Stoma and urinary incontinence due to bladder cancer

In the ABDS 2011, urinary incontinence due to bladder cancer refers to the long-term effects of primary therapy for bladder cancer—that is, removal of the bladder (radical cystectomy). It does not refer to urinary incontinence experienced as a symptom of bladder cancer, which is assumed to be short term until treatment is sought.

Radical cystectomy usually results in a stoma or a neobladder being fitted in the patient, and long-term effects depend on the diversion type. Hospitalisations for radical cystectomy were used to estimate incidence-hazard ratios for stomas and neobladders following bladder cancer. This was applied to the 10-year prevalence of bladder cancer from the ACD to obtain point prevalence estimates of stoma for each diversion type.

The likelihood of permanent stomas in bladder cancer patients increased with increasing remoteness, with patients in *Outer regional*, *Remote* and *Very remote* areas combined 40% more likely to have a permanent stoma than patients in *Major cities*. National stoma incidence-hazard rates were adjusted using rate ratios to account for this difference.

There was no difference in the stoma incidence hazard between the lowest and highest socioeconomic groups, so national stoma incidence-hazard rates were assumed to apply.

Proportions of patients with incontinence by diversion type were obtained from Gilbert et al. (2007). These proportions were applied to the estimated point prevalence estimates of stoma for each diversion type to derive the point prevalence of incontinence.

Brain injury due to malignant and benign brain tumours

Due to the scarcity of data sources on the long-term impacts of cancer and other tumours of the brain, the ABDS 2011 assumed the proportion of all brain cancer survivors with long-term sequelae was the same as the proportion of brain injury survivors with long-term sequelae (that is, 8% mild, 10% moderate, 5% severe), derived by the New Zealand Burden of Disease Study (NZMOH 2012).

For brain cancers, these proportions were applied to the lifetime prevalence of brain cancers derived from the ACD. As prevalence of survivors of benign and uncertain brain tumours was not directly available, rate ratios of age-specific prevalence rates for malignant and non-malignant tumours from a United States study (Porter et al. 2010) were applied to the lifetime prevalence of malignant tumours from the ACD to derive lifetime non-malignant prevalence.

As proportion of brain injury survivors is not currently available by remoteness or socioeconomic group, it was assumed to be constant across all subpopulations.

The same rates were also assumed for 2003 estimates; however, as the ACD only contains data from 1982, the lifetime prevalence for 2003 has a much shorter look-back period, and will therefore be lower than for 2011.

Mastectomy due to ductal carcinoma in situ

As 10-year prevalence for ductal carcinoma in situ was not available in the ACD to support using the same method as for breast cancer, data from the NHMD were used directly to derive prevalence of mastectomies due to ductal carcinoma in situ. Hospital separations for mastectomies with a principal diagnosis of ductal carcinoma in situ from 2001 to 2011 were extracted from the NHMD. To derive prevalence from separations, a 10-year prevalence-to-separations ratio was derived from Western Australian linked hospitalisations and deaths

data, and applied to the number of national separations. This assumes that the survival of women undergoing mastectomy for ductal carcinoma in situ in Western Australia is consistent across Australia.

Measuring Indigenous non-fatal burden

The 2011 cancer incidence and prevalence for the Indigenous population were derived from the average cancer incidence recorded in the 2011 ACD for 2009–2011 for the Northern Territory, Western Australia, Victoria and Queensland, and for 2007–2009 for New South Wales—these are the jurisdictions with cancer incidence data considered of sufficient quality for reporting. Rates from these states combined were then applied to the populations of the Australian Capital Territory, Tasmania and South Australia to determine national Indigenous incidence.

The 2003 cancer incidence and prevalence for the Indigenous population were derived from the average cancer incidence recorded in the ACD for 2002–2004 for the Northern Territory, Western Australia, New South Wales and Queensland. Rates from these states combined were applied to the Australian Capital Territory, Victoria, Tasmania and South Australia populations to determine national Indigenous incidence.

Mortality for 2011 was derived from the average number of deaths in 2002–2004 and 2010–2012, adjusted for under-identification using ABS mortality adjustment factors as per fatal estimates.

Except for breast cancer in females, there were insufficient data or information to derive Indigenous-specific incidence-hazard ratios for long-term sequelae. For Indigenous breast cancer cases, the overall mastectomy incidence-hazard ratio for females was 0.573 for 2011 and 0.373 for 2003; though there were insufficient data to produce age-specific ratios.

Measuring the differences in cancer burden between populations and time points

Due to differences in burden of disease methodologies, comparisons of burden between populations or time points can only be done within a single burden of disease study.

Estimates of the burden in the Aboriginal and Torres Strait Island population, estimates by state and territory, remoteness and socioeconomic group, and estimates for 2003, were produced as part of the ABDS 2011 to enable direct comparison using age-standardised rates.

Estimates for Aboriginal and Torres Strait Islanders

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. However, it was not always possible to adopt completely consistent methods due to differences in data availability, data quality and population size and characteristics.

Estimates for the Indigenous population were adjusted for under-identification where the level of under-identification could be determined. In addition, due to small numbers, several years of data and/or age groups were combined as necessary to ensure validity of the results.

Estimates for subnational populations

Subnational estimates were produced by:

- state and territory for all 8 Australian jurisdictions
- remoteness categories—based on the 2011 Australian Statistical Geographic Standard, which is divided into 5 remoteness areas: *Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote*
- socioeconomic groups—presented as quintiles of lowest to highest socioeconomic position, based on the relative socioeconomic characteristics of the area of residence defined by the Socio-Economic Indexes for Areas (SEIFA).

Estimates for 2003

Comparable 2003 YLL, years lived with disability (YLD), disability-adjusted life years (DALY) and attributable burden estimates were produced for each disease for both the Australian and Indigenous populations. Subnational estimates for 2003 were not within the scope of the ABDS 2011.

Where possible, the same (or comparable) primary data source was used for 2003 as for the 2011 estimates. If this was unavailable, secondary data sources were used to derive age- or sex-specific rate ratios that could be applied to national data. If these approaches were not possible, the 2011 age/sex prevalence rates for 2011 were applied to the population structure for 2003. This assumed no difference in disease prevalence rates between 2003 and 2011.

Estimating the potential cancer burden in 2020

The potential non-fatal and fatal burden in 2020 was estimated separately using the base methods where possible, and combined to estimate the total burden. They rely heavily on projected incidence and mortality estimates for 2020 published by the AIHW (2012b, 2016e). These estimates are age- and sex-specific extrapolations of the most recent trend (to 2007 for incidence, and 2013 for mortality) for each cancer type applied to projected populations (ABS 2013d).

It is important to recognise that the projected incidence and mortality estimates used in this analysis are not forecasts, and do not attempt to take into account changes which may affect cancer incidence and/or mortality beyond those years used in establishing the trend, such as:

- changes in cancer-detection methods, such as the introduction of new screening programs or new technologies
- changes in cancer risk factors, such as the introduction of vaccination programs or increasing obesity or smoking rates
- changes and improvements to treatment, such as targeted therapies and emerging technologies that may increase survival
- changes in government policy, economic factors, catastrophes, wars or epidemics that may impact the overall population.

The nature of the projection method used and inherent fluctuations in both cancer incidence and mortality trends, changes in risk factors and population dynamics mean that care should be taken when using and interpreting the projections of burden presented in this report.

Estimating fatal burden in 2020

The fatal burden in 2020 was estimated directly by applying the reference life table projected cancer mortality estimates by age and sex (AIHW 2016e), adjusted for redistribution from other causes of death using proportions from 2011.

Estimating non-fatal burden in 2020

The non-fatal burden in 2020 was estimated using a combination of direct and indirect methods. Point prevalence estimates for those sequelae that are derived from incidence and mortality (that is, diagnosis and primary therapy, metastatic and terminal phases) were directly derived from projected estimates of incidence (AIHW 2012b) and mortality (AIHW 2016e). Note that due to a highly variable incidence rate of prostate cancer, the published projected incidence was not considered valid. Instead, a new (unpublished) set of data exploiting a relationship with Medicare Benefits Schedule data to 2015 and then projected to 2020 using a conservative linear approach was derived by the AIHW for use in this project.

Point prevalence for the remaining sequelae were derived by extrapolating the average annual change between 2003 and 2011. This assumes that the changes between these 2 time points are linear, and will continue until 2020.

While the underlying disability weights used in the ABDS 2011 were the same for both 2003 and 2011, the process of adjusting for comorbidity produced a different set of weights (by age and sex) for each reference year. As a full set of comorbidity-adjusted weights requires a full set of prevalence data for all 188 diseases in the ABDS 2011, this could not be derived for 2020. Instead, adjusted weights for 2020 for the cancer sequelae were derived by extrapolating the average annual change between the weights for 2003 and 2011, and applied to the projected point prevalence of each sequela to obtain projected YLD.

As projected incidence and mortality are not available for every cancer type listed in the ABDS 2011, burden cannot be estimated for every ABDS cancer, and hence cannot be estimated for all cancers combined using this method. We also cannot use these methods to estimate the burden of non-malignant neoplasms.

Measuring the burden of cancer attributable to specific risk factors

The cancer burden attributable to selected risk factors was estimated using population attributable fractions (PAFs) applied to the estimated disease burden. The PAFs were estimated using comparative risk assessment methodology (AIHW 2016c, 2017b). The steps taken to estimate the attributable burden were:

1. Select the appropriate risk–outcome pairs and the effect size of the risk.
2. Estimate the population-level distribution of risk factor exposure.
3. Define the counterfactual (theoretical minimum risk exposure distribution—TMRED).

4. Calculate the population attributable fraction (PAF).
5. Quantify the cancer burden attributable to the selected risk factors by applying the PAF to the cancer burden.

Selecting risk factors and relative risks for cancer

Apart from sun exposure, risk factors and relative risks included in the ABDS 2011 were based on those used in the GBD 2010 that were relevant to Australian policy interests. To be included as a risk factor in the GBD 2010, and subsequently the ABDS 2011, there needed to have been:

- sufficient evidence for a causal association between exposure and outcome based on high-quality epidemiological studies
- a plausible biological mechanism linking the risk factor and outcome
- an exposure definition that is appropriate for Australia
- sufficient data to estimate population exposure to the risk factor
- the risk factor needed to be modifiable or preventable.

Following this assessment, there were 17 risk factors linked to 21 different cancers considered appropriate for the ABDS 2011 (Table A.8).

Table A.8: Risk factors in the ABDS 2011, measures of exposure and their cancer-related disease outcome pairs

Risk factor/cluster	Exposure description	Disease outcome
Air pollution	Particulate matter (2.5 μg/m^3)	Lung cancer
Alcohol use	Daily intake	Bowel cancer, breast cancer, laryngeal cancer, liver cancer, mouth cancer, oesophageal cancer and pharyngeal cancer
Dietary risk factors	Diet low in calcium	Prostate cancer
	Diet low in fibre	Bowel cancer
	Diet low in fruit	Laryngeal cancer, lung cancer, mouth and pharyngeal cancer, oesophageal cancer
	Diet low in milk	Bowel cancer
	Diet high in processed meats	Bowel cancer
	Diet high in red meat	Bowel cancer
	Diet high in sodium	Stomach cancer
	Diet low in vegetables	Laryngeal cancer, mouth and pharyngeal cancer
Drug use	Illicit drug use: cocaine	Liver cancer
	Illicit drug use: opioids	
	Illicit drug use: amphetamines	
	Illicit drug use: cannabis	
	Illicit drug use: injecting drug use	
High body mass[(a)]		Bowel cancer, breast cancer, gallbladder cancer, kidney cancer, leukaemia, liver cancer, oesophageal cancer, ovarian cancer, pancreatic cancer, thyroid cancer, uterine cancer
Occupational risks	Exposure by industry	Laryngeal cancer, leukaemia, lung cancer, mesothelioma, mouth and pharyngeal cancer, ovarian cancer
Physical inactivity		Bowel cancer, breast cancer,
Sun exposure[(b)]		Melanoma of the skin, non-melanoma skin cancer
Tobacco smoking cluster	Smoking: past	Bladder cancer, bowel cancer, cervical cancer, kidney cancer, leukaemia, liver cancer, lung cancer, mouth and pharyngeal cancer, oesophageal cancer, pancreatic cancer, stomach cancer
	Smoking: second-hand	Lung cancer
Unsafe sex		Cervical cancer, liver cancer

(a) Revised analysis (AIHW 2017b).

(b) Only measured for the national population.

Population exposure to selected risk factors

Estimates of risk factor exposure were calculated to align, or most closely align, with definitions used by the GBD 2010. Exposure prevalence was sourced from relevant Australian data, by age and sex, in the finest possible increments (Table A.9).

For some risk factors, it is past exposure rather than current exposure that is associated with current cancer burden. For risk factors such as tobacco use, occupational risks, alcohol use, drug use and unsafe sex, the burden might continue to exist from past high exposure levels.

Where evidence of past exposure can be linked to current burden, this is included in the analyses.

For some risk factors, such as high body mass, current exposure might have an impact on future burden. This is not accounted for in the ABDS 2011 as the burden only pertains to the reference year.

Not all risk factors are relevant to all population (age and sex) groups. The population relevant to each risk factor was informed by the GBD 2010.

For most risk–outcome pairs in the study, both fatal and non-fatal burden are relevant. For others, such as air pollution, only fatal burden has been estimated. The choices for population groups and type of burden (fatal or non-fatal) were informed by the GBD 2010.

Table A.9: ABDS 2011 risk factors, data source, units of measurement and theoretical minimum risk exposure distribution for cancer

Risk factor/cluster	Definition of exposure	National data source	Indigenous data source	Units for effect size calculation	TMRED
Air pollution	Particulate matter (2.5μg/m^3)	State/territory-based air monitoring stations	State/territory-based air monitoring stations	High atmospheric particulate matter pollution (PM2.5) levels	8.8 μg/m^3 (PM2.5)
Alcohol use	Daily intake	NDSHS 2010; Apparent consumption of alcohol data	NATSISS 2008	Lifetime risk: average consumption of pure alcohol (grams per day)	No alcohol consumption
Diet low in calcium	. .	AHS 2011–12	AATSIHS 2012–13	Per 1,000mg per day intake decrease	1,600 mg per day
Diet low in fibre	. .	AHS 2011–12	AATSIHS 2012–13	Per 20g per day of fibre intake decrease	30g/day
Diet low in fruit	. .	AHS 2011–12	AATSIHS 2012–13	Per 100g per day of fruit intake decrease (adjusted to servings 150g per day)	300g per day
Diet low in milk	. .	AHS 2011–12	AATSIHS 2012–13	Per 226.8g per day intake decrease	450g per day
Diet high in processed meats	. .	AHS 2011–12	AATSIHS 2012–13	Per 50g per day intake increase	0g per day
Diet high in sodium	. .	AHS 2011–12	AATSIHS 2012–13	Per 2.3g per day intake increase	1,600mg
Diet low in vegetables	. .	AHS 2011–12	AATSIHS 2012–13	Per 100g per day of vegetable intake decrease (adjusted to servings 75g per day)	400g per day
Drug use	Illicit drug use: cocaine	. .	. .	Direct evidence: proportion of the population cocaine use disorder	. .
	Illicit drug use: opioids	. .	. .	Direct evidence: proportion of the population opioid use disorder	. .
	Illicit drug use: cannabis	. .	. .	Direct evidence: proportion of the population cannabis use disorder	. .
	Illicit drug use: amphetamines	. .	. .	Direct evidence: proportion of the population amphetamine use disorder	. .
	Illicit drug use: injecting drug use	Kirby annual surveillance reports	Kirby annual surveillance reports	Injecting drug use: direct evidence from Kirby Institute publications (which disaggregated notifications for HIV/AIDS and bloodborne viruses by exposure category)	. .
High body mass[(a)]	. .	AHS 2011–12	AATSIHS 2012–13	Per 5kg/m^2 of body mass index increase	Body mass index 20–25kg/m^2 (SD 1 kg/m^2)

(continued)

Table A.9 (continued): ABDS 2011 risk factors, data source, units of measurement and theoretical minimum risk exposure distribution for cancer

Risk factor/cluster	Definition of exposure	National data source	Indigenous data source	Units for effect size calculation	TMRED
Occupational risks	Industry	Census of Population and Housing 2011; ABS Labour force survey, June 2011	Census of Population and Housing 2011; ABS Labour force survey, June 2011	Distribution of the labour force by broad occupation group	. .
Physical inactivity	. .	AHS 2011–12	AATSIHS 2012–13	METs of less than 600, 600–3,999, 4,000–7,999	All individuals are highly active with METs of 8,000 or more
Tobacco use	Past smoking	. .	. .	Past smokers: Peto et al. 1992	. .
	Smoking: second-hand	NDSHS 2010	AATSIHS 2012–13	Second-hand smokers: proportion of the population exposed to second-hand smoke	No exposure to second-hand smoke
Unsafe sex	. .	Kirby Institute annual surveillance reports National HIV Register	Kirby Institute annual surveillance reports National HIV Register	Direct evidence: All sexually transmitted infections and cervical cancer attributed to unsafe sex Cases of HIV/AIDS, hepatitis B and hepatitis C reported due to unsafe sex	. .

(a) Revised analysis (AIHW 2017b).

AATSIHS = Australian Aboriginal and Torres Strait Islander Health Survey; AHS = Australian Health Survey; MET = metabolic equivalent of tasks; NATSISS = National Aboriginal and Torres Strait Islander Social Survey; NDSHS = National Drug Strategy Household Survey; SD = standard deviation.

Calculation of population attributable fractions and attributable burden

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.

The key data inputs for calculating PAFs are:

- the effect size—in this case, the relative risk of the risk factor on the outcome of interest (in this case, the various cancer types)
- the prevalence of risk factor exposure in the population.

The age and sex-specific PAFs were then applied to the cancer burden estimates from the ABDS 2011, to determine the burden due to each risk factor (attributable burden). For details of this method and the formula used in this calculation see *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c).

Estimating the joint effect

In this study, as a general rule, risk factors are assessed independently. This means that the attributable burden estimated for each risk factor cannot be added together. Instead, the joint effect is estimated, which is the attributable burden from all risk factors combined, taking into account risk factors that are on the same causal pathway.

To combine risk factors the following formula was used:

$$PAF = 1 - \Pi(1 - PAF_r)$$

where:

PAF is the population attributable fraction of burden attributable to a disease from all risk factors combined

PAF_r is the population attributable fraction for risk factor 'r' and linked disease

the product Π runs over all risk factors within the cluster.

This formula, which has been used in several other burden of disease studies, has the desirable property of placing a cap on the estimated combined attributable burden and therefore avoids the possibility of it 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 this, an adjustment factor of 50% was used for risk factors that are secondary to other factors in the same causal pathway (Murray et al. 2003).

Specific risk factors

The main methodological details for the major contributors to the cancer burden are provided below. Further information about each risk factor is available in *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c).

Tobacco use

While the tobacco burden in the ABDS 2011 included the burden attributable to current smoking, past smoking and exposure to second-hand smoke in the home, only past smoking and exposure to second-hand smoke were used to attribute burden to cancer. This is due to the much longer lag between smoking and the incidence of cancers, as well as consistent reductions in smoking rates over recent decades.

The National Drug Strategy Household Survey 2007 was used to estimate the proportion of the population that are former smokers. The National Drug Strategy Household Survey 2010 was used to estimate the proportion of non-smokers exposed to environmental tobacco in the home.

To determine the current burden attributable to past exposure to tobacco use, a 'smoking impact ratio' was used to indirectly estimate the accumulated risk from tobacco smoking (described by Peto et al. 1992). This ratio is based on the excess lung cancer mortality seen in the Australian population, compared with the cohort of non-smokers, used to determine the proportion of the population living with accumulated tobacco risk, and applied to all cancers linked with tobacco use.

The burden attributable to past smoking was estimated in people aged 40 and over, because the small number of lung cancer deaths observed in those aged 25–39 meant that PAFs produced for these age groups would have been unreliable using this method.

Alcohol

The attributable cancer burden due to alcohol is based on the long-term effects of continued alcohol use, measured as the average daily consumption, rather than the impact of single occasion risk (or binge) drinking.

The attributable burden due to alcohol use was measured in people aged 15 and over. Exposure data were sourced from the National Drug Strategy Household Survey 2010, and adjusted for known under-reporting to match alcohol sales data in each reference year (AIHW 2016c).

As there are many sources of liver cancer, the PAF for liver cancer was estimated from the proportion represented by liver cancer due to alcohol of all liver cancer burden, as estimated for Australia by the GBD 2010.

Physical inactivity

The burden attributable to physical inactivity was measured as the metabolic equivalent of tasks (METs) done by people aged 25 and over. This is a categorical risk factor, and the categories are sedentary (less than 600 METs), low levels of activity (600–3,999 METs), moderate levels of activity (4,000–7,999 METs), and high levels of activity (8,000 METs and over).

Exposure was estimated from the Australian Health Survey 2011–12 as self-reported METs in the previous week. Included in the estimates were exercise due to stretching, gardening and walking for transport, as well as recreational exercise.

Sun exposure

The burden attributable to sun exposure was estimated in people of all ages using direct PAFs which are a proportion of the current burden that is due to both past and current sun exposure in the population.

The PAFs for sun exposure were calculated by collaborating experts Robyn Lucas and Fan Xiang from the National Centre for Epidemiology and Population Health at the Australian National University.

The attributable burden was not estimated for the Indigenous population as it was not possible to account for the impact of differences in skin melanin levels.

High body mass

In the ABDS 2011, the burden attributable to high body mass was estimated in people aged 25 and over. This is the population for which relative risks are available, and for which burden was estimated in recent global burden of disease studies. The AIHW has recently extended this analysis to estimate the burden attributable to high body mass in people younger than 25, revised diseases linked to overweight or obesity based on the latest evidence, and estimates by socioeconomic group (AIHW 2017b).

High body mass was found to be causally related to several cancer types, including bowel, breast, gallbladder, kidney, oesophageal, pancreatic and uterine cancers in the ABDS 2011.

As the latest evidence suggests high body mass is also causally related to leukaemia, liver, ovarian and thyroid cancers, the analysis was also extended to include these cancers (AIHW 2017b).

Exposure was estimated as the distribution of body mass index in participants from the Australian Health Survey 2011–12.

Dietary risk factors

Eight of the 13 dietary risk factors included in the ABDS 2011 were linked to cancer. The burden attributable to these was measured in people aged 25 and over.

Some of the dietary risk factors were for the consumption of whole foods, such as a diet low in fruit, a diet low in vegetables, a diet high in red meat and a diet high in processed meat. The other risk factors were for the consumption of micronutrients, such as a diet low in fibre or a diet high in sodium.

It should be noted that the methods, including the TMREDs, used in the ABDS 2011 to calculate attributable burden due to dietary risk factors do not align with current Australian dietary guidelines. For information of recommended food choices, please see the Australian Dietary Guidelines (NHMRC 2015).

Appendix B: Additional tables and figures

Table B.1: Ranked causes of cancer burden (DALY, %, ASR), by sex, 2011

Rank	Males	DALY	%	ASR	Females	DALY	%	ASR	Persons	DALY	%	ASR
1	Lung cancer	94,508	20.1	8.0	Breast cancer	70,268	19.4	5.7	Lung cancer	154,890	18.6	6.3
2	Bowel cancer	53,084	11.3	4.6	Lung cancer	60,382	16.6	4.7	Bowel cancer	92,422	11.1	3.8
3	Prostate cancer	49,232	10.5	4.4	Bowel cancer	39,338	10.8	3.0	Breast cancer	70,675	8.5	2.9
4	Pancreatic cancer	24,621	5.2	2.1	Pancreatic cancer	19,807	5.5	1.5	Prostate cancer	49,232	5.9	2.0
5	Melanoma of the skin	23,503	5.0	2.0	Ovarian cancer	19,421	5.3	1.6	Pancreatic cancer	44,428	5.3	1.8
6	Liver cancer	21,743	4.6	1.8	Unknown primary	15,567	4.3	1.2	Brain cancers	35,662	4.3	1.5
7	Brain cancers	21,457	4.6	1.9	Brain cancers	14,204	3.9	1.2	Unknown primary	35,585	4.3	1.4
8	Unknown primary	20,018	4.3	1.7	Leukaemia	12,137	3.3	1.0	Melanoma of the skin	34,654	4.2	1.4
9	Leukaemia	18,492	3.9	1.6	Melanoma of the skin	11,151	3.1	0.9	Leukaemia	30,629	3.7	1.3
10	Oesophageal cancer	18,420	3.9	1.5	Non-Hodgkin lymphoma	10,548	2.9	0.8	Liver cancer	29,376	3.5	1.2
11	Non-Hodgkin lymphoma	14,908	3.2	1.3	Stomach cancer	8,035	2.2	0.6	Non-Hodgkin lymphoma	25,456	3.1	1.1
12	Stomach cancer	14,548	3.1	1.3	Liver cancer	7,632	2.1	0.6	Oesophageal cancer	23,773	2.9	1.0
13	Mouth and pharyngeal cancer	13,517	2.9	1.1	Uterine cancer	7,622	2.1	0.6	Stomach cancer	22,583	2.7	0.9
14	Kidney cancer	12,275	2.6	1.0	Cervical cancer	6,555	1.8	0.6	Ovarian cancer	19,421	2.3	0.8
15	Bladder cancer	11,734	2.5	1.0	Myeloma	6,462	1.8	0.5	Kidney cancer	17,774	2.1	0.7
16	Mesothelioma	8,667	1.8	0.7	Kidney cancer	5,498	1.5	0.4	Mouth and pharyngeal cancer	17,617	2.1	0.7
17	Myeloma	8,502	1.8	0.7	Oesophageal cancer	5,353	1.5	0.4	Bladder cancer	15,935	1.9	0.6
18	Non-melanoma skin cancer	6,952	1.5	0.6	Bladder cancer	4,201	1.2	0.3	Myeloma	14,964	1.8	0.6
19	Other blood cancers	4,428	0.9	0.4	Mouth and pharyngeal cancer	4,100	1.1	0.3	Mesothelioma	10,476	1.3	0.4
20	Laryngeal cancer	3,436	0.7	0.3	Brain tumours	2,939	0.8	0.2	Non-melanoma skin cancer	9,369	1.1	0.4
21	Brain tumours	2,790	0.6	0.2	Other blood cancers	2,919	0.8	0.2	Uterine cancer	7,622	0.9	0.3
22	Gallbladder cancer	1,630	0.3	0.1	Gallbladder cancer	2,657	0.7	0.2	Other blood cancers	7,346	0.9	0.3
23	Hodgkin lymphoma	1,094	0.2	0.1	Non-melanoma skin cancer	2,417	0.7	0.2	Cervical cancer	6,555	0.8	0.3

(continued)

Table B.1 (continued): Ranked causes of cancer burden (DALY), by sex, 2011

Rank	Males	DALY	%	ASR	Females	DALY	%	ASR	Persons	DALY	%	ASR
24	Thyroid cancer	1,045	0.2	0.1	Mesothelioma	1,809	0.5	0.1	Brain tumours	5,729	0.7	0.2
25	Testicular cancer	1,006	0.2	0.1	Thyroid cancer	1,589	0.4	0.1	Gallbladder cancer	4,287	0.5	0.2
26	Breast cancer	407	0.1	<0.1	Hodgkin lymphoma	905	0.2	0.1	Laryngeal cancer	4,070	0.5	0.2
27	Ductal carcinoma in situ	3	0.0	<0.1	Laryngeal cancer	634	0.2	<0.1	Thyroid cancer	2,634	0.3	0.1
28	. .	. .	. .	. .	Ductal carcinoma in situ	411	0.1	<0.1	Hodgkin lymphoma	1,999	0.2	0.1
29	. .	. .	. .	. .	. .	. .	. .	. .	Testicular cancer	1,006	0.1	<0.1
30	. .	. .	. .	. .	. .	. .	. .	. .	Ductal carcinoma in situ	414	0.0	<0.1
	Other cancers	14,742	3.1	1.3	Other cancers	15,154	4.2	1.2	Other cancers	29,896	3.6	1.3
	Other non-malignant neoplasms	3,349	0.7	0.3	Other non-malignant neoplasms	3,422	0.9	0.3	Other non-malignant neoplasms	6,771	0.8	0.3
	Total	**470,110**	**100.0**	**40.6**	**Total**	**363,140**	**100.0**	**28.8**	**Total**	**833,250**	**100.0**	**34.2**

Notes

1. Proportion refers to the proportion of the total cancer burden.
2. Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 persons.
3. Columns may not add to total due to rounding.

Source: AIHW analysis of burden of disease database, 2011.

Table B.2: Ranked causes of fatal cancer burden (YLL), by sex, 2011

Rank	Males	YLL	%	ASR	Females	YLL	%	ASR	Persons	YLL	%	ASR
1	Lung cancer	92,299	20.9	7.9	Breast cancer	63,026	18.5	5.1	Lung cancer	151,205	19.3	6.1
2	Bowel cancer	49,443	11.2	4.3	Lung cancer	58,905	17.3	4.6	Bowel cancer	85,824	11.0	3.5
3	Prostate cancer	40,191	9.1	3.6	Bowel cancer	36,381	10.7	2.8	Breast cancer	63,368	8.1	2.6
4	Pancreatic cancer	24,347	5.5	2.1	Pancreatic cancer	19,544	5.7	1.5	Pancreatic cancer	43,890	5.6	1.8
5	Melanoma of the skin	21,732	4.9	1.9	Ovarian cancer	18,789	5.5	1.5	Prostate cancer	40,191	5.1	1.6
6	Liver cancer	21,523	4.9	1.8	Unknown primary	14,921	4.4	1.1	Brain cancers	34,407	4.4	1.5
7	Brain cancers	20,740	4.7	1.8	Brain cancers	13,667	4.0	1.1	Unknown primary	34,214	4.4	1.4
8	Unknown primary	19,294	4.4	1.7	Leukaemia	11,552	3.4	0.9	Melanoma of the skin	31,647	4.0	1.3
9	Oesophageal cancer	18,136	4.1	1.5	Melanoma of the skin	9,916	2.9	0.8	Leukaemia	29,210	3.7	1.2
10	Leukaemia	17,658	4.0	1.5	Non-Hodgkin lymphoma	9,869	2.9	0.8	Liver cancer	29,067	3.7	1.2
11	Stomach cancer	14,176	3.2	1.2	Stomach cancer	7,826	2.3	0.6	Non-Hodgkin lymphoma	23,909	3.1	1.0
12	Non-Hodgkin lymphoma	14,040	3.2	1.2	Liver cancer	7,544	2.2	0.6	Oesophageal cancer	23,382	3.0	0.9
13	Mouth and pharyngeal cancer	12,782	2.9	1.1	Uterine cancer	6,930	2.0	0.5	Stomach cancer	22,002	2.8	0.9
14	Kidney cancer	11,747	2.7	1.0	Cervical cancer	6,293	1.9	0.5	Ovarian cancer	18,789	2.4	0.8
15	Bladder cancer	11,071	2.5	1.0	Myeloma	6,105	1.8	0.5	Kidney cancer	16,954	2.2	0.7
16	Mesothelioma	8,464	1.9	0.7	Oesophageal cancer	5,245	1.5	0.4	Mouth and pharyngeal cancer	16,580	2.1	0.7
17	Myeloma	8,046	1.8	0.7	Kidney cancer	5,207	1.5	0.4	Bladder cancer	15,061	1.9	0.6
18	Non-melanoma skin cancer	6,135	1.4	0.5	Bladder cancer	3,990	1.2	0.3	Myeloma	14,150	1.8	0.6
19	Other blood cancers	4,217	1.0	0.4	Mouth and pharyngeal cancer	3,798	1.1	0.3	Mesothelioma	10,232	1.3	0.4
20	Laryngeal cancer	3,203	0.7	0.3	Other blood cancers	2,757	0.8	0.2	Non-melanoma skin cancer	8,022	1.0	0.3
21	Brain tumours	2,031	0.5	0.2	Gallbladder cancer	2,589	0.8	0.2	Other blood cancers	6,974	0.9	0.3
22	Gallbladder cancer	1,578	0.4	0.1	Brain tumours	2,273	0.7	0.2	Uterine cancer	6,930	0.9	0.3
23	Hodgkin lymphoma	991	0.2	0.1	Non-melanoma skin cancer	1,887	0.6	0.1	Cervical cancer	6,293	0.8	0.3

(continued)

Table B.2 (continued): Ranked causes of fatal cancer burden (YLL), by sex, 2011

Rank	Males	YLL	%	ASR	Females	YLL	%	ASR	Persons	YLL	%	ASR
24	Thyroid cancer	900	0.2	0.1	Mesothelioma	1,768	0.5	0.1	Brain tumours	4,305	0.6	0.2
25	Testicular cancer	789	0.2	0.1	Thyroid cancer	1,175	0.3	0.1	Gallbladder cancer	4,167	0.5	0.2
26	Breast cancer	342	0.1	<0.1	Hodgkin lymphoma	822	0.2	0.1	Laryngeal cancer	3,806	0.5	0.2
27	Ductal carcinoma in situ	. .	. .	. .	Laryngeal cancer	603	0.2	<0.1	Thyroid cancer	2,076	0.3	0.1
28	. .	. .	. .	. .	Ductal carcinoma in situ	. .	. .	. .	Hodgkin lymphoma	1,813	0.2	0.1
29	. .	. .	. .	. .	. .	. .	. .	. .	Testicular cancer	789	0.1	<0.1
30	. .	. .	. .	. .	. .	. .	. .	. .	Ductal carcinoma in situ	. .	. .	. .
	Other cancers	14,037	3.2	1.2	Other cancers	14,446	4.2	1.2	Other cancers	28,482	3.6	1.2
	Other non-malignant neoplasms	2,318	0.5	0.2	Other non-malignant neoplasms	2,292	0.7	0.2	Other non-malignant neoplasms	4,610	0.6	0.2
	Total	**442,228**	**100.0**	**38.1**	**Total**	**340,121**	**100.0**	**27.0**	**Total**	**782,349**	**100.0**	**32.1**

Notes

1. Proportion refers to the proportion of the fatal cancer burden.
2. Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 persons.
3. Ductal carcinoma in situ is non-fatal.

Source: AIHW analysis of burden of disease database, 2011.

Table B.3: Ranked causes of non-fatal cancer burden (YLD), by sex, 2011

Rank	Males	YLD	%	ASR	Females	YLD	%	ASR	Persons	YLD	%	ASR
1	Prostate cancer	9,041	32.4	0.8	Breast cancer	7,241	31.5	0.6	Prostate cancer	9,041	17.8	0.4
2	Bowel cancer	3,641	13.1	0.3	Bowel cancer	2,957	12.8	0.2	Breast cancer	7,307	14.4	0.3
3	Lung cancer	2,209	7.9	0.2	Lung cancer	1,477	6.4	0.1	Bowel cancer	6,598	13.0	0.3
4	Melanoma of the skin	1,771	6.4	0.2	Melanoma of the skin	1,235	5.4	0.1	Lung cancer	3,685	7.2	0.1
5	Non-Hodgkin lymphoma	868	3.1	0.1	Uterine cancer	692	3.0	0.1	Melanoma of the skin	3,007	5.9	0.1
6	Leukaemia	834	3.0	0.1	Non-Hodgkin lymphoma	679	2.9	0.1	Non-Hodgkin lymphoma	1,547	3.0	0.1
7	Non-melanoma skin cancer	817	2.9	0.1	Brain tumours	666	2.9	0.1	Brain tumours	1,424	2.8	0.1
8	Brain tumours	759	2.7	0.1	Unknown primary	646	2.8	<0.1	Leukaemia	1,420	2.8	0.1
9	Mouth and pharyngeal cancer	735	2.6	0.1	Ovarian cancer	631	2.7	<0.1	Unknown primary	1,370	2.7	0.1
10	Unknown primary	724	2.6	0.1	Leukaemia	586	2.5	<0.1	Non-melanoma skin cancer	1,347	2.6	0.1
11	Brain cancers	717	2.6	0.1	Brain cancers	538	2.3	<0.1	Brain cancers	1,255	2.5	0.1
12	Bladder cancer	663	2.4	0.1	Non-melanoma skin cancer	530	2.3	<0.1	Mouth and pharyngeal cancer	1,036	2.0	<0.1
13	Kidney cancer	529	1.9	<0.1	Thyroid cancer	414	1.8	<0.1	Bladder cancer	874	1.7	<0.1
14	Myeloma	456	1.6	<0.1	Ductal carcinoma in situ	411	1.8	<0.1	Kidney cancer	820	1.6	<0.1
15	Stomach cancer	372	1.3	<0.1	Myeloma	358	1.6	<0.1	Myeloma	814	1.6	<0.1
16	Oesophageal cancer	283	1.0	<0.1	Mouth and pharyngeal cancer	301	1.3	<0.1	Uterine cancer	692	1.4	<0.1
17	Pancreatic cancer	274	1.0	<0.1	Kidney cancer	291	1.3	<0.1	Ovarian cancer	631	1.2	<0.1
18	Laryngeal cancer	233	0.8	<0.1	Pancreatic cancer	263	1.1	<0.1	Stomach cancer	581	1.1	<0.1
19	Liver cancer	220	0.8	<0.1	Cervical cancer	263	1.1	<0.1	Thyroid cancer	559	1.1	<0.1
20	Testicular cancer	216	0.8	<0.1	Bladder cancer	211	0.9	<0.1	Pancreatic cancer	538	1.1	<0.1
21	Other blood cancers	211	0.8	<0.1	Stomach cancer	209	0.9	<0.1	Ductal carcinoma in situ	414	0.8	<0.1
22	Mesothelioma	203	0.7	<0.1	Other blood cancers	161	0.7	<0.1	Oesophageal cancer	391	0.8	<0.1
23	Thyroid cancer	145	0.5	<0.1	Oesophageal cancer	108	0.5	<0.1	Other blood cancers	373	0.7	<0.1

(continued)

Table B.3 (continued): Ranked causes of non-fatal cancer burden (YLD), by sex, 2011

Rank	Males	YLD	%	ASR	Females	YLD	%	ASR	Persons	YLD	%	ASR
24	Hodgkin lymphoma	103	0.4	<0.1	Liver cancer	89	0.4	<0.1	Liver cancer	309	0.6	<0.1
25	Breast cancer	66	0.2	<0.1	Hodgkin lymphoma	83	0.4	<0.1	Laryngeal cancer	265	0.5	<0.1
26	Gallbladder cancer	52	0.2	<0.1	Gallbladder cancer	67	0.3	<0.1	Cervical cancer	263	0.5	<0.1
27	Ductal carcinoma in situ	3	0.0	<0.1	Mesothelioma	41	0.2	<0.1	Mesothelioma	244	0.5	<0.1
28	. .	. .	. .	. .	Laryngeal cancer	31	0.1	<0.1	Testicular cancer	216	0.4	<0.1
29	. .	. .	. .	. .	. .	. .	. .	. .	Hodgkin lymphoma	186	0.4	<0.1
30	. .	. .	. .	. .	. .	. .	. .	. .	Gallbladder cancer	119	0.2	<0.1
	Other cancers	705	2.5	0.1	Other cancers	708	3.1	0.1	Other cancers	1,414	2.8	0.1
	Other non-malignant neoplasms	1,031	3.7	0.1	Other non-malignant neoplasms	1,130	4.9	0.1	Other non-malignant neoplasms	2,162	4.2	0.1
	Total	**27,882**	**100.0**	**2.4**	**Total**	**23,019**	**100.0**	**1.8**	**Total**	**50,901**	**100.0**	**2.1**

Notes

1. Proportion refers to the proportion of the non-fatal cancer burden.
2. Rates are age-standardised to the 2001 Australian Standard Population and are expressed per 1,000 persons.

Source: AIHW analysis of burden of disease database, 2011.

Table B.4a: Cancer burden (DALY) attributable to specific risk factors, 2011

	Individual risk factor									
Cancer type	**Tobacco**	**Body mass**	**Combined diet**	**Physical inactivity**	**Sun exposure**	**Alcohol**	**Occupational**	**Drug use**	**Unsafe sex**	**Air pollution**
Bladder cancer	5,476	. .	. .	. .	. .	. .	. .	. .	. .	. .
Bowel cancer	7,213	11,819	26,572	28,570	. .	4,830	. .	. .	. .	. .
Breast cancer	. .	15,843	. .	24,555	. .	5,834	. .	. .	. .	. .
Cervical cancer	619	. .	. .	. .	. .	. .	. .	. .	6,555	.
Gallbladder cancer	. .	1,054	. .	. .	. .	. .	. .	. .	. .	. .
Kidney cancer	3,135	4,402	. .	. .	. .	. .	. .	. .	. .	. .
Laryngeal cancer	. .	. .	1,500	. .	. .	742	215	. .	. .	. .
Leukaemia	3,281	3,081	. .	. .	. .	. .	1,621	. .	. .	. .
Liver cancer	6,191	6,852	. .	. .	. .	6,757	. .	15,468	2,552	.
Lung cancer	123,305	. .	12,005	. .	. .	. .	9,412	. .	. .	1,117
Melanoma of the skin	. .	. .	. .	. .	31,189	. .	. .	. .	. .	. .
Mesothelioma	. .	. .	. .	. .	. .	. .	8,452	. .	. .	. .
Mouth and pharyngeal cancer	8,124	. .	6,532	. .	. .	5,112	22	. .	. .	. .
Non-melanoma skin cancer	. .	. .	. .	. .	6,558	. .	. .	. .	. .	. .
Oesophageal cancer	12,816	8,630	4,838	. .	. .	3,971	. .	. .	. .	. .
Ovarian cancer	. .	837	. .	. .	. .	. .	64	. .	. .	. .
Pancreatic cancer	10,336	3,863	. .	. .	. .	. .	. .	. .	. .	. .
Prostate cancer	. .	. .	5,982	. .	. .	. .	. .	. .	. .	. .
Stomach cancer	3,234	. .	614	. .	. .	. .	. .	. .	. .	. .
Thyroid cancer	. .	436	. .	. .	. .	. .	. .	. .	. .	. .
Uterine cancer	. .	3,494	. .	. .	. .	. .	. .	. .	. .	. .
Total	**183,729**	**60,311**	**58,044**	**53,126**	**37,747**	**27,245**	**19,786**	**15,468**	**9,107**	**1,117**

Table B.4b: Cancer burden (DALY) attributable to individual dietary risk factors, 2011

	Individual dietary risk factor							
Cancer type	**Low in fruit**	**Low in milk**	**Low in fibre**	**High in processed meat**	**Low in calcium**	**Low in vegetables**	**High in red meat**	**High in sodium**
Bowel cancer	. .	10,214	8,982	7,124	. .	. .	3,600	. .
Laryngeal cancer	821	. .	. .	. .	. .	850	. .	. .
Lung cancer	12,005	. .	. .	. .	. .	. .	. .	. .
Mouth and pharyngeal cancer	3,609	. .	. .	. .	. .	3,681	. .	. .
Oesophageal cancer	4,838	. .	. .	. .	. .	. .	. .	. .
Prostate cancer	. .	. .	. .	. .	5,982	. .	. .	. .
Stomach cancer	. .	. .	. .	. .	. .	. .	. .	614
Total	**21,273**	**10,214**	**8,982**	**7,124**	**5,982**	**4,531**	**3,600**	**614**

Sources: AIHW analysis of burden of disease database, 2011; AIHW 2017b.

Table B.5: Ranked causes of cancer burden (DALY) in Indigenous Australians, by sex, 2011

Rank	Males	DALY	%	ASR	Females	DALY	%	ASR	Persons	DALY	%	ASR
1	Lung cancer	2,342	25.0	18.0	Lung cancer	1,916	22.6	12.1	Lung cancer	4,258	23.9	14.7
2	Mouth and pharyngeal cancer	917	9.8	5.5	Breast cancer	1,172	13.8	6.4	Bowel cancer	1,353	7.6	4.5
3	Bowel cancer	799	8.5	5.6	Bowel cancer	554	6.5	3.5	Liver cancer	1,246	7.0	4.0
4	Liver cancer	783	8.4	5.2	Cervical cancer	496	5.8	2.3	Breast cancer	1,173	6.6	3.5
5	Oesophageal cancer	655	7.0	3.7	Liver cancer	463	5.5	3.0	Mouth and pharyngeal cancer	1,126	6.3	3.2
6	Prostate cancer	445	4.8	4.7	Pancreatic cancer	415	4.9	2.7	Oesophageal cancer	850	4.8	2.4
7	Unknown primary	402	4.3	3.2	Unknown primary	414	4.9	2.7	Unknown primary	816	4.6	2.9
8	Pancreatic cancer	387	4.1	2.8	Leukaemia	346	4.1	1.6	Pancreatic cancer	802	4.5	2.8
9	Stomach cancer	320	3.4	2.5	Ovarian cancer	319	3.8	1.9	Leukaemia	624	3.5	1.7
10	Leukaemia	278	3.0	1.8	Brain cancers	255	3.0	0.9	Cervical cancer	496	2.8	1.2
11	Laryngeal cancer	213	2.3	1.4	Mouth and pharyngeal cancer	210	2.5	1.2	Stomach cancer	484	2.7	1.6
12	Brain cancers	210	2.2	0.9	Non-Hodgkin lymphoma	202	2.4	1.3	Brain cancers	464	2.6	0.9
13	Non-Hodgkin lymphoma	197	2.1	1.6	Oesophageal cancer	195	2.3	1.2	Prostate cancer	445	2.5	2.0
14	Bladder cancer	179	1.9	1.4	Stomach cancer	164	1.9	0.9	Non-Hodgkin lymphoma	399	2.2	1.4
15	Kidney cancer	168	1.8	0.9	Bladder cancer	143	1.7	0.9	Bladder cancer	322	1.8	1.1
16	Myeloma	100	1.1	0.7	Uterine cancer	139	1.6	0.9	Ovarian cancer	319	1.8	1.0
17	Melanoma of the skin	n.p.	n.p.	n.p.	Brain tumours	n.p.	n.p.	n.p.	Kidney cancer	238	1.3	0.6
18	Non-melanoma skin cancer	n.p.	n.p.	n.p.	Melanoma of the skin	n.p.	n.p.	n.p.	Laryngeal cancer	238	1.3	0.8
19	Testicular cancer	n.p.	n.p.	n.p.	Kidney cancer	n.p.	n.p.	n.p.	Melanoma of the skin	168	0.9	0.6
20	Brain tumours	n.p.	n.p.	n.p.	Thyroid cancer	n.p.	n.p.	n.p.	Myeloma	162	0.9	0.6
21	Mesothelioma	n.p.	n.p.	n.p.	Myeloma	n.p.	n.p.	n.p.	Brain tumours	154	0.9	0.3
22	Gallbladder cancer	n.p.	n.p.	n.p.	Non-melanoma skin cancer	n.p.	n.p.	n.p.	Uterine cancer	139	0.8	0.5
23	Other blood cancers	n.p.	n.p.	n.p.	Gallbladder cancer	n.p.	n.p.	n.p.	Non-melanoma skin cancer	133	0.7	0.4

(continued)

Table B.5 (continued): Ranked causes of cancer burden (DALY) in Indigenous Australians, by sex, 2011

Rank	Males	DALY	%	ASR	Females	DALY	%	ASR	Persons	DALY	%	ASR
24	Hodgkin lymphoma	n.p.	n.p.	n.p.	Other blood cancers	n.p.	n.p.	n.p.	Gallbladder cancer	111	0.6	0.4
25	Thyroid cancer	n.p.	n.p.	n.p.	Laryngeal cancer	n.p.	n.p.	n.p.	Other blood cancers	n.p.	n.p.	n.p.
26	Breast cancer	n.p.	n.p.	n.p.	Hodgkin lymphoma	n.p.	n.p.	n.p.	Thyroid cancer	n.p.	n.p.	n.p.
27	Ductal carcinoma in situ	n.p.	n.p.	n.p.	Mesothelioma	n.p.	n.p.	n.p.	Testicular cancer	n.p.	n.p.	n.p.
28	. .	. .	. .	. .	Ductal carcinoma in situ	n.p.	n.p.	n.p.	Mesothelioma	n.p.	n.p.	n.p.
29	. .	. .	. .	. .	. .	. .	. .	. .	Hodgkin lymphoma	n.p.	n.p.	n.p.
30	. .	. .	. .	. .	. .	. .	. .	. .	Ductal carcinoma in situ	n.p.	n.p.	n.p.
	Other cancers	373	4.0	1.7	Other cancers	391	4.6	2.0	Other cancers	764	4.3	1.9
	Other non-malignant neoplasms	88	0.9	0.5	Other non-malignant neoplasms	118	1.4	0.7	Other non-malignant neoplasms	206	1.2	0.7
	Total	**9,362**	**100.0**	**66.1**	**Total**	**8,485**	**100.0**	**49.7**	**Total**	**17,847**	**100.0**	**57.0**

Note: Rankings are determined by the number of DALY. Age-standardised rates may be higher for some lower ranked cancer types due to the impact of age-standardisation on the age-distribution of the burden for that cancer type.

Source: AIHW analysis of burden of disease database, 2011.

Table B.6a: Cancer burden (DALY) in Indigenous Australians attributable to specific risk factors, 2011

	Individual risk factor								
Cancer type	**Tobacco**	**Combined diet**	**Body mass**	**Physical inactivity**	**Unsafe sex**	**Drug use**	**Alcohol**	**Occupational**	**Air pollution**
Bladder cancer	158	. .	. .	. .	. .	. .	. .	. .	. .
Bowel cancer	217	419	235	439	. .	. .	10	. .	. .
Breast cancer	. .	. .	261	414	. .	. .	33	. .	. .
Cervical cancer	123	. .	. .	. .	496	. .	. .	. .	. .
Gallbladder cancer	. .	. .	33	. .	. .	. .	. .	. .	. .
Kidney cancer	76	. .	78	. .	. .	. .	. .	. .	. .
Laryngeal cancer	. .	102	. .	. .	. .	. .	12	12	. .
Leukaemia	83	. .	77	. .	. .	. .	. .	40	. .
Liver cancer	503	. .	368	. .	111	559	289	. .	. .
Lung cancer	3,970	419	. .	. .	. .	. .	. .	229	24
Mesothelioma	. .	. .	. .	. .	. .	. .	. .	59	. .
Mouth and pharyngeal cancer	719	483	. .	. .	. .	. .	109	1	. .
Oesophageal cancer	599	216	386	. .	. .	. .	39	. .	. .
Ovarian cancer	. .	. .	16	. .	. .	. .	. .	1	. .
Pancreatic cancer	364	. .	94	. .	. .	. .	. .	. .	. .
Prostate cancer	. .	54	. .	. .	. .	. .	. .	. .	. .
Stomach cancer	145	15	. .	. .	. .	. .	. .	. .	. .
Thyroid cancer	. .	. .	14	. .	. .	. .	. .	. .	. .
Uterine cancer	. .	. .	76	. .	. .	. .	. .	. .	. .
Total	**6,956**	**1,709**	**1,638**	**854**	**607**	**559**	**492**	**342**	**24**

Source: AIHW analysis of burden of disease database, 2011.

Table B.6b: Cancer burden (DALY) in Indigenous Australians attributable to dietary risk factors, 2011

	Individual dietary risk factor							
Cancer type	**Low in fruit**	**Low in vegetables**	**Low in milk**	**High in processed meat**	**Low in fibre**	**High in red meat**	**Low in calcium**	**High in sodium**
Bowel cancer	. .	. .	167	120	114	79	. .	. .
Laryngeal cancer	60	56	. .	. .	. .	. .	. .	. .
Lung cancer	419	. .	. .	. .	. .	. .	. .	. .
Mouth and pharyngeal cancer	284	267	. .	. .	. .	. .	. .	. .
Oesophageal cancer	216	. .	. .	. .	. .	. .	. .	. .
Prostate cancer	. .	. .	. .	. .	. .	. .	54	. .
Stomach cancer	. .	. .	. .	. .	. .	. .	. .	15
Total	**980**	**322**	**167**	**120**	**114**	**79**	**54**	**15**

Source: AIHW analysis of burden of disease database, 2011.

Table B.7: Rate ratio and differences of Indigenous and non-Indigenous age-standardised DALY rates, 2011

	Males		Females		Persons	
Cancer type	Rate ratio	Rate difference	Rate ratio	Rate difference	Rate ratio	Rate difference
Lung cancer	2.3	10.0	2.6	7.5	2.4	8.5
Bowel cancer	1.2	1.0	1.2	0.5	1.2	0.7
Liver cancer	2.9	3.4	5.2	2.4	3.4	2.8
Breast cancer	0.2	0.0	1.1	0.8	1.2	0.6
Mouth and pharyngeal cancer	5.1	4.4	4.1	0.9	4.8	2.6
Unknown primary	1.8	1.4	2.3	1.6	2.0	1.5
Pancreatic cancer	1.3	0.7	1.8	1.2	1.5	1.0
Oesophageal cancer	2.5	2.2	2.8	0.7	2.5	1.4
Prostate cancer	1.1	0.4	. .	0.0	1.0	0.1
Other malignant neoplasms	1.3	0.4	1.7	0.8	1.5	0.7
Leukaemia	1.1	0.2	1.7	0.7	1.3	0.4
Stomach cancer	2.0	1.2	1.5	0.3	1.7	0.7
Non-Hodgkin lymphoma	1.2	0.3	1.6	0.5	1.3	0.4
Cervical cancer	. .	0.0	4.4	1.8	4.6	1.0
Bladder cancer	1.4	0.4	2.9	0.6	1.8	0.5
Ovarian cancer	. .	0.0	1.2	0.3	1.3	0.2
Brain cancers	0.5	–1.0	0.8	–0.3	0.6	–0.6
Laryngeal cancer	5.2	1.2	3.7	0.1	4.9	0.6
Other non-malignant neoplasms	1.9	0.3	2.7	0.5	2.3	0.4
Kidney cancer	0.9	–0.1	0.8	–0.1	0.8	–0.1
Myeloma	1.0	0.0	1.0	0.0	1.0	0.0
Melanoma of the skin	0.3	–1.4	0.5	–0.4	0.4	–0.9
Uterine cancer	. .	0.0	1.5	0.3	1.6	0.2
Non-melanoma skin cancer	1.1	0.0	1.7	0.1	1.2	0.1
Other blood cancers	1.5	0.2	1.3	0.1	1.4	0.1
Gallbladder cancer	3.4	0.3	1.5	0.1	2.1	0.2
Brain tumours	1.5	0.1	1.5	0.1	1.5	0.1
Mesothelioma	0.8	–0.2	0.7	0.0	0.7	–0.1
Thyroid cancer	1.3	0.0	3.4	0.3	2.6	0.2
Hodgkin lymphoma	2.2	0.1	0.9	0.0	1.5	0.0
Testicular cancer	2.8	0.2	. .	0.0	2.8	0.1
Ductal carcinoma in situ	0.0	0.0	0.6	0.0	0.7	0.0
All cancers	**1.6**	**25.8**	**1.7**	**21.3**	**1.7**	**23.1**

Source: AIHW analysis of burden of disease database, 2011.

Table B.8: Decomposition of changes in total burden (DALY) between 2003 and 2011

Cancer type	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 DALY	% change from 2003 due to disease[c]	Total % change from 2003
Lung cancer	138,117	156,461	13.3	168,344	8.6	154,890	–9.7	12.1
Bowel cancer	96,037	108,793	13.3	117,043	8.6	92,422	–25.6	–3.8
Breast cancer	69,423	78,644	13.3	82,723	5.9	70,675	–17.4	1.8
Prostate cancer	43,204	48,942	13.3	53,025	9.5	49,232	–8.8	14.0
Pancreatic cancer	35,434	40,140	13.3	43,225	8.7	44,428	3.4	25.4
Brain cancers	33,822	38,314	13.3	39,306	2.9	35,662	–10.8	5.4
Unknown primary	32,631	36,965	13.3	39,894	9.0	35,585	–13.2	9.1
Melanoma of the skin	28,439	32,217	13.3	33,936	6.0	34,654	2.5	21.9
Leukaemia	31,222	35,369	13.3	36,950	5.1	30,629	–20.2	–1.9
Other cancers	24,164	27,373	13.3	28,504	4.7	29,896	5.8	23.7
Liver cancer	18,953	21,470	13.3	22,734	6.7	29,376	35.0	55.0
Non–Hodgkin lymphoma	29,816	33,776	13.3	36,000	7.5	25,456	–35.4	–14.6
Oesophageal cancer	22,029	24,954	13.3	26,694	7.9	23,773	–13.3	7.9
Stomach cancer	22,860	25,896	13.3	27,621	7.5	22,583	–22.0	–1.2
Ovarian cancer	17,285	19,581	13.3	20,804	7.1	19,421	–8.0	12.4
Kidney cancer	16,681	18,897	13.3	20,157	7.6	17,774	–14.3	6.5
Mouth and pharyngeal cancer	17,229	19,518	13.3	20,742	7.1	17,617	–18.1	2.2
Bladder cancer	14,401	16,314	13.3	17,626	9.1	15,935	–11.7	10.7
Myeloma	13,287	15,052	13.3	16,307	9.4	14,964	–10.1	12.6
Mesothelioma	9,368	10,612	13.3	11,495	9.4	10,476	–10.9	11.8
Non–melanoma skin cancer	7,669	8,688	13.3	9,387	9.1	9,369	–0.2	22.2

(continued)

Table B.8 (continued): Decomposition of changes in total burden (DALY) between 2003 and 2011

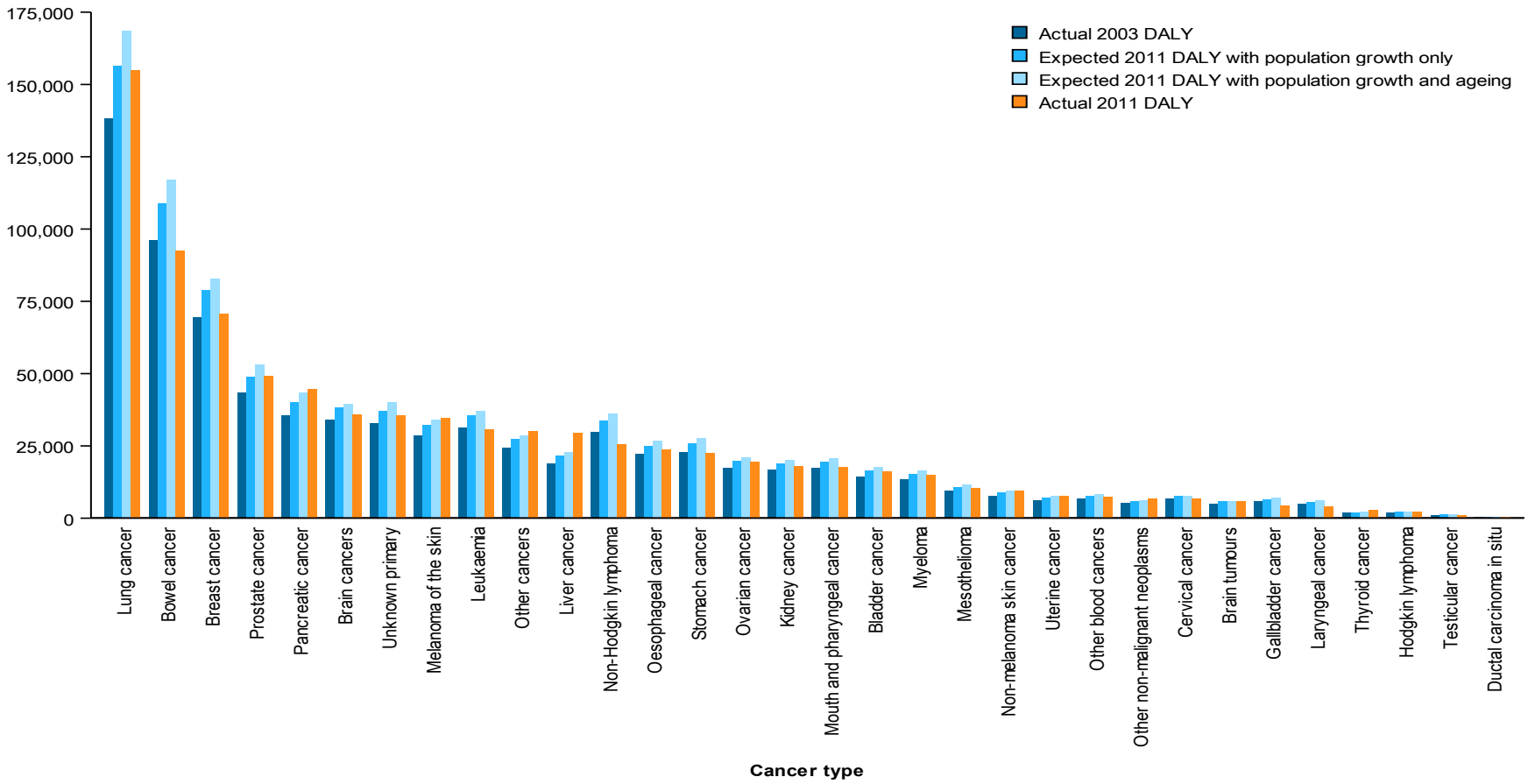
Cancer type	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 DALY	% change from 2003 due to disease[c]	Total % change from 2003
Uterine cancer	6,199	7,023	13.3	7,529	8.2	7,622	1.5	23.0
Other blood cancers	6,626	7,506	13.3	8,141	9.6	7,346	–12.0	10.9
Other non–malignant neoplasms	5,026	5,693	13.3	6,056	7.2	6,771	14.2	34.7
Cervical cancer	6,646	7,529	13.3	7,693	2.5	6,555	–17.1	–1.4
Brain tumours	5,022	5,689	13.3	5,849	3.2	5,729	–2.4	14.1
Gallbladder cancer	5,757	6,522	13.3	6,988	8.1	4,287	–46.9	–25.5
Laryngeal cancer	4,898	5,549	13.3	6,014	9.5	4,070	–39.7	–16.9
Thyroid cancer	1,738	1,969	13.3	2,127	9.1	2,634	29.2	51.6
Hodgkin lymphoma	1,958	2,218	13.3	2,267	2.5	1,999	–13.7	2.1
Testicular cancer	1,058	1,199	13.3	1,221	2.1	1,006	–20.3	–5.0
Ductal carcinoma in situ	208	236	13.3	250	6.5	414	78.6	98.3
Total	**767,210**	**869,110**	**13.3**	**926,652**	**7.5**	**833,250**	**–12.2**	**8.6**

(a) Estimated by increasing DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

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

(c) Estimated by subtracting the actual 2011 DALY estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Source: AIHW analysis of burden of disease database, 2011.



Source: Analysis of Australian burden of disease database, 2011.

Figure B.1: Expected and actual total burden (DALY) by cancer type, 2003 and 2011

Table B.9: Decomposition of changes in fatal burden (YLL) between 2003 and 2011

Cancer type[a]	Actual 2003 YLL	Expected 2011 YLL with population growth[a]	% change due to increasing population	Expected 2011 YLL with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 YLL	% change from 2003 due to disease[c]	Total % change from 2003
Lung cancer	135,098	153,041	13.3	164,655	8.6	151,205	–10.0	11.9
Bowel cancer	90,434	102,445	13.3	110,156	8.5	85,824	–26.9	–5.1
Breast cancer	63,369	71,786	13.3	75,417	5.7	63,368	–19.0	–0.0
Pancreatic cancer	35,025	39,676	13.3	42,721	8.7	43,890	3.3	25.3
Prostate cancer	37,786	42,805	13.3	46,334	9.3	40,191	–16.3	6.4
Brain cancers	32,813	37,171	13.3	38,126	2.9	34,407	–11.3	4.9
Unknown primary	31,363	35,528	13.3	38,315	8.9	34,214	–13.1	9.1
Melanoma of the skin	26,032	29,489	13.3	31,066	6.1	31,647	2.2	21.6
Leukaemia	30,016	34,003	13.3	35,494	5.0	29,210	–20.9	–2.7
Liver cancer	18,769	21,261	13.3	22,511	6.7	29,067	34.9	54.9
Other cancers	23,167	26,244	13.3	27,300	4.6	28,482	5.1	22.9
Non–Hodgkin lymphoma	28,504	32,290	13.3	34,407	7.4	23,909	–36.8	–16.1
Oesophageal cancer	21,687	24,567	13.3	26,274	7.9	23,382	–13.3	7.8
Stomach cancer	22,316	25,279	13.3	26,955	7.5	22,002	–22.2	–1.4
Ovarian cancer	16,738	18,961	13.3	20,139	7.0	18,789	–8.1	12.3
Kidney cancer	16,057	18,189	13.3	19,400	7.5	16,954	–15.2	5.6
Mouth and pharyngeal cancer	16,309	18,475	13.3	19,629	7.1	16,580	–18.7	1.7
Bladder cancer	13,604	15,411	13.3	16,646	9.1	15,061	–11.6	10.7
Myeloma	12,638	14,316	13.3	15,504	9.4	14,150	–10.7	12.0
Mesothelioma	9,150	10,365	13.3	11,227	9.4	10,232	–10.9	11.8
Non–melanoma skin cancer	6,586	7,460	13.3	8,063	9.2	8,022	–0.6	21.8
Other blood cancers	6,265	7,097	13.3	7,701	9.6	6,974	–11.6	11.3

(continued)

Table B.9 (continued): Decomposition of changes in fatal burden (YLL) between 2003 and 2011

Cancer type[a]	Actual 2003 YLL	Expected 2011 YLL with population growth[a]	% change due to increasing population	Expected 2011 YLL with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 YLL	% change from 2003 due to disease[c]	Total % change from 2003
Uterine cancer	5,683	6,437	13.3	6,895	8.0	6,930	0.6	22.0
Cervical cancer	6,390	7,238	13.3	7,394	2.4	6,293	–17.2	–1.5
Other non–malignant neoplasms	3,449	3,907	13.3	4,202	8.5	4,610	11.8	33.7
Brain tumours	4,078	4,620	13.3	4,742	3.0	4,305	–10.7	5.6
Gallbladder cancer	5,653	6,404	13.3	6,860	8.1	4,167	–47.6	–26.3
Laryngeal cancer	4,634	5,249	13.3	5,689	9.5	3,806	–40.6	–17.9
Thyroid cancer	1,404	1,590	13.3	1,740	10.7	2,076	23.9	47.9
Hodgkin lymphoma	1,813	2,054	13.3	2,101	2.6	1,813	–15.9	–0.0
Testicular cancer	872	988	13.3	1,013	2.9	789	–25.7	–9.5
Ductal carcinoma in situ[d]	. .	. .	. .	. .	. .	. .	. .	. .
Total	**727,697**	**824,349**	**13.3**	**878,678**	**7.5**	**782,349**	**–13.2**	**7.5**

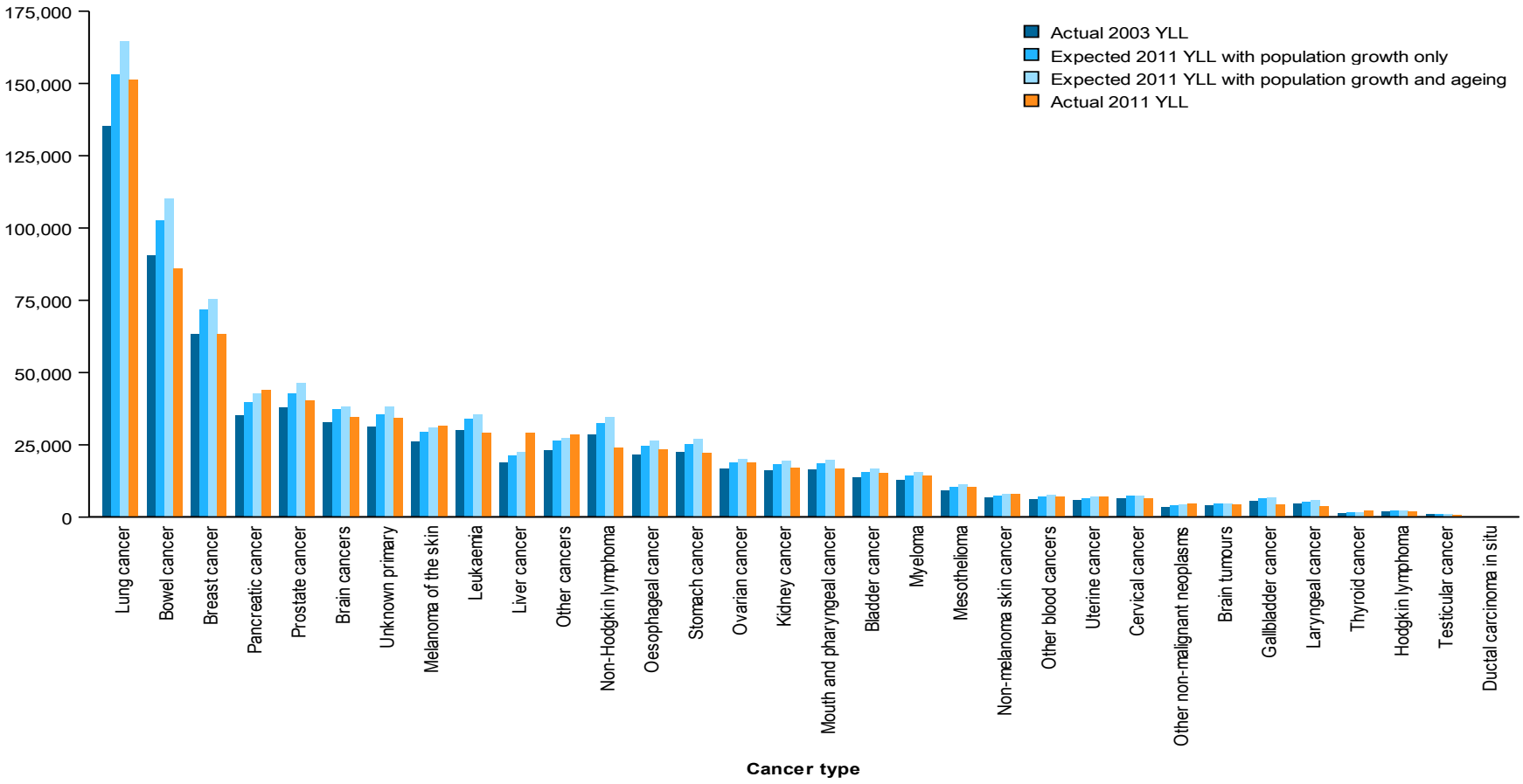
(a) Estimated by increasing DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

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

(c) Estimated by subtracting the actual 2011 DALY estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

(d) As ductal carcinoma in situ is non-fatal, there is no fatal burden for this disease.

Source: AIHW analysis of burden of disease database, 2011.



Source: Analysis of Australian burden of disease database, 2011.

Figure B.2: Expected and actual fatal burden (YLL) by cancer type, 2003 and 2011

Table B.10: Decomposition of changes in non-fatal burden (YLD) between 2003 and 2011

Cancer type	Actual 2003 YLD	Expected 2011 YLD with population growth[a]	% change due to increasing population	Expected 2011 YLD with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 YLD	% change from 2003 due to disease[c]	Total % change from 2003
Prostate cancer	5,418	6,138	13.3	6,691	10.2	9,041	43.4	66.9
Breast cancer	6,054	6,858	13.3	7,306	7.4	7,307	0.0	20.7
Bowel cancer	5,604	6,348	13.3	6,886	9.6	6,598	–5.1	17.7
Lung cancer	3,019	3,420	13.3	3,689	8.9	3,685	–0.1	22.1
Melanoma of the skin	2,407	2,727	13.3	2,869	5.9	3,007	5.7	24.9
Other non–malignant neoplasms	1,577	1,786	13.3	1,855	4.3	2,162	19.5	37.1
Non–Hodgkin lymphoma	1,312	1,486	13.3	1,593	8.1	1,547	–3.5	17.9
Brain tumours	944	1,070	13.3	1,107	4.0	1,424	33.6	50.9
Leukaemia	1,206	1,366	13.3	1,456	7.4	1,420	–3.0	17.7
Other cancers	997	1,129	13.3	1,204	7.6	1,414	21.0	41.8
Unknown primary	1,268	1,436	13.3	1,579	11.3	1,370	–16.5	8.1
Non–melanoma skin cancer	1,084	1,228	13.3	1,324	8.9	1,347	2.2	24.3
Brain cancers	1,010	1,144	13.3	1,180	3.6	1,255	7.5	24.3
Mouth and pharyngeal cancer	920	1,043	13.3	1,114	7.7	1,036	–8.4	12.6
Bladder cancer	797	903	13.3	980	9.7	874	–13.3	9.6
Kidney cancer	625	708	13.3	757	7.8	820	10.1	31.3
Myeloma	649	736	13.3	803	10.3	814	1.7	25.3
Uterine cancer	517	586	13.3	634	9.4	692	11.2	33.9
Ovarian cancer	547	620	13.3	665	8.2	631	–6.1	15.4
Stomach cancer	544	616	13.3	666	9.2	581	–15.6	6.8
Thyroid cancer	334	379	13.3	387	2.4	559	51.4	67.0

(continued)

Table B.10 (continued): Decomposition of changes in non-fatal burden (YLD) between 2003 and 2011

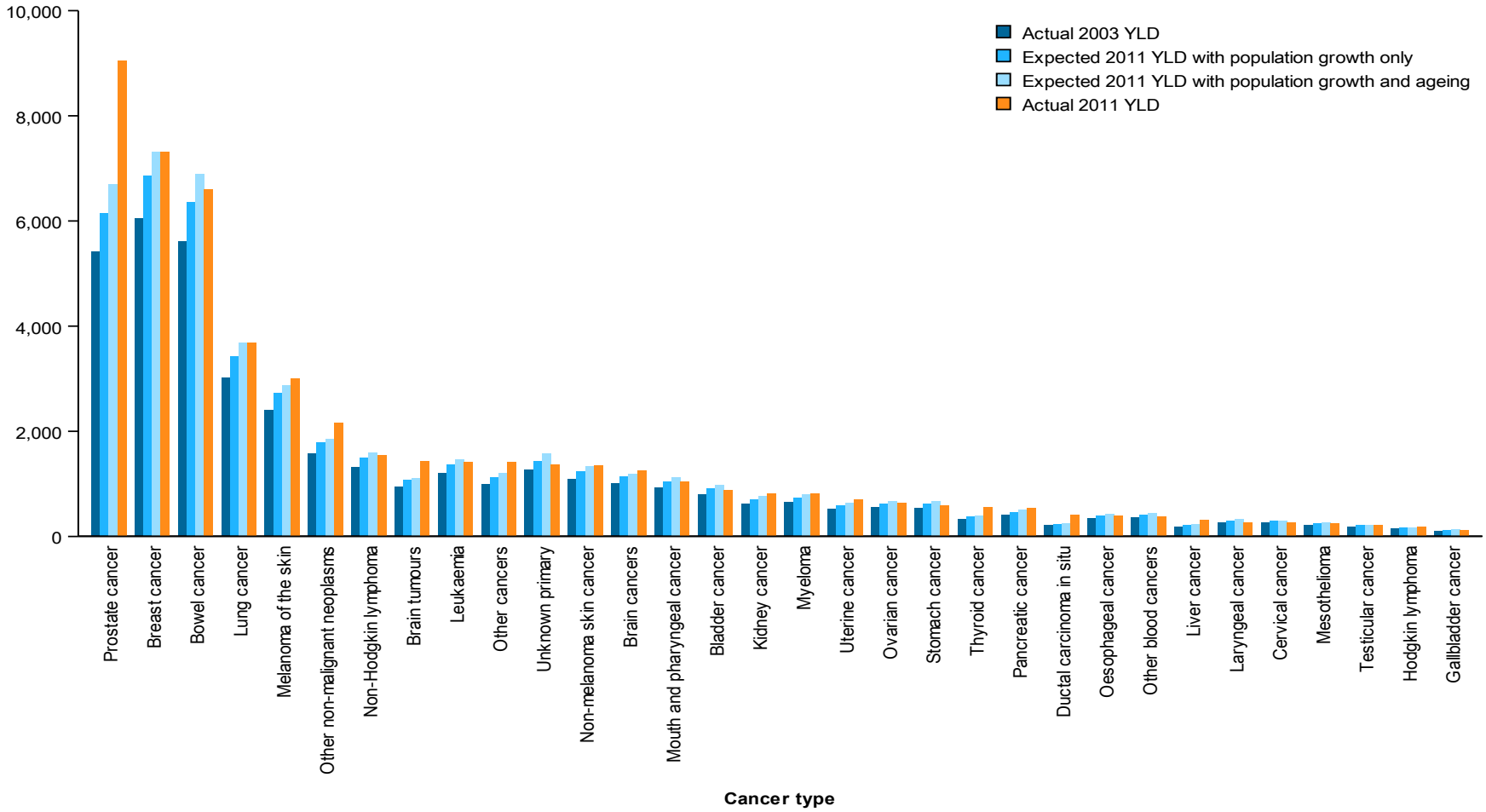
Cancer type	Actual 2003 YLD	Expected 2011 YLD with population growth[a]	% change due to increasing population	Expected 2011 YLD with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 YLD	% change from 2003 due to disease[c]	Total % change from 2003
Pancreatic cancer	409	463	13.3	504	9.8	538	8.3	31.4
Ductal carcinoma in situ	208	236	13.3	250	6.5	414	78.6	98.3
Oesophageal cancer	342	387	13.3	420	9.6	391	–8.4	14.5
Other blood cancers	361	409	13.3	439	8.6	373	–18.5	3.3
Liver cancer	184	209	13.3	223	7.9	309	46.3	67.5
Laryngeal cancer	264	300	13.3	325	9.7	265	–22.9	0.0
Cervical cancer	256	290	13.3	299	3.3	263	–14.0	2.5
Mesothelioma	218	248	13.3	268	9.4	244	–11.1	11.6
Testicular cancer	186	211	13.3	208	–1.6	216	4.6	16.3
Hodgkin lymphoma	145	164	13.3	166	1.3	186	14.1	28.6
Gallbladder cancer	104	118	13.3	128	9.7	119	–8.7	14.3
Total	**39,512**	**44,760**	**13.3**	**47,974**	**8.1**	**50,901**	**7.4**	**28.8**

(a) Estimated by increasing DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

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

(c) Estimated by subtracting the actual 2011 DALY estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Source: AIHW analysis of burden of disease database, 2011.



Source: Analysis of Australian burden of disease database, 2011.

Figure B.3: Expected and actual non-fatal burden (YLD) by cancer type, 2003 and 2011

Table B.11: Decomposition of changes in Indigenous total burden (DALY) between 2003 and 2011

Cancer type	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 DALY	% change from 2003 due to disease[c]	Total % change from 2003
Lung cancer	2,967	3,543	19.4	4,301	25.6	4,258	–1.5	43.5
Bowel cancer	1,021	1,219	19.4	1,381	15.8	1,353	–2.7	32.6
Liver cancer	472	563	19.4	666	21.7	1,246	123.0	164.1
Breast cancer	969	1,157	19.4	1,312	16.1	1,173	–14.4	21.1
Mouth and pharyngeal cancer	735	878	19.4	1,038	21.8	1,126	12.1	53.2
Oesophageal cancer	660	788	19.4	940	23.1	850	–13.7	28.7
Unknown primary	693	827	19.4	979	22.0	816	–23.6	17.8
Pancreatic cancer	437	522	19.4	626	23.8	802	40.3	83.5
Other cancers	604	721	19.4	787	10.9	764	–3.8	26.5
Leukaemia	500	597	19.4	633	7.2	624	–1.8	24.8
Cervical cancer	316	377	19.4	392	4.6	496	33.1	57.2
Stomach cancer	350	418	19.4	498	22.9	484	–4.0	38.4
Brain cancers	396	472	19.4	476	1.0	464	–3.1	17.3
Prostate cancer	232	277	19.4	334	24.5	445	48.1	92.0
Non–Hodgkin lymphoma	336	402	19.4	456	16.2	399	–16.8	18.7
Bladder cancer	201	240	19.4	288	24.1	322	16.7	60.2
Ovarian cancer	221	264	19.4	303	17.3	319	7.3	44.0
Kidney cancer	245	292	19.4	331	16.1	238	–38.1	–2.6
Laryngeal cancer	200	239	19.4	294	27.8	238	–28.3	18.9

(continued)

Table B.11 (continued): Decomposition of changes in Indigenous total burden (DALY) between 2003 and 2011

Cancer type	Actual 2003 DALY	Expected 2011 DALY with population growth[a]	% change due to increasing population	Expected 2011 DALY with increasing and ageing population[b]	% change from 2003 due to population ageing	Actual 2011 DALY	% change from 2003 due to disease[c]	Total % change from 2003
Other non–malignant neoplasms	196	234	19.4	253	9.5	206	–23.7	5.2
Melanoma of the skin	114	136	19.4	153	15.0	168	13.7	48.1
Myeloma	150	179	19.4	198	12.3	162	–23.5	8.2
Brain tumours	84	100	19.4	102	2.8	154	61.1	83.3
Uterine cancer	186	222	19.4	263	21.8	139	–66.2	–25.0
Non–melanoma skin cancer	63	76	19.4	85	15.4	133	76.0	110.8
Gallbladder cancer	117	139	19.4	178	33.0	111	–57.6	–5.1
Total	**12,801**	**15,286**	**19.4**	**17,731**	**19.1**	**17,847**	**0.9**	**39.4**

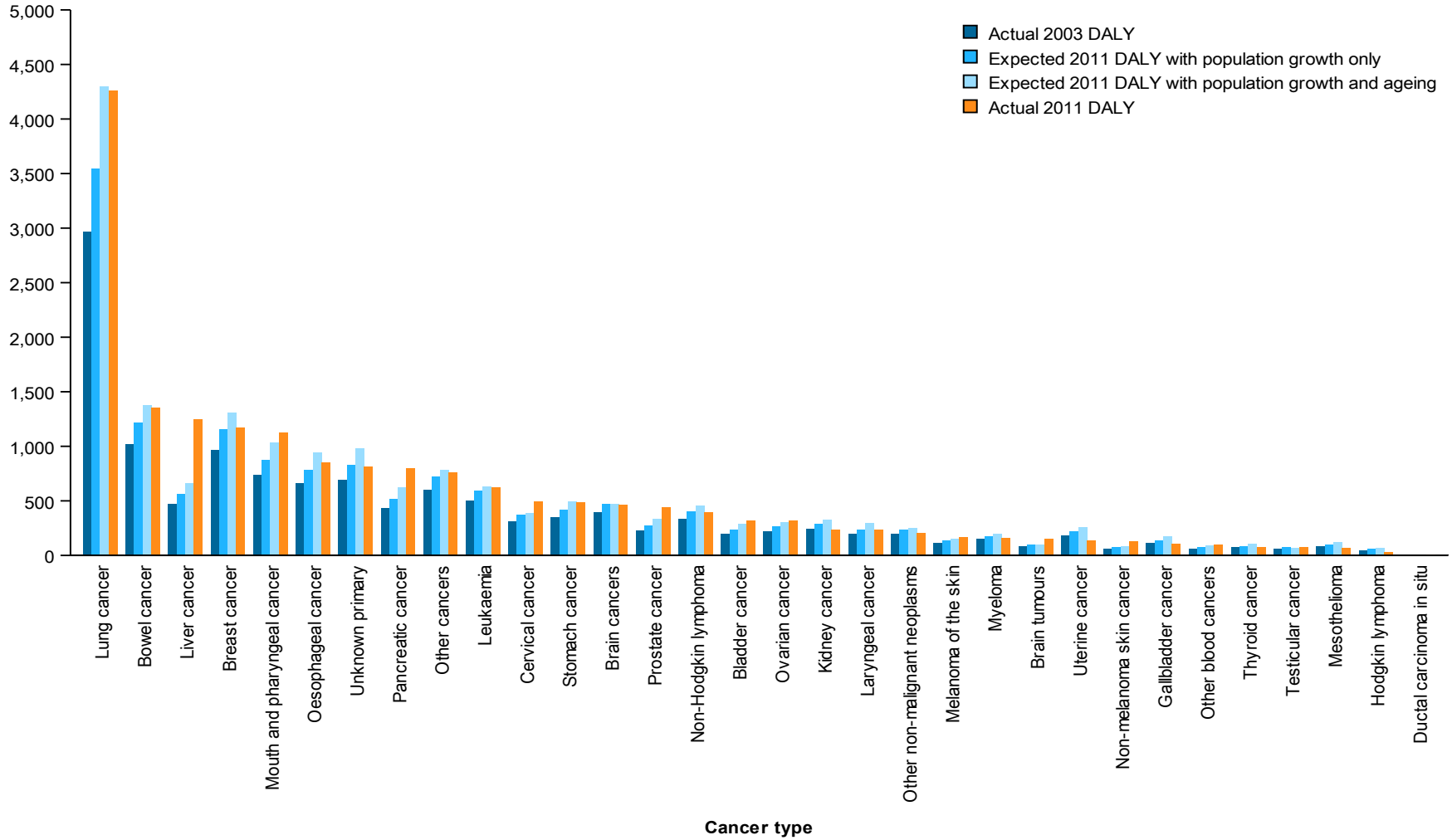
(a) Estimated by increasing DALY from 2003 by 13.3% to match the increase in the Australian population between 2003 and 2011.

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

(c) Estimated by subtracting the actual 2011 DALY estimate from the expected 2011 estimate, given population growth and ageing; expressed as a percentage increase from 2003.

Note: Estimates based on DALY less than 100 in 2011 are not included.

Source: AIHW analysis of burden of disease database, 2011.



Source: Analysis of Australian burden of disease database, 2011.

Figure B.4: Expected and actual Indigenous total burden (DALY) by cancer type, 2003 and 2011

Table B.12: Change in fatal cancer burden (YLL) between 2003 and 2011, Indigenous Australians

Cancer type	2003 YLL	2011 YLL	Change in YLL	Change in YLL (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Lung cancer	2,924	4,194	1,270	43.4	13.2	14.4	1.3	1.1
Bowel cancer	988	1,305	317	32.1	4.1	4.3	0.2	1.1
Liver cancer	468	1,239	770	164.4	2.0	4.0	2.0	2.0
Mouth and pharyngeal cancer	718	1,103	385	53.6	2.9	3.2	0.3	1.1
Breast cancer	919	1,097	179	19.5	3.6	3.2	– 0.3	0.9
Oesophageal cancer	653	842	189	28.9	2.8	2.3	–0.4	0.8
Unknown primary	677	799	122	18.0	3.1	2.8	–0.2	0.9
Pancreatic cancer	433	796	363	83.7	2.1	2.8	0.6	1.3
Other cancers	592	748	156	26.4	1.8	1.9	0.0	1.0
Leukaemia	488	608	120	24.7	1.7	1.6	–0.1	1.0
Cervical cancer	307	486	178	58.1	1.0	1.2	0.2	1.2
Stomach cancer	345	477	132	38.2	1.6	1.6	0.0	1.0
Brain cancers	386	451	65	16.8	0.9	0.9	0.0	1.0
Prostate cancer	215	405	190	88.6	1.4	1.9	0.5	1.4
Non–Hodgkin lymphoma	329	387	58	17.8	1.5	1.4	–0.1	0.9
Bladder cancer	196	315	119	60.9	1.0	1.1	0.1	1.1
Ovarian cancer	215	312	96	44.6	1.0	1.0	0.0	1.0
Kidney cancer	240	232	–8	–3.3	0.9	0.6	–0.3	0.7
Laryngeal cancer	195	231	36	18.4	0.8	0.7	–0.1	0.9
Other non–malignant	183	182	–1	–0.4	0.5	0.6	0.1	1.1
Melanoma of the skin	109	161	52	48.0	0.4	0.5	0.1	1.2
Myeloma	145	157	12	8.0	0.6	0.6	–0.1	0.9
Brain tumours	78	145	68	86.9	0.3	0.3	0.1	1.3
Non–melanoma skin cancer	61	129	68	112.0	0.2	0.4	0.2	1.7
Uterine cancer	178	127	–51	–28.6	0.9	0.5	–0.4	0.5
Gallbladder cancer	115	109	–6	–5.4	0.7	0.4	–0.4	0.5
Total	**12,478**	**17,370**	**4,893**	**39.2**	**52.3**	**55.3**	**3.0**	**1.1**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Change in YLL is 2011 YLL minus 2003 YLL, expressed as a percentage of 2003 YLL.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASR by corresponding 2003 ASR.
5. Age-standardised rates and changes based on a small number of YLL should be interpreted with caution.
6. Estimates based on YLL less than 100 in 2011 are not included.

Source: AIHW analysis of burden of disease database, 2011.

Table B.13: Change in non-fatal cancer burden (YLD) between 2003 and 2011, Indigenous Australians

Cancer type	2003 YLD	2011 YLD	Change in YLD	Change in YLD (%)	2003 ASR	2011 ASR	Change in ASR	ASR rate ratio 2011:2003
Breast cancer	50	75	26	51.2	0.2	0.3	0.0	1.1
Lung cancer	42	63	21	48.7	0.2	0.3	0.0	1.1
Bowel cancer	33	48	16	47.4	0.2	0.2	0.0	1.0
Prostate cancer	17	41	23	134.3	0.1	0.2	0.1	1.5
Other non-malignant neoplasms	13	24	11	85.6	0.0	0.1	0.0	1.6
Mouth and pharyngeal cancer	17	23	6	37.5	0.1	0.1	0.0	1.0
Unknown primary	15	16	1	5.7	0.1	0.1	0.0	0.8
Other cancers	12	16	4	34.1	0.1	0.1	0.0	1.1
Leukaemia	12	16	4	29.9	0.1	0.0	0.0	0.9
Brain cancers	9	13	4	40.2	0.0	0.0	0.0	1.1
Non-Hodgkin lymphoma	8	12	5	59.6	0.0	0.0	0.0	1.3
Uterine cancer	8	12	4	57.8	0.0	0.0	0.0	1.0
Cervical cancer	9	11	2	23.3	0.0	0.0	0.0	0.9
Total	**323**	**477**	**154**	**47.5**	**1.6**	**1.7**	**0.1**	**1.1**

Notes

1. Rates were age-standardised to the 2001 Australian Standard Population, and are expressed per 1,000 persons.
2. Change in YLD is 2011 YLD minus 2003 YLD, expressed as a percentage of 2003 YLD.
3. Change in ASR is 2011 ASR minus 2003 ASR.
4. Rate ratios divide 2011 ASR by corresponding 2003 ASR.
5. Age-standardised rates and changes based on a small number of YLD should be interpreted with caution.
6. Estimates based on YLD less than 10 in 2011 are not included.

Source: AIHW analysis of burden of disease database, 2011.

Glossary

age-standardisation: A set of techniques used to remove, as far as possible, the effects of differences in age when comparing 2 or more populations.

age-standardised rate: Rate that takes into account the age structure of the population.

attributable burden: The disease burden attributed to a particular risk factor. It is the reduction in fatal and non-fatal burden that would have occurred if exposure to the risk factor had been avoided (or, 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: Persistent and long-lasting.

comorbidity: A situation where a person has 2 or more health problems at the same time.

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

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

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

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

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

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

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

hospitalisation: Synonymous with admission and separation; that is, an episode of hospital care that starts with the formal admission process and ends with the formal separation process.

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

International Statistical Classification of Diseases and Related Health Problems (ICD): The World Health Organization's internationally accepted classification of diseases and related health conditions. The tenth revision, Australian modification (ICD-10-AM) is currently in use in Australian hospitals for admitted patients.

morbidity: Ill health in an individual, and levels of ill health in a population or group.

mortality: Death.

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

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

premature mortality: Deaths that occur at a younger age than a selected cut-off.

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

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health-care establishment. METeOR identifier: 514273.

rate: A rate is 1 number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers.

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

sequelae: Consequences of diseases.

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

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

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

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Related publications

This report, *Burden of cancer in Australia*, and other AIHW publications can be downloaded for free from the AIHW website <http://www.aihw.gov.au>. The website also includes information on ordering printed copies.

The following related AIHW publications might also be of interest:

- AIHW 2017a. Cancer in Australia 2017. Cancer series no. 101. Cat. no. CAN 100. Canberra: AIHW.
- AIHW 2017b. 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 2016a. Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2011. Australian Burden of Disease Study series no. 6. Cat. no. BOD 7. Canberra: AIHW.
- AIHW 2016b. Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011. Australian Burden of Disease Study series no. 3. Cat. no. BOD 4. Canberra: AIHW.
- AIHW 2016c. Australian Burden of Disease Study 2011: methods and supplementary material. Australian Burden of Disease Study series no. 5. Cat. no. BOD 6. Canberra: AIHW.

Cancer was the greatest cause of health burden in Australia in 2011, accounting for around one-fifth of the total disease burden. Most (94%) of this burden was due to dying prematurely, with only a small proportion of the burden due to living with a cancer diagnosis. This report explores in further detail the burden of cancer in Australia, including cancer burden in Aboriginal and Torres Strait islander people, and by remoteness and socioeconomic group. It also looks at how the cancer burden has changed since 2003, and the potential burden of cancer expected in 2020.