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Health system expenditure on cancer and other neoplasms in Australia

2015–16

AIHW

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Summary

This report provides estimates of Australia's health system expenditure on treatment and care for those with cancer, as well as on cancer screening.

The report presents estimates of cancer expenditure by age group, sex, Indigenous status, geography, and over time; by area of expenditure and for a range of types of cancer, as well as expenditure on cancer as a result of health risk factors.

Expenditure estimates included in this report are based on health system expenditure that can be attributed to cancer. Not included in this analysis are expenditure on items such as capital goods, including equipment used exclusively for the treatment of individual chronic diseases (such as, linear accelerators for cancer) and expenditure on health administration other than for cancer screening programs.

Not all health system expenditure can be allocated to specific diseases. There are other limitations to the data, and these are explained in Appendix A.

Main findings

- In 2015–16, health system expenditure on cancer and other neoplasms was estimated to be $10.1 billion, comprising $9.7 billion on diagnosing and treating cancer and $409 million on the three national population cancer screening programs—bowel, breast and cervical.
- Cancer ranked third in terms of Australia's estimated total health system expenditure on diseases, and accounted for 8.6% of total disease expenditure.
- Of total cancer expenditure, 36% related to admitted patients in public hospitals, 22% to admitted patients in private hospitals, 13% to pharmaceuticals (including chemotherapy), 10% to public hospital outpatient clinic patients, 7% to medical specialists and 4% to national cancer screening programs.
- The cancer type with the highest expenditure was breast cancer ($1,056 million, including $269 million on the national screening program), followed by non-melanoma skin cancer (NMSC, $1,005 million), bowel cancer ($876 million, including $56 million on the National Bowel Cancer Screening program), prostate cancer ($684 million), non-Hodgkin lymphoma (NHL, $481 million), lung cancer ($448 million), myeloma ($322 million), kidney cancer ($198 million), chronic myeloid leukaemia ($182 million) and brain and central nervous system cancer ($180 million), which together comprise 54% of all health system expenditure on cancer.
- Cancer expenditure was slightly higher for females ($4,982 million or 50.2%) than for males ($4,951 million). For comparison, 54.7% of cancers were diagnosed in males in 2016.
- The highest expenditure cancers for males were prostate cancer (13% of cancer expenditure for males), NMSC (11%), bowel cancer (10% including the national screening program), NHL (6%) and lung cancer (5%).
- The highest expenditure cancers for females were breast cancer (21% of cancer expenditure for females, including the national screening program), NMSC (9%), bowel cancer (8% including screening), lung cancer (4%) and NHL (4%).

- Compared with non-Indigenous people, a higher proportion of hospital admitted patient cancer expenditure on Indigenous people was in public hospitals (73% vs 52%), and a much lower proportion was in private hospitals (6% vs 33%).
- Risk factors such as high sun exposure, tobacco use and overweight and obesity, were responsible for $2.7 billion of cancer expenditure, which was 42% of expenditure on the cancers known to be affected by these risk factors.

1. Introduction

Cancer and other neoplasms are a major contributor to the burden of disease in Australia, constituting 18% of the burden in Australia (AIHW 2019a). As such, an understanding of the cost of treating these is useful for those with a personal or professional interest in the disease and for governments developing relevant policies and programs.

Box 1: Cancer expenditures presented here are modelled estimates

Health system expenditure on cancer and other neoplasms in Australia, 2015–16 describes modelled estimates of expenditure using a range of methods and available data sources (see Appendix A).This work updates estimates for 2008–09 (AIHW 2013), and is based on the most recent disease expenditure estimates (2015–16) available at the time of writing. Note that more recent (2018–19) data on health expenditure is available (AIHW 2020a), however, data on disease expenditure requires additional data and resources to prepare.

Compared with reporting for 2008–09, improved methods and newly available data sources have strengthened estimates, and have for the first time allowed some reporting of estimates for certain geographic areas, population groups and health risk factors.

The methods used have allowed 73% of all recurrent health system expenditure to be allocated to disease groups (such as cancer), with the remainder either unable to be allocated, or not logical to allocate to a specific disease.

The estimates in this report represent progress. However, readers should be aware that they are modelled estimates that rely on a number of assumptions, and that these estimates will continue to change over time as access to data improves and methods are further developed.

Methods to estimate hospital admitted patient expenditure differ slightly from those used in the *Disease expenditure in Australia* web report (AIHW 2019g), with details provided in Appendix A. Compared with the previous cancer expenditure report (AIHW 2013), the estimation method for hospital separation costs has been updated with the availability of more detailed cost data from the Independent Hospital Pricing Authority (IHPA), public hospital emergency department (ED) and outpatient clinic estimates are now available, expenditure estimation methods for Medical Benefits Scheme (MBS) and Pharmaceutical Benefits Scheme (PBS) have been improved, and estimates for cancer-related dental treatment have been included.

Note that the underlying data do not currently enable estimates to be reported by source of funds, and consequently reporting of out-of-pocket, state government and Australian government expenditure on cancer is not possible.

The onset of the coronavirus pandemic in early 2020 has reduced cancer diagnosis and treatment activities during the year, with some degree of recovery later in the year (Cancer Australia 2020). This is likely to have affected cancer-related expenditure during 2020, and will likely affect disease outcomes and expenditure into the future. However, the data presented in this report are not affected because they relate to 2015–16.

Neoplasms are diseases characterised by abnormal growth of tissue. Malignant neoplasms (cancers) are diseases in which abnormal cells divide without control and can invade nearby tissues. These cancer cells can also spread to other parts of the body through the blood and lymph systems. In contrast, benign and in situ neoplasms do not invade nearby tissues, and generally have less impact on health (with some exceptions).

Expenditure described in this report includes expenditure due to benign, in situ and uncertain (non-malignant) neoplasms as well as expenditure due to malignant neoplasms (cancer). Non-malignant neoplasms are responsible for 16% of total expenditure on all neoplasms, with cancers (malignant neoplasms) responsible for 84%.

Box 2: Cancer registrations in Australia

Registration of all cancers, excluding basal and squamous cell carcinomas of the skin, is required by law in each state and territory. Information on newly diagnosed cancers is collected by each state and territory population-based cancer registry and provided to the AIHW annually to form the Australian Cancer Database (ACD).

Data on the incidence of cancer refer to the number of new cases diagnosed and not the number of people newly diagnosed with cancer.

The incidence of all-cause cancer increased from 96,000 in 2003 to 131,000 in 2015 to an estimated 145,483 in 2020 (AIHW 2020b), an increase of 51% over 16 years. These changes in incidence reflect the increasing size of the population, increasing number of people in older age groups (noting that the incidence of cancer increases with age) and changes in the underlying rates of cancer associated with changes in risk factors (e.g. smoking and overweight) amongst the population. Increasing numbers of people diagnosed with cancer will tend to increase cancer expenditure over time, all other things being equal.

The age-standardised all-cause cancer incidence rate increased from 475 new cases per 100,000 population in 2003, to 487 new cases per 100,000 population in 2015, then decreased slightly to 483 new cases per 100,000 population in 2019 (AIHW 2019b). Overall, this is a modest increase of less than 2% over the 16 years to 2019. Small increases in the age-standardised rates of cancer suggest small increases in the underlying rates of cancer in the population, and/or slightly greater opportunity for diagnosis, or some combination of these.

Survival varies between cancer types and cancer stages, from low survival for cancers such as late-stage lung cancer (5-year relative survival is 3%) to high survival for cancers such as early-stage melanoma (5-year relative survival is 99%) (AIHW 2020b). Average 5-year relative survival from all-cause cancer has increased from 50% in the period 1986–90, to 62% in the period 2001–05, and to 69% in 2011–15 (the latest period for which survival estimates are available) (AIHW 2019b).

2. Total health system expenditure on cancer and population screening programs

Box 3: Health expenditure in Australia in 2015–16

Health system expenditure comprises recurrent expenditure and capital expenditure. Recurrent expenditure can generally be thought of as goods and services consumed within a reporting period. It includes expenditure on health goods (such as medical services), public health activities and other activities that support health systems as part of recurrent expenditure. Capital expenditure is expenditure on fixed assets such as new buildings or medical equipment.

Disease expenditure estimates for 2015–16 are the latest available at the time of writing.

Total health system expenditure in 2015–16 was $170.4 billion, comprising $10.2 billion in capital expenditure and $160.2 billion in recurrent expenditure.

Recurrent expenditure capable of being allocated to specific disease groups (including cancer) is estimated to have been $117 billion in 2015–16.

Around two-thirds of health spending was funded by governments; $70.2 billion from the Australian Government and $44.4 billion by state and territory governments.

Non-government entities (including individuals, private health insurance providers, injury compensation insurers and other private sources) spent $55.8 billion on health in 2015–16. Individuals were the largest contributor to this at $29.4 billion (AIHW 2017: Table 3.6).

National health expenditure grew at a rate greater than GDP. Total health expenditure increased by 5.42% in 2015–16, compared with GDP growth of 2.34% in that year (AIHW 2017: tables 2.1 and 2.2).

Total expenditure on cancer compared to other diseases

Health system expenditure on diseases includes expenditure funded by Australian and state and territory governments, private health insurers, and individuals.

Expenditure is not able to be reported by source of funds, though costs to all payers are included in estimates.

Expenditure not allocated by disease and therefore not presented in this report includes capital expenditure and capital consumption, patient transport, health administration (except in the case of population screening programs), health aides and appliances.

In 2015–16, an estimated total of $10.1 billion was spent on cancer screening, diagnosis and treatment of cancer and other neoplasms. This was comprised of $9.7 billion on diagnosing and treating patients, and a further $0.4 billion ($409 million) on the three national population cancer screening programs.

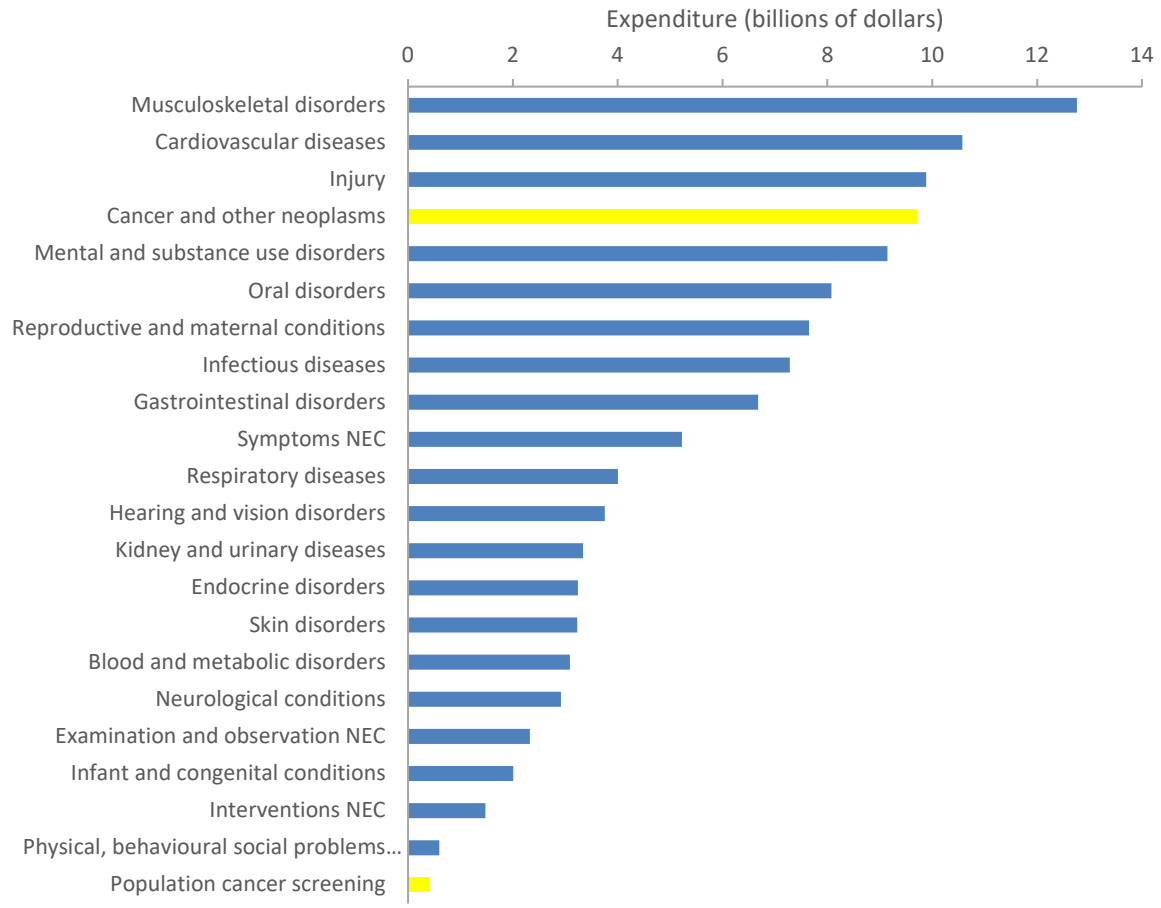
Total cancer expenditure accounted for 8.6% of the expenditure on healthcare that was allocated to diseases in Australia (Figure 2.1). Cancer had the third-highest expenditure when compared with other disease groups.

Figure 2.1 shows the proportion of health system expenditure by disease group in 2015–16. Six disease groups were responsible for just over half (51%) of health system expenditure in 2015–16:

- musculoskeletal disorders ($12.8 billion, 10.9% of expenditure)
- cardiovascular diseases ($10.6 billion, 9.0% of expenditure)
- cancer and screening ($9.7 billion and $0.4 billion, respectively, 8.6% of expenditure)
- injury ($9.9 billion, 8.4% of expenditure)
- mental and substance use disorders ($9.1 billion, 7.8% of expenditure)
- oral disorders ($8.1 billion, 6.9% of expenditure).

Due to differences in data preparation, estimates presented here differ slightly from those presented in the *Disease expenditure in Australia* web report (AIHW 2019g). For further information, refer to Appendix A.

Figure 2.1: Health system expenditure, by area of expenditure, 2015–16



Note: Data relating to this figure can be found in Online Table 1.

Source: AIHW Disease Expenditure Database.

Cancer management

Expenditure on cancer is estimated across the health system, including hospital admissions, emergency departments (EDs), outpatient clinics, non-hospital medical services, pharmaceuticals and screening programs.

The majority (68.1%) of the $10.1 billion spent on cancer treatment and diagnosis in 2015–16 related to care delivered in hospitals (Figure 2.2). This includes services provided to day-admitted patients and outpatient clinics. Of the total cancer expenditure included in this report:

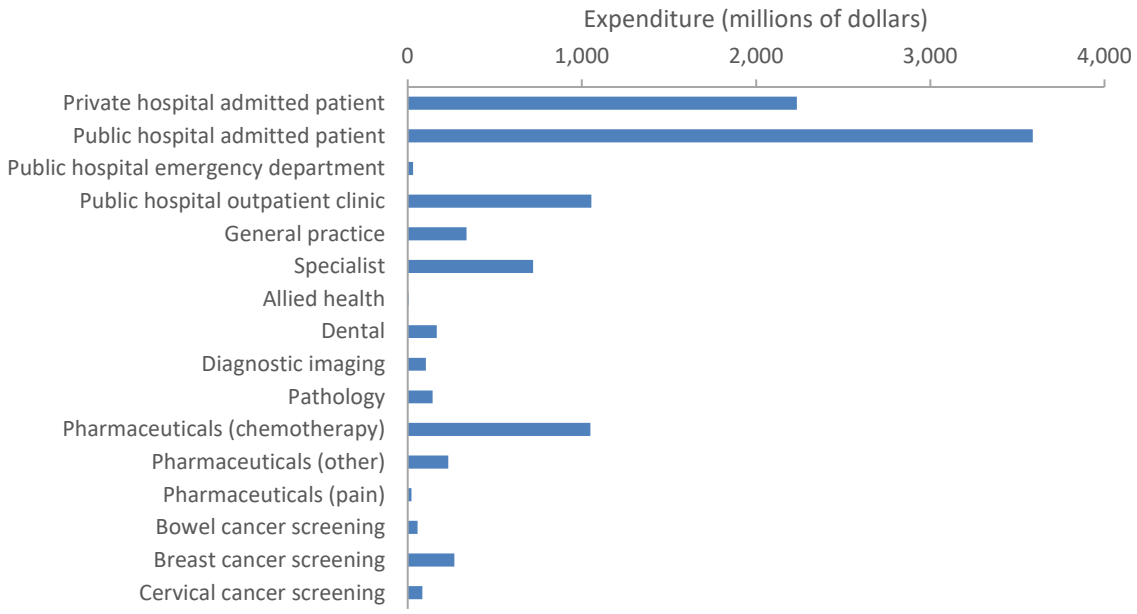
- public hospitals accounted for 46.0% ($4.7 billion – including $3.6 billion expenditure on public hospital admitted patients)
- private hospitals for 22.1% ($2.2 billion)
- pharmaceuticals for 12.9% of cancer expenditure ($1.3 billion)
- MBS expenditure on specialists and general practitioners for 10.5% ($1.06 billion)
- pathology and imaging accounted for 2.4% ($0.25 billion)
- dental and allied health for 1.7% ($0.17 billion)
- screening for 4.0% ($0.41 billion).

Expenditure on screening refers to the breast cancer ($269 million), cervical cancer ($84 million), and bowel cancer ($56 million) screening programs.

Some individual cancer-specific programs such as the National HPV vaccination program ($43 million (David Lush, pers. comm., 15 December 2020) in 2015–16 to protect girls from the risk of cervical cancer in later life) and the External Breast Prostheses Reimbursement Program, are currently beyond the scope of this report.

Cancer accounted for a large proportion of all expenditure on specialists (14.5%), public hospital outpatient clinics (12.0%), private hospital admitted patients (11.2%), and public hospital admitted patients (10.1%), but only a small percentage of all expenditure on allied health services (0.2%).

Figure 2.2: Health system expenditure on cancer, by area of expenditure, 2015–16



Note: Data relating to this figure can be found in Online Table 2.

Source: AIHW Disease Expenditure Database.

Cancer screening programs

National population-based screening programs are organised, systematic and integrated processes of testing for signs of cancer or pre-cancerous conditions in targeted populations without obvious symptoms. Programs target specific populations and/or age groups where evidence shows screening to be most effective.

Australia currently has 3 national population-based screening programs:

- BreastScreen Australia
- National Cervical Screening Program
- National Bowel Cancer Screening Program

In 2015–16, $408.9 million was spent on these population-based screening programs.

BreastScreen Australia

In 2015–16, just over $268.6 million was spent on BreastScreen Australia.

BreastScreen Australia began in 1991. It aims to reduce illness and death from breast cancer through an organised approach to the early detection of breast cancer, using screening mammography to detect unsuspected breast cancer in women. Early detection provides an opportunity for early treatment, which can reduce illness and death. Women aged 40 and over are eligible for free mammograms every 2 years, and women aged 50–74 are actively targeted to participate in the program (the target age group increased in 2013 from 50–69, to the current 50–74 years).

In 2020, it is estimated that there were 12,167 women aged 50–74 years diagnosed with breast cancer (around 61% of all female breast cancer diagnoses) and 1,400 deaths of women aged 50–74 years due to breast cancer (around 47% of all female breast cancer deaths) (AIHW 2020b).

In the 2-year period 2015–2016, 1.77 million women aged 50–74 had a screening mammogram. This was 55% of women in the target age group (AIHW 2018a).

After adjusting for lead time bias, women diagnosed through BreastScreen Australia had a 54% to 63% lower risk of dying from breast cancer than those who had never screened (AIHW 2018b).

National Cervical Screening Program

In 2015–16, $84.3 million was spent on the National Cervical Screening Program (NCSP).

The NCSP began in 1991. It aims to reduce cervical cancer cases, illness and deaths in Australia. The NCSP originally targeted women aged 20–69 for a 2-yearly Papanicolaou (Pap) smear, or 'Pap test' to detect precancerous abnormalities of the cervix. From 1 December 2017, the NCSP changed to 5-yearly cervical screening for women aged 25–74 using a primary human papilloma virus test with partial HPV genotyping and reflex liquid-based cytology triage (AIHW 2019c).

In 2020, it is estimated that there were 849 women aged 25–74 diagnosed with cervical cancer (around 91% of all cervical cancer diagnoses) and 183 deaths of women aged 25–74 years due to cervical cancer (around 77% of all cervical cancer deaths) (AIHW 2020b).

In the 2-year period 2015–2016, more than 3.8 million women aged 20–69 participated in the NCSP (55% of women in this age group) (AIHW 2018c).

Women diagnosed through cervical screening had a 77% lower risk of dying from cervical cancer than women who had never had a Pap test, and most cervical cancers (more than 70%) occurred in women who had never screened or who had not screened for some time (AIHW 2019d).

National Bowel Cancer Screening Program

In 2015–16, just over $56.1 million was spent on the National Bowel Cancer Screening Program (NBCSP).

The NBCSP began in 2006. It aims to reduce the morbidity and mortality from bowel cancer by actively recruiting and screening the eligible target population, aged 50–74, for early detection or prevention of the disease.

In 2020, it is estimated that there were 7,227 people aged 50–74 years diagnosed with bowel cancer (around 47% of all bowel cancer diagnoses in that year) and 1,905 bowel cancer deaths in people aged 50–74 (around 36% of all bowel cancer deaths in that year) (AIHW 2020b).

Of the 3.2 million people who were invited to participate in the program between 1 January 2015 and 31 December 2016, 41% participated in screening. For those who returned a positive screening result and then had a diagnostic assessment in 2016, 1,410 were found to have confirmed or suspected bowel cancer, and 4,440 people were found to have adenomas (precancerous growths which could subsequently be managed) (AIHW 2018d).

After adjusting for lead time bias, people diagnosed through the NBCSP had a 40% lower risk of dying from bowel cancer than people who had never been invited to screen (AIHW 2018e).

3. Health system expenditure on cancer, by cancer site

Health system expenditure on cancer has been estimated for 38 specific, or groups of, cancers (including groupings of 'other cancers', 'other ill-defined and unknown primary sites', and 'other benign, in situ and uncertain neoplasms').

From the data, cancers for which expenditure was greatest include breast cancer ($1,056 million, including $269 million on screening), non-melanoma skin cancer (NMSC, $1,005 million), bowel cancer ($876 million, including $56 million on screening), prostate cancer ($684 million), non-Hodgkin lymphoma (NHL, $481 million), lung cancer ($448 million), myeloma ($322 million), kidney cancer ($198 million), chronic myeloid leukaemia (CML, $182 million) and brain and central nervous system (CNS) cancer ($180 million). These cancers were responsible for $5,434 million expenditure (54% of all expenditure on cancer) and other cancers were responsible for $4,667 million expenditure.

The data also include expenditure estimates for each of the cancer sites: for example, expenditure on lung cancer comprised $216 million on public hospital inpatient services, $106 million on public hospital outpatient clinic, $73 million on private hospital inpatient services, $20 million on pharmaceuticals, $18 million on specialists, and $17 million on other services.

Table 3.1 describes expenditure for the 6 highest expenditure cancers.

Table 3.1: Cancer expenditure, for 6 highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
Bowel cancer	533	111	62	114	56	876	9%	15,530
Breast cancer	375	111	63	238	269	1,056	10%	17,304
Lung cancer	289	106	34	20	—	448	4%	12,034
NHL	241	67	30	143	—	481	5%	5,267
NMSC	471	79	443	12	—	1,005	10%	n.p.
Prostate cancer	335	69	74	205	—	684	7%	18,540
Other cancers	2,577	431	274	559	84	3,926	39%	64,604
Non-malignant neoplasms	1,001	111	498	14	—	1,624	16%	n.p.
All neoplasms	**5,822**	**1,086**	**1,478**	**1,305**	**409**	**10,100**	**100%**	**133,279**

Notes

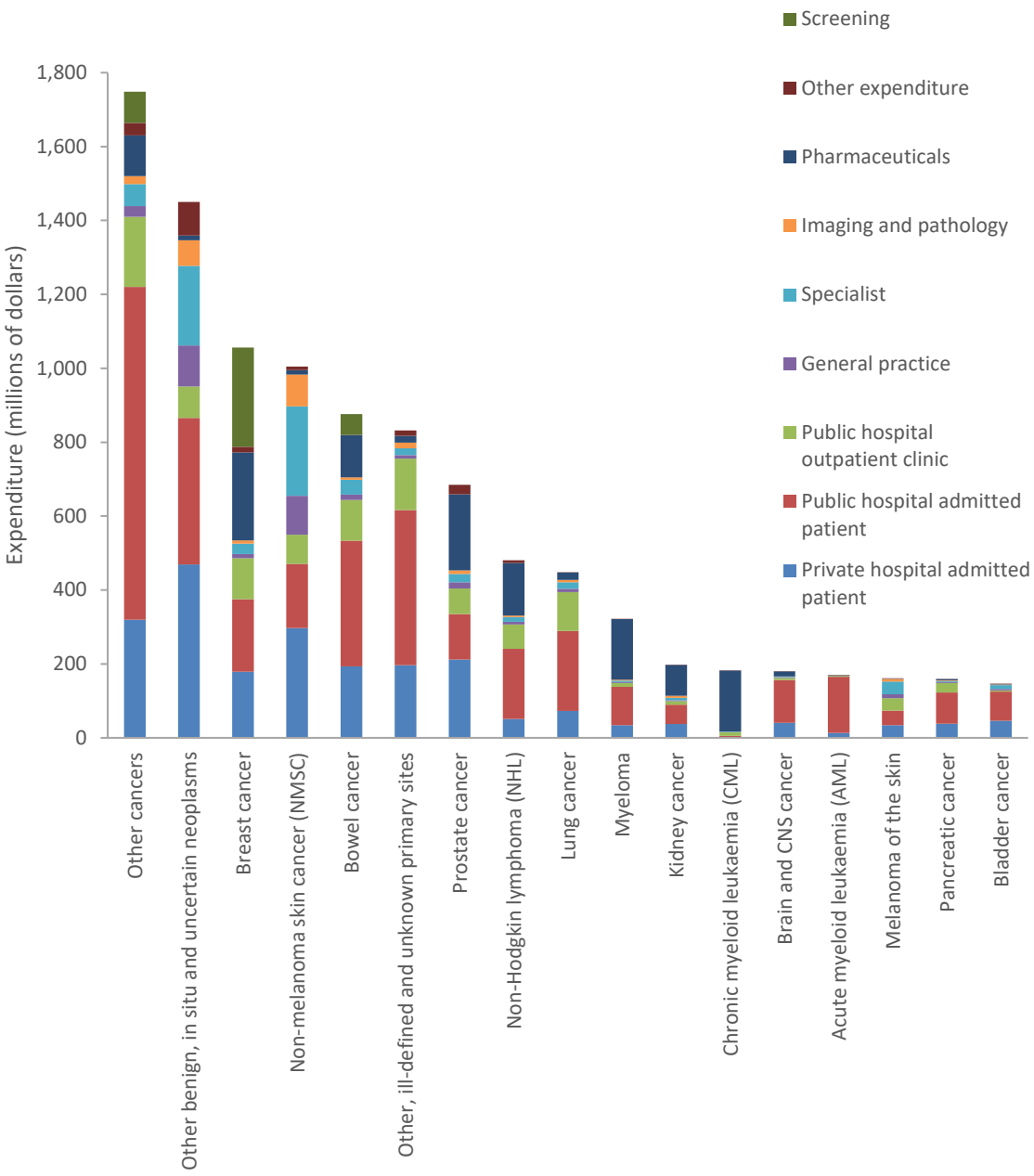
1. Expanded data relating to this table can be found in Online Table 3.
2. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

Figure 3.1 describes all cancer expenditure, with the diverse 'other cancers', and 'other benign, in situ and uncertain neoplasms' constituting a substantial amount of expenditure.

The figure shows considerable inter-cancer variation in relation to the various areas of expenditure. For example, almost all expenditure on CML is on pharmaceuticals, whereas only a small proportion of expenditure on NMSC is on pharmaceuticals.

Figure 3.1: Health system expenditure on cancer, by selected cancer site and area of expenditure, 2015–16



Note: Data relating to this figure can be found in Online Table 3.

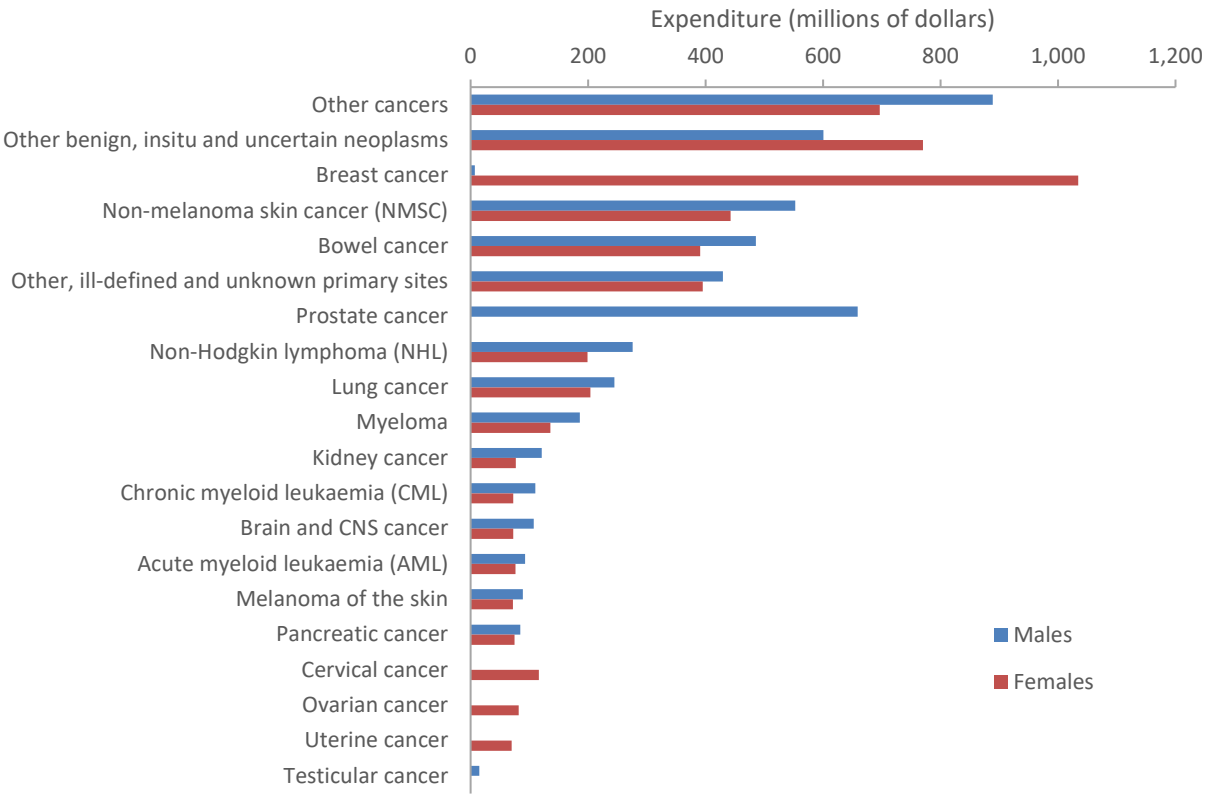
Source: AIHW Disease Expenditure Database.

4. Expenditure on cancer by sex

In contrast to many other chronic diseases, a number of cancers are 'sex-specific'. That is, they either affect women or men due to the origin or localisation of the cancer on the genital organs, or the link with 'secondary sexual characteristics'. These include cervical and ovarian cancers in the case of women, and prostate and testicular cancers in the case of men (European Commission 2009).

Figure 4.1 focuses on the more common cancers, as well as the limited number of sex-specific cancers. Table 4.1 describes expenditure on the highest expenditure cancers.

Figure 4.1: Expenditure by cancer site, males and females, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 4.
2. Estimates include screening, but exclude dental.

Source: AIHW Disease Expenditure Database.

In 2015–16, total estimated expenditure on cancer was slightly greater for females ($4,982 million, 50.2% of the total), than for males ($4,951 million, 49.8% of the total)—this excludes expenditure on dental (expenditure on dental care related to cancer is not capable of being reported by gender) and the small number of records for which sex was not available.

For males, 7 cancers accounted for 51% of health system expenditure on cancer. These were prostate cancer ($659 million, 13% of health system expenditure on cancer for males); NMSC ($553 million, 11%); bowel cancer ($486 million, 10%, which includes $28 million on bowel cancer screening); NHL ($276 million, 6%), lung cancer ($245 million, 5%); myeloma ($186 million, 4%) and kidney cancer ($121 million, 2%). Excluding common NMSCs and those other neoplasms for which incidence is not available, these cancers are responsible for 55% of cancer notifications for males, with prostate cancer alone responsible for 25% (18,540 cases in 2015–16).

There were 858 new cases of testicular cancer (the only other male-specific cancer for which expenditure has been estimated) in 2015–16, with expenditure on all testicular cancer that year amounting to $15 million.

While there were 8,337 cases of melanoma diagnosed in 2015–16 (making it one of the more common cancers diagnosed among males), expenditure was only $89 million, and while CML was one of the least common cancers diagnosed among males (188 cases in 2015–16), expenditure in 2015–16 was $110 million. In the case of melanoma, while 5-year relative survival is over 91% (AIHW 2020b), the cost of treating the disease is relatively modest, with only limited costs of ongoing management (Goldsbury et al. 2018). In the case of CML, 5-year relative survival is over 82% (AIHW 2020b) and the cost of treatment is substantial, with substantial ongoing costs involved in disease management (Goldsbury et al. 2018).

For females, the following 8 cancers accounted for 52% of health system expenditure on cancer: breast cancer ($1,034 million, 21% of health system expenditure on cancer for females, which includes $269 million on breast cancer screening), NMSC ($443 million, 9%), bowel cancer ($391 million, 8%, which includes $28 million on screening), lung cancer ($204 million, 4%), NHL ($199 million, 4%), myeloma ($136 million, 3%), cervical cancer ($116 million, 2%) and ovarian cancer ($82 million, 2%). These cancers were similar to those for males except for the cancers that are sex-specific (e.g. cervical cancer) or much more commonly diagnosed in females (e.g. breast cancer).

Excluding common NMSCs, for which incidence isn’t known, these cancers account for 57% of all cancers in females in 2015–16. Observations about expenditure and incidence of melanoma and leukaemias are similar to those for males above.

Table 4.1: Cancer expenditure by sex, for 6 highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
Males								
Bowel cancer	301	61	30	65	28	486	10%	8,490
Lung cancer	161	59	16	9	—	245	5%	6,879
Myeloma	81	6	4	95	—	186	4%	1,152
NHL	144	37	12	83	—	276	6%	3,001
NMSC	286	43	217	7	—	553	11%	n.p.
Prostate cancer	335	69	49	205	—	659	13%	18,540
Other cancers	1,349	214	109	220	—	1,892	38%	34,521
Non-malignant neoplasms	395	49	203	7	—	655	13%	n.p.
All neoplasms	**3,052**	**538**	**640**	**692**	**28**	**4,951**	**100%**	**72,583**
Females								
Bowel cancer	232	50	32	49	28	391	8%	7,040
Breast cancer	373	110	48	235	269	1,034	21%	17,165
Lung cancer	128	48	17	11	—	204	4%	5,155
Myeloma	57	5	4	69	—	136	3%	834
NHL	97	30	12	60	—	199	4%	2,266
NMSC	185	36	217	5	—	443	9%	n.p.
Other cancers	1,093	207	124	178	84	1,686	34%	28,236
Non-malignant neoplasms	606	61	216	7	—	889	18%	n.p.
All neoplasms	**2,770**	**548**	**671**	**612**	**381**	**4,982**	**100%**	**60,696**

Notes

1. Expanded data relating to this table can be found in Online Table 4.
2. Estimates include screening, but exclude dental when reporting males and females (but not persons, hence males and females will not add to persons reported in Table 3.1).
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

5. Expenditure on cancer by age group

Total health system expenditure on cancers varies considerably between age groups (Table 5.1). This report focuses on 4 age groups; children (0–14), adolescents and young adults (15–24), adults (25–64), and older adults (65 and over).

Table 5.1: Cancer expenditure by gender and age group, 2015–16

	0–14	15–24	25–64	65+	All ages
			Millions of dollars		
Males	**160**	**90**	**1,820**	**2,880**	**4,951**
Females	**125**	**109**	**2,572**	**2,176**	**4,982**
Persons	**284**	**200**	**4,392**	**5,057**	**10,100**

Notes

1. Dental expenditure of $167 million is available only for total persons (not by age or sex), therefore totals will not add to persons of all ages.
2. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

Health system expenditure on cancer is evenly spread between the sexes, but greater for older people than for younger people, with 5% of expenditure on people younger than 25 years (32% of the population), and 50% of expenditure on people older than 65 years (15% of the population).

Children aged 0–14 years

In 2015–16, health system expenditure on cancer for children aged 0–14 years of age totalled $284 million, accounting for 2.8% of total health system expenditure on cancer for all ages.

Acute lymphoblastic leukaemia (ALL, 26%), brain and CNS cancer (16%), kidney cancer (6%) and NHL (6%) accounted for over two-thirds (69%) of cancers in this age group reported to cancer registries in 2015–16 (note that, with few exceptions, this excludes all benign, in situ, and uncertain neoplasms, and also excludes most cases of non-melanoma skin cancer). This pattern was broadly similar for both sexes.

In this age group, ALL ($47 million in 2015–16) was responsible for 17% of expenditure on cancer and other neoplasms, NMSC for 8%, brain and CNS for 7%, and acute myeloid leukaemia (AML) and prostate cancer for 5% each (Table 5.2). A large percentage also went to 'other benign, in situ and uncertain neoplasms' (16%).

Table 5.2: Cancer expenditure for children aged 0–14 years, highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
ALL	47	0	0	0	—	47	17%	199
AML	13	0	0	0	—	13	5%	29
Brain and CNS cancer	19	0	0	0	—	19	7%	124
NHL	7	3	1	1	—	12	4%	48
NMSC	0	6	16	0	—	22	8%	n.p.
Prostate cancer	0	4	2	7	—	13	5%	n.p.
Other cancers	46	38	15	5	—	105	37%	349
Non-malignant neoplasms	25	9	18	0	—	52	18%	n.p.
All neoplasms	**158**	**61**	**52**	**13**	**—**	**284**	**100%**	**749**

Notes

1. Expanded data relating to this table can be found in Online Table 5.
2. Estimates include screening, but exclude dental.
3. Incidence of 'All neoplasms' excludes non-malignant neoplasms and NMSC.
4. Components may not sum to the totals due to rounding.

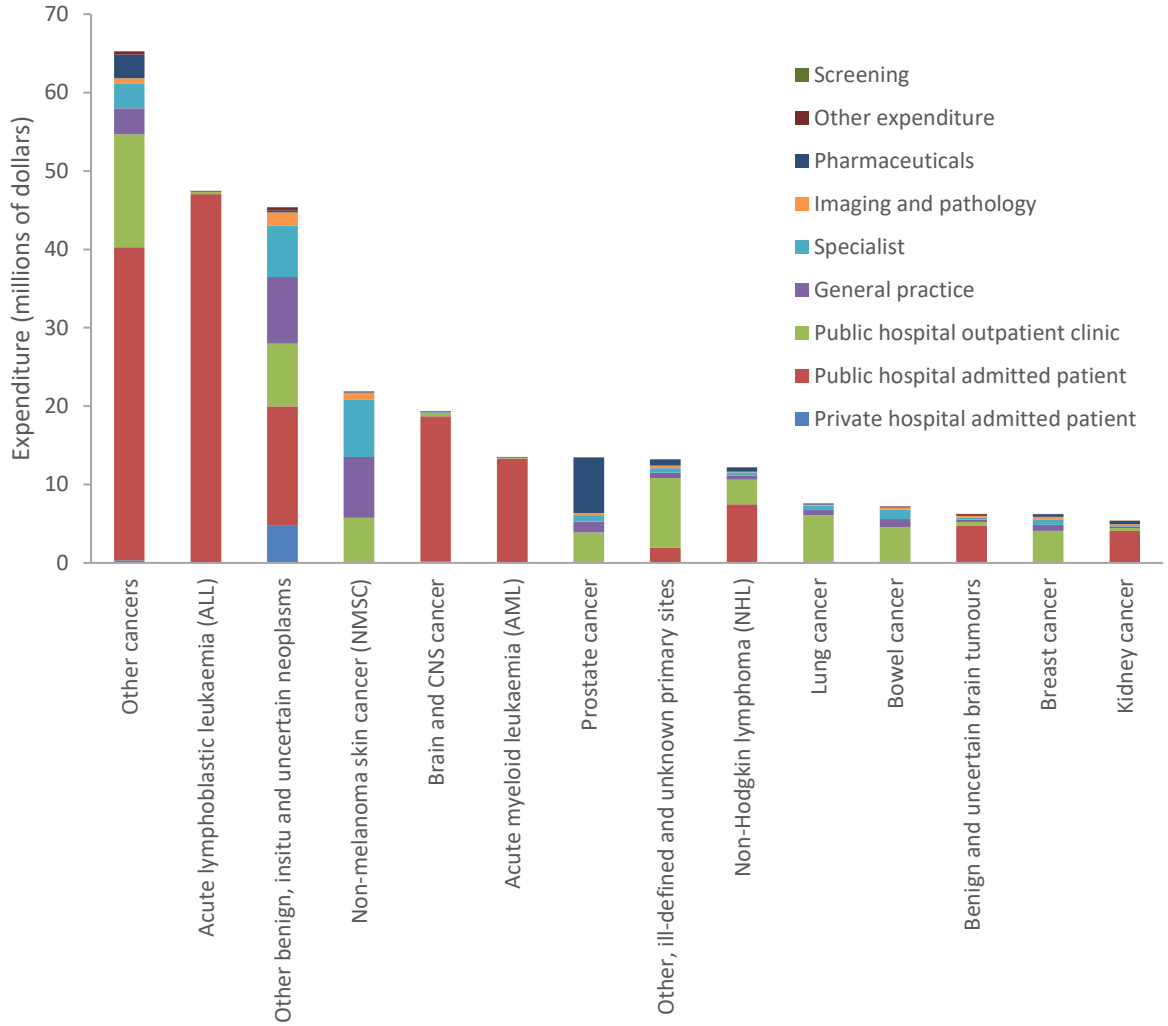
Source: AIHW Disease Expenditure Database.

Overall, the bulk of expenditure related to public hospital admitted patients (54%) and public hospital outpatients (21%).

Almost all expenditure on ALL and brain and CNS cancer related to public hospital admitted patients, while almost all of the expenditure on NMSC related to public hospital outpatients, general practitioners (GPs) and specialists.

An overview for the highest expenditure cancers is presented in Figure 5.1.

Figure 5.1: Total expenditure for 0–14 year olds, by selected cancer type, by area of expenditure, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 5.
2. Estimates include screening, but exclude dental.

Source: AIHW Disease Expenditure Database.

Persons aged 15–24 years

In 2015–16, health system expenditure on cancer for people aged 15–24 years totalled $200 million, accounting for 2.0% of total health system expenditure on cancer for all ages.

The cancers most commonly diagnosed for this age group in 2015–16 were Hodgkin lymphoma (13%), melanoma of the skin (11%), testicular cancer (12%), thyroid cancer (10%) and bowel cancer (10%), together comprising 57% of all cancers for this age group (note that, with few exceptions, this excludes all benign, in situ, and uncertain neoplasms, and also excludes most cases of NMSC). There were some differences between the sexes, with testicular cancer responsible for 23% of all cancers diagnosed in males from this age group, and thyroid cancer responsible for 17% of all cancers diagnosed in females from this age group.

Twenty-four percent (24%) of cancer expenditure for this age group related to 'other benign, in situ and uncertain cancers', 9% to NMSC, 8% to ALL, 5% to NHL, 5% to AML, and 4% to cervical cancer (Table 5.3). The higher incidence cancers for this age group (see previous paragraph) are responsible for only 11% of cancer expenditure (with Hodgkin lymphoma and bowel cancer responsible for 4% and 3% of expenditure respectively).

Table 5.3: Cancer expenditure for people aged 15–24 years, highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
Persons								
ALL	15	0	0	0	–	15	8%	43
AML	9	0	0	0	–	9	5%	31
Cervical cancer	0	0	0	0	8	9	4%	8
Hodgkin lymphoma	7	0	0	0	–	8	4%	144
NHL	6	2	1	1	–	10	5%	57
NMSC	0	4	13	0	–	17	9%	–
Other cancers	33	21	14	10	–	79	39%	802
Non-malignant neoplasms	32	6	15	0	–	53	27%	–
All neoplasms	**102**	**34**	**43**	**13**	**8**	**200**	**100%**	**1,087**
Males								
All neoplasms	**49**	**17**	**16**	**8**	**–**	**90**	**100%**	**557**
Females								
All neoplasms	**53**	**17**	**27**	**5**	**8**	**109**	**100%**	**530**

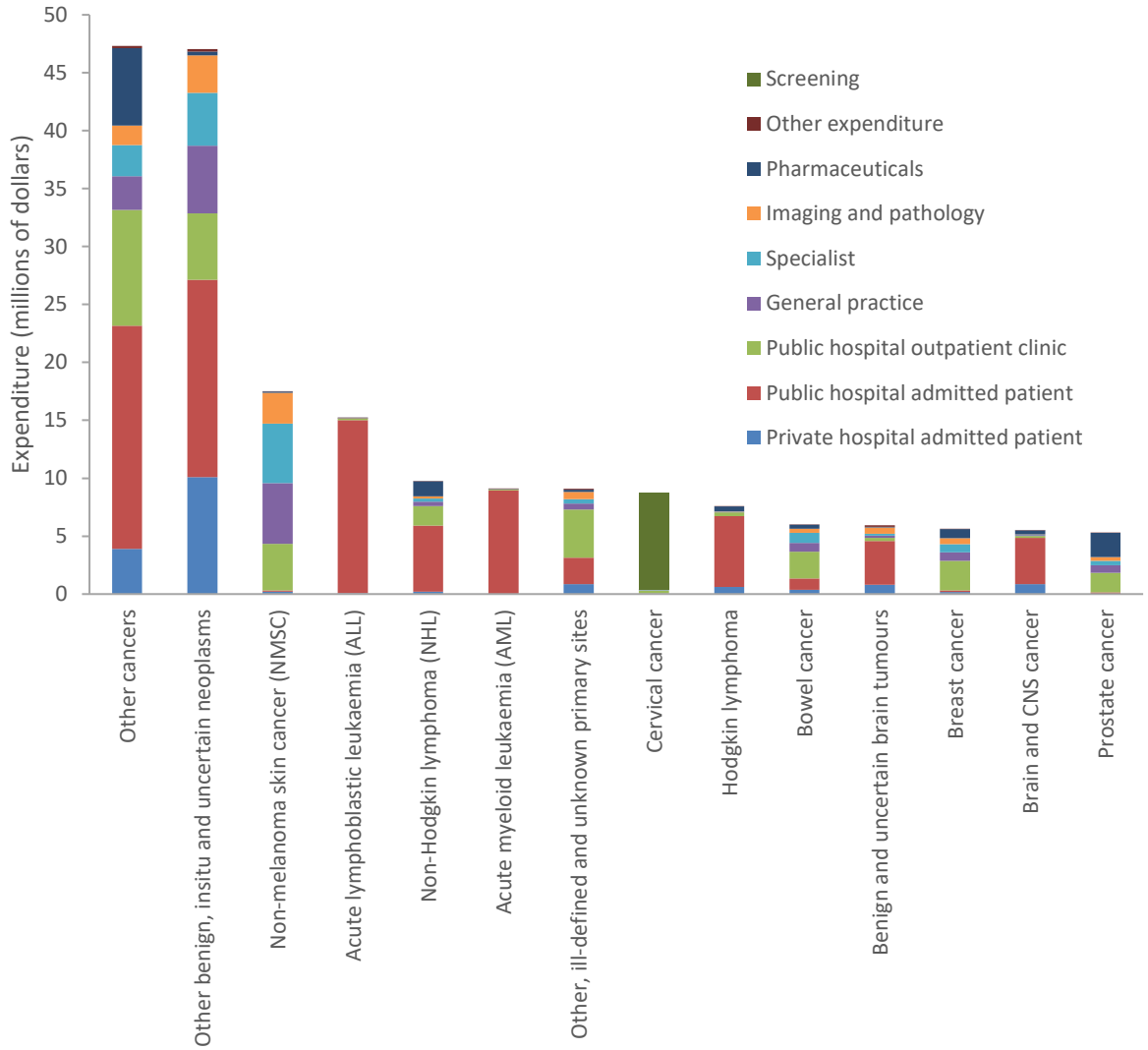
Notes

1. Expanded data relating to this table can be found in Online Table 6.
2. Estimates include screening, but exclude dental.
3. Incidence of 'Other neoplasms' and 'All neoplasms' excludes non-malignant neoplasms and NMSC.
4. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

An overview for the highest expenditure cancers is presented in Figure 5.2.

Figure 5.2: Total expenditure for 15–24 year olds, by selected cancer type, by area of expenditure, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 6.
2. Estimates include screening, but exclude dental.

Source: AIHW Disease Expenditure Database.

Persons aged 25–64 years

In 2015–16, health system expenditure on cancer for people aged 25–64 years totalled $4,392 million, accounting for 43% of total health system expenditure on cancer for all ages.

The cancers most commonly registered with cancer registries for this age group were breast cancer (19%), melanoma of the skin (13%), prostate cancer (12%), and bowel cancer (9%), together comprising 52% of all registered cancers for this age group (note that, with few exceptions, this excludes all benign, in situ, and uncertain neoplasms, and also excludes most cases of NMSC).

There were some differences between the sexes, with prostate cancer responsible for 24% of all cancers diagnosed in males from this age group, and breast cancer responsible for 37% of all cancers diagnosed in females from this age group.

Breast cancer was responsible for 15% of cancer expenditure, while NMSC, bowel cancer and 'other, ill-defined and unknown primary site' cancers were responsible for 8% each. NHL (5%), prostate (4%) and lung cancer (4%) were responsible for smaller proportions of expenditure, while the diverse group 'other benign, in situ and uncertain neoplasms' was responsible for 16% of expenditure for this age group (Table 5.4).

Table 5.4: Cancer expenditure for people aged 25–64 years, highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
Persons								
Bowel cancer	178	48	29	52	35	342	8%	4,974
Breast cancer	237	59	27	154	182	660	15%	9,958
Lung cancer	87	43	16	9	–	155	4%	3,255
NHL	97	29	12	63	–	201	5%	1,928
NMSC	129	36	204	4	–	373	8%	n.p.
Prostate cancer	118	24	20	19	–	182	4%	6,277
Other cancers	1,036	182	115	263	70	1,665	38%	26,974
Non-malignant neoplasms	551	55	201	6	–	814	19%	n.p.
All neoplasms	**2,434**	**477**	**624**	**571**	**286**	**4,392**	**100%**	**53,366**
Males								
All neoplasms	**1,118**	**196**	**258**	**230**	**17**	**1,820**	**100%**	**26,242**
Females								
All neoplasms	**1,316**	**281**	**366**	**340**	**269**	**2,572**	**100%**	**27,124**

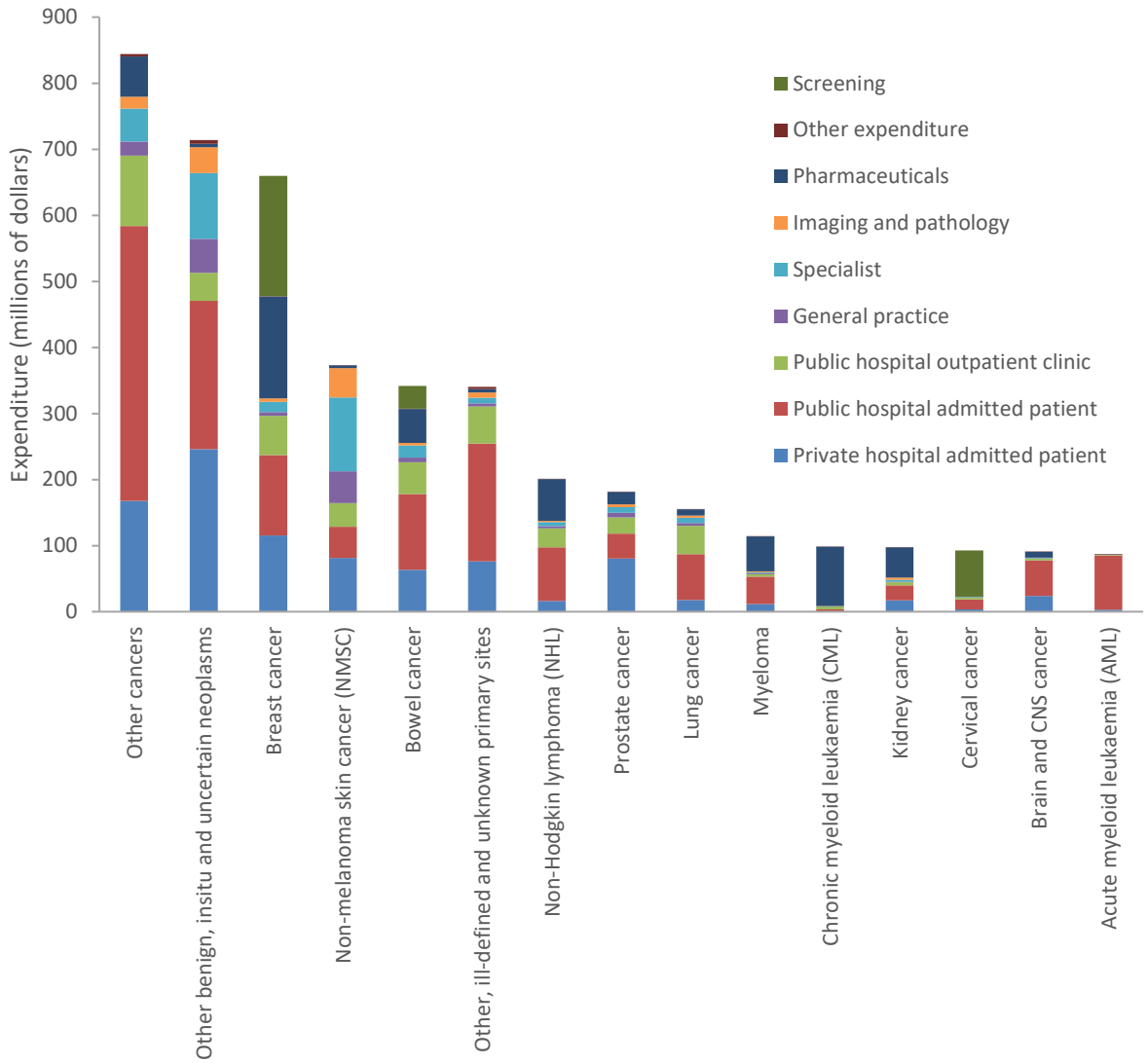
Notes

1. Expanded data relating to this table can be found in Online Table 7.
2. Estimates include screening, but exclude dental.
3. Incidence of 'Other neoplasms' and 'All neoplasms' excludes non-malignant neoplasms and NMSC.
4. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

An overview for the highest expenditure cancers is presented in Figure 5.3.

Figure 5.3: Total expenditure for 25–64 year olds, by selected cancer type, by area of expenditure, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 7.
2. Estimates include screening, but exclude dental.

Source: AIHW Disease Expenditure Database.

Persons aged 65 years and over

In 2015–16, health system expenditure on cancer for people 65 years and older totalled $5,057 million, accounting for 50% of total health system expenditure on cancer for all ages.

The cancers most commonly diagnosed for people in this age group were prostate cancer (16%), bowel cancer (13%), lung cancer (11%), melanoma 9% and breast cancer (9%), together comprising 59% of all cancers for this age group (note that, with few exceptions, this excludes all benign, in situ, and uncertain neoplasms, and also excludes most cases of non-melanoma skin cancer).

Prostate cancer was responsible for 27% of new cancers diagnosed amongst males, while breast cancer was responsible for 22% of new cancers diagnosed amongst females, otherwise the patterns for males and females were broadly similar to that for persons.

Of total expenditure on cancer, 12% related to NMSC, 10% to bowel cancer, 9% to prostate cancer, 7% to breast cancer, 6% to lung cancer and 5% to NHL, together responsible for 49% of cancer expenditure for this age group (Table 5.5). Prostate cancer was responsible for 16% of cancer expenditure for males, while breast cancer was responsible for 17% of cancer expenditure for females. The diverse group 'other benign, in situ and uncertain neoplasms' accounted for 11% of cancer expenditure for this age group.

Table 5.5: Cancer expenditure for people aged 65 years and older, highest expenditure cancers, 2015–16

	Hospital admitted patients	Outpatient and ED	Out of hospital	Pharma-ceuticals	Screening	Total	Proportion of all expenditure on neoplasms	Incidence (new cases in 2015–16)
	$(m)	$(m)	$(m)	$(m)	$(m)	$(m)	Percent	Count
Persons								
Bowel cancer	354	56	28	62	22	521	10%	10,428
Breast cancer	138	45	18	82	87	370	7%	7,330
Lung cancer	201	55	15	10	–	281	6%	8,770
NHL	130	33	11	78	–	252	5%	3,234
NMSC	342	33	201	7	–	583	12%	n.p.
Prostate cancer	217	40	25	177	–	459	9%	12,263
Other cancers	1,355	212	108	285	6	1,965	39%	36,052
Non-malignant neoplasms	393	40	185	7	–	625	12%	n.p.
All neoplasms	**3,129**	**514**	**591**	**708**	**114**	**5,057**	**100%**	**78,077**
Males								
All neoplasms	**1,799**	**290**	**337**	**444**	**11**	**2,880**	**100%**	**45,388**
Females								
All neoplasms	**1,330**	**224**	**255**	**264**	**104**	**2,176**	**100%**	**32,689**

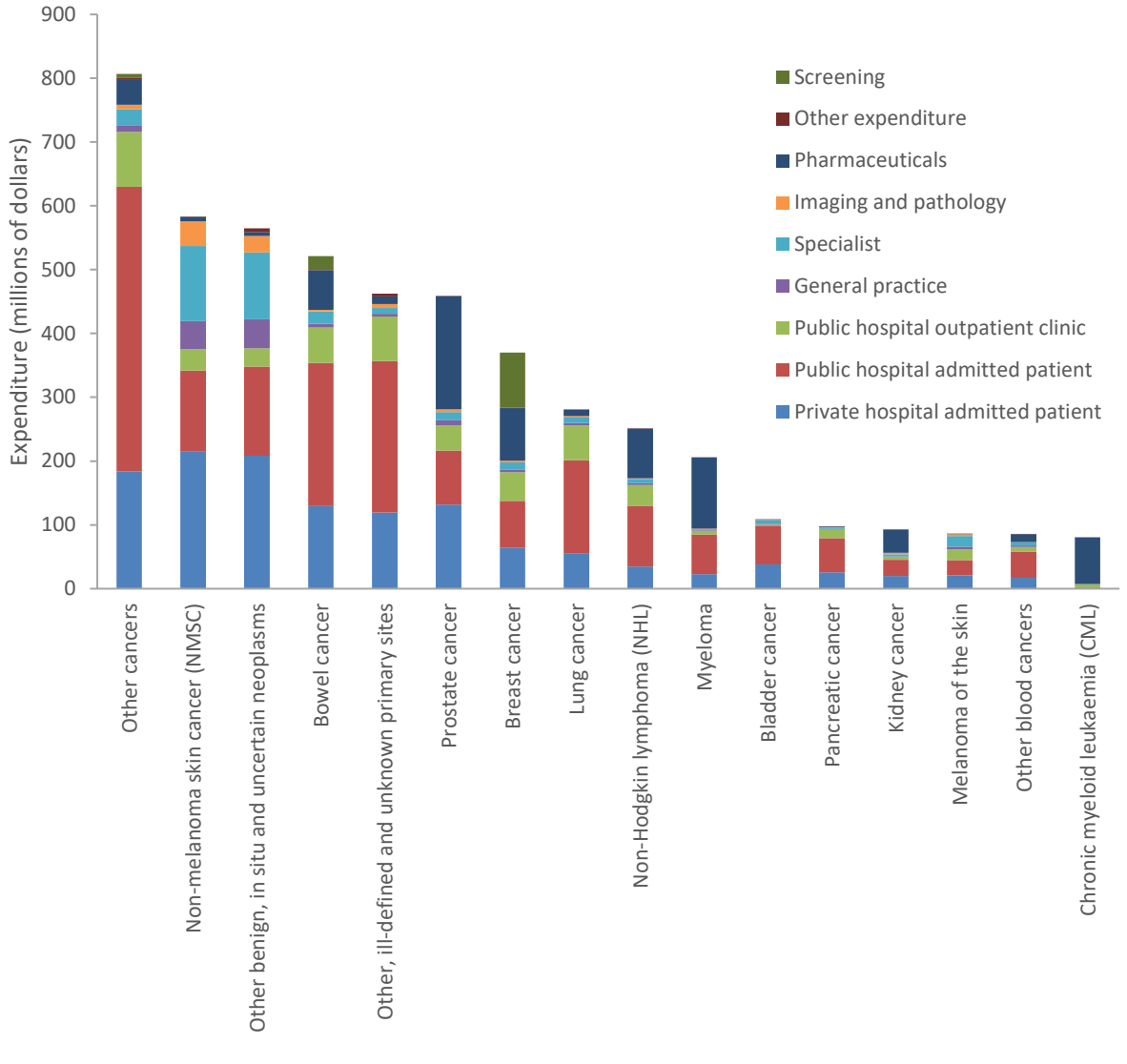
Notes

1. Expanded data relating to this table can be found in Online Table 8.
2. Estimates include screening, but exclude dental.
3. Incidence of 'Other neoplasms' and 'All neoplasms' excludes non-malignant neoplasms and NMSC
4. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

An overview for the highest expenditure cancers is presented in Figure 5.4.

Figure 5.4: Total expenditure for persons aged 65 years and older, by selected cancer type, by area of expenditure, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 8.
2. Estimates include screening, but exclude dental.

Source: AIHW Disease Expenditure Database.

Further estimates of expenditure on cancer by age group are presented in Online tables 5–8.

6. Cancer expenditure on Indigenous and non-Indigenous people

Not all areas of expenditure are able to be reported by Indigenous status due to data limitations. As a result, reporting of cancer expenditure for Indigenous Australians is possible only for hospital admitted patient care, emergency department attendances, and outpatient clinics. However, unit record outpatient data with Indigenous status were not available for Victoria and Queensland, and has been omitted from the data presented here.

Expenditure estimates have been adjusted to account for known under-identification of Indigenous people in the hospitals database.

The methodology does not support comparison of total cancer expenditure estimates reported elsewhere in this report, with those reported here by Indigenous status. Adjustment for under-identification of Indigenous status is applied to hospital separation costs, not to expenditure within condition (cancer, cardiovascular, injury etc.) groups. For this reason, the expenditure on each condition is different across the 2 measures. If all of the Indigenous estimates of hospital expenditure for the various condition groups (cancer, cardiovascular, injury etc.) are summed, they are consistent with total Australian hospital expenditure, but estimates for Indigenous and non-Indigenous hospital expenditure for each condition will not sum to total hospital expenditure for that condition.

As of June 2016, there were estimated to be 798,365 Indigenous and 23,392,542 non-Indigenous people living in Australia.

In 2015–16, an estimated $122 million was spent on Indigenous hospital admitted patients (including amounts spent by individuals), ED and outpatients attendances relating to treating or otherwise dealing with cancer, compared with $6,650 million for other Australians (Table 6.1).

Table 6.1: Cancer expenditure in hospital, by Indigenous status, 2015–16

	Private hospital admitted patient	Public hospital admitted patient	Public hospital ED	Public hospital outpatient clinic	Total
	$(m)	$(m)	$(m)	$(m)	$(m)
Indigenous	7.1	88.9	1.0	24.9	121.9
non-Indigenous	2,226.6	3,491.0	29.6	902.6	6,649.9

Notes

1. Excludes ACT Emergency Department, and Vic and Qld Outpatients. Unknown Indigenous status is initially classified as non-Indigenous. A subsequent adjustment is made to account for Indigenous under-identification. This adjustment does not preserve the aggregate allocation of expenditure across disease conditions.
2. Data relating to this figure can be found in Online Table 9.
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

On a per capita basis this is $153 per Indigenous person and $284 per non-Indigenous person. These are both higher than in other reports because slightly different methodologies were used (see Box A1 in Appendix A), but the relative difference remains similar to that in other reports (AIHW 2020c). Caution should be taken when comparing per person expenditure; some guiding commentary is provided in Appendix A.

It is not possible to report expenditure per incident case of cancer. For a number of reasons, cancer incidence for Indigenous people is currently only capable of being reported for NT, NSW, Qld and WA (further explanation is available in Online Table 9). In addition, hospital expenditure estimates have been adjusted to account for known Indigenous under-identification, whereas this is not possible with data from the Australian Cancer Database (ACD). The other issue, pertinent throughout this report, is that it is not possible to report incidence or prevalence of most NMSCs or benign, in situ and uncertain neoplasms, as these are not required to be registered by the state and territory cancer registries; consequently, caution should be taken when comparing between expenditure and incidence or prevalence.

Based on cancer registrations, lung cancer (15%), breast cancer (13%), bowel cancer (9%), prostate cancer (7%), uterine cancer (4%) and liver cancer (4%) were collectively responsible for 51% of all new cases of cancer amongst Indigenous people from NT, NSW, Qld and WA. This compares with prostate cancer (14%), breast cancer (13%), bowel cancer (12%) and melanoma (10%) responsible for 49% of cases amongst non-Indigenous people in these jurisdictions, with lung cancer being responsible for an additional 9%. The incidence of NMSC will have been high, but most cases are not required to be registered with a cancer registry and therefore will not be recorded (or reported here).

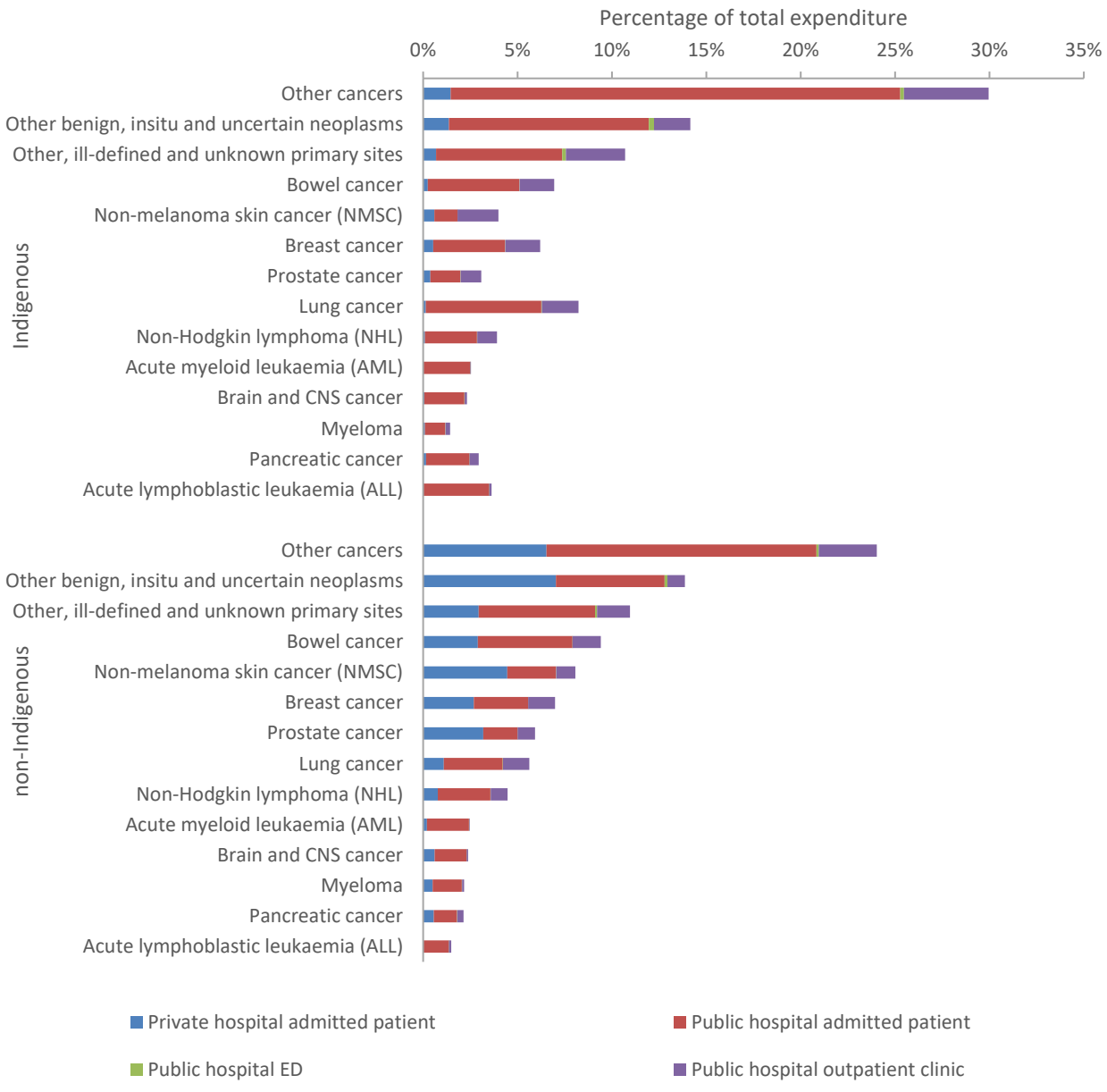
The relative importance of the various cancers to expenditure was broadly similar for Indigenous and non-Indigenous people, but there were some differences. Thirty percent (30%) of Indigenous and 24% of non-Indigenous hospital cancer expenditure related to 'other cancers'; 14% of expenditure for both populations to 'other benign, in situ and uncertain neoplasms'; and 11% of expenditure for both populations to 'other, ill-defined, and unknown primary site cancers'. Lung cancer was responsible for 8% of hospital cancer expenditure for Indigenous people, compared with 6% for non-Indigenous people; bowel cancer was responsible for 7.0% of hospital cancer expenditure for Indigenous people, compared with 9% for non-Indigenous people; and NMSC was responsible for 4% of hospital cancer expenditure for Indigenous people, compared with 8% for non-Indigenous people.

Hospital-based cancer expenditure for Indigenous Australians is more likely to be in public than private hospitals:

- 73% of hospital-related cancer expenditure for Indigenous Australians occurred in public hospitals, compared with 52% for non-Indigenous Australians.
- 6% of hospital-related cancer expenditure for Indigenous Australians occurred in private hospitals, compared with 33% for non-Indigenous people.

An overview of cancer expenditure estimates for Indigenous and non-Indigenous populations is presented in Figure 6.1.

Figure 6.1: Percentage of hospital-related cancer expenditure, by area of expenditure, for Indigenous and non-Indigenous populations, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 9.
2. Excludes ACT Emergency Department, and Vic and Qld Outpatients. Unknown Indigenous status is initially classified as non-Indigenous. A subsequent adjustment is made to account for Indigenous under-identification. This adjustment does not preserve the aggregate allocation of expenditure across disease conditions.

Source: AIHW Disease Expenditure Database.

Further cancer expenditure estimates by Indigenous and non-Indigenous populations are presented in Online Table 9.

7. Expenditure on cancer, by geography

Expenditure estimates are presented here for 3 different geographical classifications—state/territory (also referred to hereafter as jurisdiction), remoteness area and SA4.

Reported geography is based on the location of the patient's residence rather than the location where the service was provided.

Details of geographic location of patient's residence are insufficient in most cases to allow estimation of expenditure on dental, screening, and outpatients.

Box 4: A caution on the use of contextual information used in this section

As would be expected, health system expenditure on cancer tends to be higher in the more populous areas and lower in the less populous areas.

So as to provide some context to expenditure, estimates have been presented alongside average estimated resident population (ERP) in 2015–16 and also cancer incidence (the number of new cases of cancer diagnosed in 2015–16) for each level of geography. Ratios of expenditure to ERP and to incidence have also been provided in some cases.

These ratios should be used with caution.

Expenditure per head of population is influenced by a range of factors including the age structure of each population and the underlying rate of cancer.

The ratio of expenditure to new cases of cancer registered is an artificial measure, and does not reflect the actual average cost of treating a case of cancer.

Not only are new cases of cancer diagnosed in 2015–16 being treated in 2015–16, but so too are many cases diagnosed in previous years; in addition, while the expenditure data relate to all neoplasms, cancer incidence does not include benign, in situ or uncertain neoplasms, nor complete information on NMSC. These diseases, for which incidence is missing, are responsible for between 25% and 30% of expenditure on cancer in the various states and territories. Encouragingly however, when analysis is repeated with expenditure on malignant neoplasms (excluding NMSC for which incidence is unknown), as opposed to all neoplasms, comparisons between geographic areas remain essentially unchanged.

On the basis that non-malignant neoplasms appear to be relatively evenly distributed across the population at these levels of geography, the use of population counts and the incidence of new cases of cancer provide some useful context in relation to expenditure in each area.

There are many factors that could be responsible for apparent differences between populations, and some of these are discussed in Appendix A.

State and territory

As would be expected, health system expenditure on cancer tends to be higher for the more populous jurisdictions and lower in the less populous jurisdictions (Table 7.1).

Expenditure per head of population and the ratio of expenditure in 2015–16 to new cases of cancer registered in 2015–16, varies from jurisdiction to jurisdiction. Figure 7.1 compares expenditure on cancer and other neoplasms for residents of each jurisdiction in 2015–16 with the size of the population, and also with the number of new cases diagnosed in 2015–16.

Table 7.1: Cancer expenditure in the state or territory in which the patient lived, 2015–16

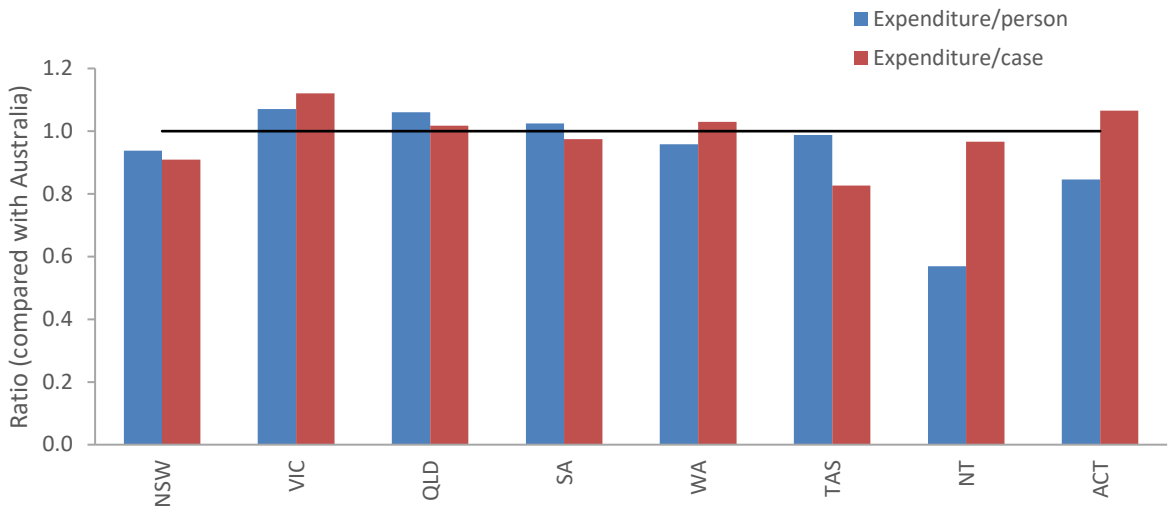
State or territory	Hospital admitted patients and ED	Out of hospital	Pharmaceuticals	Total
	$(m)	$(m)	$(m)	$(m)
NSW	1,650	462	422	2,534
VIC	1,695	287	316	2,297
QLD	1,220	298	276	1,794
SA	420	91	104	615
WA	608	123	128	859
TAS	122	27	31	179
NT	35	7	6	49
ACT	81	17	21	119
Other Territories	0.1	0.1	0.1	0.2
Australia	**5,830**	**1,311.1**	**1,305**	**8,446**

Notes

1. Data relating to this table can be found in Online Table 10.
2. Expenditure estimates are based on the location of the patient's residence, and excludes estimates for public hospital outpatients, dental and screening, for which the jurisdiction of the patient's residence was not available.
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

Figure 7.1: Health system expenditure on neoplasms in 2015–16, compared with the population in 2015–16 and number of new cases of cancer diagnosed in 2015–16, by jurisdiction, compared with Australia



Notes

1. Data relating to this figure can be found in Online Table 10.
2. Expenditure estimates are based on the location of the patient's residence, and exclude estimates for public hospital outpatients, dental and screening, for which the jurisdiction of the patient's residence was not available.
3. Excludes 'Other Territories' because of very small numbers.

Source: AIHW Disease Expenditure Database.

Expenditure on cancer per capita tends to be broadly similar across jurisdictions. The low apparent per capita expenditure for those resident in NT is likely influenced by the relatively young age (and consequent lower rate of cancer, all other things being equal) of people living in that jurisdiction.

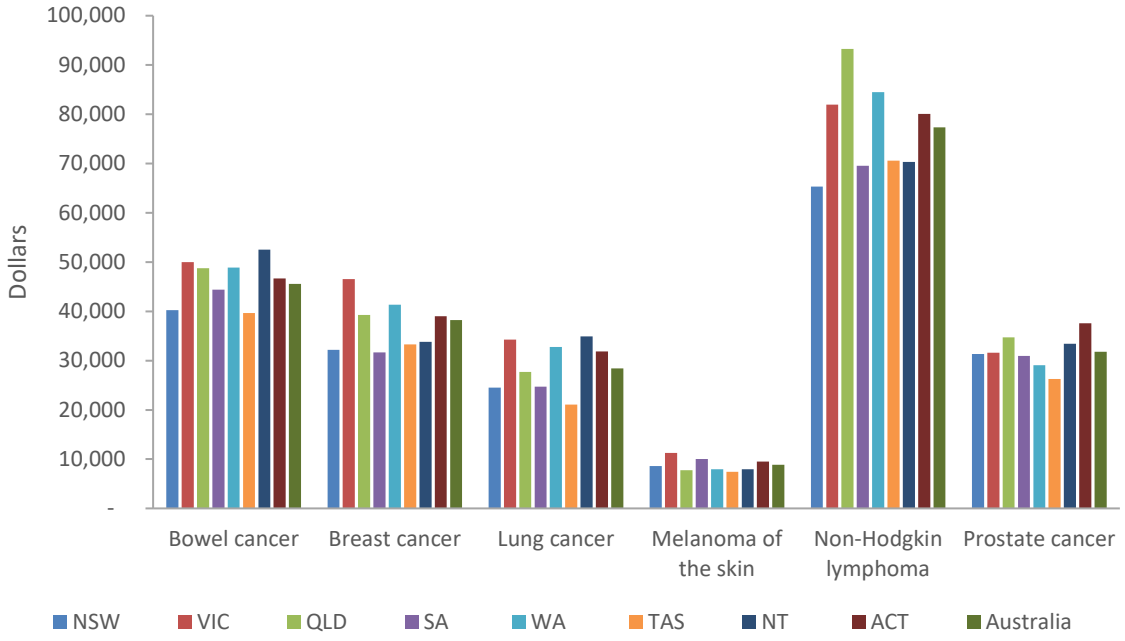
Expenditure on services per new case diagnosed is also broadly similar across jurisdictions, but with lower expenditure per case resident in Tasmania, and to a lesser extent in NSW, and higher expenditure per case resident in Victoria and the ACT.

Figure 7.2 compares the ratio of expenditure in 2015–16 to new cases of cancer diagnosed in 2015–16 (expenditure in 2015–16, divided by new cases of cancer diagnosed in 2015–16), for residents of each jurisdiction and Australia, for 6 relatively common cancers (melanoma, NHL, bowel, breast, lung and prostate cancer).

The figure shows some variation between cancer types and between jurisdictions. For example, in 2015–16, expenditure on all cases of NHL is estimated to have been $93,000 for every new case of NHL diagnosed in Queensland residents in 2015–16, but only $65,000 for residents of NSW.

Again, these ratios should be interpreted with caution as many factors will influence expenditure, and the expenditures reported here are estimates that have been generated using economic modelling.

Figure 7.2: Expenditure on all cancer cases being treated compared with the number of new cases diagnosed in 2015–16, for selected cancer types, by jurisdiction in which the patient lived



Notes

1. Data relating to this figure can be found in Online Table 11.
2. Expenditure estimates are based on the location of the patient's residence, and exclude expenditure on outpatient clinics, dental and screening for which the jurisdiction of the patient's residence was not available.
3. Excludes 'Other Territories' because of very small numbers.

Source: AIHW Disease Expenditure Database.

Further cancer expenditure estimates for jurisdictions are presented in Online tables 10 and 11.

Remoteness area

The ABS remoteness structure (ABS 2016a), categorises parts of Australia as *Major cities*, *Inner regional* and *Outer regional* (generically 'regional'), *Remote* and *Very remote* (generically 'remote') areas.

Expenditure on dental and screening were unable to be allocated to remoteness areas and have therefore been excluded. The basis that has been used in this report for geographic categorisation is the location of the patient's residential address. Unknown remoteness areas were redistributed on the basis of known records.

Cancer expenditure was higher in *Major cities* than in the less populous regional and remote areas (Table 7.2).

Table 7.2: Cancer expenditure on residents of each remoteness area, 2015–16

Remoteness area	Hospital	Out of hospital	Pharmaceuticals	Total	Estimated resident population	Incidence
	$(m)	$(m)	$(m)	$(m)	persons	count
Major Cities	4,628	909	874	6,411	17,084,419	88,128
Inner Regional	1,473	266	285	2,025	4,351,043	29,343
Outer Regional	670	117	126	912	2,087,639	13,461
Remote	83	13	14	109	308,424	1,563
Very Remote	40	6	6	53	198,006	670
Australia	**6,894**	**1,311**	**1,305**	**9,509**	**24,029,531**	**133,279**

Notes

1. Data relating to this table can be found in Online Table 12.
2. Expenditure estimates are based on the location of the patient's residence, and exclude expenditure on dental and screening.
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

The 71% of people living in *Major cities* were responsible for 67% of health system expenditure on cancer. This is consistent with the fact that on average, people living in *Major cities* tend to be younger, have healthier risk factor profiles on average (e.g. are less likely to smoke), and have lower incidence of cancer, than those living in regional or remote Australia. The 67% of health system expenditure on cancer on *Major cities* residents is consistent with the fact that 66% of cancer registrants live in *Major cities*.

As would be expected (based on older age structure in regional areas, and younger age structure in remote areas), cancer expenditure per capita is higher in regional areas and lower in remote areas (Figure 7.3).

Comparison of cancer expenditure with incidence suggests roughly similar expenditure ratios across remoteness areas, with ratios of expenditure per case slightly (~5%) lower in regional and *Remote* areas, and slightly (~8%) higher in *Very remote* areas (Figure 7.3).

Figure 7.3: Health system expenditure on neoplasms in 2015–16, compared with the population in 2015–16 and number of new cases of cancer diagnosed in 2015–16, by remoteness area, compared with Major cities

Notes

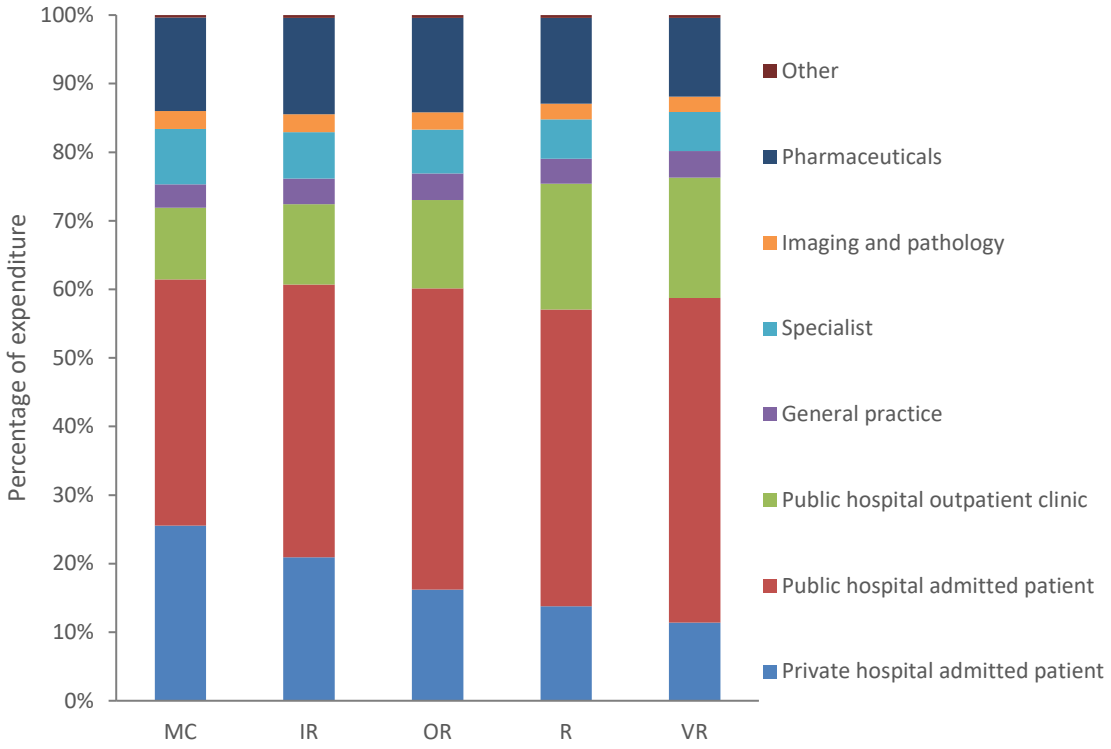
1. Remoteness areas: MC = Major cities; IR = Inner regional; OR = Outer regional; R = Remote; VR = Very remote.
2. Data relating to this figure can be found in Online Table 12.
3. Estimates exclude dental and screening.

Source: AIHW Disease Expenditure Database.

These ratios should be interpreted with caution as many factors will influence expenditure, and the expenditures reported here are estimates that have been generated using economic modelling.

While total expenditure tends to be broadly similar across areas, there are substantial differences in the percentage of expenditure on public and private hospitals in each area. Compared with residents of *Major cities*, a greater proportion of the cancer expenditure on people living in regional and remote areas was on public hospitals (40%–47% compared with 36%) and public hospital outpatient departments (12%–18% compared with 10%), and less on private hospitals (11%–21% compared with 26%). There were also small differences in the proportional expenditure on GPs, specialists, imaging and pathology, and on pharmaceuticals (Figure 7.4)

Figure 7.4: Percentage of cancer expenditure on each area of expenditure, for people living in each remoteness area, 2015–16



Notes

1. Remoteness areas: MC = Major cities; IR = Inner regional; OR = Outer regional; R = Remote; VR = Very remote.
2. Data relating to this figure can be found in Online Table 12.
3. Estimates exclude dental and screening.

Source: AIHW Disease Expenditure Database.

Further cancer expenditure estimates by remoteness area are presented in Online Table 12.

Statistical Areas Level 4 (SA4s)

SA4s are a component of ABS statistical geography (ABS 2016b). We have reported on 89 such areas (based on the 2016 census), varying in population size from 38,000 (South East Tasmania) to 781,000 (South East Melbourne), with the median being 235,000 (Townsville), with one outlier, 'Other territories' (Jervis Bay Territory, Christmas Island, the Cocos (Keeling) Islands and, from 1 January 2016, Norfolk Island) having an approximate average population, during 2015–16, of 3,730 people. In one case, the SA4 comprises the whole of a jurisdiction (ACT).

SA4 (and other ABS and non-ABS boundaries) can be visualised at https://itt.abs.gov.au/itt/r.jsp?ABSMaps.

Estimates of expenditure on dental, screening and public hospital outpatient clinic attendances were unable to be allocated to SA4 areas. The basis for geographic categorisation is the location of the patient's residential address.

When reporting for SA4s, estimates for each area of expenditure have not been reported separately, rather, these have been aggregated to reduce the effects of potential variance at

small geographic scale. So as to further reduce the opportunity for chance associated with the reporting of small numbers to affect comparisons, estimates for only the most common cancers (NMSC, NHL, bowel, breast, lung and prostate cancer) have been reported in Online Table 13.

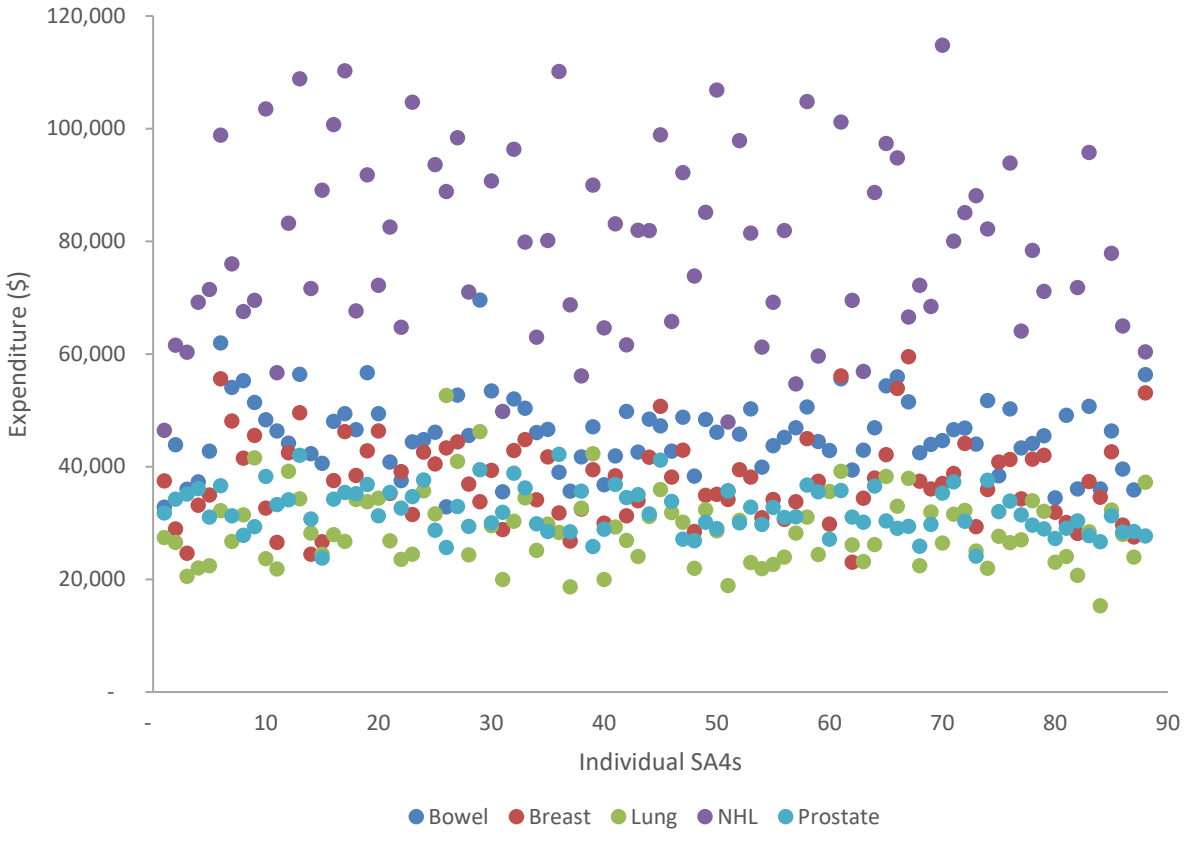
With the exception of NMSC, incidence for these cancers is also reported in the online tables.

Total cancer expenditure in 2015–16 ranged from $15 million in South East Tasmania (population about 38,000), to $244 million in South East Melbourne (population about 781,000).

Figure 7.5 describes ratios of expenditure to incidence for each of the cancers (excluding NMSC) for which expenditure is reported in the online tables, but without specifying SA4s. What is clear from the figure is that the ratio of expenditure to incidence varies substantially from area to area.

These ratios should be interpreted with a great deal of caution as many factors will influence expenditure, and the expenditures reported here are estimates that have been generated using economic modelling. Some of the factors that could be responsible for differences between populations are discussed in Appendix A.

Figure 7.5: Expenditure on 5 cancers in 2015–16, per new case of cancer diagnosed in 2015–16, for residents of each SA4



Notes

1. Data relating to this figure can be found in Online Table 13.
2. Estimates exclude dental, screening and outpatients.
3. Expenditure has been excluded where incidence in the SA4 is less than 16.
4. SA4s are presented in random order.

Source: AIHW Disease Expenditure Database.

8. Trends in cancer expenditure

To provide some context for changes in health system expenditure on cancer over time, cancer incidence has increased from 101,556 new cases diagnosed during 2004–05 to 133,279 new cases diagnosed during 2015–16 (this comparison excludes NMSC), in part reflecting an ageing and growing population.

Health system expenditure on cancer and other neoplasms in Australia, 2015–16 describes modelled estimates of expenditure using a range of methods and available data sources (see Appendix A). This work updates estimates for 2008–09 (AIHW 2013), and is based on the most recent disease expenditure estimates available at the time of writing.

Compared with reporting for 2008–09, improved methods and newly available data sources have strengthened estimates, and have for the first time allowed some reporting of estimates for certain geographic areas, population groups and health risk factors.

Due to changes in methods and data sources, estimates of the major areas of cancer expenditure are not directly comparable over time.

All estimates are in 2015–16 Australian dollars.

Hospital admitted patient expenditure on cancer was $3.3 billion in 2004–05 and $5.8 billion in 2015–16. However, the 2015–16 estimate excludes Section 100 drugs (which includes some chemotherapy pharmaceuticals) whereas the 2004–05 and 2008–09 hospital admitted patient estimates include Section 100 drugs. Consequently, estimates for these years are not directly comparable.

Expenditure on prescription pharmaceuticals (including chemotherapy) is estimated to have been $1.3 billion in 2015–16, which, as a result of the inclusion of Section 100 drugs in 2015–16 (previously included in hospital admitted patients expenditure), is not directly comparable with $0.3 billion expenditure in 2004–05 or $0.6 billion expenditure in 2008–09.

Expenditure on out-of-hospital medical services is estimated to have been $1.3 billion in 2015–16, but, as a result of the use of additional data sources and improved methodology, this is not directly comparable with the estimated $0.7 billion expenditure in 2004–05 or $0.5 billion expenditure in 2008–09.

No cancer expenditure estimates are available for hospital outpatient clinic services, ED and dental services in 2004–05 or 2008–09. In 2015–16, estimated outpatient expenditure related to cancer constituted a substantial expenditure (only slightly smaller than expenditure on out-of-hospital medical services and pharmaceuticals in that year).

Screening populations have all grown due to the increasing and ageing Australian population.

Expenditure on breast cancer screening increased from $163 million in 2004–05 to $269 million in 2015–16, at least partially influenced in 2013, by an expansion of the target screening population from 50–69 to 50–74 years.

The National Bowel Cancer Screening Program commenced in 2006, and since then expenditure has increased to $56 million with the progressive rollout of the number of ages invited to participate, culminating in all people 50–74 years being invited to screen every second year from 2020 onwards.

Expenditure on cervical screening was $84 million in 2015–16, which is not comparable with estimates in 2004–05 ($142 million). This is because data upon which the 2015–16 estimate is based exclude the proportion of the costs associated with general practitioner, specialist and nurse attendances (which were previously included). As a result, a large and unknown proportion of what appears to be a decrease in cervical cancer screening expenditure is an artefact of changes in the categorisation of data, and it is unclear by how much and in which direction total expenditure on cervical cancer has changed since 2004–05.

Cancer expenditure estimates for the 3 time periods discussed here, are, where available, presented in Online Table 14.

9. Health system expenditure on cancer attributable to personal risk factors

Health risk factors are attributes, characteristics or exposures that increase the likelihood of a person developing a disease or health disorder. Individuals have the ability to modify behavioural risk factors such as smoking, sun exposure or physical activity. Biomedical risk factors (for example overweight) are bodily states that are often influenced by behavioural risk factors.

Eleven risk factors have been identified as contributing to the disease burden due to cancer (AIHW 2019a): air pollution, alcohol use, 'all dietary risks', high blood plasma glucose (including diabetes), high sun exposure, illicit drug use, occupational exposures and hazards, overweight and obesity, physical inactivity, tobacco use and unsafe sex.

Expenditure on cancer screening has been excluded from the estimates, because the cost of screening will be independent of the prevalence of risk factors (i.e. there is no biological reason why the prevalence of risk factors would influence expenditure on cancer screening). Estimates of dental expenditure due to cancer have been excluded due to methodological issues (i.e. data on age and sex required for the analysis were not available and consequently expenditure on dental is not able to be allocated amongst genders and age groups, and so the cohort-specific risk factor population attributable fractions are unable to be applied).

The proportion a risk factor contributes to cancer burden was used to allocate cancer expenditure. For example, if 25% of the burden of disease caused by a particular cancer was estimated to be attributable to tobacco smoking, then 25% of expenditure on that cancer has been allocated to tobacco smoking. The proportion attributable was adjusted to account for overlaps between risk factors (such as blood plasma glucose (including diabetes) and obesity), ensuring that the expenditure allocated is not greater than actual expenditure. Methods for estimating the burden due to individual risk factors are described in *Australian Burden of Disease Study: methods and supplementary material 2015* (AIHW 2019e).

A full set of expenditure estimates are presented in Online Table 15, and an overview is presented in Figure 9.1 and tables 9.1 and 9.2.

There were 9 different cancer sites (including 4 that were effectively groups of less common or uncertain neoplasms) for which none of the 11 risk factors were either known to apply or could be applied. Expenditure on these cancers is estimated to have been $3,021 million during 2015–16.

Total health system expenditure on 29 cancers known to be influenced by risk factors, and for which it is possible to estimate expenditure due to risk factors, is estimated to have been $6,503 million (which excludes $80 million expenditure on dental services and $409 million expenditure on screening).

Approximately $2,725 million, or 42% of expenditure on these 29 cancers during 2015–16, can be attributed to modifiable health risk factors (e.g. to smoking, overweight, high sun exposure etc.).

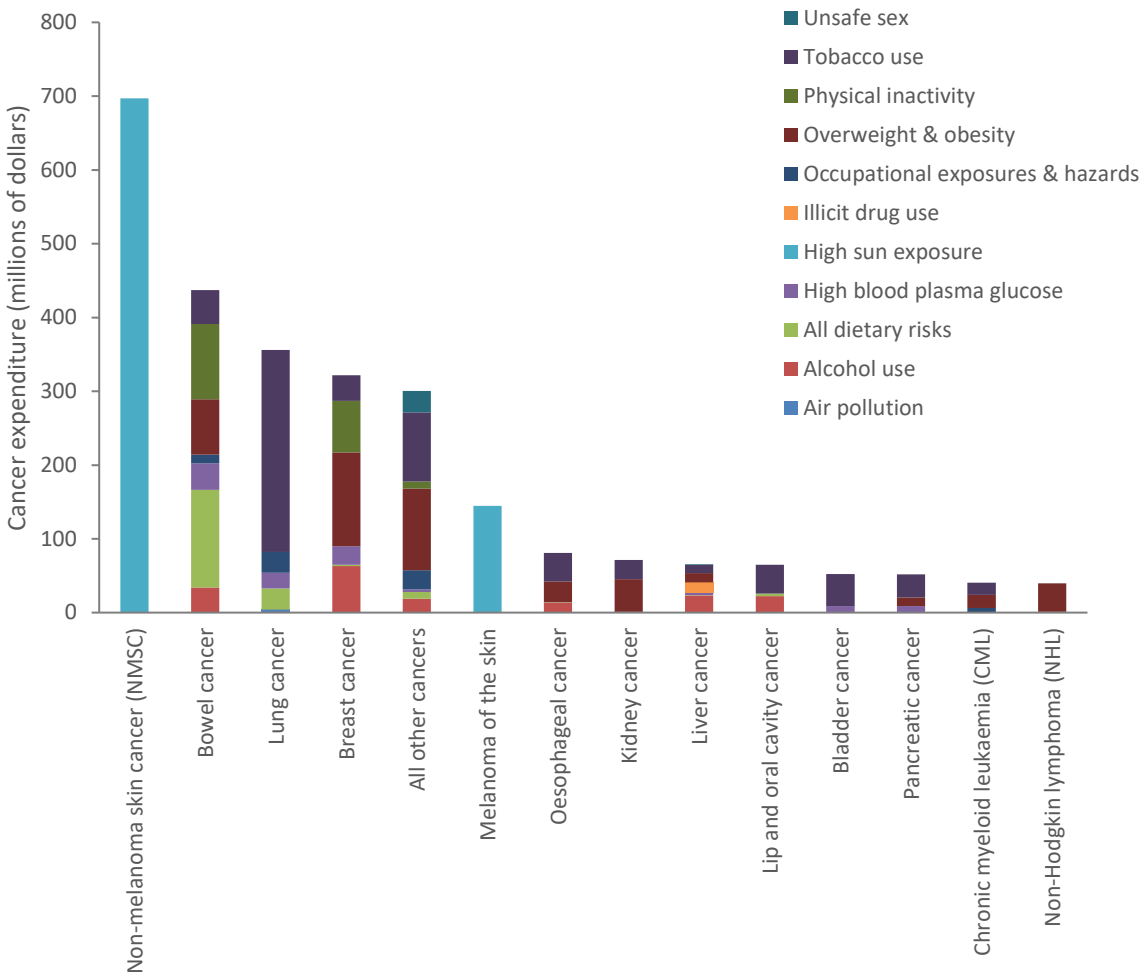
It is not possible to estimate the exact percentage of all cancer expenditure attributable to risk factors. If expenditure attributable to risk factors ($2,725 million) is compared with expenditure on all 38 specific cancers during this period (excluding dental and screening, $9,618 million), then this amount is equivalent to 29% of expenditure on all cancers. However, a large proportion (90%) of the expenditure on those cancers for which estimates were not possible ($3,021 million), relates to 'other' or 'uncertain' cancers, or cancers defined as having an

'unknown primary origin'; many of these are cancers which are likely to also be influenced by risk factors, but for which exact attribution has not been determined, or for which attribution is not possible because of the broad mix of cancers included.

So the true percentage of all cancer expenditure attributable to risk factors is unknown, but at least for those cancers for which attribution is possible, 42% of health system expenditure is attributable to risk factors such as smoking, overweight, high sun exposure and so on.

Figure 9.1 describes the distribution of the $2,725 million expenditure on cancer services that can be directly attributed to risk factors. A substantial proportion (72%) of this expenditure is directly attributable to risk factors associated with bowel, breast, lung, and non-melanoma and melanoma skin cancers.

Figure 9.1: Cancer expenditure attributable to risk factors, for selected cancer sites, 2015–16



Notes

1. Data relating to this figure can be found in Online Table 15.
2. Excludes screening and dental.
3. Excludes cancers for which it has not been technically possible to attribute expenditure to risk factors.

Source: AIHW Disease Expenditure Database.

Table 9.1: Cancer expenditure attributable to cancer risk factors, by cancer site, 2015–2016

	Cancer expenditure attributable to risk factors	Total cancer expenditure	Cancer expenditure attributable to risk factors as a percentage of total cancer expenditure
	$(m)	$(m)	Percent
Non-melanoma skin cancer (NMSC)	697	996	70%
Bowel cancer	437	820	53%
Lung cancer	356	448	79%
Breast cancer	322	773	42%
Melanoma of the skin	145	161	90%
Oesophageal cancer	81	110	73%
Kidney cancer	71	198	36%
Liver cancer	66	92	72%
Lip and oral cavity cancer	65	94	69%
Bladder cancer	52	146	36%
Pancreatic cancer	52	160	32%
Chronic myeloid leukaemia (CML)	41	182	22%
Non-Hodgkin lymphoma (NHL)	40	475	8%
Uterine cancer	38	70	54%
Acute myeloid leukaemia (AML)	33	169	19%
Cervical cancer	32	32	100%
Myeloma	31	322	10%
Prostate cancer	31	659	5%
Laryngeal cancer	23	29	80%
Stomach cancer	17	85	20%
Mesothelioma	15	25	61%
Other leukaemias	14	71	20%
Other lip, oral cavity and pharynx cancers	13	33	38%
Chronic lymphocytic leukaemia (CLL)	12	51	23%
Acute lymphoblastic leukaemia (ALL)	9	105	9%
Thyroid cancer	9	60	15%
Gallbladder cancer	9	40	23%
Nasopharyngeal cancer	8	12	62%
Ovarian cancer	7	82	8%
All cancers	**2,725**	**6,503**	**42%**

Notes

1. Estimates exclude screening and dental. Expenditure for those 11 cancer sites for which it was not possible to estimate the contribution from risk factors, has been excluded.
2. Data relating to this table can be found in Online Table 15.
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

From Table 9.1, expenditure on some cancers (cervical (100%), melanoma (90%), laryngeal (80%), lung (79%), and others) was totally or largely attributable to risk factors. For other cancers (e.g. prostate (5%) and ovarian (8%) cancers, and NHL (8%)), a smaller proportion of expenditure was attributable to the risk factors considered here.

Table 9.2: Health system expenditure on cancer attributable to risk factors, by risk factor, 2015–16

	Cancer expenditure attributable to risk factors	Cancer expenditure attributable to each risk factor as a percentage of all cancer expenditure attributable to risk factors	Cancer expenditure attributable to each risk factor as a percentage of total cancer expenditure
	$millions	Percent	Percent
High sun exposure	842	31%	13%
Tobacco use	654	24%	10%
Overweight & obesity	467	17%	7%
Physical inactivity	182	7%	3%
All dietary risks	178	7%	3%
Alcohol use	176	6%	3%
High blood plasma glucose	106	4%	2%
Occupational exposures & hazards	71	3%	1%
Unsafe sex	31	1%	0%
Illicit drug use	14	1%	0%
Air pollution	4	0%	0%
Grand Total	**2,725**	**100%**	**42%**

Notes

1. Estimates exclude screening and dental. Expenditure for those 11 cancer sites for which it was not possible to estimate the contribution from risk factors, have been excluded.
2. Data relating to this table can be found in Online Table 15.
3. Components may not sum to the totals due to rounding.

Source: AIHW Disease Expenditure Database.

Table 9.2 describes the estimated contribution of each risk factor to health system expenditure on cancer in 2015–16. For example, high sun exposure is estimated to be responsible for $842 million expenditure on cancer treatment and management, which is 31% of all cancer expenditure that can be attributed to risk factors, and 13% of expenditure on those cancers influenced by risk factors that have been considered in this report.

Table 9.2 also shows that a substantial amount of health system expenditure on cancer can be attributed to high sun exposure ($842 million), tobacco smoking ($654 million), and overweight and obesity ($467 million). These risk factors are responsible for 72% of all cancer expenditure that could be avoided if there was no exposure to these risk factors.

Appendix A: Data sources and methodology

Expenditure

The main source of information for this report is the AIHW Disease Expenditure Database. The report provides a broad picture of the use of health system resources classified by disease groups and conditions, and is a reference point for planners and researchers interested in costs and use patterns for particular diseases.

The expenditure estimates in the Disease Expenditure Database have been developed using a number of methods and data sources to provide a broad picture of how diseases are being managed across the health system. Generally, the methods used for estimating disease expenditure is a mixture of 'top-down' and 'bottom-up' approaches, where total expenditure across the health system is estimated and then allocated to the relevant conditions based on the available service use data. An advantage of this approach is that it yields consistency, good coverage and totals that add up to known expenditure, but it is not as comprehensive for any specific disease as a detailed 'bottom-up' analysis, which would include the actual costs incurred for that disease. In most cases, however, a lack of amenable data sources means that a more granular 'bottom-up' analysis is not possible. An overview of the classification codes used for cancer is available in Appendix B.

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

The Disease Expenditure Database contains estimates of expenditure by disease, sex, and age group for public and private admitted patient hospitalisations, public outpatient clinics and emergency departments, out-of-hospital medical services, and prescription pharmaceuticals. Dental estimates are available by condition but not age and sex. Expenditure is not able to be reported by source of funds, though costs to all payers are included in estimates.

Detailed methods used to estimate expenditure by disease are described in the AIHW report *Disease Expenditure Study: overview of analysis and methodology 2015–16* (AIHW 2019f).

The AIHW is continually seeking to improve the methods used to produce these estimates. As a result, estimates in this report are not comparable with estimates in the previous cancer expenditure report (AIHW 2013).

A data quality statement for the Disease Expenditure Database is in Appendix C. This provides information on a range of aspects of the quality of the data being reported by the AIHW. It is included to help readers understand the limitations of the data so they can make informed judgments about their use of the data.

It is not possible to allocate all expenditure on health goods and services by disease. Expenditure that could not be allocated by disease includes:

- capital expenditure
- over-the-counter drugs
- private prescriptions

- community health services
- other health practitioner services
- public health programs (except population screening programs)
- health administration
- health aids and appliances
- patient transport (ambulance)
- research.

This report concerns itself with the expenditure across the health system related to screening for, diagnosing, treating, and managing cancer. Costs that occur outside of the health system, such as lost productivity, are not included in this report.

This report does not describe costs associated with lower levels of economic activity for individuals who are ill or their families, economic loss associated with life forgone, the intangible costs of physical pain and discomfort, and the emotional costs of dealing with the disease, for both the individual and their family, or other indirect costs.

Expenditure associated with disease treatment should not be interpreted as an estimate of the savings that would result from prevention of disease.

Hospital admitted patients

Estimates for admitted patients are based on separations in the NHMD. The NHMD is a compilation of summary records from admitted patient morbidity data collection systems in Australian hospitals which provides information on each public and private episode of admitted patient care (also referred to as a separation) in a given year. The information collected in the NHMD relates to the patient, the hospital, the activity that occurred during the patient's stay and the diagnoses that were associated with the separation—using the ICD-10-AM.

A cost for every separation was estimated using the AIHW Hospital Morbidity Costing Model (HMCM). The HMCM estimates acute hospital admitted patient costs by apportioning the total admitted patient expenditure to individual episodes of hospitalisation with an adjustment for the resource intensity of treatment for the specific episode (using the Australian Refined Diagnosis Related Groups, AR-DRGs) and the length of stay. The length of stay adjustment is made in such a way as to reflect that some costs are proportional to length of stay (for example, ward costs and meals), whereas others are independent of length of stay (for example, theatre costs). Costs for public hospitals are sourced from the NHCDC, and for private hospitals are sourced from the PHDB and MBS.

Average cost types from the NHCDC and NPHED for each hospital (for public hospitals), state or territory (for private hospitals), AR-DRG, principal diagnosis, and care type are assigned to separations in the NHMD on the basis of the state or territory, hospital (for public hospitals), AR-DRG, principal diagnosis, and care type recorded for each separation. Records that did not match these specifications were assigned costs based on either the state/territory or national average AR-DRG and principal diagnosis costs.

Public hospital separation costs are scaled to total expenditure in public acute hospitals that relate to admitted patients using the 'admitted patient costs proportion' estimated by each hospital and state and territory in the NPHED and total expenditure in the Health Expenditure Database. Private hospital separation costs are scaled to total expenditure using the Health Expenditure database.

Expenditure attributable to diseases in hospitals is based on the ICD-10-AM coded principal diagnoses, mapped to Australian Burden of Disease Study conditions.

Box A1: Differences in expenditure reporting

In this report, all of the expenditure for a public hospital admitted patient will be allocated to the disease identified as the principal diagnosis for that admission. This differs from the approach taken in the *Disease expenditure in Australia* web report (AIHW 2019g), where a proportion of this expenditure for admissions whose primary diagnosis is cancer, is allocated to other disease groups indicated by additional diagnoses recorded for each admission, to capture cost of an admission due to other diagnoses. This allocation is made on the basis of findings from a focused regression model. However, as this report takes a view to report on the total cost of care for cancer patients rather than the cost solely attributable to cancer, the estimates are prepared on a different basis to those published in the disease expenditure study.

The method used in this report increases the estimated expenditure on cancer for public hospital admitted patients from $2.2 billion (AIHW 2019g) to $3.6 billion in 2015–16, an increase of $1.4 billion.

Public hospital emergency departments

Emergency departments have not previously been included in cost estimates for disease expenditure studies. The current disease expenditure study has included this to expand the scope of the study with estimates for emergency department presentations based on data in the NNAPEDC.

Cost estimates for emergency department presentations are derived from the NHCDC, using the Urgency Related Group (URG) emergency care classification, developed for activity-based funding purposes. Costs are assigned to presentations on the basis of the average costs from the NHCDC for each hospital and URG, and URG recorded for each presentation in the same hospital in the NNAPEDC database. Records that did not match these specifications were assigned costs that were based on either the jurisdiction or national average URG cost.

Principal diagnoses for emergency department presentations are coded in a mix of classification systems. To allocate costs to diseases, these classifications are mapped to ICD-10-AM codes and then to *Australian Burden of Disease Study 2015* (ABDS) (AIHW 2019a) conditions.

The cost estimates for all presentations are scaled so that the total cost of emergency department presentations and outpatient clinic service events reflects the cost estimates of the non-admitted patient portion of expenditure for each jurisdiction, derived from total hospital expenditure and the ‘admitted patient costs proportion’ estimated by each hospital and state and territory in the NPHED.

Public hospital outpatients clinics

Outpatient clinics have not previously been included in cost estimates for cancer expenditure studies undertaken by the AIHW.

Two databases were used to estimate outpatient cancer activity and demographics: NAPAGG contains total outpatient clinic activity by clinic type, while NAPUR contains a subset of outpatient clinic activity with patient age, sex and geographic data by outpatient clinic type. Approximately half of the service events recorded in the NAPAGG are recorded in greater detail in the NAPUR. Age and sex profiles in the NAPUR data were used to estimate the

demographics for outpatient activity in the NAPAGG not captured in the NAPUR. NAPUR data were not available for Victoria and Queensland, so demographic estimates for these states are based on those of each clinic type in all other states and territories.

Outpatient clinic service events are classified according to the type of clinic in which they are provided. Clinics are classified by Tier 2 clinic class, which is defined by the type of clinician who provided the service, and the nature of the service provided. A clinic may provide a range of services that fall into different classes, and when this occurs the clinic is classified based on its predominant activity. Average costs from the NHCDC for each hospital and clinic type are assigned to service events in the NAP disaggregated dataset on the basis of the hospital and clinic type for each service event.

As outpatient data do not include diagnostic information, the BEACH survey of GP activity has been used to map outpatient data to disease group and cancer type. It is assumed that referrals made by GPs may relate both to private practitioners and to services delivered through outpatient clinics. GP referrals to services are mapped to the Tier 2 classification of outpatient clinics, based on the ICPC-2 PLUS coding associated with the GP referral (for example, a mammography referral would map to mammography clinics, paediatrician referrals to paediatrics clinic).

The cost estimates for all service events are scaled so that the total cost of ED presentations and outpatient clinic service events reflects the cost estimates of the non-admitted patient portion of expenditure for each jurisdiction, derived from total hospital expenditure and the 'admitted patient costs proportion' estimated by each hospital and state and territory in the NPHED.

MBS-related expenditure

Cancer expenditure estimates for GPs, specialists, pathology, diagnostic imaging, and allied health and other services are derived from MBS data. All expenditure relating to MBS services includes both the government-paid MBS benefit and the copayment paid by individuals. MBS services were classified by service type on the basis of derived provider speciality (GP, specialist, and 'other and allied health') or by item subgroup (pathology and medical imaging).

Data from the BEACH survey of GPs were used to allocate MBS services to diseases. The International Classification of Primary Care Version 2 codes (ICPC2) were mapped to the ABDS conditions to enable medical services expenditure to be allocated by disease. BEACH data were aggregated over 5 years to estimate the proportion of GP encounters, referrals for specialists and other health practitioners, and requests for medical imaging and pathology that relate to ABDS conditions. Where there were multiple presenting conditions in the GP encounter, all conditions were equally counted. For referrals, medical imaging and pathology, the condition specified as the reason for the action was used for allocations.

The majority (64%) of MBS item numbers were allocated to a specific disease group (such as cancer or cardiovascular diseases). For example, item 871 *Multidisciplinary case conference* which is billed for '*attendance by a general practitioner, specialist or consultant physician as a member of a case conference team, to lead and coordinate a multidisciplinary case conference on a patient with cancer to develop a multidisciplinary treatment plan'* can be justifiably categorised as relating to the *Cancer and other neoplasms* group of diagnoses. Where an MBS item is related to a specific disease group, allocation to a specific condition (such as breast cancer) was based on the proportion of conditions within that group for each service type in the BEACH data. Where MBS items could not be mapped to a specific disease group, such as a standard GP consultation, expenditure for each service type was based on the proportion of all conditions within each service type in the BEACH data.

Pharmaceuticals

Cancer expenditure estimates for pharmaceuticals are derived using the BEACH survey data and data from the PBS. Total PBS expenditure contains both the benefit paid by the government and the copayment by individuals. Over-the-counter medications have not been reported.

BEACH survey data were aggregated over 5 years to estimate the proportion of prescriptions for each drug that related to each condition, based on the problems managed in the GP encounter that related to the prescribing of a particular drug. These proportions are then used to allocate expenditure in the PBS to diseases.

The Anatomical Therapeutic Chemical Classification System codes were mapped to codes for prescription drugs used in the BEACH survey. This does not necessarily reflect prescribing of pharmaceuticals for cancer by specialists.

Time series comparisons for both out-of-hospital medical services and prescription pharmaceuticals should be treated with caution because GP prescription and referral patterns could have varied over time.

Dental services

There is no single administrative dataset detailing dental expenditure across Australia. Dental expenditure estimates have been derived from the Health Expenditure Australia Database (AIHW 2019f). Estimates of dental expenditure in this report refer to all dental services (public and privately funded).

Data from the BEACH survey for conditions reported when a referral or recommendation was made for dentists or orthodontists were used to allocate dental expenditure to conditions.

This method assumes equal costs for all conditions, but the cost profile of dental services for patients is likely to differ for each of the conditions and groups. However, this cost difference is partially offset by the higher weighting of non-oral conditions through exclusion of self-referrals for dental checks and minor dental work. These estimates should be treated with caution.

Attributing cancer expenditure to risk factors

Of the risk factors included in the ABDS (AIHW 2019a), 11 contribute to the burden of cancer, and therefore expenditure on cancer, and were included in this report. To be included in the ABDS, there needs to be sufficient evidence of a causal link between the risk factor and the linked disease. Further details are described in *Australian Burden of Disease Study: methods and supplementary material 2015* (AIHW 2019e).

Cancer expenditure due to a risk factor represents the reduction in expenditure that would have occurred if exposure to the risk factor had been avoided or had been reduced to its lowest level. This is a theoretical minimum exposure which may not be achievable, feasible or economically viable; for example no overweight or obesity in the Australian population.

The proportion a risk factor contributes to the cancer as calculated in the ABDS (AIHW 2019a) was used to allocate cancer expenditure. For example, if 25% of the burden of disease caused by a particular cancer is estimated to be attributable to tobacco smoking, then 25% of expenditure on that cancer has been allocated to tobacco smoking. The proportion the risk factor contributes was adjusted to account for overlaps between risk factors (such as blood plasma glucose (including diabetes) and obesity) because each risk factor was calculated independently in the ABDS. This adjustment was made using the joint effect calculation and ensures that the expenditure allocated is not greater than actual expenditure (AIHW 2019e).

Selected issues to be considered when comparing expenditure to cancer incidence and population

Estimated resident population (ERP) and incidence of cancer can provide useful contextual information when interpreting expenditure on cancer. However, readers should consider the following advice when comparing ERP and incidence to expenditure, or when using statistics that compares these:

- Cancer is defined slightly differently in the Australian Cancer Database (ACD) and the Disease Expenditure Database. The ACD relates only to those cancers that are registered with jurisdictional cancer registries. This excludes common NMSCs (basal and squamous cell carcinomas)—which account for a large proportion of Australia's cancer cases—and all of the benign, in situ and uncertain neoplasms. The Disease Expenditure Database on the other hand, includes expenditure on all of these neoplasms (see Appendix B).
- Estimates of cancer expenditure will tend to be larger for larger populations, and smaller for smaller populations, simply because there are likely to be more cases of cancer requiring treatment in larger populations.
- Cancer is much more likely to affect older people than younger people; the age structure of populations can vary substantially.
- The probability of developing cancer is strongly influenced by a range of factors including behavioural (e.g. smoking) and biomedical (e.g. overweight) risk factors, as well as genetics. Environmental exposure can also play a role (e.g. high UV exposure increases the risk of melanoma and NMSC).
- Survival differs from cancer to cancer, so a cancer with a relatively low survival will tend to have fewer cases of cancer being managed over the longer term, compared with a cancer which has a relatively high survival rate because a greater proportion of those people will be alive.
- Not only does early (i.e. early stage) diagnosis increase the probability of survival, but earlier diagnosis is also associated with lower expenditure per case (Banegas et al. 2018).
- The average cost of treating a case of cancer differs by type of cancer, with treatment for some cancer types involving much greater expenditure on average, than for others (Banegas et al. 2018; Goldsbury et al. 2018).
- The timing of expenditure on cancer treatment and management differs from cancer to cancer, with large expenditures for some cancers in the months after diagnosis, and in the last months of life, while expenditure for other cancers is much more steady from year to year (Goldsbury et al. 2018).
- Cultural, financial and physical access to services could influence access to and expenditure on services.

For these reasons, caution is advised when interpreting ratios of expenditure to cancer incidence, or when otherwise comparing expenditure and cancer incidence or ERP.

Appendix B: Mapping of ICD-10-AM codes

Cancer site	Code (Disease Expenditure Database)	Code (Australian Cancer Database)
Acute lymphoblastic leukaemia (ALL)	C910	C910
Acute myeloid leukaemia (AML)	C920, C923, C924, C925, C926, C928, C930, C940, C942, C944, C945	C920, C923, C924, C925, C926, C928, C930, C940, C942, C944, C945
Benign and uncertain brain tumours	D32, D33, D42, D43	not reported in the ACD
Bladder cancer	C67	C67
Bowel cancer	C18–C20	C18–C20
Brain and CNS cancer	C70–C72	C70–C72
Breast cancer	C50	C50
Cervical cancer	C53	C53
Chronic lymphocytic leukaemia (CLL)	C911	C911
Chronic myeloid leukaemia (CML)	C921	C921
Ductal carcinoma in situ (breast)	D05	not reported in the ACD
Gallbladder cancer	C23–C24	C23–C24
Hodgkin lymphoma	C81	C81
Kidney cancer	C64	C64
Laryngeal cancer	C32	C32
Lip and oral cavity cancer [(a)]	C00–C08	C00–C08
Liver cancer	C22	C22
Lung cancer	C33–C34	C33–C34
Melanoma of the skin	C43	C43
Mesothelioma	C45	C45
Myeloma	C90	C90
Nasopharyngeal cancer	C11	C11
Non-Hodgkin lymphoma	C82–C86	C82–C86
Non-melanoma skin cancer[(b)]	C44	C44
Oesophageal cancer	C15	C15

Other benign, in situ and uncertain neoplasms	D00–D48 (excluding D05 (ductal carcinoma in situ of the breast), D32, D33, D42 and D43 (benign and uncertain brain tumours); D45, D46, D47 (other blood cancers))	not reported in the ACD
Other blood cancers	C88, C96, D45, D46, D471, D473, D474, D475	C88, C96, D45, D46, D471, D473, D474, D475
Other leukaemias	C912–C919, C922, C927, C929, C946, C947, C941, C943, C931–C939, C95	C912–C919, C922, C927, C929, C946, C947, C941, C943, C931-C939, C95
Other lip, oral cavity and pharynx cancers[(c)]	C09, C10, C12, C13, C14	C09, C10, C12, C13, C14
Ovarian cancer	C56	C56
Pancreatic cancer	C25	C25
Prostate cancer	C61	C61
Stomach cancer	C16	C16
Testicular cancer	C62	C62
Thyroid cancer	C73	C73
Unknown primary	C77, C78, C79, C80, C97	C80
Uterine cancer	C54–C55	C54–C55
Other cancers	All cancer codes below, except those reported in the table above	All cancer codes below, except those reported in the table above
All cancers	C00–C97, D00–D48	C00–C96, D45, D46, D471, D473, D474, D475

(a) Technically 'Lip, oral cavity, and salivary gland cancer'.

(b) Non-melanoma skin cancer (NMSC) recorded in the Australian Cancer Database (ACD) exclude basal cell carcinomas and squamous cell carcinomas, two very common forms of NMSC. Consequently, expenditure on NMSC will relate to a substantially larger number of tumours than are recorded in the ACD, and NMSC expenditure and NMSC incidence and prevalence should not be compared.

(c) Technically 'pharyngeal cancer excluding nasopharynx'.

Appendix C: Data Quality Statements

The Data quality statement for the Australian Cancer Database (2016) can be found at https://meteor.aihw.gov.au/content/index.phtml/itemId/729012

The Data quality statement for the AIHW Disease Expenditure Database can be found at https://meteor.aihw.gov.au/content/index.phtml/itemId/630830

The Data quality statement for the AIHW Health Expenditure Database (2015–16) can be found at https://meteor.aihw.gov.au/content/index.phtml/itemId/662758

Data technical issues

Expenditure data are derived from a substantial number of different data sources. Some data sources do not include all variables used to describe expenditure in this report. For example, available data on dental expenditure do include details of age, sex or geographic location (e.g. postcode) of the patient's home address, and therefore, when reporting expenditure for these splits, expenditure on dental will not be reported. This results in some missing data throughout the report.

Where variables (e.g. sex) exist, but data are missing through 'non-response' (e.g. sex not stated), the standard approach has been to allocate that expenditure between the categories pro rata (e.g. if 60% of expenditure for patients whose sex is known relates to males, then 60% of expenditure for patients whose sex is unknown is also allocated to males).

A small amount of hospital, MBS and PBS expenditure relates to Australians with cancer who live outside Australia. When reporting expenditure for states and territories, remoteness areas and SA4s, this expenditure has been excluded, and the totals in those tables will not add to total expenditure reported in other tables.

While expenditure reported here relates to cancer and also to other neoplasms, the Australian Cancer Database (ACD) reports only malignant neoplasms (cancers) and a small number of non-malignant (benign, in situ or uncertain) neoplasms. Consequently, there are several groups of neoplasms for which expenditure is reported, but for which incidence is unknown; these include 'Benign and uncertain brain tumours', 'Ductal carcinoma in situ (breast)', and 'Other benign, in situ and uncertain neoplasms'.

In addition, the ACD contains information on only a small proportion of the non-melanoma skin cancers (NMSC), and does not report basal cell carcinomas or squamous cell carcinomas. Consequently, expenditure on NMSC is reported here, but incidence is not.

Finally, 3 groups of cancers are defined slightly differently in the Disease Expenditure and Australian Cancer databases (see Appendix B):

- There are fewer cancers classified as unknown primary site in the ACD,
- Expenditure data relate to all malignant and non-malignant neoplasms, while ACD incidence data relate to all malignant neoplasms (except NMSC), plus a small number of non-malignant neoplasms.
- As a consequence of the points above, 'other cancers' will be defined slightly differently.

All other cancers are defined the same in the two databases.

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Abbreviations

ABS	Australian Bureau of Statistics
ACD	Australian Cancer Database
AIHW	Australian Institute of Health and Welfare
AR-DRG	Australian Refined Diagnosis Related Group
ASGS	Australian Statistical Geography Standard
ALL	acute lymphoblastic leukaemia
AML	acute myeloid leukaemia
BEACH	Bettering the Evaluation and Care of Health survey
BODMU	Burden of Disease and Mortality Unit, AIHW
CDMU	Cancer Data and Monitoring Unit, AIHW
CLL	chronic lymphocytic leukaemia
CML	chronic myeloid leukaemia
CNS	central nervous system

ED	emergency department
ERP	estimated resident population
GP	general practitioner
HEU	Health Expenditure Unit, AIHW
HMCM	AIHW Hospital Morbidity Costing Model
ICPC-2 PLUS	International Classification of Primary Care, Version 2 (BEACH coding system)
ISSU	Injuries and System Surveillance Unit, AIHW
ICD	International Statistical Classification of Diseases and Related Health Problems
MBS	Medical Benefits Scheme (or Schedule)
NAPAGG	National Non-admitted Patient Databases (aggregated data)
NAPUR	National Non-admitted Patient Databases (unit record data)
NHCDC	National Hospital Costs Data Collection
NHMD	National Hospital Morbidity Database
NHL	non-Hodgkin lymphoma
NMSC	non-melanoma skin cancer
NNAPEDC	National Non-admitted Patient Emergency Department Care Database
NPHED	National Public Hospitals Establishments Database
PBS	Pharmaceutical Benefits Scheme (or Schedule)
PHDB	Private Hospital Data Bureau
SA4	Statistical Area Level 4
SAMU	Screening Analysis & Monitoring Unit, AIHW
UV	ultra violet (radiation)

Symbols

—	nil or rounded to zero
n.p.	not publishable because of small numbers, confidentiality or other concerns about the quality of the data

Glossary

Aboriginal or Torres Strait Islander: A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Indigenous**.

adenoma (adenomatous polyp): A benign tumour that arises from epithelial cells. All adenomas have malignant potential. Adenomas in the rectum or colon have a higher chance of developing into cancer than adenomas in most other organs.

admission: An admission to hospital. See also **hospitalisation**.

admitted patient: A patient who undergoes a hospital's formal admission process to receive treatment or care. The treatment and care are provided over a period of time and can occur in hospital or in the person's home (for hospital-in-the-home patients).

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.

Anatomical Therapeutic Chemical (ATC) Classification System code: Assigns therapeutic drugs to different groups according to the organ or system on which they act, as well as their therapeutic and chemical characteristics.

benign: Non-cancerous tumours that can grow larger but do not spread to other parts of the body.

Bettering the Evaluation and Care of Health (BEACH): An ongoing national survey of general practitioners in Australia. It is conducted by the Australian General Practice Statistics and Classification Centre at the University of Sydney. It involves a random sample of about 1,000 general practitioners a year, each of whom records the details of 100 consecutive patient encounters.

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

cancer (malignant neoplasm): A large range of diseases in which some of the body's cells become defective, begin to multiply out of control, can invade and damage the area around them, and can also spread to other parts of the body to cause further damage.

chemotherapy: The use of drugs (chemicals) to prevent or treat disease, with the term being applied for treatment of cancer rather than for other uses.

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.

constant prices: Constant price expenditure adjusts current prices for the effects of inflation; that is, it aims to remove the effects of inflation.

copayment: A payment made by an individual who shares the cost of goods and services with third-party payers, such as a private health insurance provider or the Australian Government (see **out-of-pocket costs**).

current prices: Refers to expenditures reported for a particular year, unadjusted for inflation. Changes in current price expenditures reflect changes in both price and volume.

diagnostic related group (DRG): An admitted patient classification system that provides a clinically meaningful way of relating the number and type of patients treated in a hospital (that is, its casemix) to the resources required by the hospital.

disease: A physical or mental disturbance involving symptoms (such as pain or feeling unwell), dysfunction or tissue damage, especially if these symptoms and signs form a recognisable clinical pattern.

hospital services: Services provided to a patient who is receiving **admitted patient** services or non-admitted patient services in a hospital, but excluding non-admitted dental services, community health services, patient transport services, public health activities and health research done within the hospital. They can include services provided off-site, such as dialysis or hospital in the home.

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. An episode of care can be completed by the patient being discharged, transferred to another hospital or care facility, or dying, or by a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation).

International Statistical Classification of Diseases and Related Health Problems: The World Health Organization's internationally accepted classification of death and disease. The 10th Revision (ICD-10) is currently in use. The ICD-10-AM is the Australian Modification of the ICD-10; it is used for diagnoses and procedures recorded for patients admitted to hospitals).

incidence: The number of new cases (of an illness or event, and so on) in a given period.

Indigenous: A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Aboriginal or Torres Strait Islander**.

in situ: A Latin term meaning in place or position; undisturbed.

invasive: See **malignant.**

jurisdiction: In this report, a jurisdiction is either an Australian state or territory.

malignant: A tumour with the capacity to spread to surrounding tissue or to other sites in the body. See also **invasive**.

Medicare Benefits Schedule (MBS): A Department of Health list that is part of the Medicare Benefits Scheme, the aim of which is to provide an entitlement to benefits for medical and hospital services for all Australian residents.

metastasis: The process by which cancerous cells are transferred from one part of the body to another, for example, via the lymphatic system or the bloodstream.

mortality due to cancer: The number of deaths that occurred during a specified period (usually a year) for which the underlying cause of death was recorded as cancer.

neoplasm: An abnormal ('neo' = new) growth of tissue. Can be **benign** (not a cancer) or **malignant** (a cancer) (see also **invasive**). Also known as a **tumour**.

non-Indigenous: People who have declared they are not of Aboriginal or Torres Strait Islander descent.

out-of-pocket costs: The total costs incurred by individuals for health-care services over and above any refunds from the **Medicare Benefits Schedule (MBS)**, the **Pharmaceutical Benefits Scheme (PBS)** and private health insurance funds (see **copayment**).

over-the-counter medicines: Medicinal preparations that are not prescription medicines that are primarily bought from pharmacies and supermarkets.

Pharmaceutical Benefits Scheme (PBS): The Australian Government–funded scheme that subsidises the cost of a wide range of pharmaceutical drugs and covers all Australians to help them afford standard medications.

prevalence: The total number of people alive at a specific date who have ever been diagnosed with a particular disease such as cancer.

principal diagnosis: The diagnosis listed in hospital records to describe the problem that was chiefly responsible for **hospitalisation**.

primary diagnosis: See **principal diagnosis**.

private hospital: A health-care provider facility, other than a public hospital, that has been established under state or territory legislation as a hospital or freestanding day procedure unit and authorised to facilitate the provision of hospital services to patients. A private hospital is not defined by whether it is privately owned but by whether it is not a public hospital (as defined below). Private hospital expenditure includes expenditures incurred by a private hospital in providing contracted and/or ad hoc treatments for public patients.

public hospital: A health-care provider facility that has been established under state or territory legislation as a hospital or as a freestanding day procedure unit. Public hospitals are operated by, or on behalf of, the government of the state or territory in which they are established and are authorised under that state/territory's legislation to provide or facilitate the provision of hospital services to patients. Public hospitals include some denominational hospitals that are privately owned. Australian Defence Force hospitals are not included in the scope of public hospitals.

Remoteness Area: The Remoteness Areas Structure exists within the Australian Statistical Geography Standard (ASGS). Remoteness Areas divide Australia into 5 classes of remoteness (*Major cities*, *Inner regional*, *Outer regional*, *Remote* and *Very remote* areas) on the basis of a measure of relative access to services.

relative survival: The ratio of the observed survival of a group of persons diagnosed with cancer to the expected survival of those in the corresponding general population after a specified interval following diagnosis (such as 5 or 10 years).

risk factor: Any factor that represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so.

screening: Repeated testing, at regular intervals, of apparently well people to detect a medical condition at an earlier stage than would otherwise be the case. Screening tests are not diagnostic, therefore, people who receive a positive screening result require further assessment and diagnosis to determine whether or not they have the disease or risk marker being screened for.

secondary site cancer: A **tumour** that originated from a cancer elsewhere in the body.

Statistical Area Level 4 (SA4): SA4s are geographical areas built from whole Statistical Areas Level 3 (SA3s). The SA4 regions are the largest sub-state regions in the Main Structure of the Australian Statistical Geography Standard (ASGS).

survival: A general term indicating the probability of being alive for a given amount time after a particular event, such as a diagnosis of cancer.

total health expenditure (spending): The sum of health expenditure for all conditions (that is, allocated recurrent health expenditure). This excludes expenditure that cannot be allocated to a specific disease (for example, ambulance services) and capital expenditure (non-recurrent).

tumour: See **neoplasm**.

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Related publications

Health system expenditure on cancer and other neoplasms in Australia, 2008–09

Cancer in Australia 2019

Cancer Data in Australia

Disease Expenditure in Australia, 2015–16

Disease Expenditure Study. Overview of analysis and methodology, 2015–16

Health expenditure Australia 2017–18

Health system expenditure on cancer and other neoplasms in Australia, 2015–16, presents estimates of cancer expenditure by age group, sex, Indigenous status, geography, area of expenditure and for a range of types of cancer, as well as expenditure on cancer as a result of health risk factors.

Estimates are based on a number of assumptions.

Expenditure on cancer in 2015–16 was $10.1 billion, including at least $2.7 billion attributable to health risk factors.

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