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Brain and other central nervous system cancers

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Brain and other central nervous system cancers

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Contents

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Abbreviations

ABDS	Australian Burden of Disease Study
ABS	Australian Bureau of Statistics
ACCD	Australian Consortium for Classification Development
ACD	Australian Cancer Database
ACHI	Australian Classification of Health Interventions
AIHW	Australian Institute of Health and Welfare
ASR	age-standardised rate
CBTRUS	Central Brain Tumor Registry of the United States
CNS	central nervous system
CSF	cerebrospinal fluid
DALY	disability-adjusted life years
IARC	International Agency for Research on Cancer
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
MBS	Medicare Benefits Schedule
NDI	National Death Index
NHMD	National Hospital Morbidity Database
NMD	National Mortality Database
NMDS	National Minimum Data Set
NOS	Not otherwise specified
NRWTD	National Radiotherapy Waiting Times Database
WHO	World Health Organization
YLD	years lived with disability
YLL	years of life lost

Symbols

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

Summary

Brain and other central nervous system cancers is the first national report to present comprehensive data specific to brain and other central nervous system (CNS) cancers in Australia. This report provides an overview of brain and other CNS cancer, its risk factors as well as key summary measures including incidence, mortality, treatment, survival, prevalence and years of life lost due to death or disability. It also includes a 'spotlight' section which presents available data for non-malignant brain and other CNS tumours.

While brain and other CNS cancers are rare, they have a large impact

It is estimated that in Australia in 2017, 2,076 new cases of brain and other CNS cancer will be diagnosed and 1,477 people will die from this disease. On average, 6 cases of brain and other CNS cancer will be diagnosed each day and 4 people will die each day from this disease. Reflecting its impact, although brain and other CNS cancer is the 17th most commonly diagnosed cancer and represents 1.5% of all cancers diagnosed, it was the 6th leading cause of cancer burden. Australians lost 35,662 disability-adjusted life years due to brain and other CNS cancer, and most of the burden (96%) was due to dying prematurely.

In 2009–2013, Australians diagnosed with brain and other CNS cancer had on average a 25% chance of surviving for five years compared with others in the general population, whereas this figure was 68% for all cancers combined. This rate has remained steady, with no clear improvement in survival over the last 30 years. The more common types of brain and other CNS cancer have the lowest survival rates.

Leading cause of cancer burden in children

It is estimated that in 2017, 110 cases of brain and other CNS cancer will be diagnosed in children aged 0–14 and that 38 children will die from these cancers. Brain and other CNS cancer was the second most commonly diagnosed cancer in children (15% of all cancers) after leukaemia and the 7th leading cause of death from all causes. It was the second most common cause of cancer death after leukaemia, and the leading cause of cancer death in children aged under 10.

In children, brain and other CNS cancer was the leading cause of cancer burden, accounting for 29% of the burden in boys and 33% of the burden in girls. Most of this burden (98%) was due to dying prematurely.

Non-malignant brain and other CNS tumours cause significant morbidity and mortality

Unlike most non-malignant tumours, non-malignant tumours of the brain and other CNS cause high rates of morbidity and mortality. In 2013, there were 1,029 new cases of non-malignant tumours of the brain and other CNS recorded in Victoria, Queensland and Western Australia (the jurisdictions for which cancer incidence data were available). In 2015, 279 people died from these diseases in Australia. In 2011, Australians lost 5,729 disability-adjusted life years due to non-malignant brain and other CNS tumours, and most of the burden (75%) was due to people dying prematurely.

1 Introduction

This report is one of a series developed under the framework of the National Centre for Monitoring Cancer under the guidance of the Cancer Monitoring Advisory Group. Each report incorporates a 'spotlight' section that highlights a particular issue associated with specific cancers or cancer-related topics.

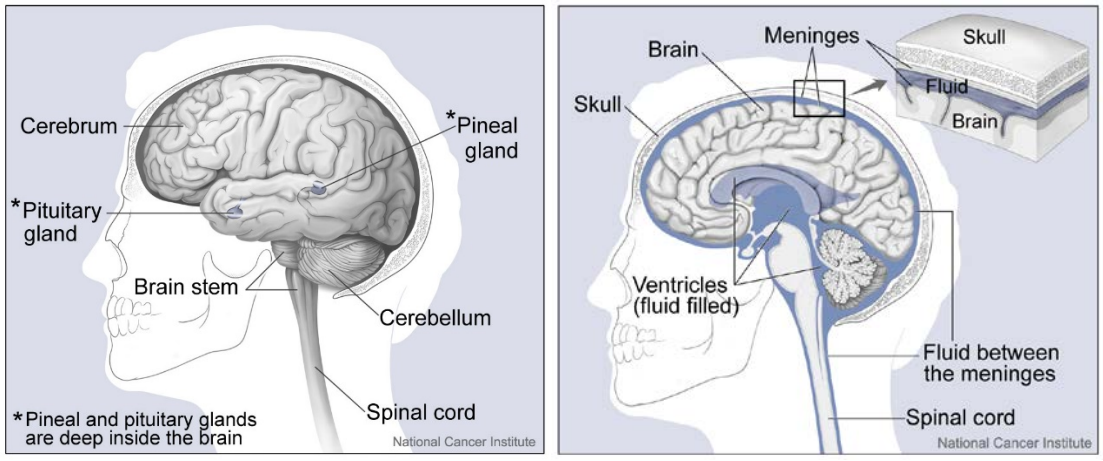
This report is the first national report to present key data specific to primary brain and central nervous system (CNS) tumours (malignant and non-malignant). While brain and other CNS cancer are rare, it has a substantial social and economic impact on individuals, families and community. It is estimated that in 2017, 2,076 new cases of brain and other CNS cancer will be diagnosed and 1,477 people will die from this disease. While brain and other CNS cancer is the 17th most commonly diagnosed cancer, it was the 6th leading cause of cancer burden in 2011. In 2008–09, it was estimated that the health system expenditure on brain cancer was around $127 million (AIHW 2013).

1.1 Defining brain and other CNS tumours

Cancer (also called a malignant neoplasm) is a diverse group of diseases characterised by the uncontrolled proliferation of abnormal cells. These abnormal cells invade and damage the tissues around them, and might then spread to other parts of the body, which can cause further damage and potentially death (AIHW & AACR 2014).

The term 'brain and other CNS cancer' does not refer to a single type of cancer, but is a term used to describe a range of different malignant (cancerous) tumours that can occur in the brain and associated tissues (Figure 1.1). For this report, brain and other CNS cancer refers to cancers arising in the following sites:

- meninges (cerebral and spinal) (ICD-10 code C70)
- brain (C71)
- spinal cord, cranial nerves and other parts of the central nervous system (C72)
- endocrine glands of the cranial cavity (pituitary gland, craniopharyngeal duct and pineal gland) (C75.1, C75.2, C75.3).



Source: National Cancer Institute

Figure 1.1: Anatomy of the brain and associated tissues

Similarly, the term ‘non-malignant tumours of the brain and other CNS’ does not refer to a single type of tumour, and refers to tumours arising in the following sites:

- benign neoplasms of the meninges (ICD-10 code D32)
- benign neoplasms of the brain and other parts of the CNS (D33)
- neoplasms of uncertain or unknown behaviour of meninges (D42)
- neoplasms of uncertain or unknown behaviour of brain and CNS (D43).

Note that it excludes neoplasms of the endocrine glands of the cranial cavity (D35.2–D35.4, D44.3–D44.5) due to data availability.

Brain and other CNS tumours (both malignant and non-malignant) can be further characterised based on sub-site in the brain and the histology (cell type). This lower-level classification detail (discussed below) is important to report as survival rates can vary between them.

Sub-site of the brain

Tumours in different locations of the brain can have an impact on functioning. This report presents information on the following sub-sites of the brain:

- cerebrum, except lobes and ventricles (ICD-10 code C71.0)—processes sensory and motor information
- frontal lobe (C71.1)—controls decision-making, planning, and movement
- temporal lobe (C71.2)—controls memory, hearing and language
- parietal lobe (C71.3)—processes sensory information
- occipital lobe (C71.4)—processes visual information
- cerebral ventricle (C71.5)—cavities filled with cerebrospinal fluid, the liquid that bathes and protects the brain and CNS
- cerebellum (C71.6)—processes multiple types of sensory information to allow skilled and coordinated movement
- brain stem (C71.7)—controls the basic functions necessary for survival, breathing, eating, and movement (Porth 2007)
- overlapping lesion of brain (used when the tumour overlaps two or more of the above sub-sites and the point of origin cannot be determined) (C71.8)
- brain, sub-site unspecified (used when information about the tumour is unavailable) (C71.9).

Histology group

Histology describes the type of cells in which cancer originates. Symptom patterns and survival outcomes vary based on histology type (Ostrom et al. 2016). Different brain and other CNS cancer histology classifications exist, including World Health Organization (WHO) Classification of Tumours of the Central Nervous System (Louis et al. 2016, 2007) and the Central Brain Tumor Registry of the United States (CBTRUS) classification for malignant tumours of brain and other CNS cancer (Ostrom et al. 2016). This report uses the CBTRUS classification, which groups tumours into 7 broad categories, 6 of which are relevant to the Australian context. See Appendix B for details on the histology groupings used in this report.

The World Health Organization updated its Classification of Tumours of the Central Nervous System in 2016. The updated classification uses molecular genetic features, such as specific mutations, in addition to histology to define brain and other CNS tumour types (Louis et al. 2016). In light of the recent WHO changes, the classification of brain and other CNS tumours in Australia is under review. Reporting by the new classification may be available once the changes have been implemented in coding standards.

1.2 Brain cancer risk factors

It is not yet known what causes brain cancer but ionising radiation and family history are factors that may increase the chance of a person developing brain cancer (see information below) (IARC 2014). It should be noted that exposure to a risk factor does not mean that a person will develop cancer. Many people are exposed to at least one cancer risk factor but will never get cancer. In recent years, a potential link between brain and other CNS cancer and mobile phone usage has been raised and explored. However, to date, no conclusive link has been found (IARC 2011).

	**Ionising radiation** Ionising radiation from natural sources, from nuclear accidents and explosions, and from diagnostic X-rays can be risk factors for cancer. In the case of brain and other CNS cancer, therapeutic irradiation as a treatment for other cancers or medical conditions is associated with an increased risk of developing brain and other CNS cancer. *Source:* IARC 2014.
	**Family history and genetic susceptibility** Tumours in the CNS can occur as a result of several inherited cancer syndromes including neurofibromatosis, tuberous sclerosis, Li-Fraumeni syndrome, Turcot syndrome and Gorlin syndrome. These account for only a very small proportion (less than 1%) of overall brain and other CNS cancer numbers. *Source:* IARC 2014.

1.3 Scope of this report

This report provides an overview of brain and other CNS cancer, including incidence, mortality, treatment, survival, prevalence and burden of disease. Brain and other CNS cancer comprises cancers coded in ICD-10 as C70–C72 and C75.1–C75.3. Cases for which the histology code was not associated with a brain and other CNS cancer (as defined in Table B1) have been excluded from this analysis. This accounts for only 0.1% of records in the Australian Cancer Database (ACD). The only variation from this definition in this report is in the burden of disease chapter, where cancers of endocrine glands of the cranial cavity (C75.1–C75.3) are excluded.

This report also includes a ‘spotlight’ section which presents available data for non-malignant brain and other CNS tumours. Non-malignant tumours of the brain and other CNS comprises tumours coded in ICD-10 as D32–D33 and D42–D43. Cases for which the histology code was not associated with a brain and other CNS tumour (as defined in Table B2) have been excluded from this analysis. This accounts for less than 0.5% of records. The only variation from this definition in this report is in the mortality section, where cancers of the endocrine glands of the cranial cavity (D35.2–D35.4, D44.3–D44.5) are included.

This report presents information on tumours as an overall grouping and by site, sub-site and histology. Information is presented by sex, age and trend. There are differences in tumours by age group, therefore data are presented by life stage: children (aged 0–14), adolescents and young adults (15–24), adults (25–64) and older adults (65+).

Data sources

The primary data sets used to produce this report are the ACD and the National Mortality Database (NMD). Several other data sources have also been used to present a broad picture of brain and other CNS cancer. Information about each of these data sources is presented in Appendix D.

Australian Cancer Database

This report extracts data from the 2013 ACD—the latest data available at the time of this report. The ACD contains information on all new cases of primary invasive cancer (excluding basal cell and squamous cell carcinoma of the skin) diagnosed in Australia since 1982. Data are collected by state and territory cancer registries from a number of sources and are supplied annually to the Australian Institute of Health and Welfare (AIHW). The AIHW is responsible for compiling the ACD through the National Cancer Statistics Clearing House—a collaboration with the Australasian Association of Cancer Registries.

Actual incidence data covers the period 1982–2013—except for New South Wales, where data are available to 2012 and estimated for 2013. Note that 2013 data for the Australian Capital Territory does not include cases identified solely from death certificates.

This report also includes estimates of cancer incidence for 2014–2017 which were projected using linear regression analysis. The 2014–2017 estimates are only indicative of future trends and the actual incidence may be different from these estimates. They are not forecasts and do not attempt to allow for future changes in cancer detection methods, changes in cancer risk factors or for non-demographic factors (such as government policy changes) that may affect future cancer incidence rates. Estimates in this report, while using similar methodology to *Cancer in Australia 2017* (AIHW 2017c), used joinpoint analysis software to determine the modelling 'window' rather than using 2004–2013 incidence data as the window. For the incidence projections in this report, the period 1982–2013 was investigated to determine the modelling window for all sites and sexes. Therefore the incidence projections in this report are not directly comparable with the incidence projections presented in *Cancer in Australia 2017*.

National Mortality Database

This report sources data from the NMD. The NMD is a national collection of information for all deaths in Australia since 1964 and is maintained by the AIHW. Information on the characteristics and causes of death of the deceased are provided by the Registrars of Births, Deaths and Marriages and the National Coronial Information System (managed by the Victorian Department of Justice), and are coded nationally by the Australian Bureau of Statistics (ABS).

Note that deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on the preliminary version. The revised and preliminary versions are subject to further revision by the ABS. The mortality data presented in this report from 1982 to 2014 are based on the *year of occurrence* of the death, and data for 2015 are based on the *year of registration* of the death.

This report includes estimates of mortality data for 2016–2017 based on the NMD. The 2016–2017 estimates are only indicative of the future trends, and the actual numbers may differ from these estimates. They are not forecasts and do not attempt to allow for future changes in cancer treatments. Estimates in this report, while using similar methodology to *Cancer in Australia: 2017* (AIHW 2017c), used joinpoint analysis software to determine the modelling window (see Table 1.1) rather than 2004–2013 mortality data as the window. Further, a more up-to-date version of the database was used for the estimates. Therefore the results in this report are not directly comparable to those published elsewhere.

Table 1.1: Modelling windows for mortality projections

Sub-site	Males	Females
Meninges (C70)	1994–2015	1990–2015
Brain (C71)	1990–2015	1968–2015
Spinal cord, cranial nerves and other parts of CNS (C72)	1981–2015	1981–2015
Endocrine glands of the cranial cavity (C75.1–75.3)	2006–2015	1973–2015

2 Incidence

Snapshot

It is estimated that in 2017:

- 2,076 new cases of brain and other CNS cancer will be diagnosed
- incidence will vary by age; 5.3% of new cases will be diagnosed in children (aged 0–14), 3.0% in adolescents and young adults (aged 15–24), 45% in adults (aged 25–64) and 46% in older adults (aged 65 and over)
- the brain will be the most common site (1,956 cases).

In 2013:

- brain and other CNS cancer was the second most commonly diagnosed cancer in children (102 cases)
- the frontal lobe was the most common brain cancer sub-site (492 cases), followed by the temporal lobe (380 cases)
- cancers of the cerebellum and brain stem were more common in children than in older adults
- tumours of neuroepithelial tissue were the most common histology group (1,592 cases) and within tumours of neuroepithelial tissue, glioblastoma was the most common histology (982 cases)
- embryonal tumours and germ cell tumours were more common in children and adolescents and young adults, and unclassified tumours were more common in older adults.

Data for this chapter are extracted from the 2013 ACD and focus on the estimated incidence of brain and other CNS cancer for 2017, cancer trends from 1982 to 2017, and brain and other CNS cancer sub-site and histology group for 2013 (as characteristics have not been projected) (see Chapter 1 and Appendix D for details). This chapter focuses on the *number of new cases* of cancers diagnosed in a year rather than *number of people* newly diagnosed (because one person can be diagnosed with more than one cancer in a year), although the two numbers are likely to be similar.

2.1 Brain and other CNS cancer

It is estimated that in 2017, 2,076 new cases of brain and other CNS cancer will be diagnosed in Australia, which on average is 6 new cases each day. This accounted for about 1.5% of all cancers diagnosed. Over half of these cases (58%) are expected to be diagnosed in males. Males were 1.5 times as likely to be diagnosed with brain and other CNS cancer as females (Table 2.1).

Table 2.1: Estimated new cases of brain and other CNS cancer, by sex, 2017

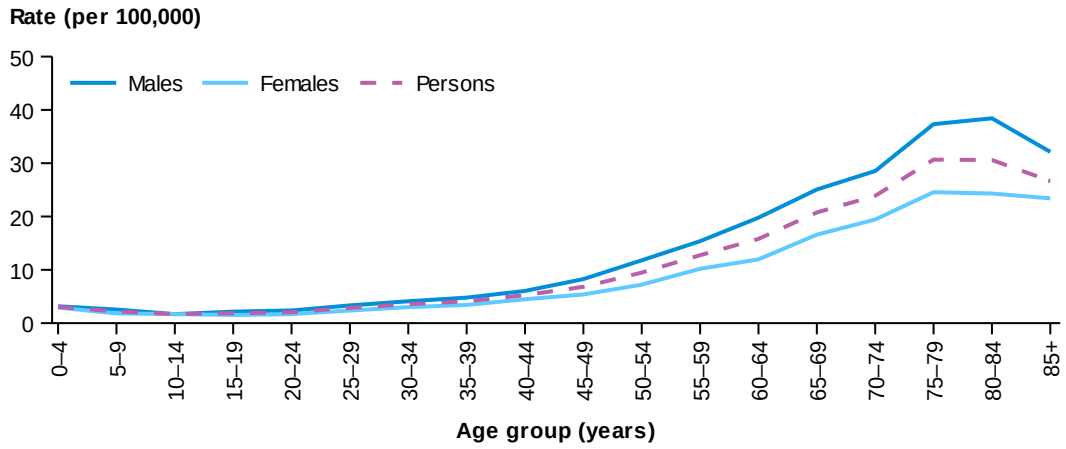
Sex	Number	ASR
Males	1,204	9.1
Females	872	6.2
Persons	**2,076**	**7.6**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Age group

The estimated age-specific incidence rate of brain and other CNS cancer generally increased with age. The rate decreased slightly from 3.0 new cases per 100,000 persons in age group 0–4 to 1.7 per 100,000 in age group 10–14, then increased to 31 per 100,000 in age group 75–79 before decreasing in older age groups. The rate is higher for males than females across all age groups (Figure 2.1).



Source: Table A2.1.

Figure 2.1: Estimated age-specific incidence rates of brain and other CNS cancer, by age at diagnosis, 2017

Life stage

Children (0–14 years)

It is estimated that in 2017, 110 cases of brain and other CNS cancer will be diagnosed in children, representing 5.3% of the brain and other CNS cancer diagnosed across all age groups (Table A2.1). Within this age group, 45% of new cases were for children aged 0–4. Children are over-represented for this type of cancer, representing 5.3% of the brain and other CNS cancer while representing only 0.5% of all cancers combined (AIHW 2017c). In 2013, brain and other CNS cancer was the second most commonly diagnosed cancer in children, after leukaemia, and represented 15% of all cancers diagnosed in this age group (Table A2.2).

Adolescents and young adults (15–24 years)

It is estimated that in 2017, 62 cases of brain and other CNS cancer will be diagnosed in adolescents and young adults, representing 3.0% of the brain and other CNS cancer diagnosed across all age groups (Table A2.1). In 2013, brain and other CNS cancer was the

7th most commonly diagnosed cancer in adolescents and young adults, representing 6.7% of all cancers diagnosed in this age group (Table A2.3).

Adults (25–64 years)

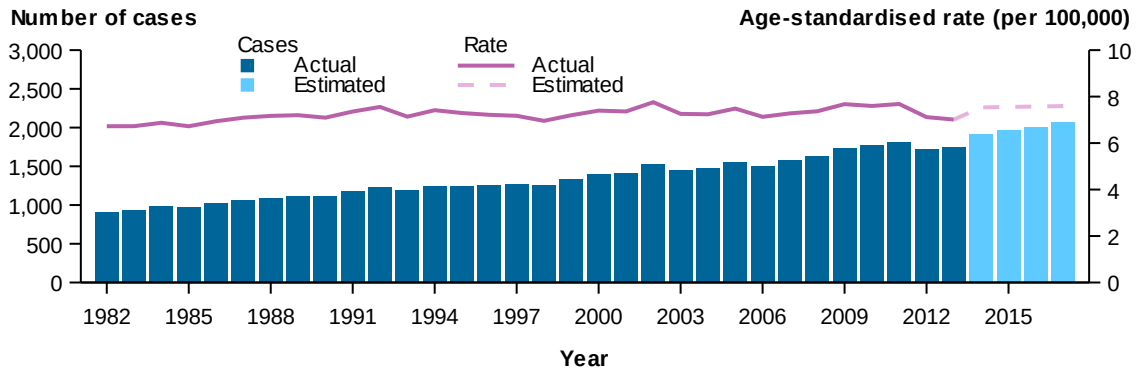
It is estimated that in 2017, 942 cases of brain and other CNS cancer will be diagnosed in adults, representing 45% of the brain and other CNS cancer diagnosed across all age groups (Table A2.1). In 2013, brain and other CNS cancer was the 12th most commonly diagnosed cancer in adults, representing 1.6% of all cancers diagnosed in this age group (Table A2.4).

Older adults (65+ years)

It is estimated that in 2017, 964 cases of brain and other CNS cancer will be diagnosed in older adults, representing 46% of the brain and other CNS cancer diagnosed across all age groups (Table A2.1). In 2013, brain and other CNS cancer was the 19th most commonly diagnosed cancer in older adults, representing 1.0% of all cancers diagnosed in this age group (Table A2.5).

Trend

The number of new cases of brain and other CNS cancer per year more than doubled from 911 cases in 1982 to an estimated 2,076 in 2017, whereas the incidence rate remained relatively steady—ranging between 6.7 and 7.8 cases per 100,000 persons over that time period (Figure 2.2). The increase in the number of new cases therefore can be largely explained by the increase in the Australian population.



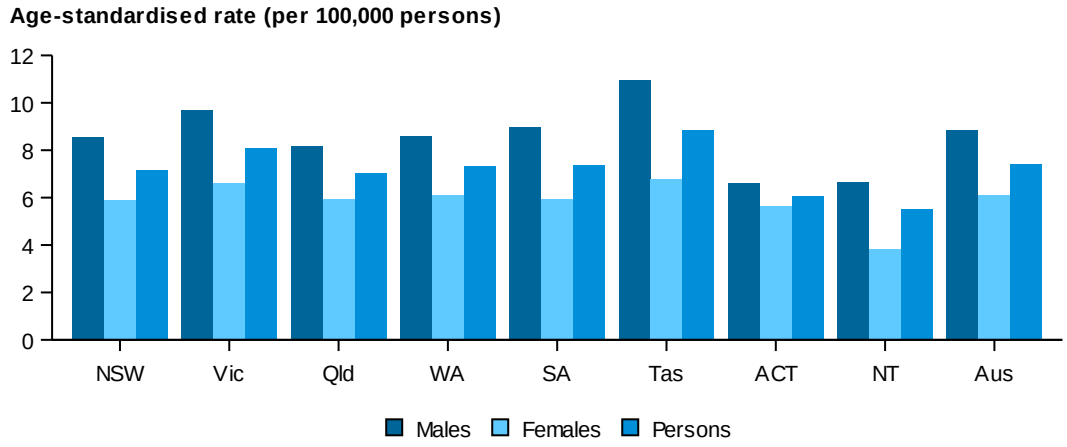
Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A2.6.

Figure 2.2: Trends in incidence of brain and other CNS cancer, 1982 to 2017

State and territory

In the years 2009–2013, the age-standardised incidence rate for brain and other CNS cancer was highest in Tasmania (8.9 cases per 100,000 persons) and lowest in the Northern Territory (5.5 per 100,000 persons). This compares with the Australian rate of 7.4 per 100,000 persons for the years 2009–2013 (Figure 2.3).



Notes

1. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.
2. The 2013 NSW incidence data were estimated by the AIHW, see *Cancer in Australia 2017* (AIHW 2017c) for methodology.

Source: Table A2.7.

Figure 2.3: Incidence of all brain and other CNS cancer, by sex and state and territory, 2009–2013

2.2 Site

In 2017, 94% of brain and other CNS cancers are expected to occur in the brain (Table 2.2). Males are 1.5 times as likely to be diagnosed with brain cancer as females. Females are more likely to be diagnosed with cancer of the meninges.

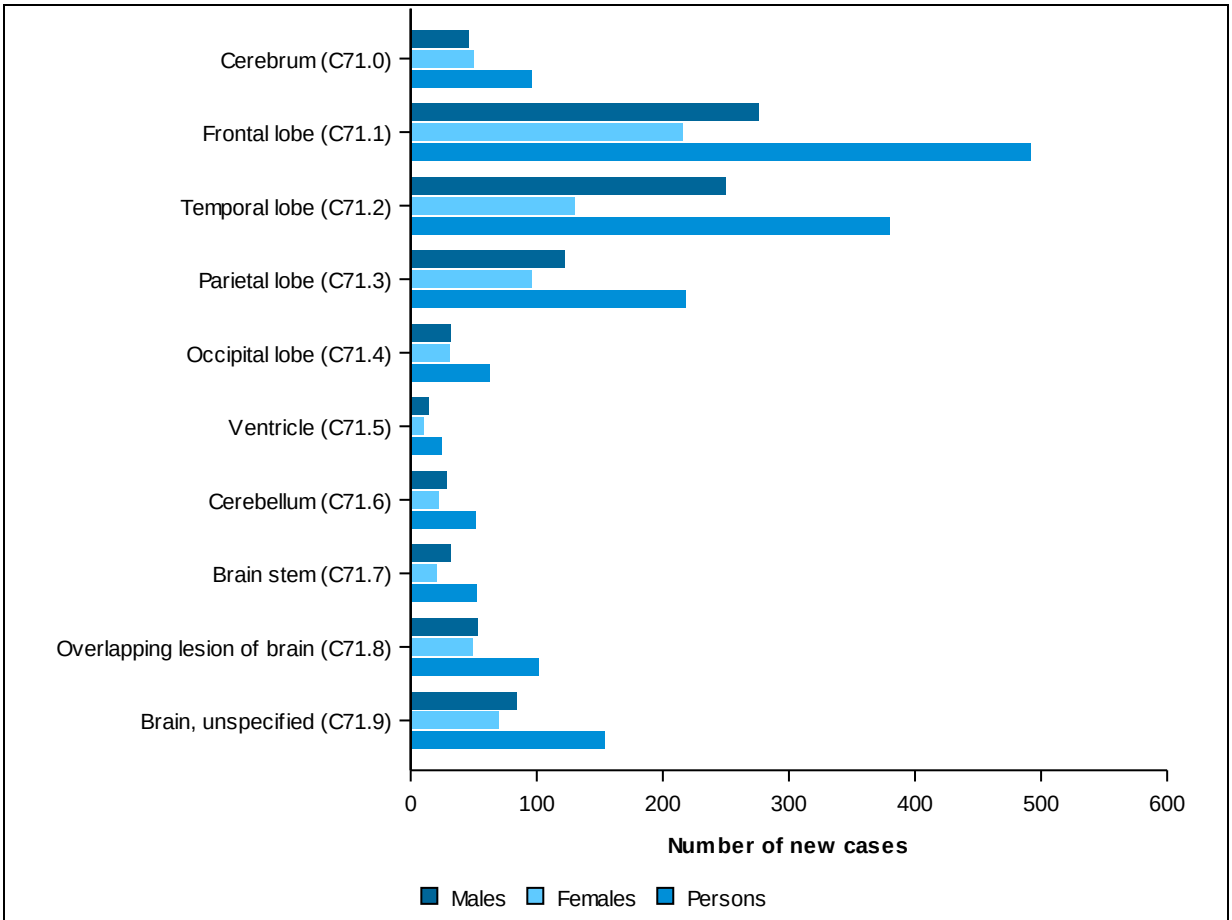
Table 2.2: Estimated new cases of brain and other CNS cancer, by site and sex, 2017

	Males		Females		Persons	
Site (ICD-10 code)	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
Meninges (C70)	18	0.1	23	0.2	41	0.1
Brain (C71)	1,139	8.6	816	5.7	1,956	7.1
Spinal cord, cranial nerves and other parts of CNS (C72)	30	0.2	26	0.2	55	0.2
Endocrine glands of the cranial cavity (C75.1–75.3)	17	0.1	7	0.1	24	0.1
Brain and other CNS cancer (C70–C72, C75.1–C75.3)	**1,204**	**9.1**	**872**	**6.2**	**2,076**	**7.6**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Sub-site details are not available for projected years. In 2013, the most common brain cancer sub-site was the frontal lobe, followed by the temporal lobe and the parietal lobe (Figure 2.4). The pattern of frequency by lobes of the cerebrum corresponds to the sizes of the lobes, with tumours more common in larger lobes (Kennedy et al. 1998). Males were twice as likely to be diagnosed with tumours of the temporal lobe, 1.5 times as likely to be diagnosed with tumours of the brain stem and 1.4 times as likely to be diagnosed with tumours of the frontal and parietal lobe (Figure 2.4).



Source: Table A2.8.

Figure 2.4: New cases of brain cancer, by sub-site and sex, 2013

Life stage

Children (0–14 years)

In 2013, of the 102 new cases of brain and other CNS cancer diagnosed in children, 79% originated in the brain; 13% in the spinal cord, cranial nerves and other parts of the CNS; and 6.9% in endocrine glands of the cranial cavity. Children are more likely to be diagnosed with cancers of the endocrine glands of the cranial cavity than adults and older adults (Table 2.3).

The most common brain cancer sub-site for children was the cerebellum (21 cases), followed by the brain stem (18). Children accounted for the most diagnoses of cancer of the cerebellum, (41% of all cases occurred in this age group), and accounted for around 1 in 3 (34%) cases in the brain stem (Figure 2.5).

Adolescents and young adults (15–24 years)

In 2013, of the 63 new cases of brain and other CNS cancer diagnosed in adolescents and young adults, 87% originated in the brain and 10% in endocrine glands of the cranial cavity. Adolescents and young adults are more likely to be diagnosed with cancers of endocrine glands of the cranial cavity than adults and older adults (Table 2.3).

The most common brain cancer sub-site for adolescents and young adults was the frontal lobe (17 cases) followed by the temporal lobe (10) (Figure 2.5).

Adults (25–64 years)

In 2013, of the 836 new cases of brain and other CNS cancer diagnosed in adults, 94% originated in the brain. Adults were 3.4 times as likely as children and 3.6 times as likely as adolescents and young adults to be diagnosed with brain cancer (Table 2.3).

The most common brain cancer sub-site for adults was the frontal lobe (274 cases) followed by the temporal lobe (195) and parietal lobe (103). Adults accounted for the most diagnoses of cancers in the frontal lobe (56% of all cases occurred in this age group), temporal lobe (51%) and the spinal cord, cranial nerves and other CNS (50%) (Figure 2.5).

Older adults (65+ years)

In 2013, of the 748 new cases of brain and other CNS cancer diagnosed in older adults, 95% originated in the brain. Older adults were 11 times as likely as children, 12 times as likely as adolescents and young adults, and 3.3 times as likely as adults to be diagnosed with brain cancer (Table 2.3). Older adults were also more likely to be diagnosed with cancer of the meninges, with 56% of all cases occurring in this age group.

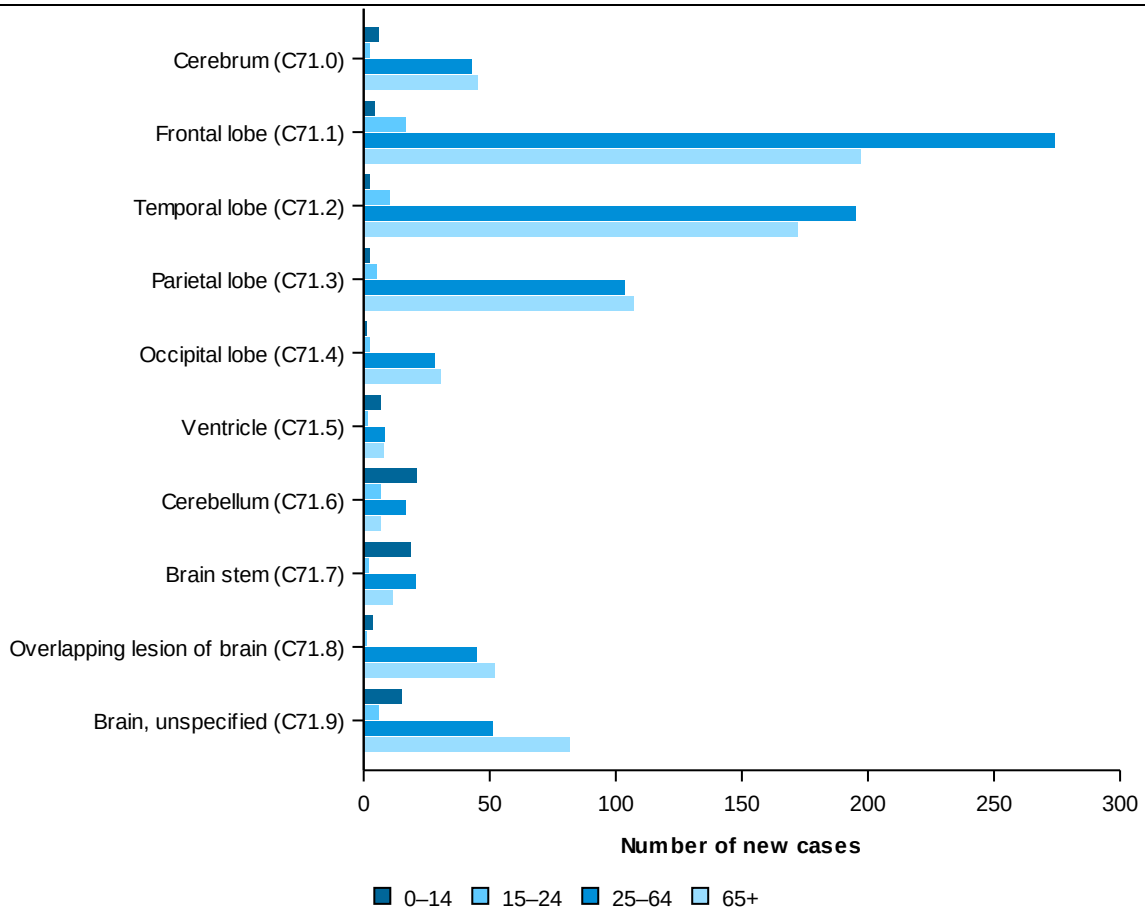
The most common brain cancer sub-site for older adults was the frontal lobe (197 cases) followed by the temporal lobe (172) and parietal lobe (107). Older adults accounted for the most diagnoses of unspecified cancers of the brain (53% of all unspecified sub-site cases occurred in this age group) and overlapping lesions of the brain (51%) (Figure 2.5). The large number of unspecified cancers of the brain may be due to comorbidities in older adults precluding surgery or biopsy.

Table 2.3: New cases of brain and other CNS cancer, by site and life stage, 2013

	0–14 years		15–24 years		25–64 years		65+ years		Total	
Site (ICD-10 code)	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**
Meninges (C70)	—	—	1	0.0	15	0.1	20	0.6	36	0.2
Brain (C71)	81	1.9	55	1.8	785	6.4	713	21.4	1,634	7.1
Spinal cord, cranial nerves and other parts of CNS (C72)	13	0.3	2	0.1	27	0.2	12	0.4	54	0.2
Endocrine glands of the cranial cavity (C75.1–75.3)	7	0.2	6	0.2	9	0.1	3	0.1	25	0.1
All brain and other CNS cancer (C70–C72, C75.1–C75.3)	**102**	**2.3**	**63**	**2.0**	**836**	**6.8**	**748**	**22.4**	**1,749**	**7.6**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.



Source: Table A2.9.

Figure 2.5: New cases of brain cancer, by sub-site and life stage, 2013

Trend

Between 1982 and 2017, the incidence rate for brain and other CNS cancer in each site remained relatively stable (Table A2.10).

2.3 Histology

Histology detail is not available for projected years. In 2013, the most common histology group of brain and other CNS cancer was tumours of neuroepithelial tissue, with 1,592 new cases diagnosed (91% of all cases). Males were 1.4 times as likely to be diagnosed with tumours of neuroepithelial tissue as females (Table 2.4).

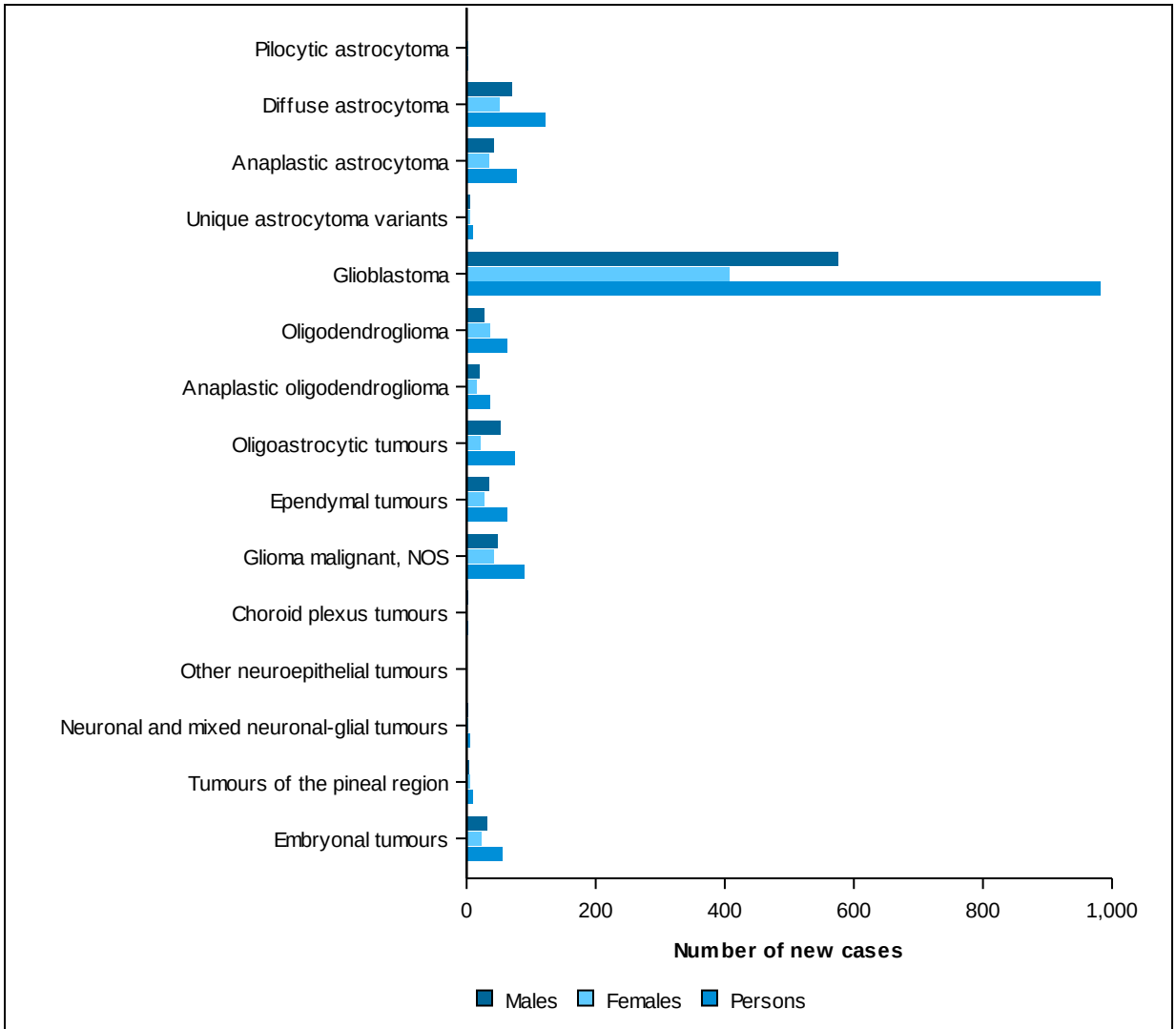
Within tumours of neuroepithelial tissue, glioblastoma was the most common histology (982 cases), accounting for nearly two thirds (62%) of all tumours of neuroepithelial tissue. This was followed by diffuse astrocytoma (121 cases) (Figure 2.6). Males had more cases of oligoastrocytic tumours, glioblastoma and diffuse astrocytoma than females, while females were more likely to be diagnosed with oligodendroglioma.

Table 2.4: New cases of brain and other CNS cancer, by sex and histology group, 2013

	Males		Females		Persons	
Histology group	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
Neuroepithelial tissue	917	7.6	675	5.3	1,592	6.4
Cranial and spinal nerves	3	0.0	1	0.0	4	0.0
Meninges	19	0.2	24	0.2	43	0.2
Germ cell tumours and cysts	13	0.1	1	0.0	14	0.1
Sellar region	2	0.0	0	0.0	2	0.0
Unclassified	41	0.4	52	0.3	93	0.3
All brain and CNS cancer combined	**995**	**8.2**	**754**	**5.8**	**1,749**	**7.0**

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.



Note: See Table B1 for information on histology groupings.

Source: Table A2.11.

Figure 2.6: New cases of tumours of neuroepithelial tissue, by histology group and sex, 2013

Life stage

Children (0–14 years)

In 2013, the most common brain and other CNS histology group for children was tumours of neuroepithelial tissue (89 cases) which accounted for 87% of cases across this age group. This was followed by germ cell tumours and cysts (5.9%) (Table A2.12). Children accounted for 45% of germ cell tumours and cysts.

Within tumours of neuroepithelial tissue, embryonal tumours was the most common histology, accounting for 38% of all neuroepithelial tumours and one third (33%) of all brain and other CNS cancer in this age group. This was followed by malignant gliomas not otherwise specified (NOS) (20% of neuroepithelial tumours). Children accounted for the highest number of embryonal tumours, with 62% of all embryonal tumours occurring in this age group (Figure 2.7).

Adolescents and young adults (15–24 years)

In 2013, the most common brain and other CNS histology group for adolescents and young adults was tumours of neuroepithelial tissue, which accounted for 87% of cases in this age group. This was followed by germ cell tumours and cysts (9.5%) (Table A2.12). Adolescents and young adults accounted for 43% of germ cell tumours and cysts.

Within tumours of neuroepithelial tissue, diffuse astrocytoma was the most common histology (16% of tumours of neuroepithelial tissue) followed by glioblastoma and oligoastrocytic tumours (both 15%) (Figure 2.7).

Adults (25–64 years)

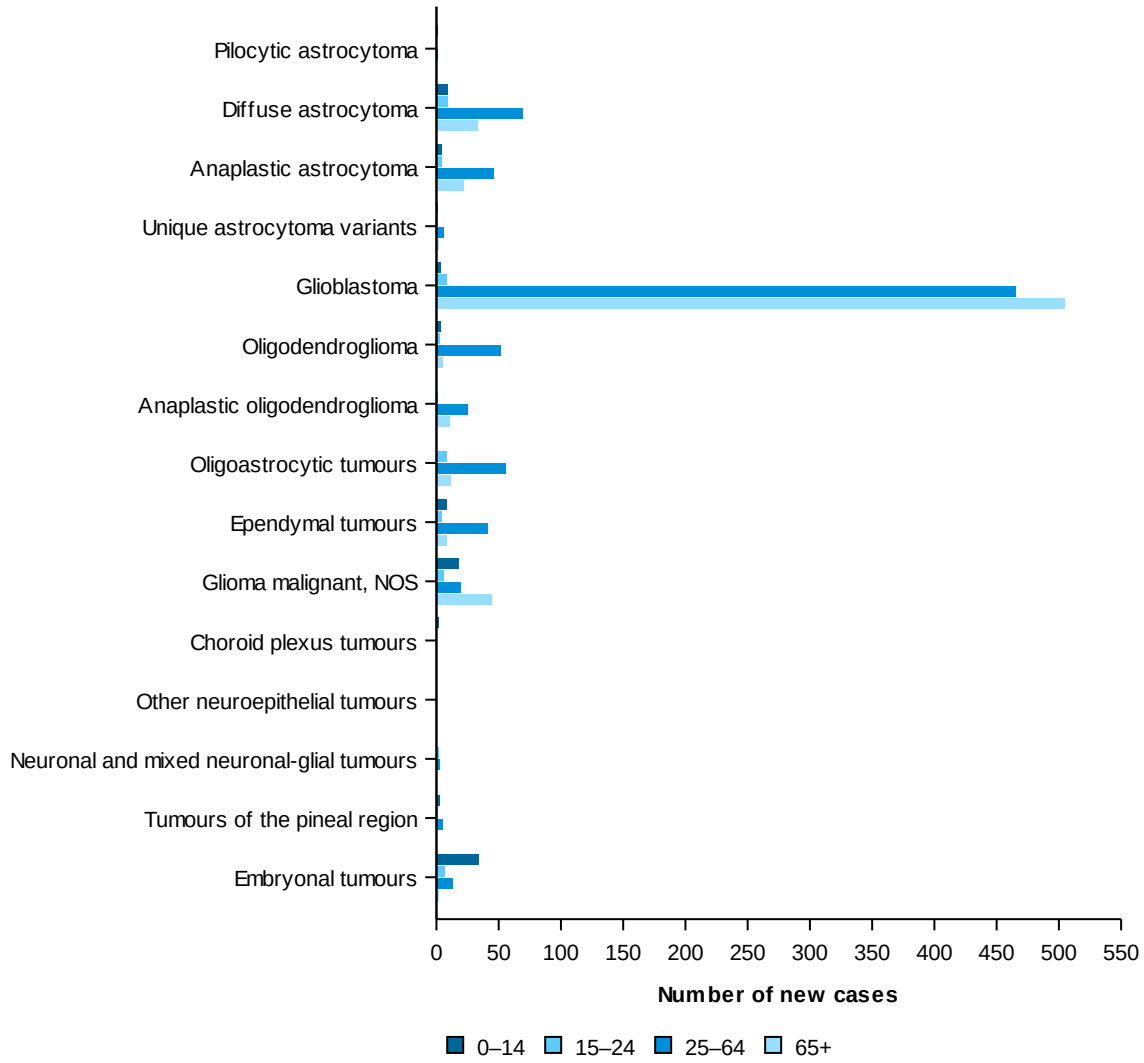
In 2013, the most common brain and other CNS histology group for adults was tumours of neuroepithelial tissue, which accounted for 96% of all cases in this age group. This was followed by tumours of the meninges (1.9%) and tumours in the unclassified group (1.4%) (Table A2.12). Adults accounted for the most tumours of neuroepithelial tissue (50% of all cases) and tumours of cranial and spinal nerves (75%).

Within tumours of neuroepithelial tissue, glioblastoma was the most common histology (58% of tumours of neuroepithelial tissue), followed by diffuse astrocytoma (8.7%) and oligoastrocytic tumours (7.0%). Adults accounted for the most cases of ependymal tumours (66% of cases were in this age group), diffuse astrocytoma (58%), anaplastic astrocytoma (59%), anaplastic oligodendroglioma (68%) and oligodendroglioma (81%) (Figure 2.7).

Older adults (65+ years)

In 2013, the most common brain and other CNS histology group for older adults was tumours of neuroepithelial tissue (86%) followed by unclassified tumours (10%) and tumours of the meninges (3.2%). This age group accounted for the majority of tumours in the unclassified group (83%) and over half (56%) of tumours of the meninges (Table A2.12).

Within tumours of neuroepithelial tissue, glioblastoma was the most common histology (78% of tumours of neuroepithelial tissue) followed by malignant gliomas NOS (7.0%) and diffuse astrocytoma (5.1%). This age group accounted for the most cases of malignant gliomas NOS (51% of cases diagnosed across all age groups) and glioblastoma (51%) (Figure 2.7). The large number of unclassified and NOS tumours may be due to comorbidities in older adults precluding surgery or biopsy.



Note: See Table B1 for information on histology groupings.

Source: Table A2.12.

Figure 2.7: New cases of tumours of neuroepithelial tissue, by histology group and life stage, 2013

Trend

Between 1982 and 2013, the number of new cases of tumours of neuroepithelial tissue diagnosed more than doubled from 709 to 1,592 and for unclassified tumours nearly halved from 172 to 93. The age-standardised incidence rate for tumours of neuroepithelial tissue has varied between 5.2 per 100,000 and 7.0 per 100,000. During that period, the incidence rate of unclassified tumours decreased from 1.3 to 0.4 per 100,000 (Table A2.13). Note that the decrease observed in unclassified tumours is likely to be due to improvements in the diagnosis, histopathological classification, and treatment of brain and CNS tumours (Ho et al. 2014). This may also explain some of the apparent increase in the incidence of other histology groups, because tumours that would have previously been unclassified might now be classified into another group.

3 Treatment

Snapshot

In 2015–16:

- there were 14,377 hospitalisations related to brain and other CNS cancer
- hospitalisation varied by age; there were high rates of hospitalisations in children, which decreased for adolescents and young adults before increasing again with age, being highest in those aged 75–79
- there were 3,281 surgical procedures for brain and other CNS cancer
- there were 4,154 chemotherapy procedures for brain and other CNS cancer
- there were 1,604 radiotherapy courses for which brain and other CNS cancer was the principal diagnosis.

Data for this chapter are mainly extracted from the National Hospital Morbidity Database (NHMD) which is a compilation of episode-level records from admitted patient morbidity data collection systems in Australian hospitals. For more information on the NHMD, refer to Appendix D and to *Admitted patient care 2015–16: Australian hospital statistics* (AIHW 2017a). In this report, hospitalisations related to brain and other CNS cancer are defined as those where:

- the principal diagnosis (the diagnosis chiefly responsible for the episode of care) is brain and other CNS cancer,
- or an additional diagnosis (a diagnosis that coexists with the principal diagnosis or arises during the episode of care and affects the care) is brain and other CNS cancer.

3.1 Number of hospitalisations

In 2015–16, there were 14,377 hospitalisations related to brain and other CNS cancer. This accounted for around 1% of all cancer-related hospitalisations. Of these, 61% were for males and 39% were for females. In just over half (52%) of these hospitalisations, brain and other CNS cancer was the principal diagnosis (Table 3.1).

Table 3.1: Brain and other CNS cancer-related hospitalisations, by sex, 2015–16

	Males			Females			Persons		
	Number	%	ASR	Number	%	ASR	Number	%	ASR
Principal diagnosis of cancer	4,671	32.5	3.7	2,872	20.0	2.2	7,543	52.5	3.0
Additional diagnosis of cancer	4,147	28.8	3.3	2,687	18.7	2.1	6,834	47.5	2.7
All brain and other CNS cancer-related hospitalisations	**8,818**	**61.3**	**7.1**	**5,559**	**38.7**	**4.3**	**14,377**	**100.0**	**5.7**

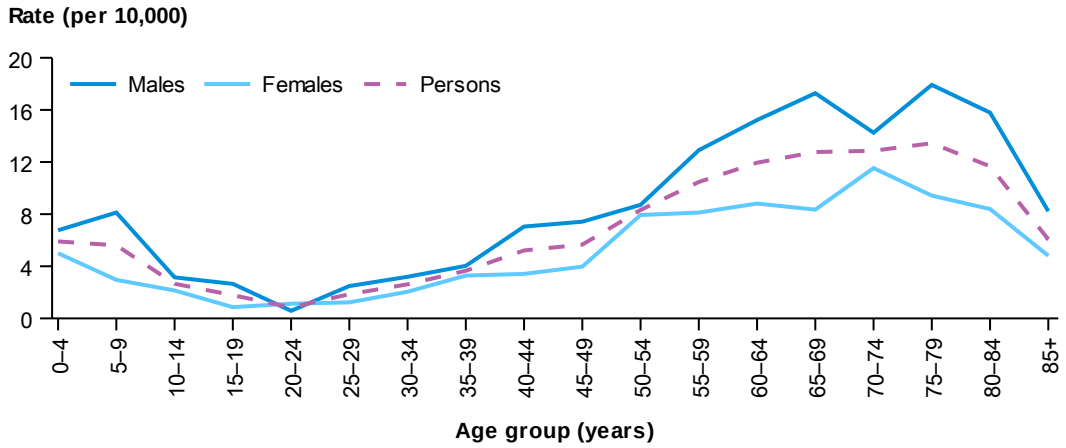
Notes

1. Hospitalisations for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Age group

In 2015–16, the brain and other CNS cancer-related hospitalisation rate was 5.9 hospitalisations per 10,000 in age group 0–4; the hospitalisation rate then decreased with age to a low of 0.8 per 10,000 in age group 20–24. Rates then increased with age to a high of 13.4 per 10,000 in age group 75–79 and then decreased in older age groups (Figure 3.1). For children aged 0–4 and 5–9, the hospitalisation rate was slightly higher than the equivalent incidence rate, whereas for older adults aged 80–84 and 85+ the hospitalisation rate was slightly lower than the incidence rate (Figure 2.1). This may suggest that children are generally hospitalised more than older people.



Notes

1. Hospitalisations for which the care type was reported as *Newborn with no qualified days* and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates are age-specific rates expressed per 10,000 population.

Source: Table A3.1.

Figure 3.1: Age-specific rates for hospitalisations related to brain and other CNS cancer, by age group and sex, 2015–16

Life stage

Children (0–14 years)

In 2015–16, there were 2,167 brain and other CNS cancer-related hospitalisations in children, representing 15% of all brain and other CNS cancer-related hospitalisations. In just under half (47%) of these hospitalisations, brain and other CNS cancer was the principal diagnosis. Boys accounted for more hospitalisations than girls (65% compared with 35%) (Table A3.2).

Adolescents and young adults (15–24 years)

In 2015–16, there were 405 brain and other CNS cancer-related hospitalisations in adolescents and young adults, representing 2.8% of all brain and other CNS cancer-related hospitalisations. In about half (52%) of these hospitalisations, brain and other CNS cancer was the principal diagnosis. Males accounted for a larger proportion of hospitalisations than females in this age group (62% compared with 38%) (Table A3.3).

Adults (25–64 years)

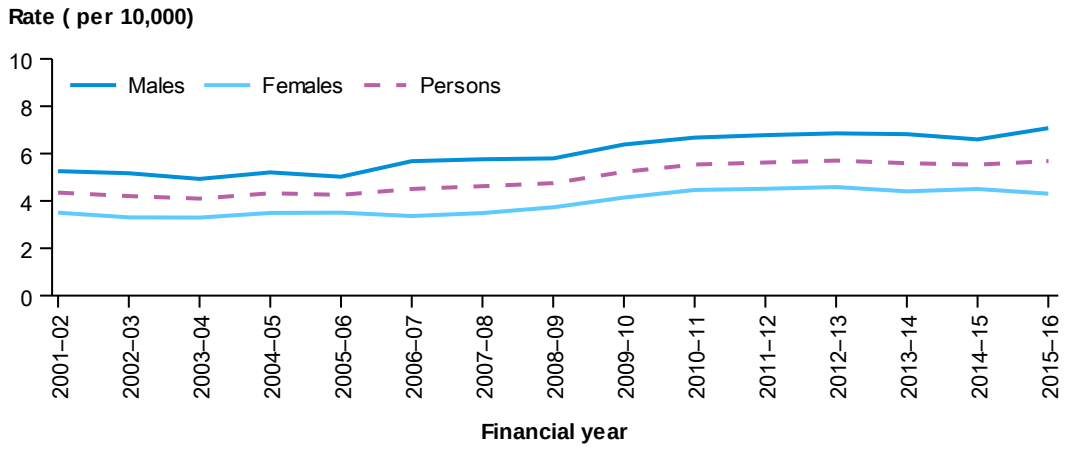
In 2015–16, there were 7,508 brain and other CNS cancer-related hospitalisations in adults, representing 52% of all brain and other CNS cancer-related hospitalisations. In about half (49%) of these hospitalisations, brain and other CNS cancer was the principal diagnosis. Males accounted for a larger proportion of hospitalisations than females in this age group (60% compared with 40%) (Table A3.4).

Older adults (65+ years)

In 2015–16, there were 4,297 brain and other CNS cancer-related hospitalisations in older adults, representing 30% of all brain and other CNS cancer-related hospitalisations. In almost two-thirds (62%) of these hospitalisations, brain and other CNS cancer was the principal diagnosis. Males accounted for more hospitalisations than females in this age group (61% compared with 39%) (Table A3.5).

Trend

Between 2001–02 and 2015–16, the age-standardised brain and other CNS cancer-related hospitalisation rate increased slightly from 4.4 per 10,000 in 2001–02 to 5.7 per 10,000 in 2015–16 (Figure 3.2).



Notes

1. Hospitalisations for which the care type was reported as *Newborn with no qualified days* and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: Table A3.6.

Figure 3.2: All brain and other CNS cancer-related hospitalisations, by sex, 2001–02 to 2015–16

Site

In 2015–16, for hospitalisations where brain and other CNS cancer was the principal diagnosis, the most common site recorded was the brain (93%) (Table 3.2). This pattern was similar to the incidence pattern (Table 2.2).

Table 3.2: Principal diagnosis of brain and other CNS cancer-related hospitalisations, by sex and site, 2015–16

Site (ICD–10 code)	Males	Females	Persons
Meninges (C70)	26	59	85
Brain (C71)	3,872	2,470	6,342
Spinal cord, cranial nerves and other parts of central nervous system (C72)	176	138	314
Endocrine glands of the cranial cavity (C75.1–75.3)	73	20	93
All brain and other CNS cancer (C70–C72, C75.1–C75.3)	**4,147**	**2,687**	**6,834**

Note: Hospitalisations for which the care type was reported as *Newborn with no qualified days* and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.

Source: AIHW NHMD.

Histology

In 2015–16, for hospitalisations where brain and other CNS cancer was the principal diagnosis, the most common histology group recorded was tumours of neuroepithelial tissue, which accounted for 95% of hospitalisations (Table 3.3). This pattern was similar to the incidence pattern (see Table 2.4).

Table 3.3: Principal diagnosis of brain and other CNS cancer-related hospitalisations by histology group and sex, 2015–16

Histology	Males	Females	Persons
Neuroepithelial tissue	3,639	2,203	5,842
Cranial and spinal nerves	4	4	8
Meninges	67	75	142
Germ cell tumours and cysts	45	16	61
Sellar region	4	5	9
Unclassified	64	34	98

Notes

1. Hospitalisations for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. Hospitalisations for which the histology was not recorded or for which the histology code was not associated with a brain and other CNS cancer (as defined in Table B1) have been excluded from this analysis. This comprised 2.9% of hospitalisations for which the primary diagnosis was a malignant brain and other CNS cancer.

Source: AIHW NHMD.

3.2 Hospital surgical procedures

This section explores surgical procedures related to brain and other CNS cancer. The data presented are counts of surgical procedures and do not to equate to the number of hospitalisations, as more than one procedure can be performed during a single hospitalisation.

In 2015–16, there were 3,281 surgical procedures related to brain and other CNS cancer. Males had a higher proportion of surgical procedures than females (61% compared with 39%). Adults had the highest proportion of surgical procedures (56%), followed by older adults (29%), children (9.8%) and adolescents and young adults (4.9%) (Table A3.7). Compared to incidence patterns (Table A2.1), a higher proportion of children (incidence 5.3%, surgical procedures 9.8%) and a lower proportion of older adults (incidence 46%,

surgeries 29%) underwent a surgical procedure. The lower proportion of older adults may be due to comorbidities.

3.3 Chemotherapy

This section explores chemotherapy procedures related to brain and other CNS cancer. The data presented are counts of chemotherapy procedures and do not equate to the number of hospitalisations, as more than one procedure can be performed during a single hospitalisation.

In 2015–16, there were 4,154 chemotherapy procedures. Males had a higher proportion of chemotherapy procedures than females (62% compared with 38%). Adults had the highest proportion of chemotherapy procedures (62%), followed by older adults (18%), children (17%), and adolescents and young adults (2.6%) (Table A3.8). Compared to incidence patterns (Table A2.1), a higher proportion of chemotherapy procedures were in children (incidence 5.3%, chemotherapy 17%) and a lower proportion were in older adults (incidence 46%, chemotherapy 18%).

3.4 Radiotherapy

Radiotherapy is often provided on a non-admitted basis so limited information is available in the NHMD. Therefore, radiotherapy numbers based on the NHMD are not presented. An alternative data source is the National Radiotherapy Waiting Times Database (NRWTD). The NRWTD provides data on the number of courses of radiotherapy that began in a reporting period, key characteristics of the patients and information on the waiting times associated with these courses. The NRWTD contains data about the principal diagnosis. The principal diagnosis is the diagnosis established after study to be chiefly responsible for causing a patient's need for a course of treatment. In the case of radiotherapy treatment, it is most typically a type of cancer.

Data reported for principal diagnosis may not reflect the incidence of certain cancers in the Australian population. The differences in principal diagnosis activity in this report may indicate data quality issues; for example, some providers, such as Victoria, are reporting the primary site of the cancer, rather than the diagnosis code associated with the health condition being treated in the specific course of radiotherapy. For this reason, comparisons with incidence data should be made with caution. See *Radiotherapy in Australia 2015–16* (AIHW 2016a) for further details.

In 2015–16, there were 1,604 reported radiotherapy courses for which brain and other CNS cancer was the principal diagnosis, representing 2.6% of all reported radiotherapy courses in this period (Table 3.4). Males received over half of the brain and other CNS cancer radiotherapy courses (59%).

Table 3.4: Radiotherapy courses for brain and other CNS cancer, by sex, 2015–16

Sex	Number of courses	% of all radiotherapy courses
Males	948	3.1
Females	656	2.2
Persons	**1,604**	**2.6**

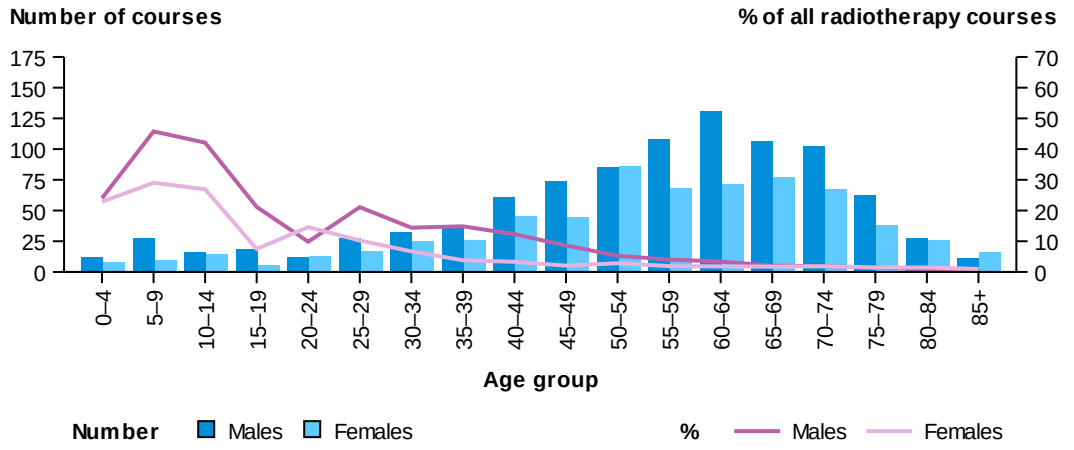
Note: Some providers report the primary site of cancer rather than the principal diagnosis.

Source: AIHW NRWTD.

Age group

The number of radiotherapy courses reported for which brain and other CNS cancer was the principal diagnosis generally increased with age, peaking in the age groups 60–64 for males and 50–54 for females before decreasing in older age groups.

The proportion of all radiotherapy courses provided for brain and other CNS cancer (as a percentage of all radiotherapy courses provided for any cause) was highest for those aged 5–9, where 40% of all radiotherapy courses provided were for brain and other CNS cancer (Figure 3.3).



Notes

1. Age group is based on age at start date of radiotherapy course; percentage of all radiotherapy courses is calculated based on totals by age group and sex.
2. Some providers report the primary site of cancer rather than the principal diagnosis.

Source: Table A3.9.

Figure 3.3: Radiotherapy courses for brain and other CNS cancer, by sex, 2015–16

Site

In 2015–16, of the 1,604 radiotherapy courses for which brain and other CNS cancer was the principal diagnosis, the majority (90%) were for brain cancer (Table 3.5).

Table 3.5: Radiotherapy courses for brain and other CNS cancer, by site, 2015–16

Principal diagnosis	Males	Females	Persons
Meninges (C70)	28	46	74
Brain (C71)	865	575	1,440
Spinal cord, cranial nerves and other parts of central nervous system (C72)	42	28	70
Endocrine glands of the cranial cavity (C75.1–75.3)	13	7	20
All brain and other CNS cancer (C70–C72, C75.1–C75.3)	**948**	**656**	**1,604**

Notes

1. Proportion of all radiotherapy courses is calculated based on totals by sex.
2. Some providers report the primary site of cancer rather than the principal diagnosis.

Source: AIHW NRWTD.

4 Survival

Snapshot

In 2009–2013:

- 5-year relative survival was 25% for brain and other CNS cancer
- males (24%) had a lower 5-year relative survival rate than females (27%)
- 5-year relative survival rates varied by age at diagnosis and was highest for adolescents and young adults (67%) and lowest for older adults (5.1%)
- brain cancer had the lowest 5-year survival rate (22%), whereas cancer of the spinal cord, cranial nerves and other parts of CNS had the highest 5-year relative survival rate (82%).

In 1994–2013, 5-year relative survival was lowest for tumours of neuroepithelial tissue (22%), which is the most common histology group, and unclassified tumours (14%).

Between 1984–1988 and 2009–2013, 5-year relative survival has remained relatively stable, ranging between 22% and 25%.

Data for this section are based on analyses using the 2013 ACD and focus on 5-year relative survival (see Chapter 1 and Appendix D for details). Data from the National Death Index (NDI) on deaths (from any cause) that occurred up to 31 December 2013 were used to determine which people with cancer had died and when this occurred.

Relative survival refers to the probability of being alive for a given amount of time after diagnosis compared with the general population. A 5-year relative survival figure of 100% means that the cancer has no impact on the person's chance of still being alive 5 years after diagnosis whereas a figure of 50% means that the cancer has halved that chance.

Information on survival from cancer provides an indication of cancer prognosis and the effectiveness of treatments available. A range of factors influence survival from cancer, including the demographic characteristics of the patient (such as age, sex and genetics), the nature of the tumour (such as site, stage at diagnosis and histology) and the health-care system (such as availability of health-care services, screening, diagnostic and treatment facilities, and follow-up services) (Black et al. 1998; WCRF & AICR 2007).

4.1 Brain and other CNS cancer

In 2009–2013, Australians diagnosed with a brain and other CNS cancer had a 25% chance of surviving for five years compared with their counterparts in the general population (Table 4.1). Males (24%) had a lower 5-year relative survival rate than females (27%).

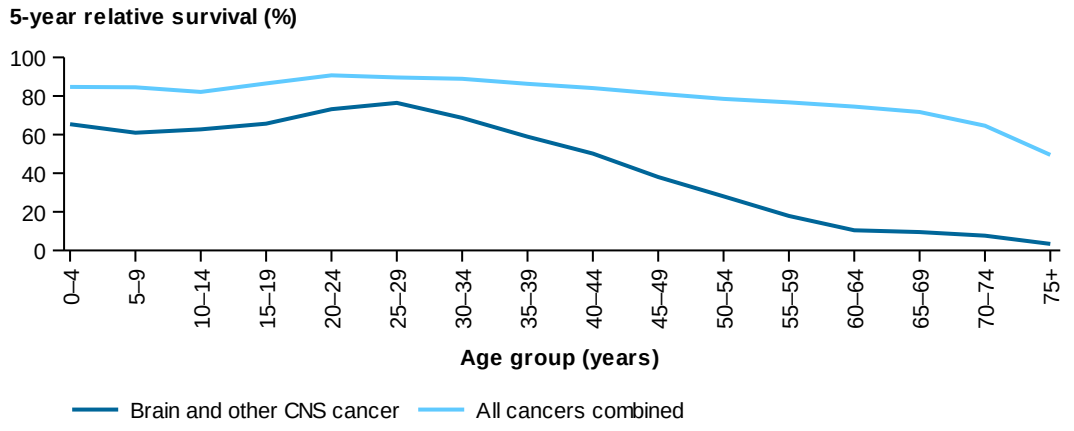
Table 4.1: Five-year relative survival from brain and other CNS cancer, by sex, 2009–2013

Sex	5-year relative survival (%)
Males	23.8
Females	26.9
Persons	**25.1**

Source: AIHW ACD 2013.

Age group

In 2009–2013, 5-year relative survival was highest for younger people and ranged between 61% and 76% for people aged between 0–4 and 30–34. The 5-year relative survival rate then decreased with increasing age to a low of 3.4% for people aged 75 and older. The pattern by age was similar for males and females (Table A4.1). The overall pattern by age differed from all cancers combined, with the decline in brain and other CNS 5-year relative survival by age being steeper than for all cancers combined (Figure 4.1).



Sources: Table A4.1 and AIHW 2017c.

Figure 4.1: Five-year relative survival from brain and other CNS cancer and all cancers combined, by age group, 2009–2013

Life stage

For information by life stage, data are presented for the 1994–2013 period rather than for 2009–2013 due to low counts associated with some brain and other CNS cancer characteristics.

Children (0–14 years)

In 1994–2013, children diagnosed with brain and other CNS cancer had a 59% chance of surviving for five years compared with their counterparts in the general population (Table A4.8). Five-year relative survival was lower in children than in adolescents and young adults and higher than in adults and older adults.

Adolescents and young adults (15–24 years)

In 1994–2013, adolescents and young adults diagnosed with brain and other CNS cancer had a 67% chance of surviving for five years compared with their counterparts in the general population (Table A4.8). Five-year relative survival was higher for adolescents and young adults than for children and adults and older adults.

Adults (25–64 years)

In 1994–2013, adults diagnosed with brain and other CNS cancer had a 31% chance of surviving for five years compared with their counterparts in the general population (Table A4.8). Five-year relative survival was lower in adults than in children and adolescents and young adults and higher than in older adults. Within this broad age group in 2009–2013,

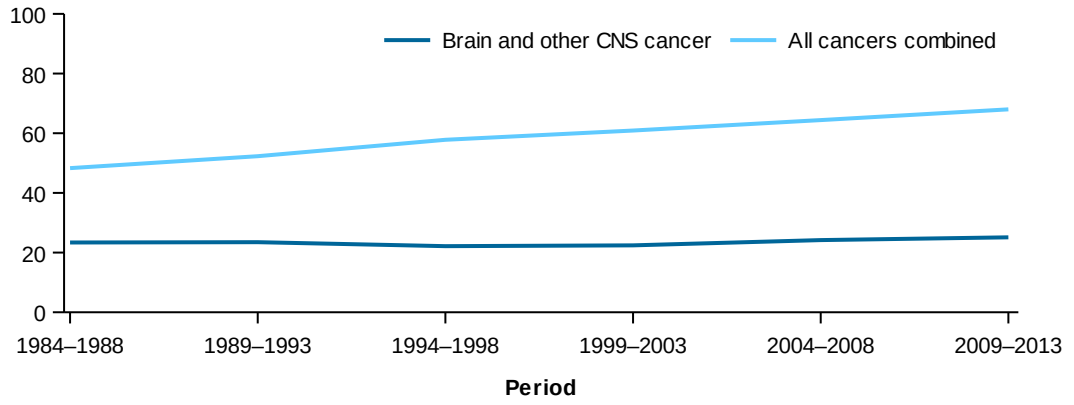
5-year relative survival peaked at 76% for people aged 25–29, before steadily decreasing to 10% for people aged 60–64 (Table A4.1).

Older adults (65+ years)

In 1994–2013, older adults diagnosed with brain and other CNS cancer had a 5.1% chance of surviving for five years compared with their counterparts in the general population (Table A4.8). Five-year relative survival was substantially lower in older adults than in younger life stages.

Trend

Between 1984–1988 and 2009–2013, 5-year relative survival has remained stable, and ranged between 22% and 25% (Figure 4.2). No differences between the trends for males and females were observed (Table A4.2). The overall trend for brain and other CNS cancer differed from all cancers combined (see *Cancer in Australia 2017*), where the 5-year relative survival rate for all cancers combined increased from 48% to 68% during the same period (Figure 4.2).



Sources: Table A4.2 and AIHW 2017c .

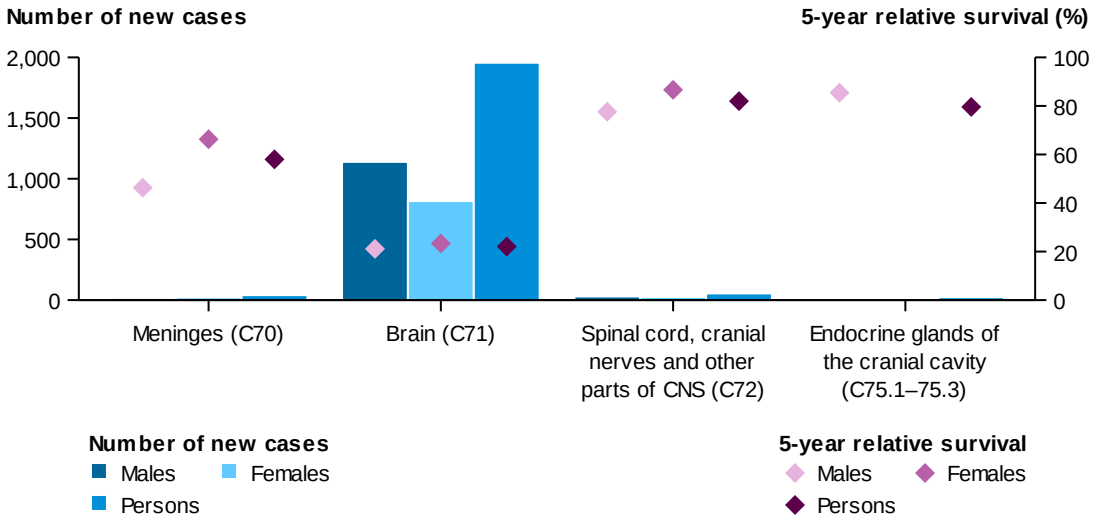
Figure 4.2: Five-year relative survival from brain and other CNS cancer and all cancers combined, 1984–1988 to 2009–2013

4.2 Site

In 2009–2013, brain cancer (the most common brain and other CNS cancer) was associated with the lowest 5-year relative survival rate (22%), whereas cancer of the spinal cord, cranial nerves and other parts of the CNS had the highest 5-year relative survival rate (82%) (Figure 4.3).

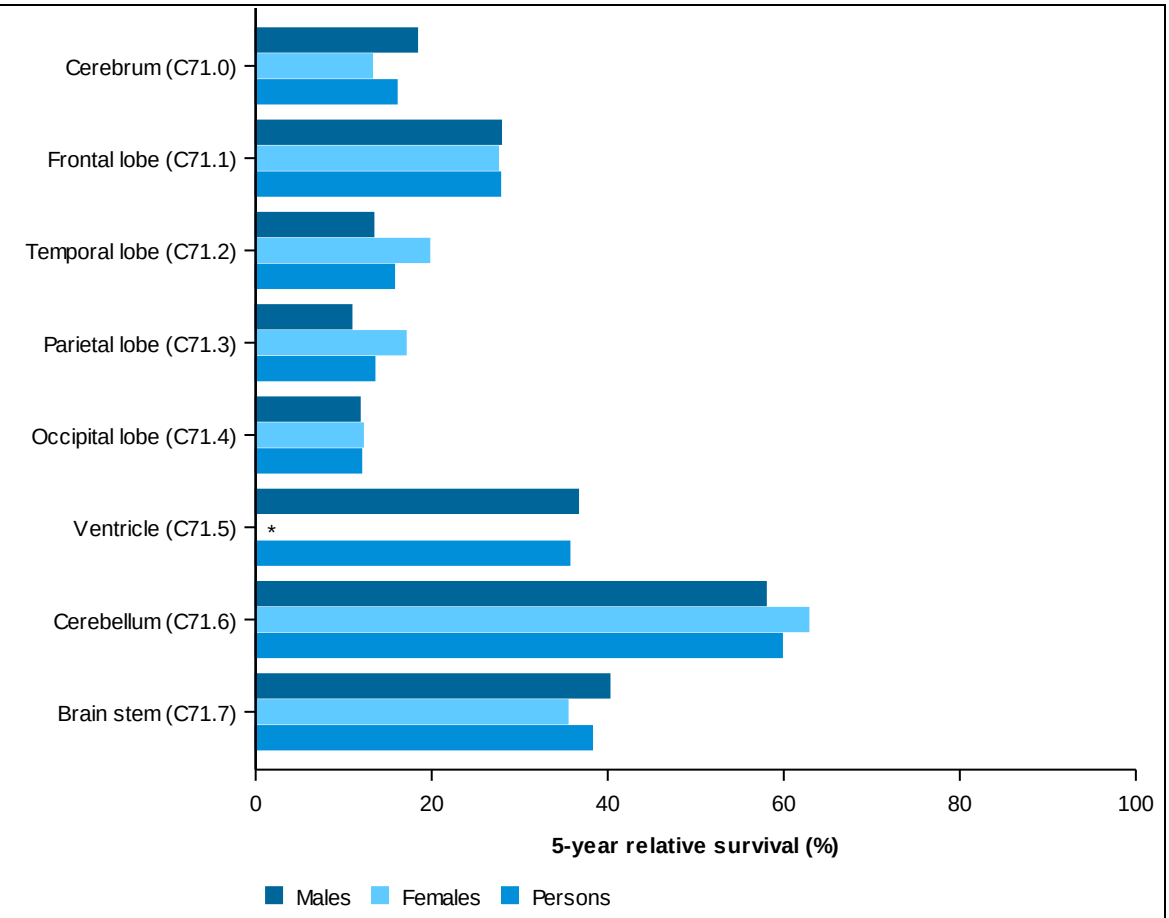
Brain cancer that was located in the occipital lobe had the lowest 5-year relative survival rate (12%), followed by parietal lobe (14%), and temporal lobe and cerebrum (both 16%). Brain cancers in the cerebellum had the highest 5-year relative survival rate (60%) (Figure 4.4).

Due to low counts, further analyses of brain and other CNS cancer by sub-site and life stage are not presented.



Sources: Tables 2.2 Table A4.3.

Figure 4.3: Number of new cases of brain and other CNS cancer (2013) and 5-year relative survival from brain and other CNS cancer (2009–2013), by site and sex



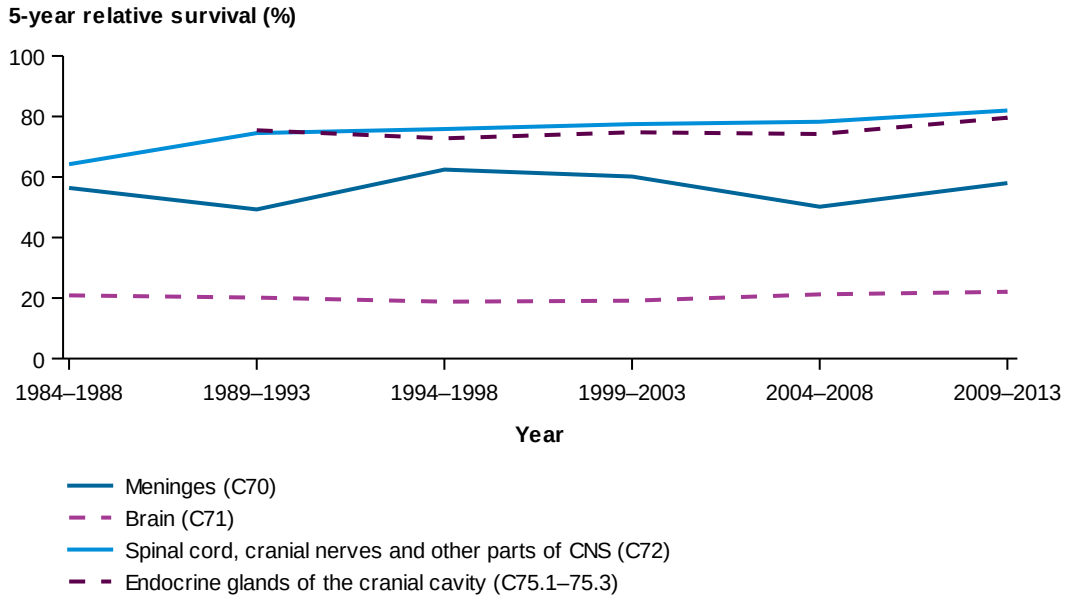
* n.p.

Source: Table A4.4.

Figure 4.4: Five-year relative survival from brain and other CNS cancer, by sub-site of the brain and sex, 2009–2013

Trend

Between 1984–1988 and 2009–2013, 5-year relative survival from brain cancer remained stable, and ranged between 19% and 22%. The largest improvement in survival was for cancer of the spinal cord, cranial nerves and other parts of the CNS, which increased from 64% in 1984–1988 to 82% 2009–2013 (Figure 4.5).



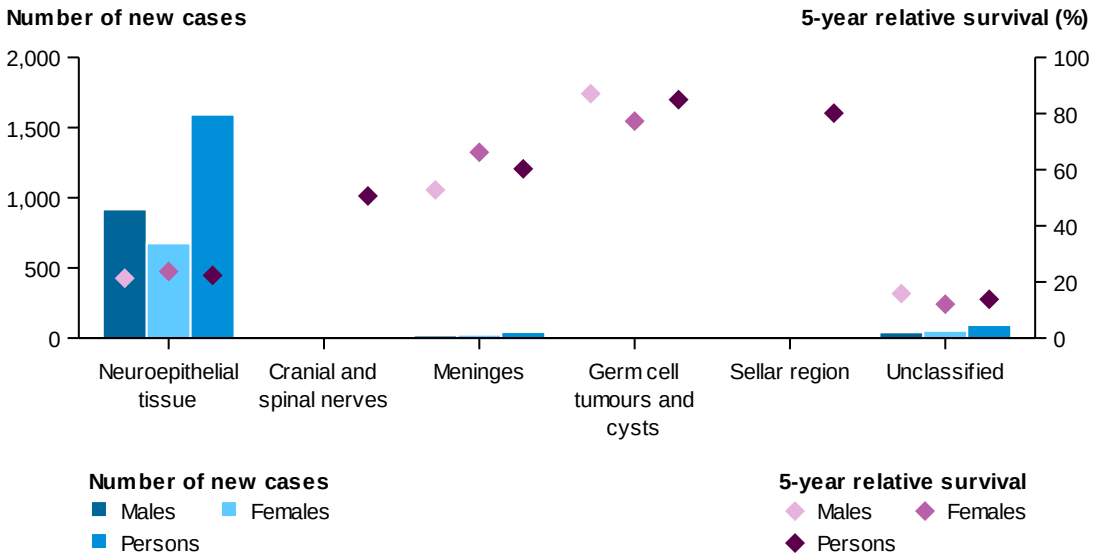
Source: Table A4.5.

Figure 4.5: Five-year relative survival from brain and other CNS cancer, by site, 1984–1988 to 2009–2013

4.3 Histology

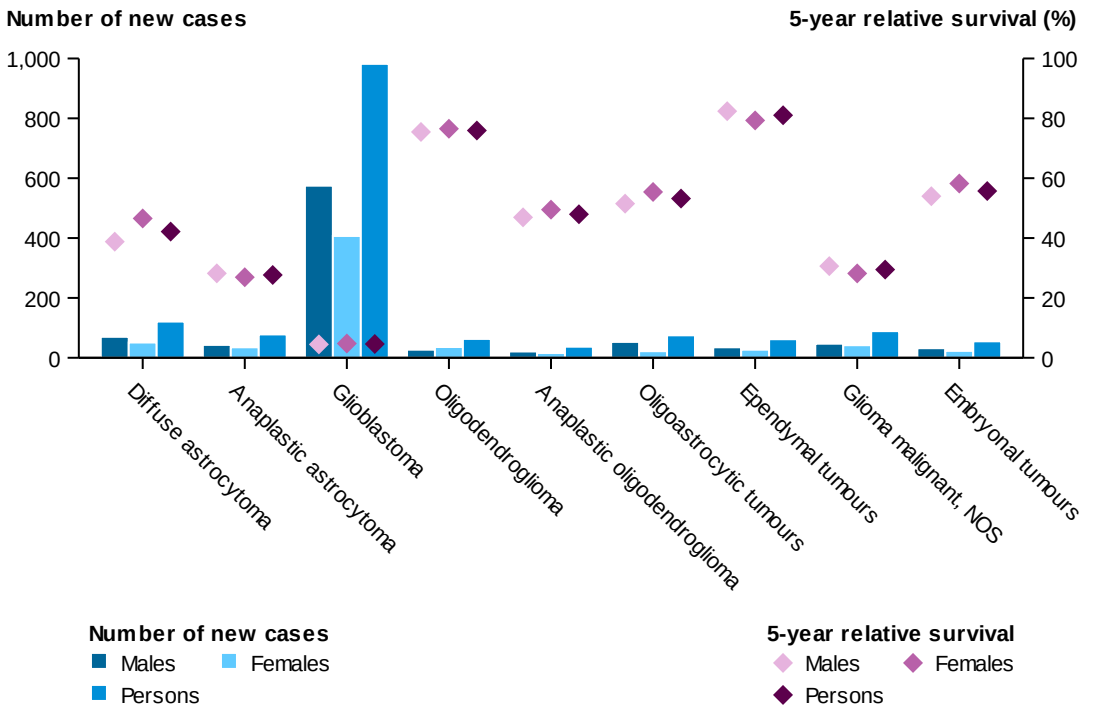
In this section, data are presented for the 1994–2013 period rather than for 2009–2013 due to low counts associated with some brain and other CNS cancer characteristics. In 1994–2013, 5-year relative survival was highest for germ cell tumours and cysts (85%) and tumours of sellar region (80%) and lowest for unclassified tumours (14%) and tumours of neuroepithelial tissue (22%) (Figure 4.6). Tumours of neuroepithelial tissue are the most common brain and other CNS cancer histology group (Table 2.4).

Within tumours of neuroepithelial tissue, 5-year relative survival was highest for ependymal tumours (81%) and oligodendroglioma (76%) and lowest for glioblastoma (4.6%) (Figure 4.8). Glioblastomas are the most common neuroepithelial tissue tumour and are associated with the lowest 5-year relative survival (Figure 4.7).



Sources: Tables 2.4 and A4.6.

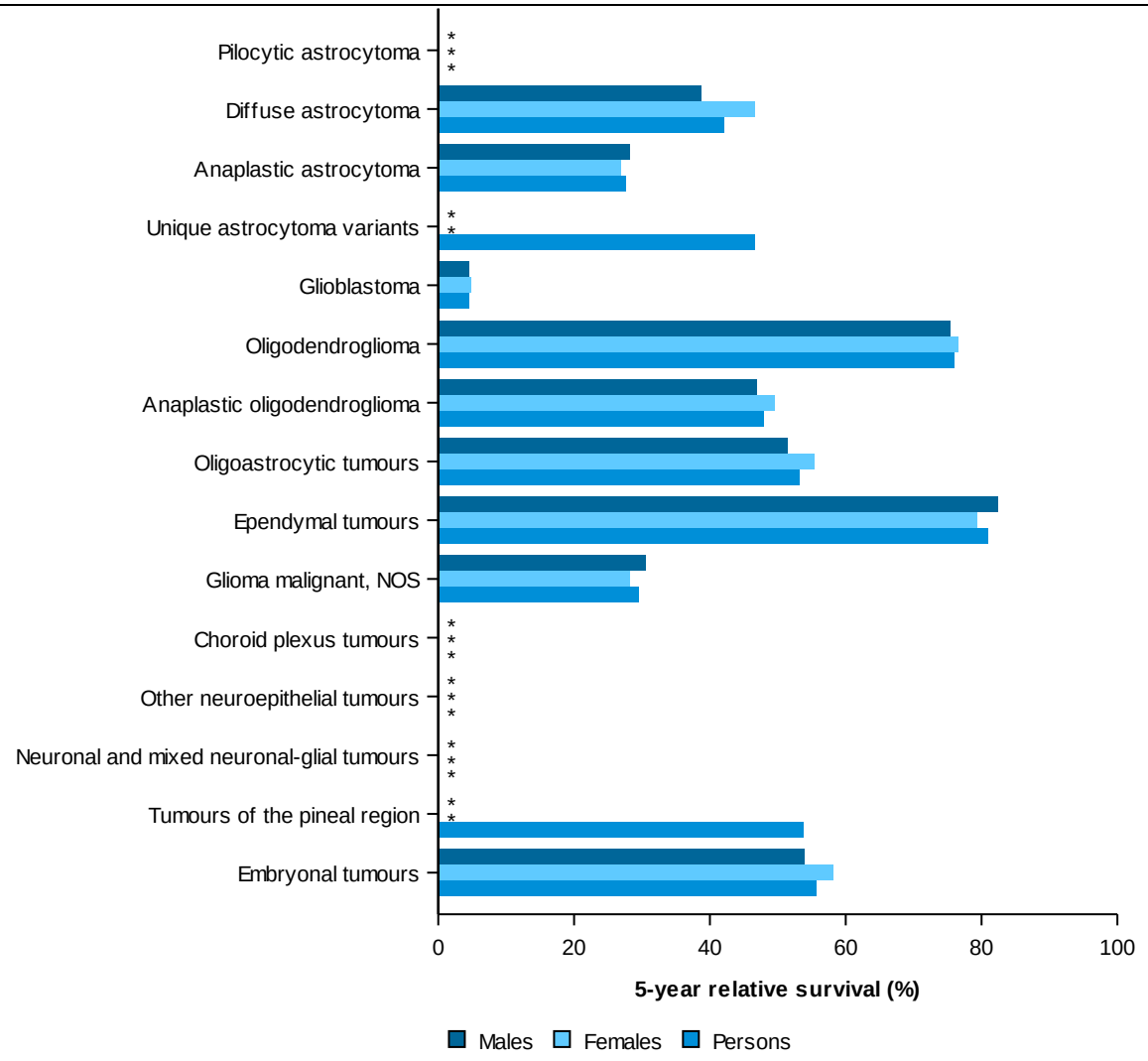
Figure 4.6: Number of new cases of brain and other CNS cancer (2013) and 5-year relative survival from brain and other CNS cancer (1994–2013), by histology group and sex



Note: See Table B1 for information on histology groupings.

Sources: Tables A2.11 and A4.7.

Figure 4.7: Number of new cases of brain and other CNS cancer (2013) and 5-year relative survival from brain and other CNS cancer (1994–2013), by selected histology group and sex



* n.p.

Note: See Table B1 for information on histology groupings.

Source: Table A4.7.

Figure 4.8: Five-year relative survival from brain and other CNS cancer, by histology group and sex, 1994–2013

Life stage

Children (0–14 years)

In 1994–2013, 5-year relative survival was 58% for tumours of neuroepithelial tissue (Table A4.8). Of the neuroepithelial tissue histologies, oligodendroglioma had the highest (87%) and embryonal tumours had the lowest 5-year relative survival (54%) (Figure 4.9).

Adolescents and young adults (15–24 years)

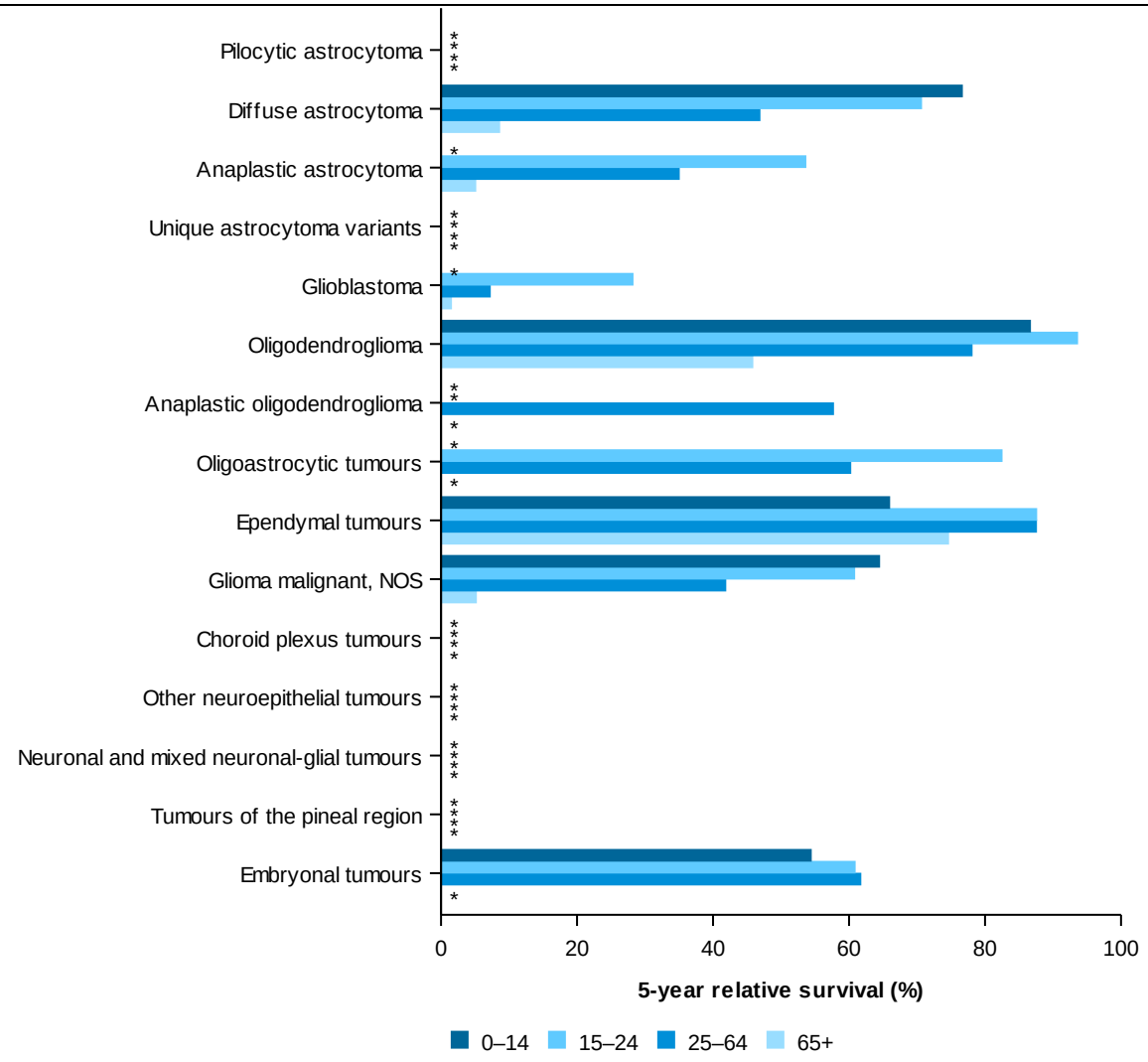
In 1994–2013, 5-year relative survival was 64% for tumours of neuroepithelial tissue (Table A4.8). Of the neuroepithelial tissue histologies, oligodendroglioma (94%) and ependymal tumours (88%) had the highest and glioblastoma (28%) had the lowest 5-year relative survival. Glioblastoma, while rare in this age group, is associated with higher 5-year relative survival rates than in adults and older adults (Figure 4.9).

Adults (25–64 years)

In 1994–2013, 5-year relative survival was 29% for tumours of neuroepithelial tissue (Table A4.8). Of the neuroepithelial tissue histologies, ependymal tumours (88%) had the highest and glioblastoma (7.2%) had the lowest 5-year relative survival. Glioblastoma is associated with slightly higher 5-year relative survival rates in adults than in older adults (Figure 4.9).

Older adults (65+ years)

In 1994–2013, 5-year relative survival was 4.1% for tumours of neuroepithelial tissue (Table A4.8). Of the neuroepithelial tissue histologies, ependymal tumours (75%) had the highest and glioblastoma had the lowest 5-year relative survival (1.5%). Glioblastoma is associated with lower 5-year relative survival rates than in younger life stages (Figure 4.9).



* n.p.

Note: See Table B1 for information on histology groupings.

Source: Table A4.8.

Figure 4.9: Five-year relative survival from brain and other CNS cancer, by histology group and life stage, Australia, 1994–2013

5 Survivorship

Snapshot

At the end of 2012 there were:

- 3,444 people alive who had been diagnosed with a brain and other CNS cancer in the previous 5 years
- 8,417 people alive who had been diagnosed with a brain and other CNS cancer in the previous 31 years (the maximum number of years for which prevalence can be calculated using the available data).

Cancer survivorship focuses on the health and life of a person with cancer after treatment until the end of life (National Cancer Institute 2015). Cancer survivorship is more than simply not dying from cancer; it focuses on living with, and after, a cancer diagnosis (Jackson et al. 2013). Survivorship covers the physical, psychosocial and economic issues of cancer and includes issues relating to late effects of treatment, secondary cancers and quality of life (National Cancer Institute 2015).

The size of the survivorship population is measured using prevalence data. Prevalence refers to the number of people alive who have previously been diagnosed with cancer. Data for this section are based on analyses using the 2013 ACD and presented for limited-duration prevalence with an index date of 31 December 2012 (due to availability of actual cancer incidence data) (see Chapter 1 and Appendix D for details). Data from the NDI on deaths (from any cause) that occurred up to 31 December 2013 were used to determine which people with cancer had died and when this occurred. The maximum period for which prevalence could be calculated using the available data is 31 years.

5.1 Survivorship population

At the end of 2012, there were 3,444 people alive who had been diagnosed with brain and other CNS cancer in the previous 5 years. Males represented 57% of the 5-year prevalent cases (Table 5.1). At the end of 2012, the 10-year prevalence of brain and other CNS cancer was 5,002 and the 31-year prevalence (the maximum period for which prevalence can be calculated using the available data) was 8,417.

Table 5.1: Limited-duration prevalence of brain and other CNS cancer, by sex and duration, as at end of 2012

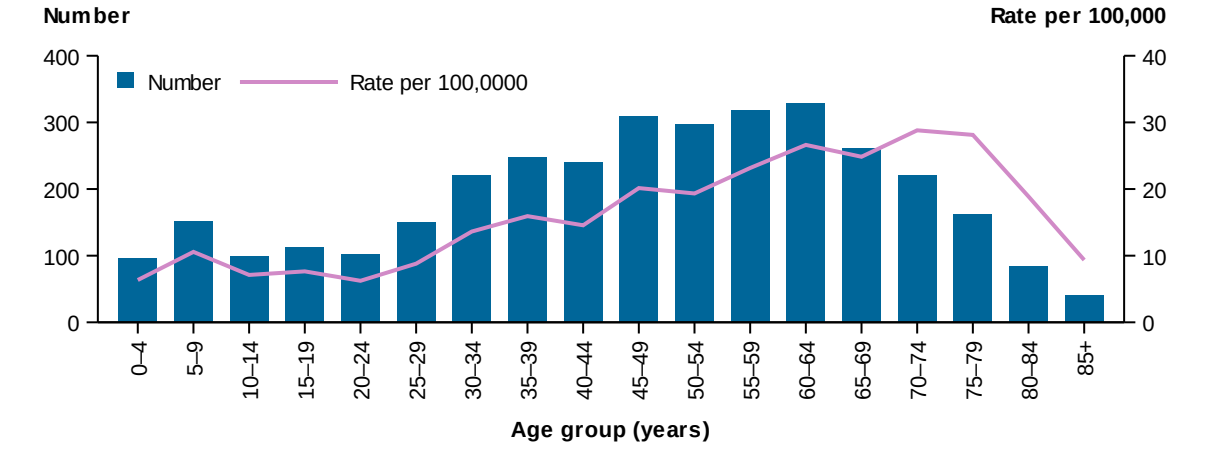
	5-year prevalence		10-year prevalence		31-year prevalence	
Sex	**Number**	**Rate per 100,000**	**Number**	**Rate per 100,000**	**Number**	**Rate per 100,000**
Males	1,946	17.0	2,787	24.4	4,664	40.9
Females	1,498	13.0	2,215	19.2	3,753	32.6
Persons	**3,444**	**15.0**	**5,002**	**21.8**	**8,417**	**36.7**

Note: Rate is based on the Australian population as at 31 December 2012.

Source: AIHW ACD 2013.

Age group

Five-year prevalence for brain and other CNS cancer increased with age until the age group 60–64 years, after which the 5-year prevalence decreased (Figure 5.1).



Source: Table A5.1.

Figure 5.1: Five-year prevalence of brain and other CNS cancer, by age group, as at end of 2012

Site

Of the brain and other CNS cancer sites, brain cancer had the highest 5-year prevalence (3,051), followed by cancers of the spinal cord, cranial nerves and other parts of the CNS (203) (Table 5.2). Brain cancer prevalence represented 89% of brain and other CNS cancer prevalence, whereas brain cancer incidence represented 94% of brain and other CNS cancer incidence (Table 2.2).

Table 5.2: Five-year prevalence of brain and other CNS cancer, by sex and site, at end of 2012

	Males		Females		Persons	
Site (ICD–10 code)	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
Meninges (C70)	42	0.4	70	0.6	112	0.5
Brain (C71)	1,752	15.3	1,299	11.3	3,051	13.3
Spinal cord, cranial nerves and other parts of CNS (C72)	98	0.9	105	0.9	203	0.9
Endocrine glands of the cranial cavity (C75.1–75.3)	54	0.5	24	0.2	78	0.3
Brain and other CNS cancer (C70–C72, C75.1–C75.3)	**1,946**	**17.0**	**1,498**	**13.0**	**3,444**	**15.0**

Note: Rate is based on the Australian population as at 31 December 2012.

Source: AIHW ACD 2013.

5.2 Survivorship experience

All cancers come with the struggle of dealing with a diagnosis of a potentially fatal disease, and the side effects of treatment. However, brain and other CNS cancer comes with unique challenges as it affects a vital organ (Kleihues et al. 2002). Survivors can have life-long cognitive, physical, and psychosocial effects due to the cancer and its treatment.

Brain cancer symptoms and progression can vary depending on the site and type of cancer. These symptoms may reduce or cease following treatment, but many brain cancer survivors have ongoing symptoms. Common symptoms include headache, nausea and vomiting, cognitive difficulties, physical difficulties such as weakness or impaired coordination, seizures, vision or hearing problems and emotional and behavioural changes (CCA 2016).

Cognitive functioning problems can occur as a result of the tumour or the treatment (Taphoorn & Klein 2004). Cognitive decline may include deficits in working memory, cognitive control and flexibility, cognitive processing speed, visual searching, planning and foresight, and general attention (Gehrke et al. 2013). Further, informed consent for treatment can be difficult for people with cognitive decline, as patients can have difficulties comprehending information and understanding risk. As cognitive functioning declines, carers are sometimes required to take over decision making for the patient (CCA & COSA 2011, CCA et al. 2009).

Many brain cancer patients experience seizures. The seizures may occur as a symptom of brain cancer or as a complication of treatment. If a patient has recurring seizures, they are generally prescribed anti-epileptic drug therapy and are restricted from driving (CCA et al. 2009). Driving restrictions compound difficulties in access to treatment, affect patients' sense of independence and could increase feelings of worthlessness and the belief that they are a burden on their families and carers (CCA 2016, CCA & COSA 2011).

Mental health problems such as depression can also arise as a result of brain cancer diagnosis (Rooney et al. 2013). These might go unrecognised because many symptoms, such as fatigue or insomnia, may be assumed to be from the cancer itself.

Impact for children

The survivorship experience in children differs from that in adults, as cancers may occur before mental and physical development is complete. Survivors of childhood brain and other CNS cancer are at an increased risk of nerve problems, motor problems, hormonal and growth abnormalities, vision problems such as blindness, cataracts or double vision, hearing problems and behavioural changes (Wilne et al. 2012, Packer 2003). Symptoms can vary depending on the age of the child (Cancer Australia 2017).

Radiation treatment, despite its benefits as a treatment for cancer, may pose a risk to developing brains. Additionally, radiation treatment to the brain for cancer can increase the risk of motor problems, seizures, and hormonal problems later in life, depending on the site of treatment (Packer et al 2003). Radiation treatment to the brain or other parts of the CNS at a young age is also associated with a higher risk of developing brain and other CNS cancer later in life (Neglia et al. 2006).

Survivors of childhood brain cancer are more likely to experience problems with physical tasks and attending to personal care when compared to unaffected children and to survivors of other childhood cancers (Ness et al. 2005). They are likely to have fewer opportunities in regard to work and education; they are less likely to complete high school or university (Mitby et al. 2003) and are less likely to be employed (Ribi et al. 2005). Poorer academic performance may be due to difficulties in cognitive processing speed and attention (Willard et al. 2013, Palmer et al. 2001).

Childhood brain and other CNS cancer survivors tend to have high psychological distress (Kier et al. 2007; Zebrack et al. 2004) and are more likely to experience symptoms of anxiety and depression, thoughts of suicide (Brinkman et al. 2013) and sleep problems (Nolan et al. 2013), and to display antisocial behaviours (Schultz et al. 2007).

6 Burden of disease

Snapshot

In 2011:

- Australians lost 35,662 disability-adjusted life years due to premature death or living with disability due to brain and other CNS cancer
- the burden of disease from brain and other CNS cancer was higher in males (60%) than females (40%)
- most of the burden from brain and other CNS cancer was due to premature death (96%)
- brain and other CNS cancer was the leading cause of cancer burden for children.

Burden of disease analysis measures the combined impact of fatal and non-fatal burden. More than merely counting deaths or disease prevalence, it takes into account age at death and severity of disease. Burden of disease analysis quantifies the gap between a population's actual health and an ideal level of health in a given year—that is, every individual living in full health to a theoretical maximum life span—for all diseases at the same time.

This chapter presents data on the burden of cancer, based on the Australian Burden of Disease Study (ABDS) 2011. The ABDS 2011 provides Australia-specific burden of disease estimates best matched to the Australian context for the total 2011 population. In the ABDS 2011, the cancer and other neoplasms disease group also includes the impact of benign, in situ and uncertain neoplasms. See *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016b) and *Burden of cancer in Australia: Australian Burden of Disease Study 2011* (AIHW 2017b) for more information.

Data are presented for the fatal burden, non-fatal burden and the overall burden. Fatal burden, which is expressed as years of life lost (YLL), measures the years lost between the age at which people die and the number of years they could have potentially lived, based on the best life expectancy across the world. Total YLL are influenced by both the number of deaths, and the ages at which the deaths occur.

Non-fatal burden, which is expressed as years lived with disability (YLD), measures the years of healthy life lost due to living with a disease in a given year. Total YLD are influenced by the number of people with each disease, the duration of its effects and how severe those effects are.

The overall burden, which is expressed as disability-adjusted life years (DALY), is the sum of YLL and YLD. One DALY is one year of 'healthy life' lost due to premature death or living with the effects of an illness or injury. The more DALY associated with a disease, the greater the burden.

The definition of brain and other CNS cancer used for burden of disease analysis is based on the ABDS 2011 definition and is different from what is presented elsewhere in this report. The definition includes:

- meninges (ICD-10 code C70)
- brain (C71)
- spinal cord, cranial nerves and other parts of the CNS (C72).

The definition does not include cancers of endocrine glands of the cranial cavity (C75.1, C75.2 and C75.3), which are included in the other malignant neoplasms group for the purposes of burden of disease analysis. It is estimated that in 2017, cancers of endocrine glands of the cranial cavity will represent approximately 1.2% of all brain and other CNS cancer diagnoses (Table 2.2). For further information on burden associated with other types of cancer, including their rankings, see *Burden of cancer in Australia: Australian Burden of Disease Study 2011* (AIHW 2017b).

6.1 Brain and other CNS cancer

In 2011, Australians lost 35,662 DALY due to premature death or living with disability due to brain and other CNS cancer. This accounted for 4.3% of the total cancer burden of 833,250 DALY. Males accounted for a larger proportion of the burden (60%) than females (40%) (Table 6.1).

In 2011, 96% of the burden due to brain and other CNS cancer was fatal burden, whereas 3.5% was non-fatal. For brain and other CNS cancer, over one-third (36%) of the non-fatal burden was due to the long-term impacts of brain injury.

Brain and other CNS cancer was the 6th leading cause of cancer burden in 2011. It was the 6th highest cause of fatal cancer burden, accounting for 4.4% of the burden, and the 11th leading cause of non-fatal cancer burden, accounting for 2.5% of the burden (Table 6.1). Brain and other CNS cancer ranked higher in its burden compared to cancer incidence. The high burden of brain and other CNS cancer is due to the low survival rates, high fatal burden and the high non-fatal long-term impact of brain injury.

Table 6.1: Burden of disease from brain and other CNS cancer, by sex, 2011

	Males			Females			Persons		
	Number	% of cancer burden	Rank	Number	% of cancer burden	Rank	Number	% of cancer burden	Rank
Fatal burden (YLL)	20,740	4.7	7	13,667	4.0	7	34,407	4.4	6
Non-fatal burden (YLD)	717	2.6	11	538	2.3	11	1,255	2.5	11
Total burden (DALY)	**21,457**	**4.6**	**7**	**14,204**	**3.9**	**7**	**35,662**	**4.3**	**6**

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. Columns may not add to total due to rounding.
3. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Life stage

Children (0–14 years)

In 2011, children lost 2,835 DALY due to premature death or living with disability as a result of brain and other CNS cancer (Figure 6.1). In children, brain and other CNS cancer was the leading cause of cancer burden for boys and girls, accounting for 29% and 33%, respectively, of the total cancer burden in this age group (Table A6.1). For children, most of the burden (98%) was due to dying prematurely (Table A6.5).

Adolescents and young adults (15–24 years)

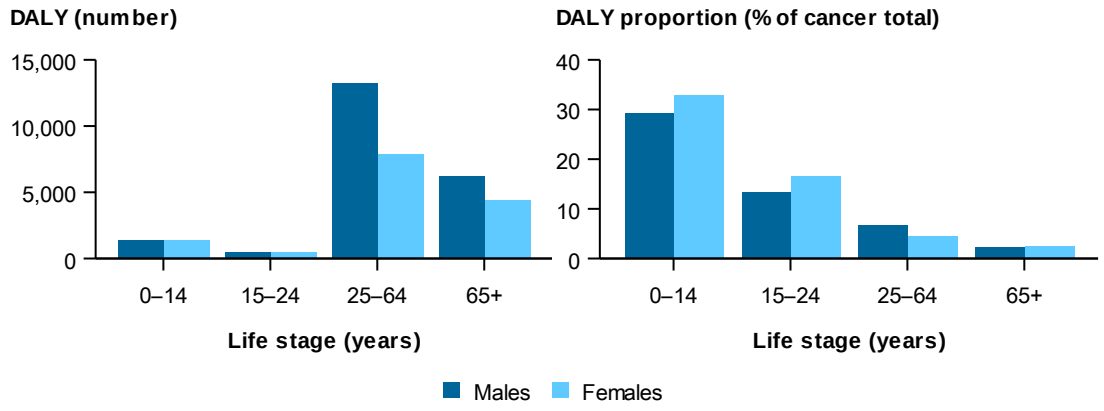
In 2011, adolescents and young adults lost 1,012 DALY due to premature death or living with disability as a result of brain and other CNS cancer (Figure 6.1). In males, brain and other CNS cancer was the 2nd leading cause of cancer burden, accounting for 13% of the total cancer burden in this age group, whereas in females, it was the leading cause of burden, accounting for 17% of the total cancer burden (Table A6.2). For adolescents and young adults, most of the burden (94%) was due to people dying prematurely (Table A6.5).

Adults (25–64 years)

In 2011, adults lost 21,163 DALY due to premature death or living with disability as a result of brain and other CNS cancer (Figure 6.1). In males, brain and other CNS cancer was the 3rd leading cause of cancer burden, accounting for 6.6% of the total cancer burden in this age group, whereas in females it was the 5th leading cause of burden, accounting for 4.5% of the total cancer burden (Table A6.3). For adults, most of the burden (97%) was due to people dying prematurely (Table A6.5).

Older adults (65+ years)

In 2011, older adults lost 10,652 DALY due to premature death or living with disability as a result of brain and other CNS cancer (Figure 6.1). In males, brain and other CNS cancer was the 13th leading cause of cancer burden, accounting for 2.4% of the total cancer burden in that age group, whereas in females it was the 10th leading cause of burden, accounting for 2.4% of the total cancer burden (Table A6.4). For older adults, most of the burden (96%) was due to people dying prematurely (Table A6.5).



Sources: Tables A6.1–A6.4

Figure 6.1: Burden of brain and other CNS cancer, by sex and life stage, 2011

7 Mortality

Key findings

It is estimated that in 2017:

- 1,477 people will die from brain and other CNS cancer
- over half of these deaths will be in males
- the mortality rate will be higher in older age groups
- the most common site for brain and other CNS cancer causing death will be the brain.

Between 1982 and 2017 the age-standardised brain and other CNS cancer mortality rate has remained stable.

Data for this section are extracted from the National Mortality Database and focus on the estimated deaths from brain and other CNS cancer for 2017 based on deaths recorded up to 2015, and mortality trends from 1982 to 2017 (see Chapter 1 and Appendix D).

In this chapter, the number of cancer deaths relates to deaths where the underlying cause was a brain and other CNS cancer. The cancer that led to the death of the person might have been diagnosed many years previously, in the same year in which the person died or, in some cases, after death (for example, at autopsy). Information on the underlying cause of death is derived from the medical certificate of cause of death, which is completed by a medical practitioner or coroner.

7.1 Brain and other CNS cancer

It is estimated that in 2017, 1,477 people will die from brain and other CNS cancer in Australia, which on average is 4 deaths per day (Table 7.1). More males (59%) than females are expected to die from brain and other CNS cancer.

Table 7.1: Estimated mortality from brain and other CNS cancer, by sex, 2017

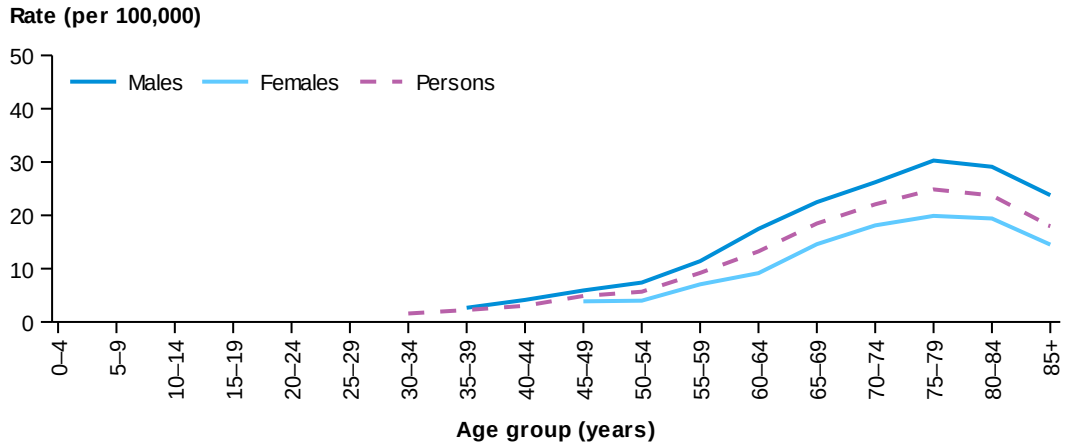
Sex	Number	ASR
Males	878	6.5
Females	599	4.1
Persons	**1,477**	**5.3**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Age group

The age-specific mortality rate for brain and other CNS cancer increased with each increasing age group, peaking for those aged 75–79 before decreasing in older age groups (Figure 7.1). The mortality rate in males is estimated to be higher than or similar to the rate in females for all age groups in 2017.



Note: Rates for males, females and persons aged 0–4 to 25–29, for males and females aged 30–34, and for females aged 35–39 and 40–44 have been suppressed due to small numbers.

Source: Table A7.1.

Figure 7.1: Estimated mortality from brain and other CNS cancer, by age at death and sex, 2017

Life stage

Children (0–14 years)

It is estimated in 2017, that 38 children will die from brain and other CNS cancer, representing 2.5% of brain and other CNS cancer deaths across all ages (Table A7.1). In 2015, brain and other CNS cancer was the 7th leading cause of death in children (Table A7.2). It was the 2nd leading cause of cancer-related death in children, after leukaemia, and the leading cause of death in children aged under 10.

Adolescents and young adults (15–24 years)

It is estimated that in 2017, 21 adolescents and young adults will die from brain and other CNS cancer, representing 1.4% of all brain and other CNS cancer deaths across all ages (Table A7.1). In 2015, brain and other CNS cancer was the 11th leading cause of death (Table A7.3) and the 3rd leading cause of cancer-related death in adolescents and young adults, after leukaemia and bone cancer.

Adults (25–64 years)

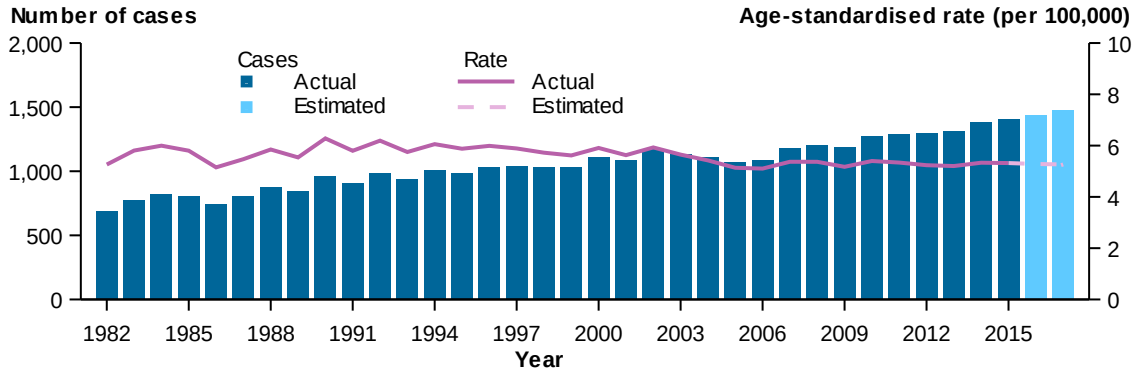
It is estimated that in 2017, 616 adults will die from brain and other CNS cancer, representing 42% of brain and other CNS cancer deaths across all ages (Table A7.1). In 2015, brain and other CNS cancer was the 12th leading cause of death (Table A7.4) and the 4th leading cause of cancer-related death in adults, after lung, breast and colorectal cancer.

Older adults (65+ years)

It is estimated that in 2017, 803 older adults will die from brain and other CNS cancer, representing 54% of brain and other CNS cancer deaths across all ages (Table A7.1). In 2015, brain and other CNS cancer was the 38th leading cause of death (Table A7.5) and the 16th leading cause of cancer-related death in older adults.

Trend

The number of deaths from brain and other CNS cancer increased from 691 cases in 1982 to an estimated 1,477 in 2017 (Figure 7.2). Between 1982 and 2003, the age-standardised mortality rate varied between 5.2 and 6.3 deaths per 100,000 people. Since 2004, the age-standardised mortality rate remained relatively stable (between 5.1 and 5.4 deaths per 100,000 people within that period).



Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

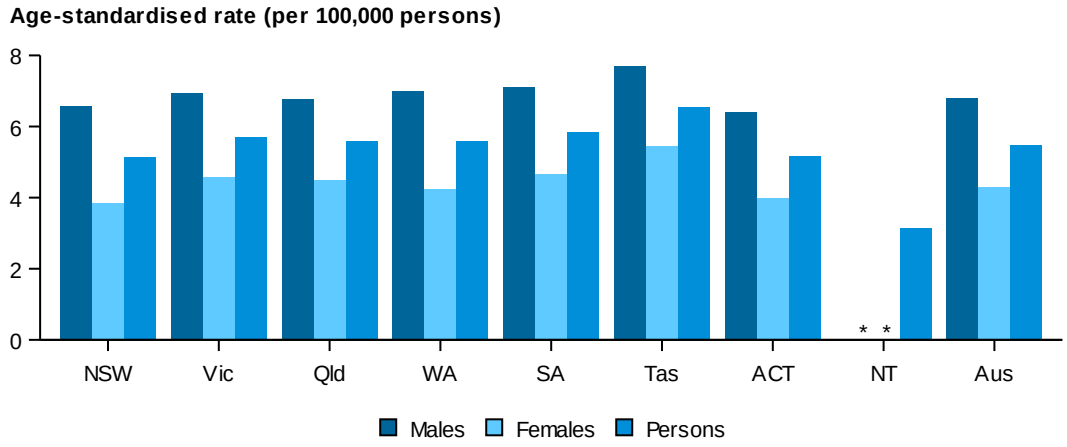
Source: Table A7.6.

Figure 7.2: Trends in mortality for brain and other CNS cancer, 1982 to 2017

State and territory

In the years 2011–2015, the age-standardised mortality rate of brain and other CNS cancer was highest in Tasmania (6.5 deaths per 100,000) and South Australia (5.8 per 100,000 persons) and lowest in the Northern Territory (3.1 per 100,000) (Figure 7.3).

Due to the difference in data sources and analysis approaches, mortality data are not directly comparable with those published by individual state and territory cancer registries. Mortality data in this chapter were derived using the place of a person's residence at the time of *death*. In contrast, some state and territory cancer registries present mortality information based on a person's place of residence at the time of *diagnosis*. In the latter data, the deaths may or may not have occurred in the state or territory indicated.



* n.p.

Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A7.7.

Figure 7.3: Mortality of all brain and other CNS cancer, by sex and state and territory, 2011–2015

7.2 Site

Of the 1,477 estimated brain and other CNS cancer deaths in 2017, 98% are estimated to be due to brain cancer (Table 7.2). Analysis of actual mortality data (2015) indicated that 90% of brain cancer deaths are not further classified. Due to this, more detailed classifications of site are not presented.

Table 7.2: Estimated mortality from brain and other CNS cancer, by site and sex, 2017

Site (ICD–10 code)	Number	ASR
Meninges (C70)	13	0.05
Brain (C71)	1,446	5.15
Spinal cord, cranial nerves and other parts of CNS (C72)	10	0.04
Endocrine glands of the cranial cavity (C75.1–75.3)	8	0.03
Brain and other CNS cancer (C70–C72, C75.1–C75.3)	**1,477**	**5.27**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

7.3 Histology

The National Mortality Database does not contain data on histology of cancer deaths and therefore data cannot be presented.

8 Spotlight on non-malignant tumours of the brain and other CNS

Snapshot

In 2013, there were 1,029 cases of non-malignant tumours of the brain and other CNS in Victoria, Queensland and Western Australia. The majority (66%) occurred in the meninges.

In 2009–2013, people living in Victoria, Queensland and Western Australia diagnosed with a non-malignant tumour of the brain and other CNS had a 5-year relative survival rate of 91%.

In 2011, the burden of disease attributable to non-malignant tumours of the brain and other CNS was 5,729 disability-adjusted life years.

In 2015, 279 people died from non-malignant tumours of the brain and other CNS.

More females were diagnosed with and died from non-malignant tumours of the brain and other CNS than males. This contrasts with the findings for malignant brain and other CNS cancers.

This section presents incidence, survival, burden of disease and mortality data for non-malignant tumours of the brain and other CNS. Unlike most non-malignant tumours, non-malignant tumours of the brain and other CNS cause significant morbidity and mortality due to their location (McCarthy et al. 2009).

Data for incidence and survival are extracted from the 2013 ACD. Non-malignant tumours of the brain and other CNS are currently notifiable diseases in Victoria, Queensland, Western Australia and Tasmania only. After analysing these data the AIHW concluded that Victoria, Queensland and Western Australia have incidence rates that are broadly consistent with each other and with rates in the United States of America and the United Kingdom from the year 2003. The rates in Tasmania are substantially lower than these. Incidence rates for Victoria, Queensland and Western Australia are similar from 2003 and can be pooled from that year onwards. In earlier years notification of non-malignant tumours in Queensland was voluntary rather than mandatory. This section focuses on non-malignant tumours of the brain and other CNS for 2013 and trends from 2003 to 2013 for Victoria, Queensland and Western Australia.

Data for the burden of non-malignant tumours are based on the Australian Burden of Disease Study 2011. Estimates were derived from national mortality data, national admitted hospital data and incidence data from Western Australia, Queensland and Victoria only. Estimates of fatal burden (which account for the majority of the disease burden) are considered highly relevant and accurate; however, as incidence data were limited to 3 states, and no reliable data on the prevalence of long-term effects of these tumours were available, national estimates of non-fatal burden were assessed to be of undetermined reliability which could be improved with more comprehensive data. See *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011* (AIHW 2016b) for more information.

Data for mortality are extracted from the NMD. While the ACD does not contain diagnosis information from all jurisdictions on non-malignant tumours, and also excludes those of the endocrine glands of the cranial cavity, the NMD contains this information for all jurisdictions, and mortality data for these tumours are reported on.

8.1 Incidence

In 2013, there were 1,029 new cases of non-malignant tumours of the brain and other CNS in Victoria, Queensland and Western Australia combined. Nearly two-thirds of these cases (64%) were diagnosed in females. Females were 1.7 times as likely as males to be diagnosed with non-malignant tumours of the brain and other CNS (Table 8.1).

Table 8.1: New cases of non-malignant tumours of the brain and other CNS, by sex, Victoria, Queensland and Western Australia combined, 2013

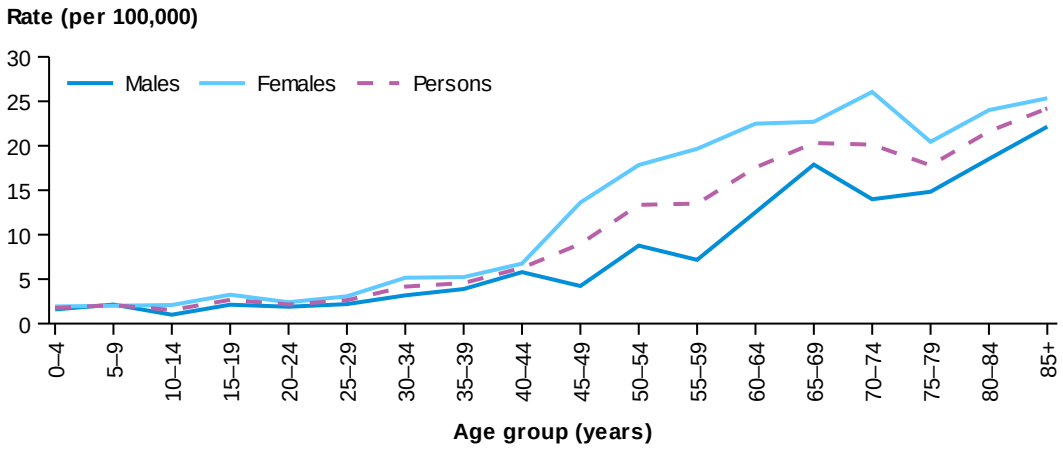
Sex	Number	ASR
Males	372	5.6
Females	657	9.4
Persons	**1,029**	**7.5**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Age group

In 2013, the age-specific incidence rate of non-malignant tumours of the brain and other CNS generally increased with age, from a rate of 1.8 per 100,000 in age group 0–4 to 24 per 100,000 persons in age group 85 and over. Incidence was similar in males and females in younger age groups, but was higher for females than males in age groups 45–49 and above, with rates over twice as high in females as in males in some age groups. For females, the incidence rate peaked in the age group 70–74 at a rate of 26 per 100,000 women. For males, the incidence rate was highest in the age group 85 and over at a rate of 22 per 100,000 men (Figure 8.1).

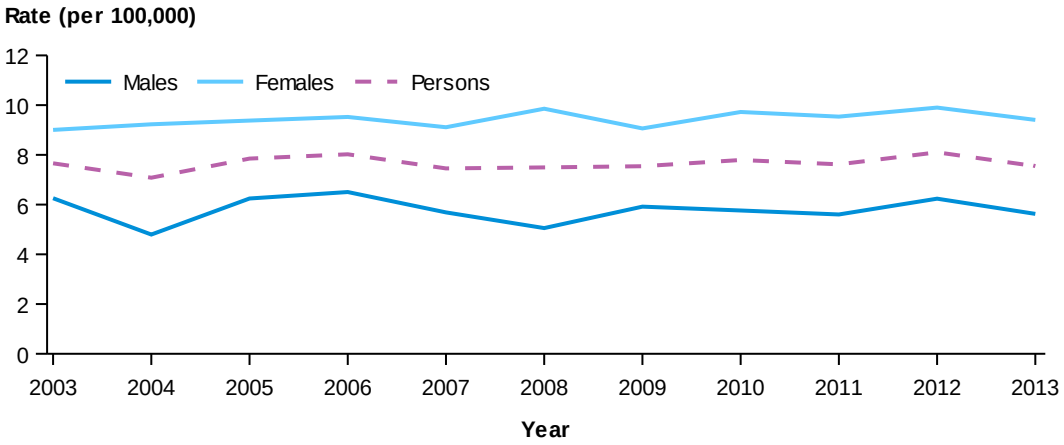


Source: Table A8.1.

Figure 8.1: Age-specific incidence rates of non-malignant tumours of the brain and other CNS, by age group and sex, Victoria, Queensland and Western Australia combined, 2013

Trend

Between 2003 and 2013, the number of new cases of non-malignant tumours of the brain and other CNS increased from 814 in 2003 to 1,029 in 2013 (Table A8.2), while the age-standardised incidence rate remained relatively stable (between 7.1 and 8.1 cases per 100,000 during this period) (Figure 8.2).



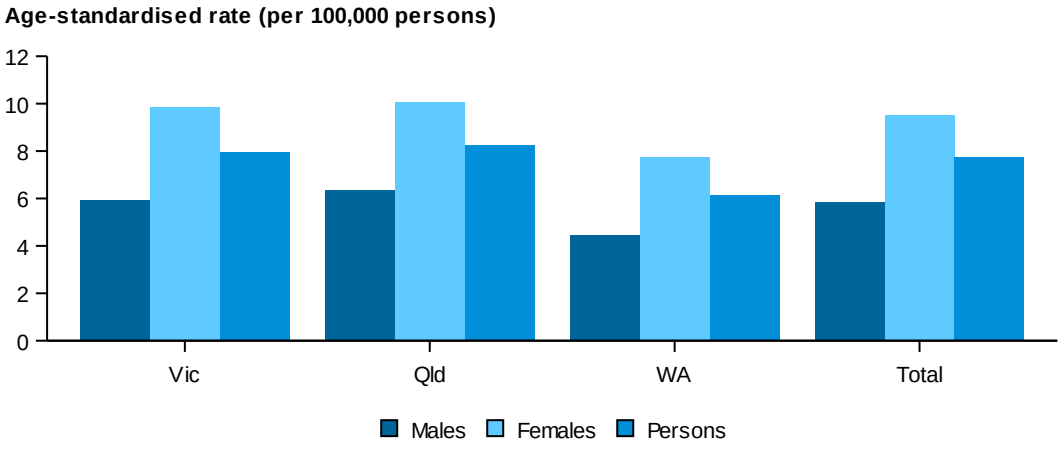
Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A8.2.

Figure 8.2: Trends in age-standardised incidence rates of non-malignant tumours of the brain and other CNS, by sex, Victoria, Queensland and Western Australia combined, 2003–2013

State and territory

In the years 2009–2013, the age-standardised incidence rate of non-malignant tumours of the brain and other CNS was highest in Queensland (8.3 cases per 100,000 persons) and lowest in Western Australia (6.1 per 100,000 persons) (Figure 8.3).



Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A8.3.

Figure 8.3: Age-standardised incidence rates of non-malignant tumours of the brain and other CNS, by sex and state, 2009–2013

Site

In 2013, the most common site for non-malignant tumours of the brain and other CNS was the meninges (674 new cases), followed by the brain (355 new cases) (Table 8.2). For neoplasms of the meninges, there were over twice as many new cases in females as in males, whereas there were only slightly more cases of brain neoplasms in females than in males. Over three-quarters of new cases (78%) were recorded as having benign behaviour, and 22% as having uncertain or unknown behaviour.

Table 8.2: Incidence of non-malignant tumours of the brain and other CNS, by sex, site and behaviour, Victoria, Queensland and Western Australia combined, 2013

Site (ICD-10 code)	Males	Females	Persons
Meninges, benign neoplasm (D32)	170	431	601
Brain and other CNS, benign neoplasm (D33)	93	104	197
Meninges, neoplasm of uncertain or unknown behaviour (D42)	30	43	73
Brain and other CNS, neoplasm of uncertain or unknown behaviour (D43)	79	79	158
Non-malignant tumours of the brain and CNS (D32–D33, D42–D43)	**372**	**657**	**1,029**

Source: AIHW ACD 2013.

Histology

In 2013, the most common histology group for non-malignant tumours of the brain and other CNS was tumours of the meninges, with 657 new cases diagnosed (64% of all cases) (Table 8.3). Note that this group is not equivalent to the meninges site (Table 8.2), as the site includes tumours with other histologies, such as unclassified tumours. The second most common histology group was tumours of cranial and spinal nerves (136 new cases).

Table 8.3: Incidence of non-malignant tumours of the brain and other CNS, by sex and histology group, Victoria, Queensland and Western Australia combined, 2013

Type	Males	Females	Persons
Tumours of neuroepithelial tissue	49	59	108
Pilocytic astrocytoma	17	25	42
Unique astrocytoma variants	2	4	6
Ependymal tumours	14	9	23
Glioma malignant, NOS	—	—	—
Choroid plexus tumours	1	1	2
Other neuroepithelial tumours	—	—	—
Neuronal and mixed neuronal-glial tumours	15	20	35
Tumours of the pineal region	—	—	—
Embryonal tumours	—	—	—
Tumours of cranial and spinal nerves	63	73	136
Tumours of meninges	197	460	657
Germ cell tumours and cysts	1	—	1
Tumours of sellar region	5	2	7
Unclassified tumours	57	63	120
Non-malignant tumours of the brain and other CNS tumours	**372**	**657**	**1,029**

Notes

1. Some tumours occurring in the sub-site of the meninges were not reported as having a histology of tumours of the meninges; the majority of these cases (80%) were unclassified tumours.
2. See Table B2 for information on histology groupings.

Source: AIHW ACD 2013.

8.2 Survival

In 2009–2013, people living in Victoria, Queensland and Western Australia diagnosed with non-malignant tumours of the brain and other CNS had a 91% chance of surviving for five years compared with their counterparts in the general population (Table 8.4). Males had a slightly lower 5-year relative survival rate than females (89% compared with 92%).

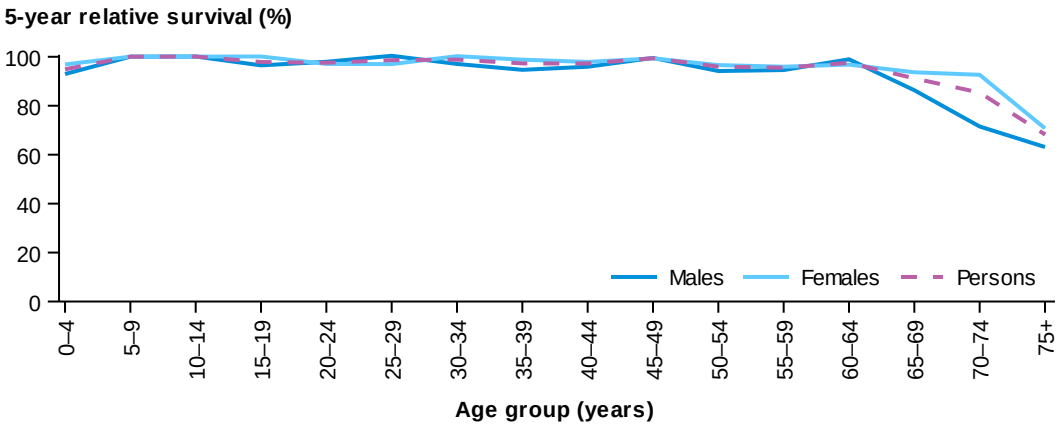
Table 8.4: Five-year relative survival from non-malignant tumours of the brain and other CNS, by sex, Victoria, Queensland and Western Australia combined, 2009–2013

Sex	5-year relative survival (%)
Males	88.6
Females	92.0
Persons	**90.8**

Source: AIHW ACD 2013.

Age group

In 2009–2013, 5-year relative survival ranged between 95% and 100% for people aged between 0–4 and 60–64. The 5-year relative survival rate then decreased with increasing age to a low of 68% for people aged 75 and older. The pattern by age was similar for both males and females aged between 0–4 and 60–64. Males aged 65 or over had a greater decrease in 5-year relative survival than females (Figure 8.4).



Source: Table A8.4.

Figure 8.4: Five-year relative survival from non-malignant tumours of the brain and other CNS, by age group and sex, Victoria, Queensland and Western Australia combined, 2009–2013

Site

In 2009–2013, brain and other CNS neoplasms of uncertain or unknown behaviour had the lowest 5-year relative survival rate (86%), whereas benign neoplasms of the brain and other CNS had the highest 5-year relative survival rate (96%) (Table 8.5).

Table 8.5: Five-year relative survival from non-malignant tumours of the brain and other CNS, by sex, site and behaviour, Victoria, Queensland and Western Australia combined, 2009–2013

Site and behaviour (ICD–10 code)	Males	Females	Persons
Meninges, benign neoplasm (D32)	84.1	91.6	89.7
Brain and other CNS, benign neoplasm (D33)	97.6	95.0	96.2
Meninges, neoplasm of uncertain or unknown behaviour (D42)	90.1	95.9	93.4
Brain and other CNS, neoplasm of uncertain or unknown behaviour (D43)	84.9	88.0	86.2
Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)	**88.6**	**92.0**	**90.8**

Source: AIHW ACD 2013.

Histology

Data on survival by histology are presented for 2003–2013 rather than for 2009–2013 due to low counts associated with some characteristics. In 2003–2013, 5-year relative survival was highest for tumours of cranial and spinal nerves (98%) and tumours of neuroepithelial tissue (96%) and lowest for unclassified tumours (78%) and tumours of the meninges (92%) (Table 8.6).

Table 8.6: Five-year relative survival from non-malignant tumours of the brain and other CNS, by histology group and sex, Victoria, Queensland and Western Australia combined, 2003–2013

Histology group	Males	Females	Persons
Neuroepithelial tissue	94.8	97.4	95.9
Pilocytic astrocytoma	96.5	97.0	96.7
Unique astrocytoma variants	91.8	n.p.	93.7
Ependymal tumours	100.0	100.0	100.0
Choroid plexus tumours	n.p.	89.2	91.6
Other neuroepithelial tumours	n.p.	n.p.	n.p.
Neuronal and mixed neuronal-glial tumours	90.5	98.3	93.6
Embryonal tumours	n.p.	n.p.	n.p.
Cranial and spinal nerves	99.7	97.0	98.4
Meninges	87.5	93.4	91.8
Germ cell tumours and cysts	n.p.	n.p.	n.p.
Sellar region	n.p.	n.p.	n.p.
Unclassified	77.3	77.9	77.7
Non-malignant tumours of the brain and other CNS	**89.4**	**92.0**	**91.1**

Note: See Table B2 for information on histology groupings.

Source: AIHW ACD 2013.

8.3 Burden of disease

In 2011, Australians lost 5,729 disability-adjusted life years due to non-malignant tumours of the brain and other CNS. While this was only 0.7% of the total cancer burden, it was the 7th leading cause of non-fatal cancer burden. The burden was higher in females than in males (Table 8.7).

In 2011, 75% of the burden due to non-malignant tumours of the brain and other CNS was fatal burden and 25% was non-fatal. For non-malignant tumours of the brain and other CNS, around 91% of the non-fatal burden is due to the long-term impacts of brain injury.

Table 8.7: Burden of disease from non-malignant tumours of the brain and other CNS, by sex, 2011

	Males			Females			Persons		
	Number	% of cancer burden	Rank	Number	% of cancer burden	Rank	Number	% of cancer burden	Rank
Fatal burden (YLL)	2,031	0.5	21	2,273	0.7	22	4,305	0.6	24
Non-fatal burden (YLD)	759	2.7	8	666	2.9	7	1,424	2.8	7
Total burden (DALY)	**2,790**	**0.6**	**21**	**2,939**	**0.8**	**20**	**5,729**	**0.7**	**24**

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. Columns may not add to total due to rounding.

Source: AIHW Burden of Disease Database 2011.

Life stage

Children (0–14 years)

In 2011, children lost 413 DALY due to premature death or living with disability as a result of non-malignant tumours of the brain and other CNS (Figure 8.5). For boys, non-malignant tumours of the brain and other CNS was the 7th leading cause of cancer burden, accounting for 1.8% of the total cancer burden in this age group, whereas for girls it was the 3rd leading cause of burden, accounting for 7.6% of the total cancer burden (Table A6.1). For children, most of the burden (94%) was due to dying prematurely (Table A8.5).

Adolescents and young adults (15–24 years)

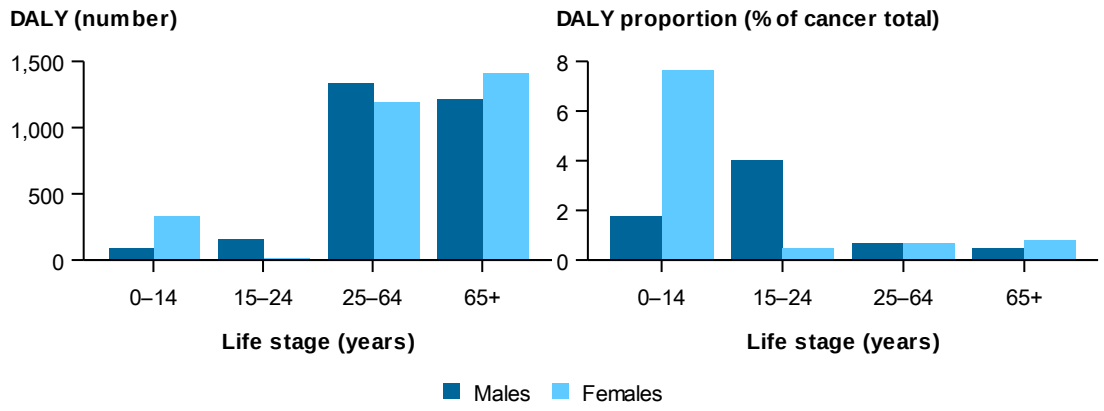
In 2011, adolescents and young adults lost 168 DALY due to premature death or living with disability as a result of non-malignant tumours of the brain and other CNS (Figure 8.5). For males, non-malignant tumours of the brain and other CNS was the 4th leading cause of cancer burden, accounting for 4.0% of the total cancer burden in this age group, whereas for females it was the 14th leading cause of burden, accounting for 0.5% of the total cancer burden (Table A6.2). For adolescents and young adults, most of the burden (81%) was due to dying prematurely (Table A8.5).

Adults (25–64 years)

In 2011, adults lost 2,528 DALY due to premature death or living with disability as a result of non-malignant tumours of the brain and other CNS (Figure 8.5). For men, non-malignant tumours of the brain and other CNS was the 20th leading cause of cancer burden, accounting for 0.7% of the total cancer burden in this age group, whereas for women it was the 19th leading cause of burden, accounting for 0.7% of the total cancer burden (Table A6.3). For adults, most of the burden (69%) was due to dying prematurely (Table A8.5).

Older adults (65+ years)

In 2011, older adults lost 2,621 DALY due to premature death or living with disability as a result of non-malignant tumours of the brain and other CNS (Figure 8.5). In men, non-malignant tumours of the brain and other CNS was the 21st leading cause of cancer burden, accounting for 0.5% of the total cancer burden in this age group, whereas in women it was the 22nd leading cause of burden, accounting for 0.8% of the total cancer burden (Table A6.4). For older adults, most of the burden (78%) was due to dying prematurely (Table A8.5).



Sources: Tables A6.1–A6.4.

Figure 8.5: Burden of non-malignant tumours of the brain and other CNS, by sex and life stage, 2011

8.4 Mortality

In 2015, 279 people died from non-malignant tumours of the brain and other CNS (Table 8.8). More females (56%) than males died from non-malignant tumours of the brain and other CNS.

Table 8.8: Mortality from non-malignant tumours of the brain and other CNS, by sex, 2015

Sex	Number	ASR
Males	122	1.0
Females	157	1.0
Persons	**279**	**1.0**

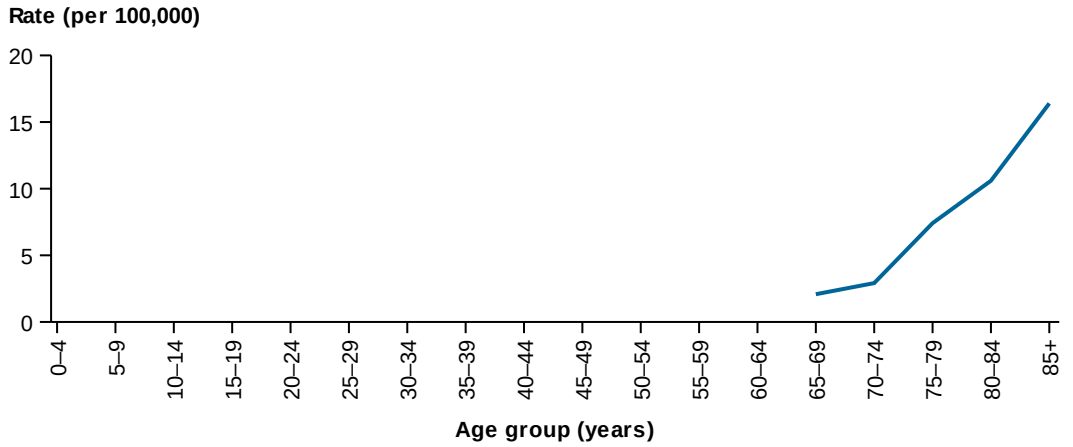
Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Age group

In 2015, 79% of deaths from non-malignant tumours of the brain and other CNS occurred in people aged 65 and older. The age-specific mortality rate for non-malignant tumours of the brain and other CNS increased with age group from age group 65–69, peaking for those aged 85 and older (16 per 100,000) (Figure 8.6).



Notes

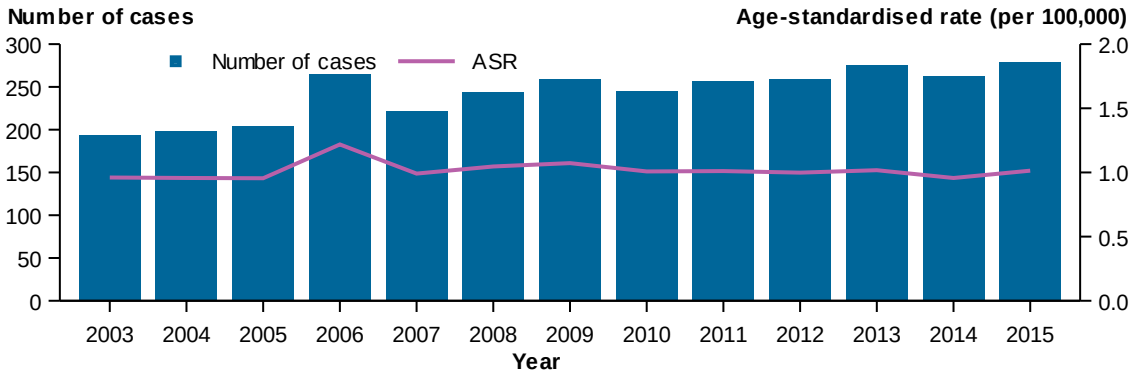
1. Rates for persons aged 0–4 to 60–64 have been suppressed due to small numbers.
2. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
3. Data for 2015 are based on the year of *registration* of the death.

Source: Table A8.6.

Figure 8.6: Mortality from non-malignant tumours of the brain and other CNS, by age group, 2015

Trend

The number of deaths from non-malignant tumours of the brain and other CNS increased from 194 cases in 2003 to 279 in 2015 (Figure 8.7). Between 2003 and 2015, the age-standardised mortality rate remained stable, between 1.0 and 1.2 deaths per 100,000 people.



Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death).
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A8.7.

Figure 8.7: Trends in mortality of non-malignant tumours of the brain and other CNS, 2003–2015

Site

In 2015, there were 184 deaths from neoplasms of the brain and CNS and 75 deaths from neoplasm of the meninges. About three-quarters of deaths (68%) were recorded as having uncertain or unknown behaviour, with 32% having benign behaviour (Table 8.9).

Table 8.9: Mortality from non-malignant tumours of the brain and other CNS, by sex, site and behaviour, 2015

	Males		Females		Persons	
Sub-site and behaviour (ICD–10 code)	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
Meninges, benign neoplasm (D32)	27	0.2	48	0.3	75	0.3
Brain and other CNS, benign neoplasm (D33)	4	0.0	4	0.0	8	0.0
Endocrine glands of the cranial cavity, benign neoplasm (D35.2–D35.4)	3	0.0	3	0.0	6	0.0
Meninges, neoplasm of uncertain or unknown behaviour (D42)	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
Brain and other CNS, neoplasm of uncertain or unknown behaviour (D43)	80	0.6	96	0.6	176	0.6
Endocrine glands of the cranial cavity, neoplasm of uncertain or unknown behaviour (D44.3–D44.5)	8	0.1	5	0.0	13	0.1
Benign or uncertain neoplasms of the brain and other CNS (D32–D33, D35.2–D35.4, D42–D43, D44.3–D44.5)	**122**	**1.0**	**157**	**1.0**	**279**	**1.0**

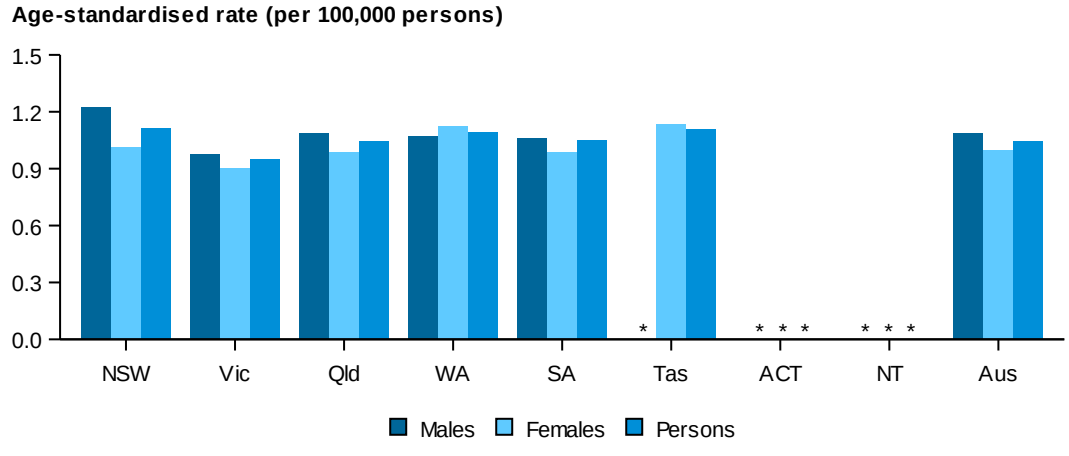
Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

State and territory

In the years 2011–2015, the age-standardised mortality rate of non-malignant tumours of the brain and other CNS was similar across states and territories (Figure 8.8).



* n.p.

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: Table A8.8.

Figure 8.8: Age-standardised mortality rates of non-malignant tumours of the brain and other CNS, by sex and state and territory, 2011–2015

Appendix A: Additional tables

Additional tables for Chapter 2 Incidence

Table A2.1: Estimated age-specific incidence rates of brain and other CNS cancer, by age at diagnosis, 2017

	Males		Females		Persons	
Age group	Number	Rate	Number	Rate	Number	Rate
0–4	26	3.2	23	2.9	50	3.0
5–9	21	2.6	14	1.8	35	2.2
10–14	13	1.7	12	1.7	25	1.7
15–19	17	2.2	11	1.5	28	1.9
20–24	20	2.4	14	1.7	34	2.0
25–29	31	3.3	21	2.4	52	2.9
30–34	38	4.1	28	3.0	66	3.6
35–39	41	4.8	29	3.4	70	4.1
40–44	49	6.0	37	4.5	86	5.3
45–49	69	8.3	46	5.4	114	6.8
50–54	90	11.8	56	7.2	147	9.5
55–59	115	15.4	79	10.2	194	12.7
60–64	131	19.8	82	12.0	213	15.8
65–69	146	25.1	100	16.6	246	20.8
70–74	135	28.5	96	19.4	231	23.9
75–79	122	37.3	87	24.6	209	30.7
80–84	81	38.4	64	24.3	145	30.6
85+	60	32.1	73	23.4	133	26.7

Note: The rates are expressed per 100,000 population.

Source: AIHW ACD 2013.

Table A2.2: Most common cancers diagnosed in children (0–14 years), 2013

Rank	Cancer Type (ICD-10 code)	Number	% of all cancers diagnosed in age group
1	Leukaemia (C91–C95)	228	34.1
2	*Brain and other CNS cancer (C70–C72, C75.1–C75.3)*	*102*	*15.2*
3	Lymphoma (C81–C86)	70	10.4
4	Kidney (C64)	36	5.3
5	Other soft tissue (C47, C49)	30	4.5

Source: AIHW ACD 2013.

Table A2.3: Most common cancers diagnosed in adolescents and young adults (15–24 years), 2013

Rank	Cancer Type (ICD-10 code)	Number	% of all cancers diagnosed in age group
1	Lymphoma (C81–C86)	174	18.6
2	Melanoma of the skin (C43)	154	16.5
3	Testis (C62)	95	10.2
4	Thyroid (C73)	78	8.4
5	Colorectal (C18–C20)	77	8.3
7	*Brain and other CNS cancer (C70–C72, C75.1–C75.3)*	*63*	*6.7*

Source: AIHW ACD 2013.

Table A2.4: Most common cancers diagnosed in adults (25–64 years), 2013

Rank	Cancer Type (ICD-10 code)	Number	% of all cancers diagnosed in age group
1	Breast (females) (C50)	9,600	18.7
2	Prostate (C61)	7,146	13.9
3	Melanoma of the skin (C43)	6,241	12.2
4	Colorectal (C18–C20)	4,886	9.5
5	Lung (C33–C34)	3,073	6.0
12	*Brain and other CNS cancer (C70–C72, C75.1–C75.3)*	*836*	*1.6*

Source: AIHW ACD 2013.

Table A2.5: Most common cancers diagnosed in older adults (65 years and over), 2013

Rank	Cancer Type (ICD-10 code)	Number	% of all cancers diagnosed in age group
1	Prostate (C61)	12,087	16.9
2	Colorectal (C18–C20)	9,977	13.9
3	Lung (C33–C34)	8,091	11.3
4	Melanoma of the skin (C43)	6,338	8.9
5	Breast (females) (C50)	6,296	8.8
19	*Brain and other CNS cancer (C70–C72, C75.1–C75.3)*	*748*	*1.0*

Source: AIHW ACD 2013.

Table A2.6: Trends in incidence of brain and other CNS cancer, 1982–2017

Year	Number	ASR
1982	911	6.7
1983	936	6.7
1984	982	6.9
1985	976	6.7
1986	1,031	6.9
1987	1,066	7.1
1988	1,093	7.2
1989	1,116	7.2
1990	1,120	7.1
1991	1,186	7.4
1992	1,238	7.6
1993	1,188	7.1
1994	1,250	7.4
1995	1,244	7.3
1996	1,265	7.2
1997	1,274	7.2
1998	1,260	7.0
1999	1,332	7.2
2000	1,395	7.4
2001	1,419	7.4
2002	1,525	7.8
2003	1,451	7.3
2004	1,476	7.2
2005	1,553	7.5
2006	1,507	7.1
2007	1,580	7.3
2008	1,630	7.4
2009	1,740	7.7
2010	1,774	7.6
2011	1,815	7.7
2012	1,729	7.1
2013	1,749	7.0
2014	1,918	7.5
2015	1,963	7.6
2016	2,010	7.6
2017	2,076	7.6

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.
Source: AIHW ACD 2013.

Table A2.7: Incidence of all brain and other CNS cancer, by sex and state and territory, 2009–2013

	Males		Females		Persons	
State	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
New South Wales	1,612	8.6	1,185	5.9	2,797	7.2
Victoria	1,370	9.7	1,022	6.6	2,392	8.1
Queensland	928	8.2	702	5.9	1,630	7.0
Western Australia	507	8.6	369	6.1	876	7.3
South Australia	403	9.0	290	5.9	693	7.4
Tasmania	152	11.0	105	6.8	257	8.9
Australian Capital Territory	57	6.6	52	5.6	109	6.1
Northern Territory	37	6.7	16	3.8	53	5.5
Australia	**5,066**	**8.8**	**3,741**	**6.1**	**8,807**	**7.4**

Notes

1. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.
2. The 2013 NSW incidence data were estimated by the AIHW, see *Cancer in Australia 2017* (AIHW 2017c) for methodology.

Source: AIHW ACD 2013.

Table A2.8: New cases of brain cancer, by sub-site and sex, 2013

	Males		Females		Persons	
Sub-site (ICD-10 code)	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
Cerebrum (C71.0)	46	0.4	50	0.4	96	0.4
Frontal lobe (C71.1)	276	2.3	216	1.7	492	2.0
Temporal lobe (C71.2)	250	2.0	130	1.0	380	1.5
Parietal lobe (C71.3)	122	1.0	96	0.7	219	0.9
Occipital lobe (C71.4)	31	0.3	31	0.2	63	0.2
Ventricle (C71.5)	15	0.1	10	0.1	25	0.1
Cerebellum (C71.6)	29	0.2	23	0.2	51	0.2
Brain stem (C71.7)	32	0.3	21	0.2	53	0.2
Overlapping lesion of brain (C71.8)	53	0.4	49	0.4	102	0.4
Brain, unspecified (C71.9)	84	0.7	70	0.5	154	0.6
All brain and other CNS cancer (C70–C72, C75.1–C75.3)	**995**	**8.2**	**754**	**5.8**	**1,749**	**7.0**

Source: AIHW ACD 2013.

Table A2.9: New cases of brain cancer, by sub-site and life stage, 2013

Site	0–14 years	15–24 years	25–64 years	65+ years	Total
Cerebrum (C71.0)	6	2	43	45	96
Frontal lobe (C71.1)	4	17	274	197	492
Temporal lobe (C71.2)	2	10	195	172	380
Parietal lobe (C71.3)	3	5	103	107	219
Occipital lobe (C71.4)	1	2	28	31	63
Ventricle (C71.5)	7	2	8	8	25
Cerebellum (C71.6)	21	7	17	7	51
Brain stem (C71.7)	18	2	21	12	53
Overlapping lesion of brain (C71.8)	4	1	45	52	102
Brain, unspecified (C71.9)	15	6	51	82	154
All brain (C71)	**81**	**55**	**785**	**713**	**1,634**

Source: AIHW ACD 2013.

Table A2.10: Age-standardised incidence rates of brain and other CNS cancer, by site, 1982–2017

Year	Meninges (C70)	Brain (C71)	Spinal cord, cranial nerves and other CNS (C72)	Endocrine glands of the cranial cavity (C75.1–75.3)	All brain and other CNS (C70–C72, C75.1–C75.3)
1982	0.1	6.3	0.2	0.1	6.7
1983	0.1	6.3	0.2	0.1	6.7
1984	0.1	6.5	0.2	0.1	6.9
1985	0.1	6.4	0.1	0.1	6.7
1986	0.1	6.6	0.1	0.1	6.9
1987	0.1	6.7	0.2	0.1	7.1
1988	0.2	6.6	0.3	0.1	7.2
1989	0.2	6.6	0.2	0.1	7.2
1990	0.1	6.7	0.2	0.1	7.1
1991	0.2	6.8	0.3	0.1	7.4
1992	0.1	7.1	0.2	0.1	7.6
1993	0.2	6.7	0.2	0.1	7.1
1994	0.2	6.9	0.2	0.1	7.4
1995	0.1	6.9	0.3	0.1	7.3
1996	0.1	6.8	0.2	0.1	7.2
1997	0.2	6.7	0.3	0.1	7.2
1998	0.1	6.5	0.2	0.1	7.0
1999	0.2	6.7	0.2	0.1	7.2
2000	0.2	6.9	0.2	0.1	7.4
2001	0.2	6.9	0.2	0.1	7.4
2002	0.2	7.3	0.2	0.1	7.8
2003	0.1	6.8	0.2	0.1	7.3
2004	0.2	6.7	0.2	0.1	7.2
2005	0.2	7.0	0.2	0.1	7.5
2006	0.1	6.6	0.2	0.2	7.1
2007	0.2	6.8	0.2	0.1	7.3
2008	0.1	7.0	0.2	0.1	7.4
2009	0.2	7.2	0.2	0.1	7.7
2010	0.2	7.1	0.2	0.1	7.6
2011	0.2	7.2	0.2	0.1	7.7
2012	0.1	6.7	0.2	0.1	7.1
2013	0.1	6.5	0.2	0.1	7.0
2014	0.1	7.1	0.2	0.1	7.5
2015	0.1	7.1	0.2	0.1	7.6
2016	0.1	7.1	0.2	0.1	7.6
2017	0.1	7.1	0.2	0.1	7.6

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Table A2.11: New cases of tumours of neuroepithelial tissue, by histology group and sex, 2013

Histology	Males	Females	Persons
Pilocytic astrocytoma	—	2	2
Diffuse astrocytoma	70	51	121
Anaplastic astrocytoma	43	35	78
Unique astrocytoma variants	5	5	10
Glioblastoma	575	407	982
Oligodendroglioma	27	36	63
Anaplastic oligodendroglioma	21	16	37
Oligoastrocytic tumours	53	22	75
Ependymal tumours	35	27	62
Glioma malignant, NOS	47	42	89
Choroid plexus tumours	2	—	2
Other neuroepithelial tumours	—	—	—
Neuronal and mixed neuronal-glial tumours	3	3	5
Tumours of the pineal region	4	5	9
Embryonal tumours	32	23	55
All tumours of neuroepithelial tissue	**917**	**675**	**1,592**

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.

Table A2.12: Number of new cases of brain and other CNS cancer, by histology group and life stage, 2013

Type	0–14 years	15–24 years	25–64 years	65+ years	Total
Neuroepithelial tissue	89	55	803	645	1,592
Pilocytic astrocytoma	1	—	1	—	2
Diffuse astrocytoma	9	9	70	33	121
Anaplastic astrocytoma	5	4	46	22	78
Unique astrocytoma variants	1	1	6	2	10
Glioblastoma	4	8	465	505	982
Oligodendroglioma	4	3	51	5	63
Anaplastic oligodendroglioma	—	1	25	11	37
Oligoastrocytic tumours	—	8	56	11	75
Ependymal tumours	8	4	41	8	62
Glioma malignant, NOS	18	6	20	45	89
Choroid plexus tumours	2	—	—	—	2
Other neuroepithelial tumours	—	—	—	—	—
Neuronal and mixed neuronal-glial tumours	—	2	3	—	5
Tumours of the pineal region	3	1	5	—	9
Embryonal tumours	34	7	13	2	55
Cranial and spinal nerves	1	—	3	—	4
Meninges	1	2	16	24	43
Germ cell tumours and cysts	6	6	2	—	14
Sellar region	—	—	1	2	2
Unclassified	4	—	12	77	93
All brain and CNS cancer	**102**	**63**	**836**	**748**	**1,749**

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.

Table A2.13: Trend in age-standardised incidence rates of brain and other CNS cancer, by histology group, 1982–2013

Year	Neuroepithelial tissue	Cranial and spinal nerves	Meninges	Germ cell tumours and cysts	Sellar region	Unclassified
1982	5.2	0.01	0.15	0.05	—	1.3
1983	5.5	0.01	0.19	0.01	0.01	0.97
1984	5.5	0.01	0.12	0.06	0.01	1.2
1985	5.5	0.02	0.15	0.05	—	1.1
1986	5.7	0.02	0.13	0.04	0.01	1.1
1987	5.8	0.03	0.15	0.03	0.01	1.0
1988	6.1	0.06	0.19	0.05	0.01	0.78
1989	6.0	0.02	0.20	0.06	—	0.91
1990	6.1	0.01	0.12	0.06	—	0.84
1991	6.4	0.02	0.25	0.03	—	0.63
1992	6.7	0.01	0.18	0.08	0.01	0.62
1993	6.2	0.02	0.21	0.04	0.02	0.61
1994	6.5	0.01	0.27	0.05	0.02	0.60
1995	6.4	0.01	0.10	0.08	0.01	0.67
1996	6.4	—	0.20	0.05	0.01	0.53
1997	6.3	0.01	0.21	0.06	—	0.61
1998	6.3	0.03	0.15	0.05	0.01	0.43
1999	6.4	0.01	0.19	0.10	—	0.54
2000	6.5	0.03	0.21	0.08	0.01	0.61
2001	6.7	0.01	0.18	0.06	0.01	0.44
2002	6.9	0.03	0.16	0.04	0.01	0.59
2003	6.6	0.01	0.21	0.05	0.01	0.40
2004	6.5	0.00	0.17	0.07	0.01	0.46
2005	6.8	—	0.19	0.05	0.01	0.47
2006	6.5	0.03	0.14	0.10	0.01	0.41
2007	6.5	0.02	0.20	0.07	—	0.44
2008	6.7	—	0.16	0.07	0.01	0.39
2009	6.9	0.02	0.21	0.09	0.01	0.46
2010	6.9	0.01	0.17	0.03	0.01	0.43
2011	7.0	0.01	0.17	0.06	0.01	0.46
2012	6.5	0.01	0.12	0.06	0.00	0.42
2013	6.4	0.02	0.17	0.07	0.01	0.35

Notes

1. See Table B1 for information on histology groupings.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Additional tables for Chapter 3 Treatment

Table A3.1: Age-specific rates for hospitalisations related to brain and other CNS cancer, by age group and sex, 2015–16

	Males		Females		Persons	
Age group	Number	Rate	Number	Rate	Number	Rate
0–4	541	6.8	379	5.0	920	5.9
5–9	646	8.1	223	3.0	869	5.6
10–14	230	3.2	148	2.1	378	2.7
15–19	200	2.6	62	0.9	262	1.8
20–24	50	0.6	93	1.1	143	0.8
25–29	224	2.5	111	1.2	335	1.9
30–34	282	3.2	182	2.0	464	2.6
35–39	320	4.0	262	3.3	582	3.7
40–44	573	7.0	283	3.4	856	5.2
45–49	577	7.4	321	4.0	898	5.7
50–54	668	8.7	626	7.9	1,294	8.3
55–59	926	12.9	605	8.1	1,531	10.5
60–64	965	15.2	583	8.8	1,548	11.9
65–69	1,005	17.3	496	8.3	1,501	12.8
70–74	608	14.3	512	11.5	1,120	12.9
75–79	543	17.9	318	9.4	861	13.4
80–84	316	15.8	211	8.4	527	11.7
85+	144	8.2	144	4.8	288	6.1

Note: The rates are age-specific rates expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.2: Number of brain and other CNS cancer-related hospitalisations in children (0–14 years), 2015–16

	Males		Females		Persons	
	Number	Rate	Number	Rate	Number	Rate
Principal diagnosis of cancer	671	2.9	341	1.5	1,012	2.2
Additional diagnosis of cancer	746	3.2	409	1.9	1,155	2.6
All brain and other CNS cancer-related hospitalisations	**1,417**	**6.1**	**750**	**3.4**	**2,167**	**4.8**

Notes

1. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.3: Number of brain and other CNS cancer-related hospitalisations in adolescents and young adults (15–24 years), 2015–16

	Males		Females		Persons	
	Number	Rate	Number	Rate	Number	Rate
Principal diagnosis of cancer	122	0.8	90	0.6	212	0.7
Additional diagnosis of cancer	128	0.8	65	0.4	193	0.6
All brain and other CNS cancer-related hospitalisations	**250**	**1.5**	**155**	**1.0**	**405**	**1.3**

Notes

1. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.4: Number of brain and other CNS cancer-related hospitalisations in adults (25–64 years), 2015–16

	Males		Females		Persons	
	Number	Rate	Number	Rate	Number	Rate
Principal diagnosis of cancer	2,210	3.5	1,461	2.3	3,671	2.9
Additional diagnosis of cancer	2,325	3.7	1,512	2.4	3,837	3.0
All brain and other CNS cancer-related hospitalisations	**4,535**	**7.2**	**2,973**	**4.6**	**7,508**	**5.9**

Notes

1. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.5: Number of brain and other CNS cancer-related hospitalisations in older adults (65+ years), 2015–16

	Males		Females		Persons	
	Number	Rate	Number	Rate	Number	Rate
Principal diagnosis of cancer	1,668	9.9	980	5.1	2,648	7.3
Additional diagnosis of cancer	948	5.6	701	3.6	1,649	4.6
All brain and other CNS cancer-related hospitalisations	**2,616**	**15.5**	**1,681**	**8.7**	**4,297**	**11.9**

Notes

1. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.6: All brain and other CNS cancer-related hospitalisations, by sex, 2001–02 to 2015–16

	Males		Females		Persons	
Financial year	**Number**	**ASR**	**Number**	**ASR**	**Number**	**ASR**
2001–02	5,008	5.3	3,454	3.5	8,462	4.4
2002–03	4,998	5.2	3,299	3.3	8,297	4.2
2003–04	4,864	4.9	3,349	3.3	8,213	4.1
2004–05	5,200	5.2	3,574	3.5	8,774	4.3
2005–06	5,107	5.0	3,668	3.5	8,775	4.3
2006–07	5,880	5.7	3,610	3.4	9,490	4.5
2007–08	6,109	5.8	3,805	3.5	9,914	4.6
2008–09	6,263	5.8	4,173	3.7	10,436	4.8
2009–10	7,091	6.4	4,705	4.1	11,796	5.2
2010–11	7,640	6.7	5,193	4.5	12,833	5.5
2011–12	7,801	6.8	5,362	4.5	13,163	5.6
2012–13	8,044	6.9	5,583	4.6	13,627	5.7
2013–14	8,159	6.8	5,404	4.4	13,563	5.6
2014–15	8,079	6.6	5,644	4.5	13,723	5.5
2015–16	8,818	7.1	5,559	4.3	14,377	5.7

Notes

1. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.
2. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 10,000 population.

Source: AIHW NHMD.

Table A3.7: Number of brain and other CNS cancer surgical procedures, by sex and life stage, 2015–16

Life stage (years)	Males	Females	Persons
0–14	210	110	320
15–24	96	65	161
25–64	1,096	746	1,842
65+	592	366	958
All ages	**1,994**	**1,287**	**3,281**

Note: See Table C2 for information on procedures included.

Source: AIHW NHMD.

Table A3.8: Number of brain and other CNS cancer chemotherapy procedures, by sex and life stage, 2015–16

Life stage (years)	Males	Females	Persons
0–14	479	247	726
15–24	84	22	106
25–64	1,588	998	2,586
65+	421	315	736
All ages	**2,572**	**1,582**	**4,154**

Note: Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.

Source: AIHW NHMD.

Table A3.9: Radiotherapy courses for brain and other CNS cancer, by sex and age group, 2015–16

Age group	Males		Females		Persons	
	Number	% of all radiotherapy courses	Number	% of all radiotherapy courses	Number	% of all radiotherapy courses
0–4	12	24.0	8	22.9	20	23.5
5–9	27	45.8	9	29.0	36	40.0
10–14	16	42.1	14	26.9	30	33.3
15–19	18	21.2	5	7.5	23	15.1
20–24	12	9.8	13	14.6	25	11.8
25–29	27	21.1	17	10.2	44	15.0
30–34	32	14.4	25	6.7	57	9.6
35–39	37	14.9	26	3.8	63	6.8
40–44	61	12.3	45	3.3	106	5.7
45–49	74	8.6	44	2.1	118	3.9
50–54	85	5.3	86	2.8	171	3.7
55–59	108	4.0	68	1.9	176	2.8
60–64	131	3.4	71	1.8	202	2.6
65–69	106	2.0	77	1.7	183	1.9
70–74	102	1.9	67	1.8	169	1.9
75–79	62	1.4	38	1.5	100	1.4
80–84	27	0.9	26	1.5	53	1.1
85+	11	0.4	16	1.0	27	0.7
Total	**948**	**3.1**	**656**	**2.2**	**1604**	**2.6**

Notes

1. Age group is based on age at start date of radiotherapy course, percentage of all radiotherapy courses is calculated based on totals by age group and sex.
2. Some providers report the primary site of cancer rather than the principal diagnosis.

Source: AIHW NRWTD.

Additional tables for Chapter 4 Survival

Table A4.1: Five-year relative survival (%) from brain and other CNS cancer, by sex and age group, 2009–2013

Age group	Males	Females	Persons
0–4	64.7	66.0	65.4
5–9	66.0	54.5	61.0
10–14	58.5	67.4	62.7
15–19	64.4	67.6	65.7
20–24	71.3	76.1	73.2
25–29	78.2	74.4	76.4
30–34	63.1	76.3	68.7
35–39	57.3	61.6	58.9
40–44	47.1	54.7	50.2
45–49	34.0	44.1	38.0
50–54	21.8	37.7	28.0
55–59	16.9	18.8	17.9
60–64	9.3	12.2	10.4
65–69	9.2	10.0	9.5
70–74	6.3	9.4	7.6
75+	n.p.	4.0	3.4
Total	**23.8**	**26.9**	**25.1**

Source: AIHW ACD 2013.

Table A4.2: Five-year relative survival (%) from brain and other CNS cancer, by sex, 1984–1988 to 2009–2013

Period	Males	Females	Persons
1984–1988	23.5	23.2	23.4
1989–1993	23.3	23.8	23.5
1994–1998	22.2	22.1	22.2
1999–2003	21.5	23.6	22.4
2004–2008	23.1	25.6	24.2
2009–2013	23.8	26.9	25.1

Source: AIHW ACD 2013.

Table A4.3: Five-year relative survival (%) from brain and other CNS cancer, by site and sex, 2009–2013

Site (ICD-10 code)	Males	Females	Persons
Meninges (C70)	46.3	66.3	58.0
Brain (C71)	21.1	23.3	22.1
Spinal cord, cranial nerves and other parts of CNS (C72)	77.6	86.6	82.0
Endocrine glands of the cranial cavity (C75.1–75.3)	85.4	n.p.	79.6

Source: AIHW ACD 2013.

Table A4.4: Five-year relative survival (%) from brain and CNS cancer, by sub-site of the brain and sex, 2009–2013

Sub-site (ICD-10 code)	Males	Females	Persons
Cerebrum (C71.0)	18.3	13.2	16.0
Frontal lobe (C71.1)	27.9	27.5	27.8
Temporal lobe (C71.2)	13.4	19.7	15.7
Parietal lobe (C71.3)	10.9	17.0	13.5
Occipital lobe (C71.4)	11.8	12.2	12.0
Ventricle (C71.5)	36.6	n.p.	35.6
Cerebellum (C71.6)	58.0	62.8	59.8
Brain stem (C71.7)	40.2	35.4	38.2

Source: AIHW ACD 2013.

Table A4.5: Five-year relative survival (%) from brain and other CNS cancer, by site, 1984–1988 to 2009–2013

Site (ICD-10 code)	1984–1988	1989–1993	1994–1998	1999–2003	2004–2008	2009–2013
Meninges (C70)	56.4	49.3	62.4	60.1	50.2	58.0
Brain (C71)	20.9	20.2	18.8	19.1	21.2	22.1
Spinal cord, cranial nerves and other parts of CNS (C72)	64.2	74.5	75.8	77.5	78.3	82.0
Endocrine glands of the cranial cavity (C75.1–75.3)	n.p.	75.4	72.8	74.8	74.2	79.6
Brain and other CNS cancer (C70–C72, C75.1–C75.3)	**23.4**	**23.5**	**22.2**	**22.4**	**24.2**	**25.1**

Source: AIHW ACD 2013.

Table A4.6: Five-year relative survival (%) from brain and other CNS cancer, by histology group and sex, 1994–2013

Histology group	Males	Females	Persons
Neuroepithelial tissue	21.3	23.7	22.3
Cranial and spinal nerves	n.p.	n.p.	50.6
Meninges	52.8	66.2	60.3
Germ cell tumours and cysts	87.1	77.3	84.9
Sellar region	n.p.	n.p.	80.1
Unclassified	15.8	12.1	13.8

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.

Table A4.7: Five-year relative survival (%) from tumours of neuroepithelial tissue, by histology and sex, 1994–2013

Histology group	Males	Females	Persons
Pilocytic astrocytoma	n.p.	n.p.	n.p.
Diffuse astrocytoma	38.8	46.6	42.2
Anaplastic astrocytoma	28.2	26.9	27.7
Unique astrocytoma variants	n.p.	n.p.	46.6
Glioblastoma	4.5	4.8	4.6
Oligodendroglioma	75.4	76.5	75.9
Anaplastic oligodendroglioma	46.9	49.5	48.0
Oligoastrocytic tumours	51.5	55.4	53.2
Ependymal tumours	82.4	79.3	81.0
Glioma malignant, NOS	30.6	28.2	29.5
Choroid plexus tumours	n.p.	n.p.	n.p.
Other neuroepithelial tumours	n.p.	n.p.	n.p.
Neuronal and mixed neuronal-glial tumours	n.p.	n.p.	n.p.
Tumours of the pineal region	n.p.	n.p.	53.7
Embryonal tumours	54.0	58.2	55.7

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.

Table A4.8: Five-year relative survival (%) from brain and other CNS cancer, by histology group and life stage, 1994–2013

Histology group	0–14 years	15–24 years	25–64 years	65+ years	Total
Neuroepithelial tissue	57.6	64.4	28.8	4.1	22.3
Pilocytic astrocytoma	n.p.	n.p.	n.p.	n.p.	n.p.
Diffuse astrocytoma	76.6	70.6	46.8	8.5	42.2
Anaplastic astrocytoma	n.p.	53.6	35.0	5.0	27.7
Unique astrocytoma variants	n.p.	n.p.	n.p.	n.p.	46.6
Glioblastoma	n.p.	28.2	7.2	1.5	4.6
Oligodendroglioma	86.6	93.5	78.0	45.8	75.9
Anaplastic oligodendroglioma	n.p.	n.p.	57.6	n.p.	48.0
Oligoastrocytic tumours	n.p.	82.4	60.2	n.p.	53.2
Ependymal tumours	65.9	87.5	87.5	74.6	81.0
Glioma malignant, NOS	64.4	60.8	41.8	5.1	29.5
Choroid plexus tumours	n.p.	n.p.	n.p.	n.p.	n.p.
Other neuroepithelial tumours	n.p.	n.p.	n.p.	n.p.	n.p.
Neuronal and mixed neuronal-glial tumours	n.p.	n.p.	n.p.	n.p.	n.p.
Tumours of the pineal region	n.p.	n.p.	n.p.	n.p.	53.7
Embryonal tumours	54.4	60.8	61.7	n.p.	55.7
Cranial and spinal nerves	n.p.	n.p.	n.p.	n.p.	50.6
Meninges	n.p.	n.p.	72.8	42.8	60.3
Germ cell tumours and cysts	83.1	89.4	80.5	n.p.	84.9
Sellar region	n.p.	n.p.	92.4	n.p.	80.1
Unclassified	63.7	84.1	44.9	2.4	13.8
Brain and other CNS cancer (C70–C72, C75.1–C75.3)	**59.4**	**67.4**	**30.6**	**5.1**	**23.6**

Note: See Table B1 for information on histology groupings.

Source: AIHW ACD 2013.

Additional tables for Chapter 5 Survivorship

Table A5.1: Five-year prevalence of brain and other CNS cancer, by age group, as at end of 2012

Age group	Number	Rate per 100,000
0–4	96	6.3
5–9	152	10.6
10–14	99	7.1
15–19	112	7.6
20–24	102	6.2
25–29	151	8.8
30–34	221	13.6
35–39	248	15.9
40–44	240	14.6
45–49	309	20.1
50–54	297	19.3
55–59	319	23.2
60–64	329	26.6
65–69	261	24.8
70–74	221	28.8
75–79	163	28.1
80–84	84	18.9
85+	40	9.4

Source: AIHW ACD 2013.

Additional tables for Chapter 6 Burden of disease

Table A6.1: Most common causes of cancer burden, by sex, in children (0–14 years), 2011

Males				Females			
Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden	Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden
1	*Brain and other CNS cancer (C70–C72)*	*1,415*	*29.4*	*1*	*Brain and other CNS cancer (C70–C72)*	*1,420*	*33.0*
2	Leukaemia (C91–C95)	1,031	21.4	2	Leukaemia (C91–C95)	426	9.9
3	Non-Hodgkin lymphoma (C82–C85)	258	5.4	3	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*328*	*7.6*
4	Kidney cancer (C64)	173	3.6	4	Kidney cancer (C64)	168	3.9
5	Liver cancer (C22)	163	3.4	5	Ovarian cancer (C56)	154	3.6
7	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*85*	*1.8*	—	—	—	—

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Table A6.2: Most common causes of cancer burden, by sex, in adolescents and young adults (15–24 years), 2011

Males				Females			
Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden	Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden
1	Leukaemia (C91–C95)	920	24.0	1	*Brain and other CNS cancer (C70–C72)*	*498*	*16.6*
2	*Brain and other CNS cancer (C70–C72)*	*514*	*13.4*	2	Leukaemia (C91–C95)	348	11.6
3	Bowel (colorectal) cancer (C18–C20)	273	7.1	3	Ovarian cancer (C56)	199	6.6
4	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*153*	*4.0*	4	Hodgkin lymphoma (C81)	149	5.0
5	Hodgkin lymphoma (C81)	151	3.9	5	Melanoma of the skin (C43)	141	4.7
—	—	—	—	*14*	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*15*	*0.5*

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Table A6.3: Most common causes of cancer burden, by sex, in adults (25–64 years), 2011

Males				Females			
Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden	Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden
1	Lung cancer (C33–C34)	39,451	19.7	1	Breast cancer (C50)	44,839	25.6
2	Bowel (colorectal) cancer (C18–C20)	22,061	11.0	2	Lung cancer (C33–C34)	27,447	15.7
3	*Brain and other CNS cancer (C70–C72)*	*13,286*	*6.6*	3	Bowel (colorectal) cancer (C18–C20)	16,783	9.6
4	Liver cancer (C22)	12,928	6.5	4	Ovarian cancer (C56)	10,322	5.9
5	Melanoma of the skin (C43)	12,864	6.4	*5*	*Brain and other CNS cancer (C70–C72)*	*7,877*	*4.5*
20	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*1,337*	*0.7*	*19*	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*1,191*	*0.7*

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Table A6.4: Most common causes of cancer burden, by sex, in older adults (65 years and over), 2011

Males				Females			
Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden	Rank	Cancer Type (ICD-10 code)	DALY	% of cancer burden
1	Lung cancer (C33–C34)	55,057	21.0	1	Lung cancer (C33–C34)	32,870	18.2
2	Prostate cancer (C61)	40,030	15.3	2	Breast cancer (C50)	25,427	14.1
3	Bowel (colorectal) cancer (C18–C20)	30,748	11.8	3	Bowel (colorectal) cancer (C18–C20)	22,473	12.4
4	Pancreatic cancer (C25)	12,603	4.8	4	Pancreatic cancer (C25)	12,371	6.8
5	Cancer of unknown primary site (C26, C39, C76, C77–C79, C80, C97)	11,904	4.6	5	Cancer of unknown primary site (C26, C39, C76, C77–C79, C80, C97)	9,783	5.4
13	*Brain and other CNS cancer (C70–C72)*	*6,242*	*2.4*	*10*	*Brain and other CNS cancer (C70–C72)*	*4,410*	*2.4*
21	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*1,216*	*0.5*	*22*	*Non-malignant tumours of the brain and other CNS (D32–D33, D42–D43)*	*1,405*	*0.8*

Notes

1. 'Other malignant neoplasms (cancers)' and 'other non-malignant neoplasms' are excluded from the rankings.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Table A6.5: Burden of brain and other CNS cancer, by YLL and YLD, sex and life stage, 2011

	Males			Female		
Life stage (years)	YLL	YLD	DALY	YLL	YLD	DALY
0–14	1,381	33	1,415	1,387	32	1,420
15–24	482	31	514	471	26	498
25–64	12,880	406	13,286	7,583	295	7,877
65+	5,995	248	6,242	4,225	185	4,410

Notes

1. YLL and YLD may not add to DALY due to rounding.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Additional tables for Chapter 7 Mortality

Table A7.1: Estimated mortality from brain and other CNS cancer, by age at death and sex, 2017

	Males		Females		Persons	
Age group	Number	Rate	Number	Rate	Number	Rate
0–4	5	n.p.	7	n.p.	12	n.p.
5–9	9	n.p.	9	n.p.	18	n.p.
10–14	6	n.p.	3	n.p.	8	n.p.
15–19	6	n.p.	5	n.p.	11	n.p.
20–24	6	n.p.	4	n.p.	10	n.p.
25–29	7	n.p.	4	n.p.	11	n.p.
30–34	18	n.p.	11	n.p.	29	1.6
35–39	23	2.7	15	n.p.	38	2.2
40–44	34	4.1	16	n.p.	50	3.0
45–49	49	5.9	33	3.9	82	4.9
50–54	57	7.4	31	4.0	88	5.7
55–59	85	11.4	54	7.1	140	9.2
60–64	116	17.5	63	9.2	178	13.2
65–69	131	22.5	88	14.6	219	18.5
70–74	124	26.2	90	18.1	213	22.1
75–79	99	30.3	71	19.9	169	24.9
80–84	61	29.1	51	19.4	112	23.7
85+	44	23.8	45	14.5	89	18.0

Note: The rates are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Table A7.2: Most common causes of death, for children (0–14 years), 2015

Rank	Cause of death (ICD-10)	Number	% of all deaths
1	Certain conditions originating in the perinatal period (P00–P96)	540	36.5
2	Congenital malformations, deformations and chromosomal abnormalities (Q00–Q99)	255	17.2
3	Other ill-defined causes (R00–R99)	137	9.3
4	Land transport accidents (V01–V89)	54	3.6
5	Accidental drowning and submersion (W65–W74)	32	2.2
7	*Brain cancer and other CNS (C70–C72, C75.1–C75.3)*	*28*	*1.9*

Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.

Source: AIHW National Mortality Database.

Table A7.3: Most common causes of death, for adolescents and young adults (15–24 years), 2015

Rank	Cause of death (ICD-10)	Number	% of all deaths
1	Intentional self-harm (suicide) (X60–X84)	391	33.9
2	Land transport accidents (V01–V89)	228	19.8
3	Accidental poisoning (X40–X49)	43	3.7
4	Other ill-defined causes (R00–R99)	36	3.1
5	Assault [homicide] (X85–Y09)	35	3.0
11	*Brain cancer and other CNS (C70–C72, C75.1–C75.3)*	*15*	*1.3*

Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.

Source: AIHW National Mortality Database.

Table A7.4: Most common causes of death, for adults (25–64 years), 2015

Rank	Cause of death (ICD-10)	Number	% of all deaths
1	Ischaemic heart diseases (I20–I25)	2,460	9.2
2	Intentional self-harm (suicide) (X60–X84)	2,149	8.0
3	Lung cancer (C33–C34)	2,034	7.6
4	Breast cancer (C50)	1,099	4.1
5	Accidental poisoning (X40–X49)	1,066	4.0
12	*Brain cancer and other CNS (C70–C72, C75.1–C75.3)*	*648*	*2.4*

Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.

Source: AIHW National Mortality Database.

Table A7.5: Most common causes of death, for older adults (65+ years), 2015

Rank	Cause of death (ICD-10)	Number	% of all deaths
1	Ischaemic heart diseases (I20–I25)	17,310	13.3
2	Dementia and Alzheimer disease (F01, F03, G30)	12,537	9.7
3	Cerebrovascular diseases (I60–I69)	10,157	7.8
4	Chronic lower respiratory diseases (J40–J47)	7,242	5.6
5	Lung cancer (C33–C34)	6,428	5.0
38	*Brain cancer and other CNS (C70–C72, C75.1–C75.3)*	*719*	*0.6*

Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.

Source: AIHW National Mortality Database.

Table A7.6: Trends in mortality for brain and other CNS cancer, 1982–2017

	Males		Females		Persons	
Year	Number	ASR	Number	ASR	Number	ASR
1982	393	6.3	298	4.3	691	5.3
1983	451	7.2	328	4.7	779	5.8
1984	464	7.1	358	5.0	822	6.0
1985	454	7.0	353	4.8	807	5.8
1986	441	6.5	305	4.0	746	5.2
1987	455	6.6	348	4.5	803	5.5
1988	502	7.2	372	4.7	874	5.8
1989	468	6.4	374	4.6	842	5.5
1990	535	7.5	424	5.3	959	6.3
1991	516	7.1	395	4.7	911	5.8
1992	563	7.5	425	5.0	988	6.2
1993	549	7.1	391	4.5	940	5.8
1994	564	7.3	442	5.0	1,006	6.1
1995	569	7.2	418	4.7	987	5.9
1996	613	7.6	418	4.6	1,031	6.0
1997	593	7.2	449	4.8	1,042	5.9
1998	581	6.9	448	4.7	1,029	5.7
1999	600	6.9	435	4.4	1,035	5.6
2000	640	7.2	473	4.7	1,113	5.9
2001	646	7.0	438	4.3	1,084	5.6
2002	665	7.1	505	4.9	1,170	5.9
2003	650	6.8	487	4.6	1,137	5.6
2004	652	6.7	457	4.3	1,109	5.4
2005	632	6.3	442	4.0	1,074	5.1
2006	636	6.2	455	4.0	1,091	5.1

(continued)

Table A7.6 continued: Trends in mortality for brain and other CNS cancer, 1982–2017

	Males		Females		Persons	
Year	Number	ASR	Number	ASR	Number	ASR
2007	693	6.6	485	4.2	1,178	5.4
2008	713	6.7	492	4.2	1,205	5.4
2009	700	6.4	486	4.0	1,186	5.2
2010	752	6.6	522	4.3	1,274	5.4
2011	770	6.7	518	4.1	1,288	5.3
2012	763	6.4	537	4.1	1,300	5.2
2013	763	6.3	550	4.2	1,313	5.2
2014	808	6.5	579	4.3	1,387	5.3
2015	857	6.7	553	4.0	1,410	5.3
2016	853	6.5	584	4.1	1,437	5.3
2017	878	6.5	599	4.1	1,477	5.3

Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Table A7.7: Age-standardised mortality rates of all brain and other CNS cancer, by sex and state and territory, 2011–2015

	Males		Females		Persons	
State	Number	ASR	Number	ASR	Number	ASR
New South Wales	1,274	6.6	813	3.8	2,087	5.1
Victoria	989	6.9	738	4.6	1,727	5.7
Queensland	776	6.8	544	4.5	1,320	5.6
Western Australia	409	7.0	264	4.2	673	5.6
South Australia	328	7.1	242	4.7	570	5.8
Tasmania	113	7.7	87	5.4	200	6.5
Australian Capital Territory	54	6.4	37	4.0	91	5.1
Northern Territory	17	n.p.	11	n.p.	28	3.1
Australia	**3,960**	**6.8**	**2,736**	**4.3**	**6,696**	**5.5**

Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Additional tables for Chapter 8 Spotlight on non-malignant tumours of the brain and other CNS

Table A8.1: Incidence of non-malignant tumours of the brain and other CNS, by age group and sex, Victoria, Queensland and Western Australia combined, 2013

	Males		Females		Persons	
Age group	Number	Rate	Number	Rate	Number	Rate
0–4	7	1.6	8	1.9	15	1.8
5–9	9	2.1	8	2.0	17	2.1
10–14	4	1.0	8	2.1	12	1.5
15–19	9	2.1	13	3.2	22	2.7
20–24	9	1.9	11	2.4	20	2.1
25–29	11	2.2	15	3.1	26	2.6
30–34	15	3.2	24	5.2	39	4.2
35–39	17	3.9	23	5.2	40	4.6
40–44	27	5.8	32	6.7	59	6.3
45–49	18	4.2	59	13.6	77	9.0
50–54	37	8.8	77	17.8	114	13.4
55–59	27	7.2	76	19.7	103	13.5
60–64	42	12.5	77	22.5	119	17.6
65–69	52	17.9	67	22.7	119	20.3
70–74	29	14.0	56	26.1	85	20.1
75–79	22	14.8	34	20.4	56	17.8
80–84	19	18.5	32	24.0	51	21.6
85+	18	22.1	37	25.3	55	24.2

Note: The rates are expressed per 100,000 population.

Source: AIHW ACD 2013.

Table A8.2: Trends in incidence of non-malignant tumours of the brain and other CNS, by sex, Victoria, Queensland and Western Australia combined, 2003–2013

	Males		Females		Persons	
Year	Number	ASR	Number	ASR	Number	ASR
2003	315	6.3	499	9.0	814	7.7
2004	249	4.8	520	9.2	769	7.1
2005	329	6.2	542	9.4	871	7.9
2006	351	6.5	567	9.5	918	8.0
2007	318	5.7	557	9.1	875	7.5
2008	290	5.1	614	9.9	904	7.5
2009	352	5.9	578	9.1	930	7.5
2010	347	5.8	637	9.7	984	7.8
2011	347	5.6	640	9.5	987	7.6
2012	395	6.2	672	9.9	1,067	8.1
2013	372	5.6	657	9.4	1,029	7.5

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Table A8.3: Age-standardised incidence rates of non-malignant tumours of the brain and other CNS, by sex and state, 2009–2013

	Males		Females		Persons	
State	Number	ASR	Number	ASR	Number	ASR
Victoria	835	5.9	1,520	9.9	2,355	8.0
Queensland	713	6.4	1,193	10.0	1,906	8.3
Western Australia	265	4.5	471	7.7	736	6.1
Total	**1,813**	**5.8**	**3,184**	**9.5**	**4,997**	**7.7**

Note: The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW ACD 2013.

Table A8.4: Five-year relative survival (%) from non-malignant tumours of the brain and other CNS, by sex and age group, Victoria, Queensland, Western Australia, 2009–2013

Age group	Males	Females	Persons
0–4	93.0	96.9	94.9
5–9	100.0	100.0	100.0
10–14	100.0	n.p.	100.0
15–19	96.5	100.0	97.9
20–24	98.0	97.1	97.6
25–29	100.0	97.0	98.6
30–34	97.1	100.0	98.8
35–39	94.7	98.8	97.3
40–44	95.9	97.9	97.3
45–49	99.5	99.4	99.4
50–54	94.2	96.6	96.0
55–59	94.6	95.9	95.5
60–64	99.0	96.8	97.5
65–69	86.3	93.7	91.2
70–74	71.5	92.6	85.4
75+	63.1	70.8	68.3
Total	**88.6**	**92.0**	**90.8**

Source: AIHW ACD 2013.

Table A8.5: Burden of non-malignant tumours of the brain and other CNS, by YLL and YLD, sex and life stage, 2011

	Males			Female		
Life stage (years)	**YLL**	**YLD**	**DALY**	**YLL**	**YLD**	**DALY**
0–14	73	11	85	317	11	328
15–24	136	17	153	0	15	15
25–64	913	423	1,337	825	368	1,191
65+	907	307	1,216	1,132	274	1,405

Notes

1. YLL and YLD may not add to DALY due to rounding.
2. See Appendix D for information on the ABDS 2011, including technical details on calculating fatal and non-fatal burden.

Source: AIHW Burden of Disease Database 2011.

Table A8.6: Mortality from non-malignant tumours of the brain and other CNS, by age group and sex, 2015

	Males		Females		Persons	
Age group	Number	Rate	Number	Rate	Number	Rate
0–4	n.p.	n.p.	n.p.	n.p.	6	n.p.
5–9	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
10–14	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
15–19	—	—	—	—	—	—
20–24	n.p.	n.p.	n.p.	n.p.	4	n.p.
25–29	n.p.	n.p.	n.p.	n.p.	4	n.p.
30–34	—	—	4	0.5	4	n.p.
35–39	4	0.5	4	0.5	8	n.p.
40–44	n.p.	n.p.	n.p.	n.p.	n.p.	n.p.
45–49	n.p.	n.p.	n.p.	0.3	5	n.p.
50–54	n.p.	n.p.	n.p.	0.3	7	n.p.
55–59	6	0.8	3	0.4	9	n.p.
60–64	n.p.	n.p.	n.p.	n.p.	6	n.p.
65–69	15	2.6	9	1.5	24	2.1
70–74	15	3.6	10	2.3	25	2.9
75–79	21	6.9	26	7.8	47	7.4
80–84	20	10.0	28	11.0	48	10.6
85+	24	14.0	53	17.8	77	16.4

Notes

1. Deaths registered in 2015 are based on the preliminary version of cause of death data and are subject to further revision by the ABS.
2. Data for 2015 are based on the year of *registration* of the death.
3. The rates are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Table A8.7: Trends in mortality of non-malignant tumours of the brain and other CNS, 2003–2015

	Males		Females		Persons	
Year	Number	ASR	Number	ASR	Number	ASR
2003	87	1.0	107	0.9	194	1.0
2004	92	1.0	106	0.9	198	1.0
2005	98	1.0	106	0.9	204	1.0
2006	127	1.4	138	1.1	265	1.2
2007	117	1.2	105	0.8	222	1.0
2008	111	1.1	133	1.0	244	1.0
2009	119	1.1	140	1.0	259	1.1
2010	128	1.2	117	0.8	245	1.0
2011	109	1.0	147	1.0	256	1.0
2012	130	1.1	129	0.9	259	1.0
2013	133	1.1	142	0.9	275	1.0
2014	121	1.0	141	0.9	262	1.0
2015	122	1.0	157	1.0	279	1.0

Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Table A8.8: Age-standardised mortality rates of non-malignant tumours of the brain and other CNS, by sex and state and territory, 2011–2015

	Males		Females		Persons	
State	Number	ASR	Number	ASR	Number	ASR
New South Wales	231	1.2	241	1.0	472	1.1
Victoria	139	1.0	173	0.9	312	1.0
Queensland	114	1.1	131	1.0	245	1.0
Western Australia	60	1.1	73	1.1	133	1.1
South Australia	48	1.1	62	1.0	110	1.0
Tasmania	16	n.p.	20	1.1	36	1.1
Australian Capital Territory	8	n.p.	10	n.p.	18	n.p.
Northern Territory	n.p	n.p.	n.p	n.p.	7	n.p.
Australia	**617**	**1.1**	**716**	**1.0**	**1,333**	**1.1**

Notes

1. Deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.
2. Actual mortality data from 1982 to 2014 are based on the year of *occurrence* of the death, and data for 2015 are based on the year of *registration* of the death.
3. The rates were age standardised to the 2001 Australian Standard Population and are expressed per 100,000 population.

Source: AIHW National Mortality Database.

Appendix B: Defining brain and other CNS cancer

The Central Brain Tumor Registry of the United States (CBTRUS) is an organisation responsible for providing descriptive statistical data on all primary benign and malignant brain and other central nervous system tumours in the United States. CBTRUS histology groupings are based on clinical relevance and *The 2007 WHO Classification of Tumours of the Central Nervous System* (Louis et al. 2007). This report uses the CBTRUS histology groupings to best capture the variation in brain and other CNS tumours while allowing comparisons to international data.

Table B1: CBTRUS histology groupings for malignant tumours of the brain and other CNS, modified for Australian context

Histology group	ICD-O-3 histology codes
Neuroepithelial Tissue	
Pilocytic astrocytoma	9425
Diffuse astrocytoma	9400, 9410, 9411, 9420
Anaplastic astrocytoma	9401
Unique astrocytoma variants	9381, 9424
Glioblastoma	9440, 9441, 9442
Oligodendroglioma	9450
Anaplastic oligodendroglioma	9451, 9460
Oligoastrocytic tumours	9382
Ependymal tumours	9391, 9392, 9393
Glioma malignant, NOS	9380
Choroid plexus tumours	9390
Other neuroepithelial tumours	9423, 9430
Neuronal and mixed neuronal-glial tumours	8680, 8693, 9505, 9522, 9523
Tumours of the pineal region	9362, 9395
Embryonal tumours	8963, 9364, 9470, 9471, 9472,9473, 9474, 9480, 9490, 9500, 9501, 9502, 9508
Cranial and Spinal Nerves	9540, 9560, 9561, 9571
Meninges	9530, 9538, 9539, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8815, 8830, 8850, 8851, 8852, 8853, 8854, 8857, 8890, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8990, 9040, 9150, 9170, 9180, 9260, 8720, 8728, 8770, 8771, 9220, 9231, 9240, 9243, 9370, 9371, 9372
Germ Cell Tumours and Cysts	8020, 8440, 9060, 9061, 9064, 9065, 9070, 9071, 9072, 9080, 9081, 9082, 9083, 9084, 9085, 9100, 9101
Sellar Region	8140, 8246, 8260, 8270, 8272, 8280, 8281, 8290, 8300, 8310, 8323
Unclassified	8000, 8001, 8002, 8003, 8004, 8005, 8010, 8021, 8320, 8710, 8711, 8811, 8840, 8896, 8980, 9120, 9130, 9133, 9140, 9503, 9580

Note: The original CBTRUS classification includes the code 9421/1 in group 1.01 and the codes 9431/1 and 9432/1 in group 1.10 even though they are not malignant. For the Australian context these codes have been classfied as non-malignant (see next table) because they are not notifiable in all jurisdictions.

Source: Ostrom et al. 2016.

Table B2: CBTRUS histology groupings for benign (/0) and uncertain-behaviour neoplasms (/1) of the brain and other CNS, modified for Australian context

Histology group	ICD-O-3 histology codes and behaviours
Neuroepithelial Tissue	
Pilocytic astrocytoma	9421/1
Unique astrocytoma variants	9384/1
Ependymal tumours	9383/1, 9394/1
Glioma malignant, NOS	9431/1, 9432/1
Choroid plexus tumours	9390/0,1
Other neuroepithelial tumours	9363/0, 9444/1
Neuronal and mixed neuronal-glial tumours	8680/0,1, 8681/1, 8690/1, 8693/1, 9412/1, 9413/0, 9442/1, 9492/0 (excluding site C75.1), 9493/0, 9505/1, 9506/1, 9509/1
Tumours of the pineal region	9360/1, 9361/1
Embryonal tumours	9490/0
Cranial and Spinal Nerves	9540/0,1, 9541/0, 9550/0, 9560/0,1, 9570/0, 9571/0, 9562/0
Meninges	9530/0,1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, 9539/1, 8324/0, 8800/0, 8810/0, 8815/0, 8824/0,1, 8830/0,1, 8831/0, 8835/1, 8836/1, 8850/0,1, 8851/0, 8852/0, 8854/0, 8857/0, 8861/0, 8870/0, 8880/0, 8890/0,1, 8897/1, 8900/0, 8920/1, 8935/0,1, 8990/0,1, 9040/0, 9136/1, 9150/0,1, 9170/0, 9180/0, 9210/0, 9241/0, 9373/0, 8728/0,1, 8770/0, 8771/0, 9161/1, 9220/0,1, 9535/0
Germ Cell Tumours and Cysts	8440/0, 9080/0,1, 9084/0
Sellar Region	8040/0,1, 8140/0,1, 8146/0, 8260/0, 8270/0, 8271/0, 8272/0, 8280/0, 8281/0, 8290/0, 8300/0, 8310/0, 8323/0, 9492/0 (site C75.1 only), 9582/0, 9350/1, 9351/1, 9352/1
Unclassified	9120/0, 9121/0, 9122/0, 9123/0, 9125/0, 9130/0,1, 9131/0, 9133/1, 8000/0,1, 8001/0,1, 8005/0, 8010/0, 8452/1, 8711/0, 8713/0, 8811/0, 8840/0, 9173/0, 9580/0

Note: The original CBTRUS classification includes the codes 9421/1, 9431/1 and 9432/1 (groups 1.01 and 1.04 in this table) with malignant neoplasms (see previous table). For the Australian context these codes have been classfied as non-malignant (see next table) because they are not notifiable in all jurisdictions.

Source: Ostrom et al. 2016.

Appendix C: Defining brain and other CNS cancer hospitalisations

Table C1: Definition of brain and other CNS cancer-related hospitalisations

Group	Definition	Codes
Brain and other CNS cancer	Principal diagnosis	C70, C71, C72, C75.1, C75.2, C75.3
	Additional diagnosis	C70, C71, C72, C75.1, C75.2, C75.3

Notes

1. Codes were sourced from the ninth edition of the ACHI (ACCD 2014, ACCD 2015).
2. Hospitalisation for which the care type was reported as Newborn with no qualified days and records for 'Hospital boarders' and 'Posthumous organ procurement' have been excluded from the analysis.

Table C2: Definition of chemotherapy procedures for brain and other CNS cancer-related hospitalisations

Block codes	Block Name
1920	Administration of pharmacotherapy
1922	Other procedures related to pharmacotherapy

Note: Codes were sourced from the ninth edition of the ACHI (ACCD 2014, ACCD 2015).

Table C3: Definition of surgical procedures for brain and other CNS cancer-related hospitalisations

Block codes	Block Name
1	Examination of skull, meninges or brain[(a)]
2	Cranial tap or puncture
3	Insertion of intracranial CSF devices
4	Removal of intracranial CSF devices
5	Irrigation, insertion or removal of intracranial CSF shunt
6	Other application, insertion or removal procedures on skull, meninges or brain
7	Incisional exploration of meninges or brain
8	Intracranial drainage
9	Intracranial decompression
10	Postoperative reopening of craniotomy or craniectomy site
12	Biopsy of brain or meninges
13	Excision of lesion of skull
15	Removal of intracranial lesion
16	Other intracranial excision
17	Skull base surgery for lesion
19	Ventriculostomy
20	Repair of dura of brain
21	Extracranial to intracranial bypass
22	Other repair of meninges or brain
23	Cranioplasty
24	Revision of intracranial CSF shunt
27	Functional intracranial stereotactic procedure
28	Other procedures on skull, meninges or brain
41	Insertion and removal of spinal CSF drain
42	Insertion and removal of spinal CSF shunt
50	Biopsy of spinal cord or meninges
53	Removal of spinal lesion
54	Other excision procedures on spinal canal or spinal cord structures
55	Repair of spinal canal or spinal cord structures
56	Revision procedures on spinal canal or spinal cord structures
58	Functional spinal stereotactic procedure
59	Other procedures on spinal canal or spinal cord structures
124	Biopsy of pituitary gland
125	Other excision procedures on pituitary gland
126	Other procedures on pituitary gland
122	Excision procedures on pineal gland
123	Other procedures on pineal gland

(a) Excludes procedure *40803–00–Intracranial stereotactic localisation* as this code is used to indicate the use of stereotactic localisation during another procedure.

Note: Codes were sourced from the ninth edition of the ACHI (ACCD 2014, 2015).

Appendix D: Data sources

AIHW Australian Cancer Database

All forms of cancer, except basal and squamous cell carcinomas of the skin, are notifiable diseases in each Australian state and territory. This means there is legislation in each jurisdiction that requires hospitals, pathology laboratories and various other institutions to report all cases of cancer to their central cancer registry. An agreed subset of the data collected by these cancer registries is supplied annually to the AIHW, where it is compiled into the ACD. The ACD currently contains data on all cases of cancer diagnosed from 1982 to 2012 for all states and territories, and for 2013 cases for all jurisdictions except NSW.

Cancer reporting and registration is a dynamic process, and records in the state and territory cancer registries may be modified if new information is received. As a result, the number of cancer cases reported by the AIHW for any particular year may change slightly over time and may not always align with state and territory reporting for that same year.

The Data Quality Statement for the ACD 2013 can be found at <http://meteor.aihw.gov.au/content/index.phtml/itemId/658607>.

AIHW National Mortality Database

The AIHW National Mortality Database contains information provided by the Registry of Births, Deaths and Marriages in each state and territory and the National Coronial Information System—and coded by the ABS—for deaths from 1964 to 2015. Registration of deaths is the responsibility of each state and territory Registry of Births, Deaths and Marriages. These data are then collated and coded by the ABS and are maintained at the AIHW in the NMD.

In the NMD, both the year in which the death occurred and the year in which it was registered are provided. For the purposes of this report, actual mortality data are shown based on the year the death occurred, except for the most recent year (namely 2015) where the number of people whose death was registered is used. Previous investigation has shown that the year of death and its registration coincide for the most part. However, in some instances, deaths at the end of each calendar year may not be registered until the following year. Thus, year of death information for the latest available year is generally an underestimate of the actual number of deaths that occurred in that year.

In this report, deaths registered in 2012 and earlier are based on the final version of cause of death data, deaths registered in 2013 are based on the revised version and deaths registered in 2014 and 2015 are based on preliminary versions and are subject to further revision by the ABS.

Due to the difference in data sources and analysis approaches, mortality data are not directly comparable with those published by individual state and territory cancer registries. Mortality data in this chapter were derived using the place of a person's residence at the time of *death*. In contrast, some state and territory cancer registries present mortality information based on a person's place of residence at the time of *diagnosis*. In the latter data, the deaths may or may not have occurred in the state or territory indicated.

The data quality statements underpinning the AIHW NMD can be found on the following ABS internet pages:

- ABS quality declaration summary for *Deaths, Australia* (ABS cat. no. 3302.0) <http://www.abs.gov.au/ausstats/abs%40.nsf/mf/3302.0/>
- ABS quality declaration summary for *Causes of death, Australia* (ABS cat. no. 3303.0) <http://www.abs.gov.au/ausstats/abs%40.nsf/mf/3303.0/>.

For more information on the AIHW NMD see *Deaths data at AIHW* <http://www.aihw.gov.au/deaths/aihw-deaths-data/>.

AIHW National Hospital Morbidity Database

The AIHW NHMD is a compilation of episode-level records from admitted patient morbidity data collection systems in Australian hospitals. The data supplied are based on the National Minimum Data Set (NMDS) for Admitted patient care; they include demographic, administrative and length of stay data, as well as data on the diagnoses of the patients, the procedures they underwent in hospital and external causes of injury and poisoning.

The purpose of the NMDS for admitted patient care is to collect information about care provided to admitted patients in Australian hospitals. The scope of the NMDS is episodes of care for admitted patients in all public and private acute and psychiatric hospitals, free-standing day hospital facilities, and alcohol and drug treatment centres in Australia. Hospitals operated by the Australian Defence Force, corrections authorities and in Australia's off-shore territories are not in scope, but some are included.

The Data Quality Statement for the AIHW NHMD 2014–15 can be found at <http://meteor.aihw.gov.au/content/index.phtml/itemId/638202>.

National Radiotherapy Waiting Times Database

The National Radiotherapy Waiting Times Database is a compilation of data supplied to the AIHW—based on the Radiotherapy Waiting Times National Minimum Data Set specification—which was collected from participating radiotherapy providers for the period 2015–16. Each record provides information relating to a course of radiotherapy that began in the reference period (that is, where the waiting period associated with the course of radiotherapy ended in the reference period). Other data collected includes administrative details, patient demographic characteristics and some clinical information, including principal diagnosis (ninth edition of ICD-10-AM).

The Data Quality Statement for the National Radiotherapy Waiting Times Database can be found at <http://meteor.aihw.gov.au/content/index.phtml/itemId/668535>.

National Death Index

The NDI is a database, housed at the AIHW, which contains records of all deaths occurring in Australia since 1980. The data are obtained from the Registrar of Births, Deaths and Marriages in each state and territory. The NDI is designed to facilitate the conduct of epidemiological studies and its use is strictly confined to medical research. Cancer incidence records from the ACD were linked to the NDI and used to calculate the survival and prevalence data presented in this report.

The Data Quality Statement for the NDI can be found at <http://meteor.aihw.gov.au/content/index.phtml/itemId/480010>.

Australian Burden of Disease Study

Data to develop the ABDS estimates for cancer were obtained from many different sources. Deaths data for the fatal burden were sourced from the NMD. Data for the non-fatal burden came from a variety of administrative sources including the ACD, the NHMD and Medicare Benefits Schedule (MBS) claims data, as well as a number of epidemiological studies.

Other inputs for the ABDS were obtained from the 2010 or 2013 Global Burden of Disease. These included the standard life table for fatal burden, health states and disability weights for the non-fatal burden and relative risks, and Theoretical Minimum Risk Exposure Distributions for the risk factor attribution. Population estimates underpinning all estimates were sourced from the Australian Demographic Statistics from the ABS.

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

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

As proportion of brain injury survivors is not currently available by remoteness or socioeconomic group, it was assumed to be constant across all subpopulations. The same rates were also assumed for 2003 estimates; however, as the ACD only contains data from 1982, the lifetime prevalence for 2003 has a much shorter look-back period, and will therefore be lower than for 2011.

Full details on the various methods, data sources and standard inputs are available in *Australian Burden of Disease Study 2011: methods and supplementary material* (AIHW 2016c) and *Burden of Cancer in Australia: Australian Burden of Disease Study 2011* (AIHW 2017b).

Population data

Throughout this report, population data were used to derive rates of, for example, cancer incidence and mortality. The population data were sourced from the ABS using the most up-to-date estimates available at the time of analysis.

To derive its estimates of the resident populations, the ABS uses the 5-yearly Census of Population and Housing data and adjusts it as described here:

- All respondents in the Census are placed in their state or territory, Statistical Local Area and postcode of usual residence; overseas visitors are excluded.
- An adjustment is made for persons missed in the Census.
- Australians temporarily overseas on Census night are added to the usual residence Census count.

Estimated resident populations are then updated each year from the Census data, using indicators of population change, such as births, deaths and net migration. More information is available from the ABS website at <www.abs.gov.au>.

Glossary

additional diagnosis: A diagnosis established after study to be a contributing factor to, or affecting, the patient's episode of care in hospital (or attendance at the health-care facility). Compare with **principal diagnosis**.

admitted patient: A person who undergoes a hospital's formal admission process to receive treatment and/or care. Such treatment or care can occur in hospital and/or in the person's home (as a 'hospital-in-home' patient).

age-standardisation: A method of removing the influence of age when comparing populations with different age-structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, and then the disease rates that would have occurred with that structure are calculated and compared.

age-standardised rate: A rate that results from removing the influence of age by converting the age-structures of the different populations to the same 'standard' structure. This provides a more valid way of comparing rates from populations with different age-structures.

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

cancer: Cancer, also called malignancy, is a term for diseases in which abnormal cells divide without control and can invade nearby tissues. Cancer cells can also spread to other parts of the body through the blood and lymph systems.

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

disability-adjusted life year (DALY): A year of healthy life lost, either through premature death or equivalently through living with disability due to illness or injury. It is the basic unit used in *burden of disease and injury* estimates.

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).

impairment: Any loss or abnormality of psychological, physiological or anatomical structure or function.

incidence: The number of new cases (of an illness or event, and so on) occurring during a given period. Compare with **prevalence**.

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

Medicare: A national, government-funded scheme that subsidises the cost of personal medical services for all Australians and aims to help them afford medical care. The Medicare Benefits Schedule (MBS) is the listing of the Medicare services subsidised by the Australian Government. The schedule is part of the wider Medicare Benefits Scheme (Medicare).

mortality: Death.

mortality rate: The number of deaths in a given period, adjusted to take account of population age-structure, expressed per 100,000 population.

neoplasm: An abnormal ('neo', new) growth of tissue. Can be 'benign' (not a cancer) or 'malignant' (a cancer). Same as a **tumour**.

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

principal diagnosis: The diagnosis listed in hospitals records to describe the problem that was chiefly responsible for the patient's episode of care in hospital.

radiotherapy: Radiation directed at a localised area to kill or damage cancer cells. There are several types of radiotherapy. This report focuses on megavoltage external beam radiotherapy delivered by linear accelerator machines.

relative survival: A measure of the average survival experience of a population of people diagnosed with cancer, relative to the 'average' Australian of the same sex and age, at a specified interval after diagnosis (usually 5 or 10 years).

separation: An episode of care for an **admitted patient** which may include a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay that begins or ends in a change of type of care (for example, from acute to rehabilitation). In this report, separations are also referred to as **hospitalisations**.

tumour: See neoplasm.

years lived with disability (YLD): YLD is calculated as the prevalence of a condition multiplied by a disability weight for that condition. This is also sometimes referred to as years of healthy life lost due to disability (YLD).

years of healthy life lost due to disability (YLD): For each new case of cancer, YLD equals the average duration of the cancer (to remission or death) multiplied by a severity weight for cancer (which depends upon its disabling effect over the disease duration).

years of life lost (YLL): For each new case, YLL equals the number of years between premature death and the standard life expectancy for the individual.

References

ACCD (Australian Consortium for Classification Development) 2014. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM)—9th edn.—Tabular list of diseases, and Alphabetic index of diseases. Adelaide: Independent Hospital Pricing Authority.

ACCD 2015. The Australian Classification of Health Interventions (ACHI)—9th edn.—Tabular list of interventions, and Alphabetic index of interventions. Adelaide: Independent Hospital Pricing Authority.

AIHW (Australian Institute of Health and Welfare) 2013. Health system expenditure on cancer and other neoplasms in Australia 2008–09. Cancer series no. 81. Cat. no. CAN 78. Canberra: AIHW.

AIHW 2016a. Radiotherapy in Australia: report on the second year of a pilot collection 2014–15. Cat. no. HSE 181. Canberra: AIHW.

AIHW 2016b. Australian Burden of Disease Study: impact and causes of illness and death in Australia 2011. Australian Burden of Disease Study series no. 3. Cat. no. BOD 4. Canberra: AIHW.

AIHW 2016c. Australian Burden of Disease Study 2011: methods and supplementary material. Australian Burden of Disease Study series no. 5. Cat. no. BOD 6. Canberra: AIHW.

AIHW 2017a. Admitted patient care 2015–16: Australian hospital statistics. Health services series no. 60. Cat. no. HSE 156. Canberra: AIHW.

AIHW 2017b. Burden of cancer in Australia: Australian Burden of Disease Study 2011. Australian Burden of Disease Study series no. 12. Cat no. BOD 13. Canberra: AIHW.

AIHW 2017c. Cancer in Australia 2017. Cancer series no. 101. Cat. no. CAN 100. Canberra: AIHW.

AIHW & AACR (Australasian Association of Cancer Registries) 2014. Cancer in Australia: an overview 2014. Cancer series no. 90. Cat. no. CAN 88. Canberra: AIHW.

Black R, Sankaranarayanan R & Parkin D 1998. Interpretation of population-based cancer survival data. In: Black R, Sankaranarayanan R & Parkin D (eds). Cancer survival in developing countries. Lyon: IARC (International Agency for Research on Cancer) Scientific Publication.

Brinkman T, Liptak C, Delaney B, Chordas C, Muriel A & Manley P 2013. Suicide ideation in pediatric and adult survivors of childhood brain tumors. Journal of Neuro-Oncology 113(3):425–32.

Cancer Australia 2017. Types of children's cancers: Brain and other central nervous system tumours. Viewed 15 November 2017, <https://childrenscancer.canceraustralia.gov.au/types-childrens-cancers>.

CCA (Cancer Council Australia) 2016. Understanding brain tumours: a guide for people with brain or spinal cord tumours, their families and friends. Sydney: CCA.

CCA & COSA (Clinical Oncological Society of Australia) 2011. Adult gliomas (astrocytomas and oligodendrogliomas): a guide for patients, their families and carers. Sydney: CCA/COSA.

CCA, Australian Cancer Network & COSA 2009. Clinical practice guidelines for the management of adult gliomas: astrocytomas and oligodendrogliomas. 1st edn. Sydney: CCA.

Gehrke A, Baisley M, Sonck A, Wronsk, S & Feuerstein M 2013. Neurocognitive deficits following primary brain tumor treatment: systematic review of a decade of comparative studies. Journal of Neuro-Oncology 115(2):135–42.

Ho V, Reijneveld J, Enting R, Bienfait H, Robe P, Baumert B et al. 2014. Changing incidence and improved survival of gliomas. European Journal of Cancer 50(13):2309–18.

IARC (International Agency for Research on Cancer) 2011. Possible relationship between use of mobile phones and the risk of cancer: Questions and Answers. Viewed 29 May 2017, <https://www.iarc.fr/en/media-centre/iarcnews/2011/IARC_Mobiles_QA.php>.

IARC 2014. World cancer report 2014. Lyon, France: IARC.

Jackson J, Scheid K & Rolnick S 2013. Development of the Cancer Survivorship Care Plan: what's next? Life after cancer treatment. Clinical Journal of Oncology Nursing 17:280–4.

Keir S, Swartz J & Friedman, H 2007. Stress and long-term survivors of brain cancer. Supportive Care in Cancer 15(12):1423–8.

Kennedy DN, Lange N, Makris N, Bates J, Meyer J & Caviness Jr VS 1998. Gyri of the human neocortex: an MRI-based analysis of volume and variance. Cerebral Cortex 8(4):372–84.

Kleihues P, Louis DN, Scheithauer BW, Rorke LB, Reifenberger G, Burger PC et al. 2002. The WHO Classification of Tumors of the Nervous System. Journal of Neuropathology and Experimental Neurology 61(3):215–25.

Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK et al. 2016. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathologica 131:803.

Louis DN, Ohgaki H, Wiestler OD, Cavenee WK, Burger PC, Jouvet A et al. 2007. The 2007 WHO Classification of Tumours of the Central Nervous System. Acta Neuropathologica 114(2):97–109.

McCarthy BJ, Schellinger KA, Propp JM, Kruchko C, & Malmer B 2009. A case for the worldwide collection of primary benign brain tumors. Neuroepidemiology 33(3):268–75.

Mitby PA, Robison LL, Whitton JA, Zevon MA, Gibbs IC, Tersak JM et al. 2003. Utilization of special education services and educational attainment among long-term survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. Cancer 97(4):1115–26.

National Cancer Institute 2015. National Cancer Institute Dictionary of Cancer Terms. Bethesda, Maryland: National Cancer Institute. Viewed 5 November 2016, <http://www.cancer.gov/publications/dictionaries/cancer-terms?expand=S>.

Neglia J, Robison L, Stovall M, Liu Y, Packer R, Hammond S et al. 2006. New primary neoplasms of the central nervous system in survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. Journal of the National Cancer Institute 98(21):1528–37.

Ness K, Mertens A, Hudson M, Wall M, Leisenring W, Oeffinger K et al. 2005. Limitations on physical performance and daily activities among long-term survivors of childhood cancer. Annals of Internal Medicine 143(9):639.

Nolan V, Gapstur R, Gross C, DeSain L, Neglia J, Gajjar A et al. 2013. Sleep disturbances in adult survivors of childhood brain tumors. Quality of Life Research 22(4):781–9.

NZMOH (New Zealand Ministry of Health) 2012. Ways and means: a report on methodology from the New Zealand Burden of Diseases, Injuries and Risk Factors Study, 2000–2016. Wellington: New Zealand Ministry of Health.

Ostrom Q, Gittleman H, Xu J, Kromer C, Wolinsky Y, Kruchko C et al. 2016. CBTRUS Statistical Report: primary brain and other central nervous system tumors diagnosed in the United States in 2009–2013. Neuro-Oncology 18(5):v1–v75.

Packer RJ, Gurney JG, Punyko JA, Donaldson SS, Inskip PD, Stovall M et al. 2003. Long-term neurologic and neurosensory sequelae in adult survivors of a childhood brain tumor: Childhood Cancer Survivor Study. Journal of Clinical Oncology 21(17):3255–61.

Palmer SL, Goloubeva O, Reddick WE, Glass JO, Gajjar A, Kun L et al. 2001. Patterns of intellectual development among survivors of pediatric medulloblastoma: a longitudinal analysis. Journal of Clinical Oncology 19(8):2302–8.

Porter KR, McCarthy BJ, Freels S, Kim Y & Davis FG 2010. Prevalence estimates for primary brain tumors in the United States by age, gender, behavior and histology. Neuro-Oncology 12(6):520–7.

Porth C 2007. Essentials of pathophysiology: concepts of altered health states. 2nd edn. Philadelphia: J.B. Lippincott.

Ribi K, Relly C, Landolt MA, Alber FD, Boltshauser E & Grotzer MA 2005. Outcome of medulloblastoma in children: long-term complications and quality of life. Neuropediatrics 36(6):357–65.

Rooney A, Brown P, Reijneveld J & Grant R 2013. Depression in glioma: a primer for clinicians and researchers. Journal of Neurology, Neurosurgery and Psychiatry 85(2):230–5.

Schultz K, Ness K, Whitton J, Recklitis C, Zebrack B, Robison L et al. 2007. Behavioral and social outcomes in adolescent survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. Journal of Clinical Oncology 25(24):3649–56.

Taphoorn M & Klein M 2004. Cognitive deficits in adult patients with brain tumours. The Lancet Neurology 3(3):159–68.

Willard V, Hardy K, Allen T, Hwang E, Gururangan S, Hostetter S et al. 2013. Sluggish cognitive tempo in survivors of pediatric brain tumors. Journal of Neuro-Oncology 114(1):71–8.

Wilne S, Collier J, Kennedy C, Jenkins A, Grout J, Mackie S et al. 2012. Progression from first symptom to diagnosis in childhood brain tumours. European Journal of Pediatrics 171(1):87–93.

WCRF (World Cancer Research Fund) & AICR (American Institute for Cancer Research) 2007. Food, nutrition, physical activity, and the prevention of cancer: a global perspective. Washington, DC: AICR.

Zebrack B, Gurney JG, Oeffinger K, Whitton J, Packer RJ, Mertens A et al. 2004. Psychological outcomes in long-term survivors of childhood brain cancer: a report from the Childhood Cancer Survivor Study. Journal of Clinical Oncology 22(6):999–1006.

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Related publications

The following AIHW publications relating to cancer might be of interest:

- AIHW 2014. Head and neck cancers in Australia. Cancer series no. 83. Cat. no. CAN 80. Canberra: AIHW.
- AIHW 2015. Breast cancer in young women: key facts about breast cancer in women in their 20s and 30s. Cancer series no. 96. Cat. no. CAN 94. Canberra: AIHW.
- AIHW 2016. Skin cancer in Australia. Cat. no. CAN 96. Canberra: AIHW.
- AIHW 2017. Cancer in Australia 2017. Cancer series no. 101. Cat. no. CAN 100. Canberra: AIHW.

This report is the first national report to present key data specific to brain and other central nervous system (CNS) cancer. While brain and other CNS cancer is rare, it has a substantial social and economic impact on individuals, families and community. Non-malignant brain and other CNS tumours also cause significant morbidity and mortality.

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