SURVIVAL AND PREVALENCE REPORT

Brain Tumour Registry of Canada (BTRC): Survival and Prevalence Report 2010–2017

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Executive Summary

This report builds on previous reports by providing the most up-to-date data on the survival experience of patients with primary CNS tumours in Canada, with estimates of net survival and median survival among all Canadians (excluding Quebec) diagnosed from 2010-2017. Additionally, we present the first Canadian-wide estimates of primary CNS tumour prevalence.

Estimated 1- and 5-year net survival was higher for non-malignant CNS tumours (1-year: 90%; 5-year: 84%), relative to those with malignant behaviours (1-year: 50%; 5-year: 23%). Of classifiable histological subtypes, 8 were associated with median survival time more than 8 years. The shortest median survival was among patients with glioblastoma (8 months) or lymphoma (12 months). Survival estimates presented in this report were consistent with those estimated in previous reports using a subset of Canadian data, and published estimates from other jurisdictions.

Males and females had comparable survival time for most histological groupings. Females with meningioma had slightly longer survival time relative to males. Conversely, males with glioblastoma and malignant gliomas not otherwise specified (NOS) had slightly longer survival time relative to females. Younger age was associated with longer survival time. However, the AYA age category had the longest survival time for glioblastoma, anaplastic astrocytoma, malignant ependymoma, and malignant glioma NOS.

At the index date of January 1, 2018, there were an estimated 37,575 patients living with a primary CNS tumour in Canada. Of these, 80.4% were non-malignant, which is consistent with the longer survival time among those diagnosed with non-malignant tumours. The prevalence of primary CNS tumours was slightly higher in males than females. These estimates provide a measure of the disease burden from primary CNS tumours.

While this report contains the most comprehensive and up-to-date data on the survival experience among Canadians with primary CNS tumours, data from Quebec continues to be missing. We applied the prevalence proportion estimated in other provinces/territories to the Quebec population to get the prevalence counts estimate for Canada. As time passes since the initiation of supplementary case ascertainment activities for non-malignant CNS tumours, more data will be available, permitting further refinement of tumour classifications. Additionally, one of the scientific directions of the Brain Tumour Registry of Canada is to identify strategies for ensuring routine and complete capture of molecular marker data in provincial/territorial cancer registries. We anticipate including these tumour characteristics in our classification schema in future reports.

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INTRODUCTION

The objective of this report is to present estimates of survival and prevalence among Canadians diagnosed with primary central nervous system (CNS) tumours from 2010 to 2017. Estimates are presented by various tumour- and person-based characteristics, and by province. At the time of analysis, Quebec data on tumour diagnoses were not available beyond 2010, so all estimates exclude Quebec. This report builds off previous reports released by the Brain Tumour Registry of Canada (BTRC), to provide the most up-to-date and comprehensive surveillance data for CNS tumours in Canada.

BACKGROUND

The BTRC is a surveillance research collaborative established in 2016, with the aim of enhancing surveillance of CNS tumours diagnosed in Canada. Ongoing efforts have involved working to improve the quality of CNS tumour data available in Canadian cancer registries, as well as provide routine reporting of the incidence and survival experience by histology and behaviour.

Data quality improvements have focused on increasing the capture of non-malignant CNS tumours by Canadian cancer registries. This effort is in response to the private members' motion passed in 2007, which mandated the collection of these tumours (Private Members' Bill MB235, 2007). This work began with a collaboration across four provinces: British Columbia, Alberta, Manitoba and Ontario. These provinces participated in additional case-ascertainment activities, meetings and workshops to identify strategies for improving the routine capture of non-malignant CNS tumours in cancer registries. These four provinces contributed data on all primary CNS tumour diagnoses from 2010-2015, compiled in two reports released by the BTRC (Smith et. al., 2019; Smith et. al., 2019). Since these reports, we obtained data from the Canadian Cancer Registry (CCR), to provide current estimates for more regions of Canada. The first report using pan-Canadian data summarized incidence and mortality rates by tumour and demographic characteristics (Walker et. al., 2021). The focus of the second and current pan-Canadian report is to provide complimentary survival and prevalence estimates. Data used in these two reports can be obtained by the research community through Statistics Canada, or through each individual cancer registry.

Brain cancers have the worst overall net survival of all cancer types diagnosed among Canadians (Ellison, 2018). However, these estimates are based on all CNS tumours combined. Primary CNS tumours are heterogeneous, with a high degree of variation in diagnosis, treatment and prognosis depending on the type of tumour. To be more informative to the clinical and research communities, estimates should be provided for histology subgroups. Clinical studies characterize prognosis in relatively controlled environments providing evidence of patient outcomes in the context of optimal care. Population surveillance studies, such as this one, describe patient outcomes in a real-world setting and are complementary to clinical data. To reflect the ongoing transition in cancer registries from capturing data on ma-

lignant CNS tumours to data on all primary CNS tumours, whether malignant or non-malignant, we also provide information by behaviour code.

METHODOLOGICAL NOTES

Data Sources

The CCR is a population-based database comprised of tumours diagnosed and corresponding deaths among Canadian residents since 1992 (Statistics Canada, 2021). The CCR is a dynamic database, meaning information is updated as it becomes available. The CCR data file used for this analysis, which included death information linked from the Canadian Vital Statistics Death database (CVSD) and T1 Personal Master Files (T1PMF), was accessed in collaboration with the Research Data Center at U of A and under the approval of Statistics Canada (Statistics Canada, 2021). This file contains information on all primary tumour diagnoses among Canadian residents and their vital status between January 1, 1992 and December 31, 2017. Data are collected by each provincial/territorial cancer registry, who are mandated by their respective health legislations to collect information on all primary tumour diagnoses among residents of their jurisdictions. Statistics Canada compiles the submission of cancer diagnosis data from each province/territory into the CCR (Statistics Canada, 2021). It is a passive surveillance system that relies on healthcare providers and laboratories to report new cases to provincial/territorial health agencies for inclusion in disease registries. The cancer diagnosis data in CCR is then linked to the CVSD and additional death information comes through the T1PMF with a cut-off date of December 31, 2017 (Statistics Canada, 2021). The CCR death-linked file was compiled using National Cancer Institute Surveillance, Epidemiology, and End Results Program rules for 2007 and onward (Statistics Canada, 2021).

Due to delays in reporting, undercounting of cases is most prominent in the last reported diagnosis year of 2017. The under-reporting is estimated to be 2% to 3% for all cancers combined (Statistics Canada, 2021). Additionally, tumours diagnosed and deaths occurring in Quebec residents are not collected by CCR due to data sharing agreement issues, estimates for Canada are based on all provinces and territories excluding Quebec.

Missing Dates. Records of individuals with completely missing date of birth and/or death were removed. When the year is not missing but month and/or date is missing, the missing data is imputed with an average of all potential month and/or date.

Tumour Classification Methods

Tumours can be classified according to their site (topography), histology, behaviour, molecular features, or some combination of these characteristics. At present, data on the molecular features of these tumours are not routinely available in the CCR. Therefore, disease groups presented in this report reflect a combination of topography, histology, and behaviour. The classification system used by cancer registries in Canada is the International Classification of Diseases for Oncology, 3rd edition, or ICD-O-3 (Canadian Cancer Statistics Advisory

Committee, 2019). This multiaxial classification system assigns alphanumeric codes for the anatomical site of the tumour (topography) and numeric codes for the histology and behaviour. Primary CNS tumours were defined as those occurring at the following ICD-O-3 sites: C70.0–C70.9, C71.0–71.9, C72.0–C72.9, C75.1–C75.3, and C30.0 (limited to histology codes 9522–9523). Histology codes were grouped into categories based on classifications used by the Central Brain Tumour Registry of the U.S. (CBTRUS) (Appendix) (Forjaz et al., 2021). Primary CNS tumours without sufficient information on pathology or not classifiable according to the schema developed by CBTRUS were grouped into a category called "unclassified tumours" (Appendix). Primary CNS tumours are categorized as having one of three behaviours: benign, uncertain whether benign or malignant, or malignant. For simplicity, we dichotomize tumours as either non-malignant (including benign and uncertain) or malignant. It should be noted that while behaviour codes are aligned with each histological diagnosis according to the World Health Organization Classification of Tumours, the two categories in this report reflect traditional (malignant) and current (malignant and non-malignant) criteria used by cancer registries for case reporting. As such, stratification by behaviour demonstrates the value added and the transition in CNS tumour reporting taking place to be consistent with MB235.

Data Analysis

We included CNS tumour diagnoses from January 1, 2010 or later as registration and surveillance of non-malignant tumours significantly improved from 2010 and onwards. Demographic variables are sex, age group (categories include: children 0-14, adolescents and young adults 15-39, adults 40-64, older adults 65+ years old), and region ("Atlantic Region" consisting of Newfoundland and Labrador, New Brunswick, Nova Scotia, and Prince Edward Island; British Columbia; Ontario; "Prairie Region" consisting of Alberta, Saskatchewan, Manitoba).

The main measures presented in this report are net survival and prevalence. For comparison across regions, age standardized net survival and prevalence rates are reported with the 2011 Canadian standard population as the reference population. The direct method was used for age-standardization to account for differences in population age structure, which allows comparison across different geographic regions and over time.

Population estimates for all rate calculations were obtained from Statistics Canada (Canadian Cancer Statistics Advisory Committee, 2019). A macro program written by Paul Dickman (Dickman 2011) and adapted to calculate Pohar-Perme net survival by Ron Dewar (Cancer Care Program of Nova Scotia Health Authority) was used in SAS (version 9.4). Figures were generated using R (version 4.1.2) (R Core Team, 2022). Individuals may be diagnosed with more than one primary CNS tumour. That is, multiple tumours originating in the brain or another part of the CNS independently and not metastasizing from another tumour. For patients with multiple CNS tumours, regardless of whether they are of the same type or multiple types, only the first brain tumour diagnosis was considered in the

survival analysis and the last brain tumour diagnosis occurrence was considered in the prevalence estimate.

Prevalence. Prevalence gives a snapshot of the number of patients alive with a certain disease in a population at a given time, referred to as the index date (Pearce et. al., 2005). The prevalence data file was created using the CCR imputed death file and the index date was set to Jan 1, 2018. Prevalence counts or proportions were estimated for the *attained age* at the index date.

Person-based prevalence counts refer to the number of people diagnosed with primary CNS tumours between Jan 1, 2010 and Dec 31, 2017 and still alive as of the index date. To estimate the number of prevalent cases, we first divided the number of cases in the CCR by the Canadian population (excluding Quebec) at the index date, to obtain a prevalence proportion. This proportion was then multiplied by the Canadian population (including Quebec) to estimate the number of prevalent cases at the index date. The 95% confidence intervals of the prevalence proportions were estimated based on the Poisson distribution.

The prevalence calculated in this report is based on a defined time period. It differs from point prevalence, which includes all cases of cancer at a specific point in time. As we only included diagnosed after Jan 1, 2010, cases diagnosed before the cut-off date were not included. Thus, we report the limited duration person-based prevalence count and prevalence proportion.

Net Survival. Net survival is a common measure of cancer prognosis that provides an estimate of the probability of surviving cancer in the absence of other causes of death (National Cancer Institute, 2021). It provides estimates of patient outcomes that take account for the mortality experience of the patient population relative to the general population.

The survival data file was created using the CCR imputed death file and limited to CNS tumours excluding tumours diagnosed solely through death certificate or autopsy. For the remaining patient records, if an individual was diagnosed and died on the same day, the date of diagnosis was changed to be 1 day prior to the date of death to prevent the record from being excluded from the survival analysis. Lastly, all tumours diagnosed in patients whose age was greater than 99 years old were excluded as the net survival approach excludes this age group.

For net survival, we used the Pohar-Perme method of estimation through the period approach using three years combined method to estimate the 1-, 2- and 5- years net survival rates (Seppä et al., 2015; Coviello et al., 2015). Net survival is estimated quarterly over the first two years and biannually thereafter to 5 years. The Kaplan-Meier method was used to estimate the median survival time.

Estimated net survival rate greater than 1.0 were replaced by 1.0, indicating no survival disadvantage associated with the corresponding CNS tumour diagnosis.

Median Survival. The median survival time uses the cancer patient file generated during survival analysis. The data was extracted from the CCR with cases limited according to rules described above. Survival was calculated using the Kaplan-Meier method and the time at which 50% of patients died was deemed as the median survival duration (Dudley, et al., 2016). Median survival is estimated for groups with at least 16 diagnoses to ensure an accurate estimation of median survival time without large variations due to sparse data.

Disclosure Rules and Rounding. Several measures were taken to protect the confidentiality of individuals underlying the data. All counts reported are randomly rounded using an unbiased random rounding scheme with a base of five. Estimates of prevalence case counts based on fewer than five but greater than zero observed cases or could disclose which category have fewer than five observed cases are suppressed. If the standard error of the net survival estimate was ≥0.10, or less than 10 patients contributed to the net survival estimate, then the estimate was suppressed. Age-standardized net survival estimates were suppressed if any of the contributing age-groups had a follow-up interval with no person at risk or no deaths occurring among <10 people. If the net survival estimates had a standard error >0.05 but < 0.10, they are italicized to highlight uncertainty around the estimate and the need for cautious interpretation.

RESULTS

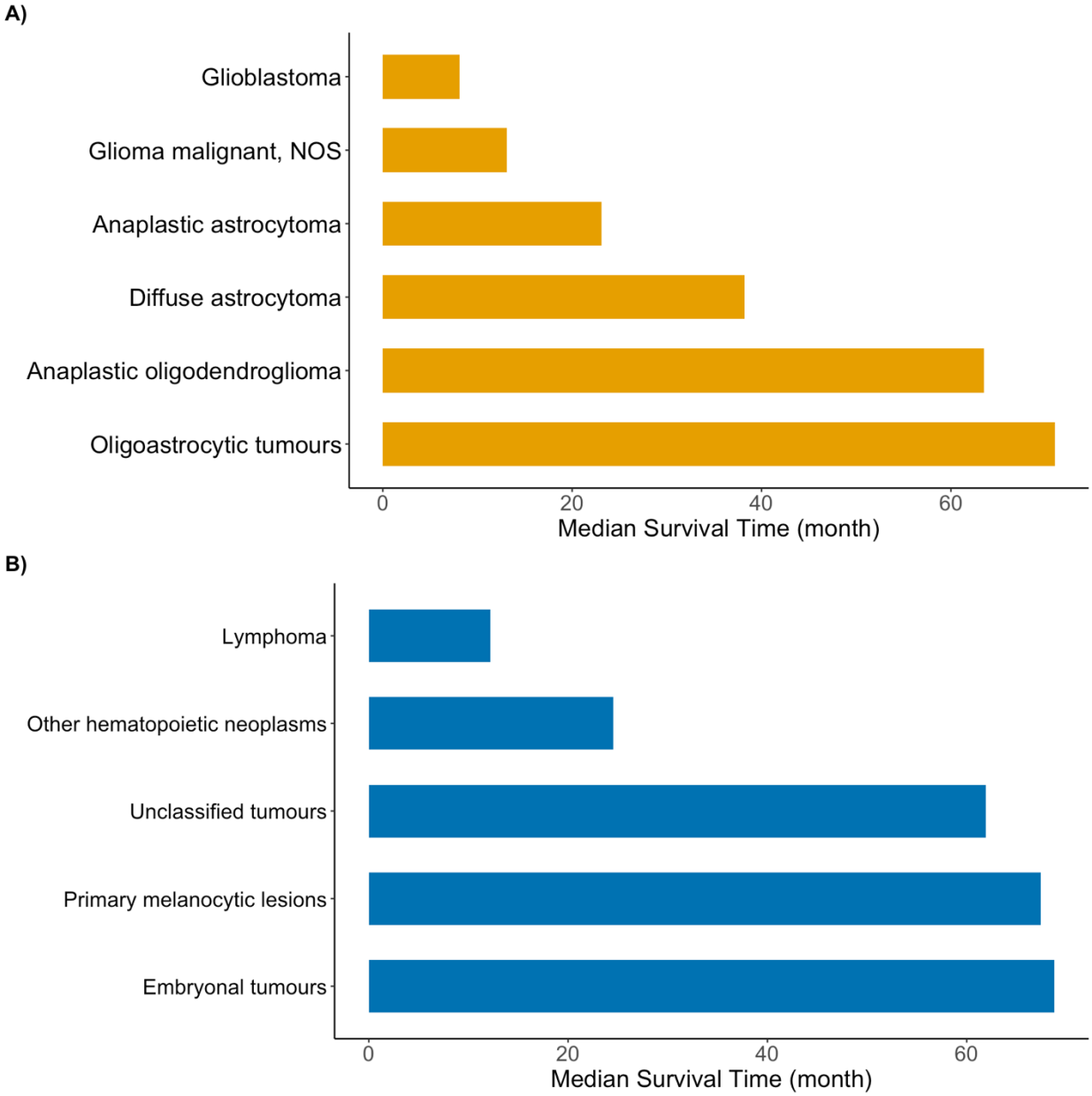
Survival

A total of 40,235 patients diagnosed between 2010 and 2017 in Canada (excluding Quebec) contributed to the primary CNS tumour net survival estimates in this report. Of these, 38,510 were aged 15–99 and 1,725 were children (age 0–14). Survival estimates are presented in Tables 1-7.

The overall 1-, 2- and 5-year net survival rates for all primary CNS tumours diagnosed in patients aged 15-99 years were 75.6%, 68.6% and 61.9%, respectively (Table 1). Survival varied greatly by histology group and behaviour. For malignant primary CNS tumours, the 1- and 5-year net survival rates were 49.7% and 23.0%. The median survival length ranged from 8 months for glioblastoma, 12 months for lymphoma, 13 months for malignant glioma not otherwise specified (NOS), 23 months for anaplastic astrocytoma, to more than 8 years for eight other histology groups (Table 2, Figure 1).

For non-malignant primary CNS tumours, these rates were: 1-year: 90.3%; and 5-year: 83.7% (Table 2). The median survival time for non-malignant primary CNS tumour was over 8 years for all except the unclassified tumours histology group, which was at 7 years and 4 months, the 5-year net survival rates ranged from 62.9% (95%CI 60.9-64.9%) for the unclassified tumours to 100.0% for unique astrocytoma variants and germ cell tumours, cysts and heterotopias, while they ranged from 85.4% to 98.4% for other histology types.

Figure 1: Median survival time (in months) for selected malignant primary CNS tumours diagnosed in patients 15-99 years of age from 2010-2017.



Notes: The Median survival time was greater than 8 years (96 months) for the other histology types, i.e. pilocytic astrocytoma, unique astrocytoma variants, oligodendroglioma, ependymal tumours, choroid plexus tumours, neuronal and mixed neuronal-glial tumours, tumours of the pineal region, tumours of cranial and spinal nerves, meningioma, mesenchymal tumours, other neoplasms related to the meninges, germ cell tumours, cysts and heterotopias and tumours of sellar region.

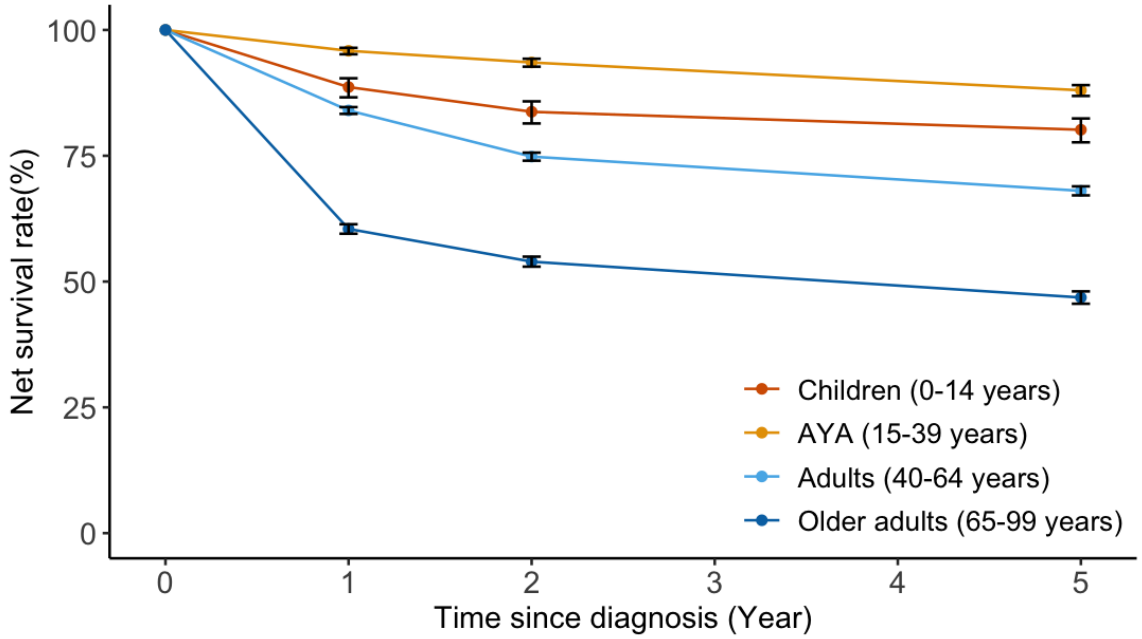
Sex. Survival of primary CNS tumours diagnosed in patients aged 15-99 years stratified by sex were shown in Tables 3 and 4 (stratified further by tumour behaviour). For most histology types, males and females had comparable survival (Table 3). Females had better net survival rates for meningioma (e.g. 87.2%, 95%CI 85.7-88.5% vs. 81.0%, 95%CI 78.3-83.4% at 5-years) and unclassified tumours (e.g. 61.2%, 95%CI 58.6-63.6% vs. 54.1%, 95%CI 51.1-57.9% at 5-year) (Table 3). When further stratified by tumour behaviour (Table 4), the respective median survival for males and females were 8.3 and 7.8 months for glioblastoma, 14.2 and 11.4 months for malignant glioma NOS, and more than 8 years for all but one non-malignant histology groups (Table 4). Females had better net survival rates than males at 1-year post-diagnosis in diffuse astrocytoma (74.4%, 95%CI 67.3%-80.2% vs. 67.2%, 95%CI 60.8%-72.7%), and at 5-year post-diagnosis in malignant meningioma (60.1%, 95%CI 49.3%-69.2% vs. 47.4%, 95%CI 32.5-54.8%), non-malignant meningioma (87.1%, 95%CI 85.6-88.5% vs. 81.3%, 95%CI 78.6-83.7%), non-malignant ependymal tumours (96.5%, 95%CI 85.0-99.2% vs. 89.8%, 95%CI 79.3-95.2%), and non-malignant unclassified tumours (66.1%, 95%CI 63.4-68.6% vs. 58.5%, 95%CI 55.4-61.5%). Comparing to females, males had better 5-year net survival rates in pilocytic astrocytoma (91.7%, 95%CI 82.6-96.1% vs. 84.8%, 95%CI 72.1-92.0%) and in non-malignant neuronal and mixed neuronal-glial tumours (92.2%, 95%CI 85.1-96.0% vs. 85.3%, 95%CI 76.0-91.2%).

***Age*.** Table 5 showed the survival of primary CNS tumours stratified by age group. The 1-, 2- and 5-year net survival rates were 88.7% (95%CI 86.6-90.4%), 83.8% (95%CI 81.4-85.8%) and 80.2% (95%CI 77.7-82.4%) respectively in children, 95.9% (95%CI 95.2-96.5%), 93.5% (95%CI 92.7-94.3%) and 88.0% (95%CI 86.9-89.0%) in adolescents and young adults (AYA), 84.0% (95%CI 83.3-84.7%), 74.8% (95%CI 74.0-75.6%), and 68.0% (95%CI 67.1-68.9%) in adults, and 60.5% (95%CI 59.5-61.4%), 54.0% (95%CI 53.0-55.0%) and 46.8% (95%CI 45.6-48.1%) in older adults (65-99 years of age) (Figure 2).

Tables 6 and 7 showed that younger age was associated with better survival for patients with the same tumour type and behaviour, with some exceptions stated below. The 5-year net survival rate of glioblastoma were: children 10.3% (95%CI 2.9-23.3%); AYA 28.0% (95% CI 21.9-34.5%); adults 6.1% (95%CI 5.1-7.2%); and older adults 1.7% (95%CI 1.2-2.4%). Similarly, AYA had the best 5-year net survival rate for anaplastic astrocytoma, malignant ependymal tumours and malignant glioma NOS. In addition, the 5-year net survival rate were similar between adults and older adults for malignant meningioma (55.0%, 95%CI 41.2-66.9% vs. 49.2%, 95%CI 33.9-62.8%) and non-malignant other neoplasms related to the meninges (91.5%, 95CI 83.9-95.6% vs. 94.6%, 95%CI 61.3-99.4%).

All children and AYA CNS tumours had a median survival time exceeding 8 years except for glioblastoma (11 months in children and 26 months in AYA), anaplastic astrocytoma (11 months in children and 82 months in AYA), tumours of the

Figure 2: 1-, 2- and 5-year net survival rates (and 95%CIs) for primary CNS tumours, by age group (2010-2017)



pineal region and tumours of meninges in children (44 months for both histology).

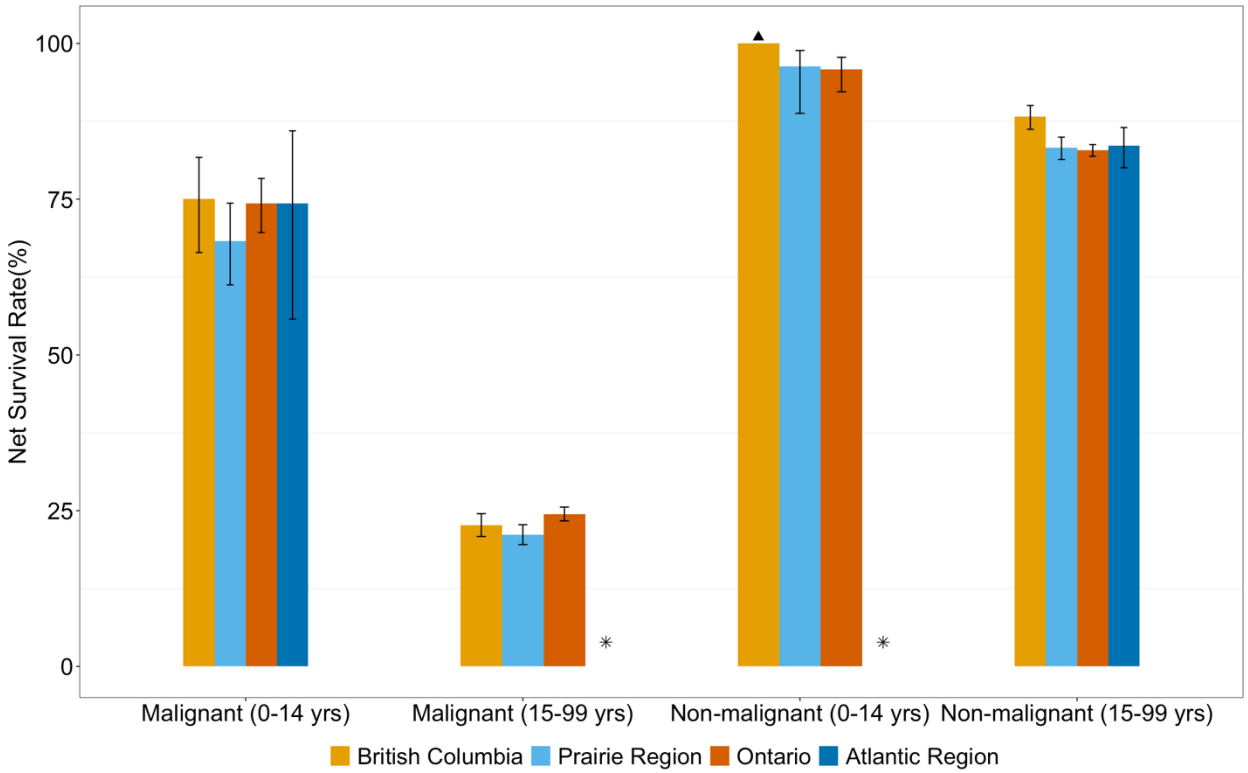
For malignant CNS tumours (Table 6), 5-year net survival rates of children, from lowest to highest, were glioblastoma (10.3%, 95%CI 2.9-23.3%), anaplastic astrocytoma (19.2%, 95%CI 5.0-40.3%), glioma not otherwise specified (54.3%, 95%CI 45.6-62.2%), embryonal tumours (72.7%, 95%CI 65.35-78.8%), diffuse astrocytoma (74.4%, 95%CI 58.6-85.0%), ependymal tumours (78.7%, 95%CI 67.0-86.6%), germ cell tumours, cysts and heterotopias (85.2%, 95%CI 69.8-93.1%) and pilocytic astrocytoma (100.0%).For non-malignant CNS tumours (Table 7), the 5-year net survival rates of children ranged from 90.0% (95%CI 47.3-98.5%) for unique astrocytoma variants, 94.7% for germ cell tumours, cysts and heterotopias (95%CI 67.0-99.2%), to 1.0 for choroid plexus tumours, tumours of cranial and spinal nerves, and meningioma.

Region. The age-standardized 5-year net survival rates across regions were shown in Figure 3. Ontario had the highest overall 5-year net survival for malignant brain tumours in patients aged 15-99 years while British Columbia had the highest overall 5-year net survival for non-malignant brain tumours in both children and non-children, however, sample size was small for pediatric CNS tumours resulting in wide confidence intervals.

Prevalence

On the index date of January 1, 2018, an estimated 37,575 Canadians who were diagnosed since 2010 were living with primary CNS tumours. Of these, 7,360 had malignant tumours and 30,215 had non-malignant tumours (Table 8). The top three most prevalent malignant histology groups were

Figure 3: Age standardized 5-year net survival rates (and 95%CIs) for malignant and non-malignant primary CNS tumours diagnosed in patients 15-99 years and 0-14 years, by region (2010-2017)

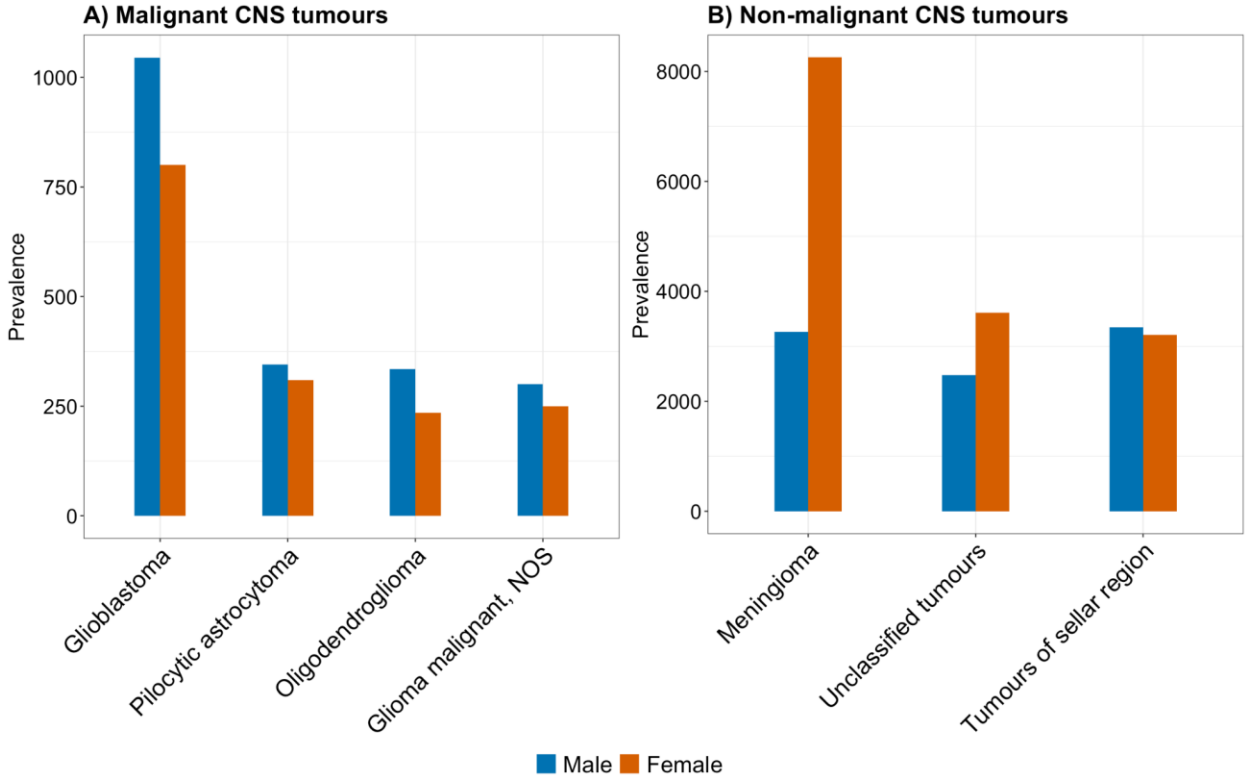


Notes: ▲The net survival for non-malignant pediatric tumours in BC is 100%, thus there is no 95%CI associated with it. *Survival rates for the Atlantic Region were suppressed for malignant tumours in patients diagnosed between 15-99 years of age and non-malignant tumours in patients diagnosed between 0-14 years of age.

glioblastoma, pilocytic astrocytoma and oligodendroglioma. The top three most prevalent non-malignant histology groups were meningioma, tumour of sellar region and unclassified tumours.

Sex. Table 9 showed prevalence estimates stratified by sex, histology group and tumour behaviour. Overall, compared to females, the prevalence was higher in males for malignant CNS tumours and lower for non-malignant CNS tumour (Figure 4). For the majority of the tumour groups, there were more male patients living with the disease at the index date than female patients. Females outnumbered males in malignant meningioma and four non-malignant histology types: tumours of cranial and spinal nerves, meningioma, mesenchymal tumours and unclassified tumours. Due to the random rounding rule, any differences within ± 5 counts are deemed equivalent. There was no difference across sexes for the majority of rare histology types (n<55). These included the following malignant tumours: choroid plexus, pineal region, other neuroepithelial, cranial and spinal nerves, mesenchymal tumours, other neoplasms related to the meninges, and sellar

Figure 4: Top three prevalent tumours in females and males on Jan 1, 2018, stratified by tumour behaviour.



Notes: Four tumour types are displayed in A) because the third most prevalent tumours are of different histology types between males and females.

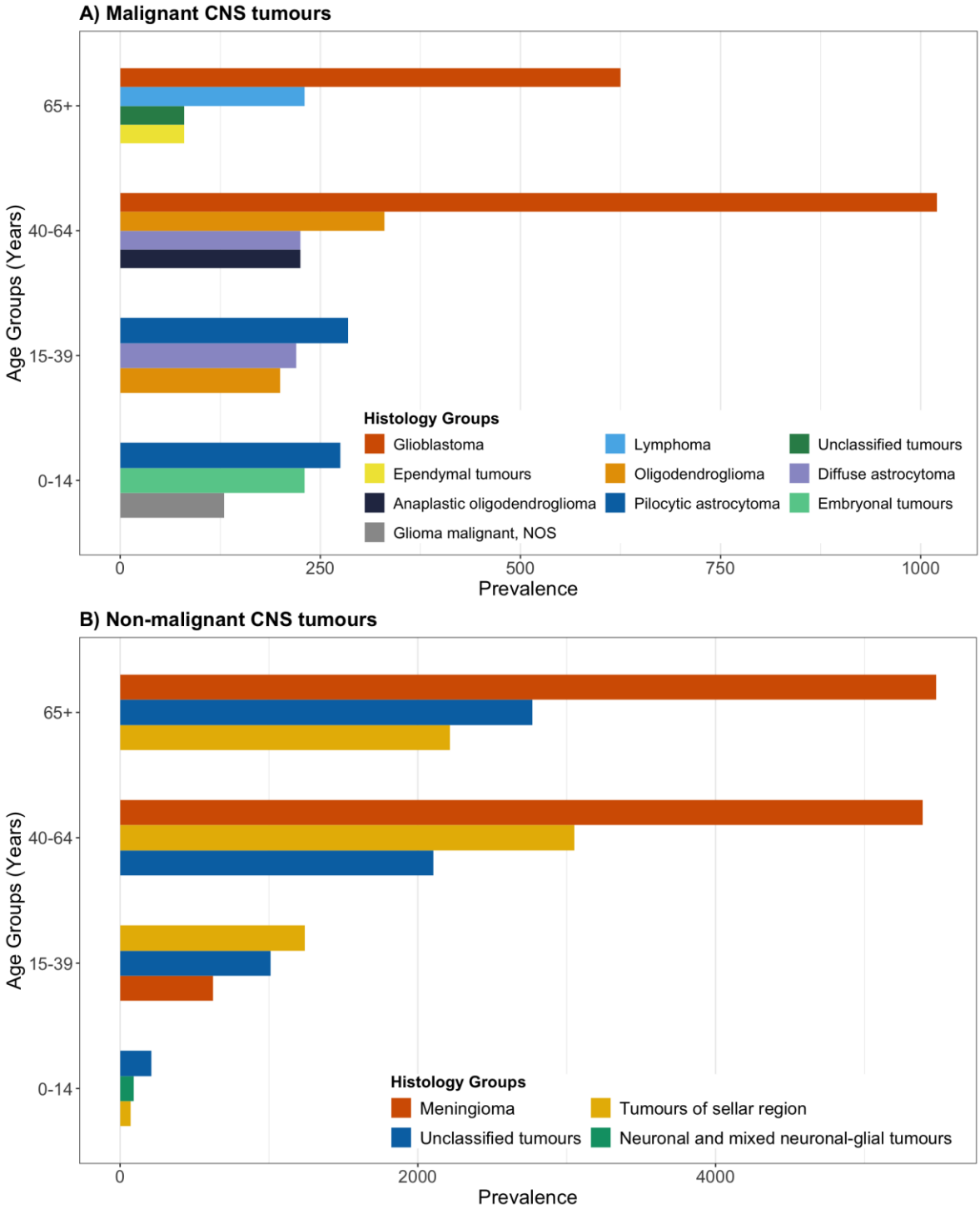
region; non-malignant tumours: germ cell, cysts and heterotopias; and both malignant and non-malignant primary melanocytic lesions.

Age. Patients with attained age 40-64 outnumbered other age groups in a majority of histology groups, followed by AYA patients with attained age 15-39. Pediatric patients (age 0-14) had the most cases in embryonal tumours and choroid plexus tumours. Older adults (age 65 and over) had the most cases in meningioma, lymphoma and the unclassified tumours (Table 10). The top three most prevalent malignant histology groups in the four age groups were (Figure 5A): pilocytic astrocytoma, embryonal tumours and glioma malignant (NOS) for children; pilocytic astrocytoma, diffuse astrocytoma and oligodendroglioma in AYA; glioblastoma, oligodendroglioma, anaplastic oligodendroglioma and diffuse astrocytoma (tied for third most cases) in adults between 40-64, and glioblastoma, lymphoma, ependymal tumours and unclassified tumours (tied for third most cases) in older adults (Table 10).

For non-malignant histology groups, unclassified tumours and tumours of sellar region were among the top three most prevalent types in all four age groups (Figure 5B). The other top category was neuronal and mixed neuronal-glial tumours in children, and meningioma in AYA, adults

aged 40-64 years and older adults
(Table 10).

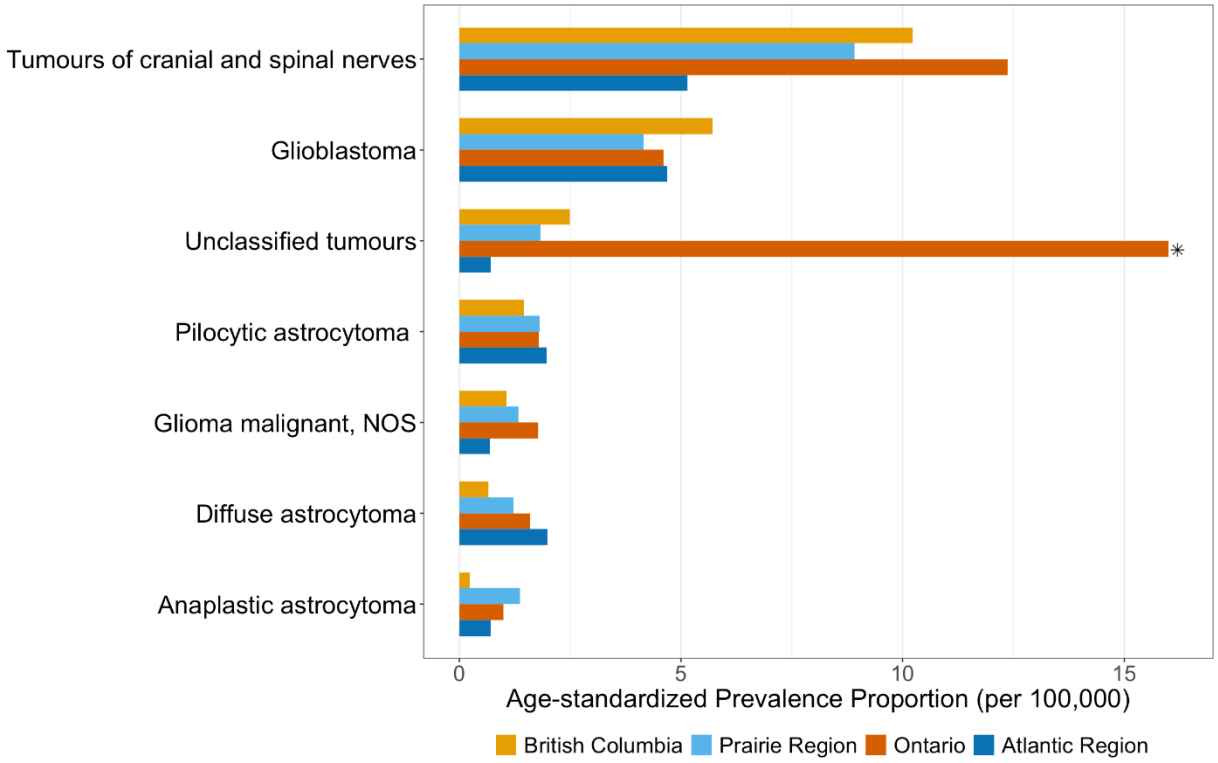
Figure 5: Top three prevalent tumours across age-groups on Jan 1, 2018, stratified by behaviour



Notes: More than 3 tumour histology groups are displayed for the age 65+ and the age 40-64 groups in A), due to histology groups with tied prevalence counts.

Region. Table 11 displayed the age-standardized prevalence proportion in four regions of Canada, British Columbia, Prairie region, Ontario and Atlantic region. British Columbia had the highest prevalence proportion in glioblastoma and oligodendroglioma, and Ontario had the highest overall prevalence proportion as well as in unclassified tumours, tumour of cranial and spinal nerves, glioma malignant (NOS) (Figure 6). The prairie region had the highest prevalence proportion in anaplastic astrocytoma. British Columbia had the lowest prevalence proportion in pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma. The Atlantic region had the lowest overall prevalence proportion as well as in tumours of cranial and spinal nerves, meningioma, tumours of sellar region and unclassified tumours.

Figure 6: Age-standardized prevalence proportion on Jan 1, 2018 for selected histology types, stratified by region.



Notes: *The Prevalence Proportion of unclassified tumours in Ontario is truncated. It exceeds 30 per 100,000.

DISCUSSION

Summary. This report includes population-based estimates of net survival, median survival and prevalence for all primary CNS tumours in Canada diagnosed in 2010-2017 (exclude Quebec). Estimated 1- and 5-year net survival was higher for non-malignant CNS tumours (1-year: 0.9; 5-year: 0.84), relative to those with malignant behaviours (1-year: 0.5; 5-year: 0.23). Of classifiable histological subtypes, 8 were associated with median survival time >8 years. The shortest median survival was among

patients with glioblastoma (8 months) or lymphoma (12 months). Males and females had comparable survival time for most histological groupings. Females with meningioma had slightly longer survival time relative to males. Conversely, males with glioblastoma and malignant gliomas NOS had slightly longer survival time relative to females. Younger age was associated with longer survival time. However, the AYA age category had the longest survival time for glioblastoma, anaplastic astrocytoma, malignant ependymoma, and malignant glioma NOS.

This report builds on previous pan-Canadian CNS tumour surveillance reports with the addition of prevalence estimates. Prevalence is a valuable measure providing an indication of the total burden of disease from primary CNS tumours at a given time or period of time. It reflects both incidence and survival. For example, glioblastoma is the most prevalent CNS tumours due to their high incidence (account for ~50% of all malignant CNS tumours diagnosed) irrespective of their poor survival. Oligodendroglioma is in the top three prevalent malignant CNS tumours in spite of being a fairly low incident tumour as they have a long survival. At the index date of January 1, 2018, there were an estimated 37,575 Canadians living with a primary CNS tumour. Of these, 80.4% were non-malignant, which is consistent with the longer survival time for those diagnosed with non-malignant tumours. The prevalence of primary CNS tumours was slightly higher in males than females. The low prevalence proportion reported in the Atlantic region may reflect the disproportionate underreporting of the non-malignant tumour diagnoses.

Comparison with Previous BTRC Report. The previous BTRC report on primary CNS survival in Canada included estimated net survival from 2010-2015 among those diagnosed in British Columbia, Alberta, Manitoba and Ontario, representing approximately 67% of the Canadian population. The overall 1- and 5-year net survival estimates were approximately the same as those presented in this report. For malignant tumours, both 1- and 5-year net survival estimates were 0.02 above those in the current report (0.52 and 0.25, respectively). For non-malignant tumours, 1- and 5-year net survival was 0.01 higher in the previous report (0.91 and 0.95, respectively). This comparison indicates that the previous report accurately reflected the survival experience among Canadians with primary CNS tumours.

Estimates generated for the previous report did not yield evidence of variation in survival time by sex. Conversely, the present analysis shows slight variation in median survival time for certain histological subtypes. In both reports, younger age was associated with longer survival. However, the age categories used in the two reports are slightly different, which limits the ability to compare them. Specifically, the use of the AYA group in this report, rather than grouping adolescents with children and young adults with older adults in the previous report. The groupings used in the previous report masked some effects identified through the more recent analysis, including that the AYA group had the longest survival time of all age groups for four

histological categories (glioblastoma, anaplastic astrocytoma, malignant ependymoma, and malignant glioma NOS), relative to both children and adults ≥40 years of age.

Comparison with Other Regions. Net survival was selected for this report, as it provides an estimate of survival time for primary CNS tumours, relative to the expected survival experience of the underlying population. Therefore, these estimates cannot be directly compared to those from other jurisdictions, given that the overall survival experience of those underlying populations may be different from among Canadians. However, a descriptive comparison of general patterns in survival indicates that these estimates are very similar to those generated in the United States (Ostrom et al., 2020), which presented 5-year relative survival estimates from 2013-2017 of 82.4% for non-malignant CNS tumours and 23.5% for malignant behaviours. These estimates are approximately the same as those presented in this report, with slight variations that are likely due to differences in estimation methods.

The Canadian 5-year net-survival for primary malignant neuro-epithelial tumours (21.7%) is also comparable to Western European countries. European 5-year relative survival estimates for primary malignant neuroepithelial tumours from the EUROCARE-5 study show survival estimates of 24.6% for Norway, 17.9% for Ireland and UK, 25.1% for Germany, 18.5% for France, and 20.3% for Europe as a whole (Visser et. al., 2015). Glioblastoma 5-year relative survival was reported to be 3.4% in the UK (Brodbelt et. al. 2015), 6.3% overall in Europe (Visser et. al., 2015), and was estimated to be 4.9% in the present report. However, these comparisons must be interpreted with caution because of differences in methods of: data capture, calculating survival, and for grouping CNS tumours into histological categories.

Median survival time can be directly compared across jurisdictions without the same inferential limitations. Estimated median survival in this report was lowest for those with glioblastoma (8 months). Ostrom *et al.* (2020) estimated the same median survival time for glioblastoma patients in the United States. Population based studies in England from 2007-2011 reported a median survival length of 6.1 months for glioblastoma patients. Differences in estimates across regions may reflect the time periods of the analysis, with improvements in cancer care over time improving median survival time in patients diagnosed in later time periods.

Limitations. The estimates presented in this report represent broader categories of histological subtypes than may be relevant clinically. This is because primary CNS tumours are rare, and therefore the number of diagnoses is often too low to permit reporting on smaller categories of tumours while adhering to reporting guidelines set by Statistics Canada to ensure the privacy of those represented by these numbers.

While some unclassified tumours are normal, the large proportion shown in this report may partially reflect the recent efforts in capturing complete non-malignant CNS tumours in cancer registries combined with logistics of implementing

of newer CNS tumour classifications. The large proportion of unclassified tumours may limit some histologic specific estimates. We know that the large proportion of unclassified in Ontario data reflect their approach to tumour identification.

Additionally, data on molecular markers are not available through the Canadian Cancer Registry at this time. Therefore, tumour classifications do not include molecular subtypes, although this information may have been included in the initial diagnostic decisions.

While this report contains the most complete Canadian data on primary CNS tumours to date, it remains incomplete – because Quebec has not submitted data to the CCR since 2010. Some data on CNS tumours diagnosed among residents of Quebec is available through other sources, including through Cancer in Young People in Canada (CYP-C). However, these data only include those aged 15 years or younger and are collected through pediatric oncology centers. Conversely, data from the CCR are population-based. Differences in age and population coverage preclude incorporating those data in the present report.

CONCLUSION

The present report includes the most recent data on survival among primary CNS tumour patients in Canada. Additionally, this report contains estimates of the prevalence of these tumours in Canada, providing an indication of the number of Canadian patients living with a CNS tumour diagnosis. Findings were consistent with previous reports and with those reported from other jurisdictions.

Continued reporting will permit ongoing assessment of trends in diagnoses, survival, and prevalence over time. As more time passes since the initiation of supplementary case ascertainment for non-malignant CNS tumours in Canadian registries, case numbers will be sufficient to permit further refinement of categories, including tumours with mixed behaviour codes, to better align with clinically meaningful classifications. Scientific direction for the BTRC includes identifying strategies for ensuring routine and complete capture of molecular marker data in Canadian cancer registries. We anticipate being able to incorporate these data in tumour classifications in the future.

TABLES

Table 1: 1-, 2- and 5-year net survival by histology group for people with primary central nervous system tumours, ages 15-99, Canada (excluding Quebec), 2010-2017

		1-year		2-year		5-year	
Histology group (**major**/specific)	Median survival length (month)	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI
Tumours of neuroepithelial tissue	13.3	53.4	52.3-54.4	36.5	35.5-37.5	25.7	24.8-26.7
Pilocytic astrocytoma	>96	95.5	90.4-98.0	94.4	88.8-97.2	89.0	82.2-93.3
Diffuse astrocytoma	38.2	70.2	65.6-74.4	60.7	55.8-65.2	44.7	39.7-49.5
Anaplastic astrocytoma	23.1	68.1	63.4-72.4	54.6	49.5-59.4	37.0	31.8-42.1
Unique astrocytoma variants	>96	71.7	60.2-80.4	64.0	52.2-73.7	56.9	44.2-67.8
Glioblastoma	8.1	38.9	37.6-40.2	16.1	15.1-17.1	4.9	4.3-5.5
Oligodendroglioma	>96	94.2	91.1-96.3	91.0	87.3-93.7	86.4	81.5-90.0
Anaplastic oligodendroglioma	63.5	80.1	75.2-84.2	69.5	63.9-74.4	55.2	48.9-61.0
Oligoastrocytic tumours	71.0	82.4	76.8-86.8	70.2	64.2-75.4	52.8	47.0-58.4
Ependymal tumours	>96	94.0	91.0-96.0	91.3	87.8-93.8	87.1	82.7-90.5
Glioma malignant, NOS	13.1	49.4	44.8-53.8	40.2	35.8-44.6	30.0	25.9-34.2
Choroid plexus tumours	>96	96.9	76.1-99.6	97.2	73.4-99.7	93.3	66.6-98.8
Neuronal and mixed neuronal-glial tumours	>96	94.0	90.5-96.3	90.7	86.6-93.6	86.6	81.5-90.3
Tumours of the pineal region	>96	97.9	78.5-99.8	93.0	76.6-98.0	74.1	52.8-86.9
Embryonal tumours	68.8	79.5	70.4-86.0	68.4	58.6-76.4	57.0	46.6-66.1
Other neuroepithelial tumours	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	>96	98.6	97.7-99.1	98.4	97.4-99.1	98.4	96.6-99.2
Tumours of meninges	>96	92.9	92.2-93.6	90.8	90.0-91.6	85.5	84.2-86.6
Meningioma	>96	92.8	92.1-93.5	90.7	89.8-91.5	85.3	84.0-86.5
Mesenchymal tumours	>96	91.2	82.9-95.6	88.1	79.1-93.3	80.8	70.5-87.7
Primary melanocytic lesions	67.4	-	-	-	-	-	-
Other neoplasms related to the meninges	>96	96.3	93.2-98.0	95.3	91.7-97.4	90.9	85.6-94.3
Lymphomas and hematopoietic neoplasms	12.3	52.3	48.5-56.0	45.0	41.1-48.8	33.8	29.8-37.9
Lymphoma	12.2	52.1	48.2-55.8	44.8	40.9-48.6	34.1	30.1-38.2
Other hematopoietic neoplasms	24.5	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	>96	94.8	86.3-98.1	93.6	84.6-97.5	94.1	84.6-97.8
Tumours of sellar region	>96	97.4	96.6-97.9	96.5	95.6-97.2	95.1	93.7-96.2
Unclassified tumours	61.9	69.1	67.6-70.5	65.4	63.8-66.9	58.2	56.2-60.0
Total	>96	75.6	75.1-76.2	68.6	68.0-69.1	61.9	61.2-62.6

Table 2: 1- and 5-year net survival by histology group for people with primary malignant and non-malignant brain and other central nervous system tumours, ages 15-99, Canada (excluding Quebec), 2010-2017

	Malignant					Non-malignant				
		1-year		5-year			1-year		5-year	
Histology group (**major**/specific)	Median survival length (month)	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI	Median survival length (month)	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI
Tumours of neuroepithelial tissue	12.2	50.9	49.8-52.0	21.7	20.8-22.7	>96	96.3	94.1-97.7	91.1	87.6-93.6
Pilocytic astrocytoma	>96	95.5	90.4-97.9	89.0	82.2-93.3					
Diffuse astrocytoma	38.2	70.2	65.6-74.4	44.7	39.7-49.5					
Anaplastic astrocytoma	23.1	68.1	63.4-72.4	37.0	31.8-42.1					
Unique astrocytoma variants	25.3	*62.1*	*48.4-73.2*	*44.0*	*30.4-56.7*	>96	100.0*	-	100.0*	-
Glioblastoma	8.1	38.9	37.6-40.2	4.86	4.3-5.5					
Oligodendroglioma	>96	94.2	91.1-96.3	86.4	81.5-90.0					
Anaplastic oligodendroglioma	63.5	80.1	75.2-84.2	55.2	48.9-61.0					
Oligoastrocytic tumours	71.0	82.4	76.8-86.8	52.8	47.0-58.4					
Ependymal tumours	>96	92.7	88.0-95.6	81.6	75.0-86.7	>96	94.6	90.0-97.1	92.5	85.7-96.1
Glioma malignant, NOS	13.1	49.4	44.8-53.8	30.0	25.9-34.2					
Choroid plexus tumours	-	-	-	-	-	>96	96.9	76.1-99.6	98.3	41.1-100.0
Neuronal and mixed neuronal-glial tumours	79.1	81.6	69.7-89.2	*59.7*	*45.7-71.2*	>96	97.2	94.0-98.7	89.2	84.0-92.8
Tumours of the pineal region	>96	100.0*	-	-	-	>96	*94.0*	*57.8-99.3*	-	-
Embryonal tumours	68.6	78.7	69.4-85.5	*55.6*	*45.1-64.9*	-	-	-	-	-
Other neuroepithelial tumours	-	-	-	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	>96	-	-	-	-	>96	98.6	97.7-99.1	98.4	5.59-99.23
Tumours of meninges	58.0	82.0	75.5-87.0	53.0	45.1-60.2	>96	93.0	92.3-93.6	85.8	84.6-87.0
Meningioma	54.1	83.6	75.8-89.1	54.3	44.6-63.1	>96	92.7	92.0-93.4	85.4	4.05-86.59
Mesenchymal tumours	>96	*85.3*	*69.3-93.3*	*59.6*	*42.9-72.8*	>96	93.8	84.1-97.7	89.2	76.9-95.1
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	59.1	-	-	-	-	>96	97.2	94.2-98.7	93.8	88.7-96.7
Lymphomas and hematopoietic neoplasms	12.3	52.5	48.7-56.2	33.9	29.9-38.0	-	-	-	-	-
Lymphoma	12.2	52.2	48.3-55.9	34.1	30.1-38.2					
Other hematopoietic neoplasms	24.5	-	-	-	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	>96	92.0	79.8-96.9	90.2	77.3-95.9	>96	100.0*	-	100.0*	-
Tumours of sellar region	>96	-	-	-	-	>96	97.4	96.7-98.0	95.1	93.7-96.2
Unclassified tumours	2.3	20.3	17.2-23.5	12.9	10.3-15.9	88.4	75.7	74.3-77.1	62.9	60.9-64.9
Total	11.6	49.7	48.7-50.7	23.0	22.1-23.9	>96	90.3	89.8-90.8	83.7	82.9-84.5

Notes: 100.0* indicates the estiamted net survival rate is greater than 100%. Tumours defined as malignant are blacked out in the non-maligant section.

Table 3: 1-, 2- and 5-year net survival by histology group and sex for people with primary central nervous system tumours, ages 15-99, Canada (excluding Quebec), 2010-2017

	Males							Females						
		1-year		2-year		5-year			1-year		2-year		5-year	
Histology group (**major**/specific)	Median survival length (month)	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI	Median survival length (month)	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI	Net survival rate (%)	95% CI
Tumours of neuroepithelial tissue	12.9	52.6	51.2-54.0	35.6	34.3-37.0	25.1	23.9-26.4	14.0	54.5	52.9-56.1	37.7	36.1-39.2	26.6	25.1-28.0
Pilocytic astrocytoma	>96	95.4	87.7-98.3	94.4	86.3-97.8	91.7	82.6-96.1	>96	95.5	85.7-98.7	94.2	83.6-98.1	84.8	72.1-92.0
Diffuse astrocytoma	39.3	67.2	60.8-72.7	59.0	52.5-64.9	43.8	37.5-49.9	34.3	74.4	67.3-80.2	62.9	55.1-69.6	45.8	37.6-53.6
Anaplastic astrocytoma	18.9	66.5	60.0-72.2	55.3	48.4-61.7	34.5	27.2-41.8	27.4	70.3	63.0-76.4	54.0	46.2-61.0	39.2	31.8-46.4
Unique astrocytoma variants	>96	*64.1*	*49.0-75.8*	*62.2*	*46.8-74.2*	*54.4*	*37.2-68.7*	78.5	*84.1*	*64.3-93.4*	*67.8*	*47.7-81.6*	*60.5*	*39.9-76.0*
Glioblastoma	8.3	38.6	36.9-40.3	15.4	14.2-16.7	4.7	3.9-5.5	7.8	39.3	37.3-41.3	17.1	15.6-18.7	5.2	4.2-6.2
Oligodendroglioma	>96	94.1	89.7-96.7	91.6	86.6-94.7	86.7	80.1-91.3	>96	94.4	88.9-97.3	90.0	83.3-94.1	85.8	77.8-91.1
Anaplastic oligodendroglioma	63.5	80.6	74.1-85.6	69.1	61.8-75.4	55.1	47.0-62.5	60.0	79.5	71.2-85.6	70.1	61.0-77.5	55.4	45.3-64.3
Oligoastrocytic tumours	71.0	80.7	72.5-86.6	67.5	59.1-74.5	52.4	44.4-59.8	71.0	84.5	75.8-90.3	73.7	64.6-80.8	53.4	44.6-61.4
Ependymal tumours	>96	91.9	87.3-94.9	89.7	84.5-93.2	85.9	79.3-90.5	>96	96.9	92.5-98.7	93.5	88.3-96.4	88.9	82.5-93.0
Glioma malignant, NOS	14.2	49.8	43.6-55.7	41.8	35.8-47.6	30.6	25.2-36.3	11.4	48.9	41.8-55.5	38.1	31.4-44.7	29.1	23.0-35.4
Choroid plexus tumours	>96	*92.3*	*52.6-99.0*	*92.8*	*49.9-99.2*	*93.4*	*45.3-99.4*	>96	100.0*	-	100.0*	-	*95.2*	*51.3-99.6*
Neuronal and mixed neuronal-glial tumours	>96	94.5	89.4-97.2	92.6	87.0-95.8	90.9	84.4-94.7	>96	93.4	87.3-96.7	88.2	80.9-92.8	80.8	72.0-87.1
Tumours of the pineal region	>96	100.0*	-	96.1	61.7-99.7	-	-	>96	*93.5*	*58.4-99.2*	*88.2*	*57.1-97.2*	-	-
Embryonal tumours	63.2	78.3	67.0-86.2	*69.2*	*57.3-78.4*	*55.1*	*42.2-66.2*	>96	*81.9*	*63.9-91.5*	*66.6*	*47.6-80.0*	*60.4*	*41.4-75.0*
Other neuroepithelial tumours	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	>96	98.1	96.7-98.9	98.4	96.5-99.2	98.5	94.9-99.6	>96	99.0	97.8-99.6	98.5	96.9-99.3	98.2	95.7-99.3
Tumours of meninges	>96	90.7	89.3-92.0	87.8	86.1-89.3	81.6	79.1-83.8	>96	93.9	93.2-94.7	92.3	91.3-93.1	87.3	85.8-88.6
Meningioma	>96	90.3	88.7-91.6	87.2	85.4-88.9	81.0	78.3-83.4	>96	93.9	93.1-94.6	92.2	91.2-93.0	87.2	85.7-88.5
Mesenchymal tumours	>96	96.8	82.3-99.5	89.9	76.0-95.9	*81.1*	*64.6-90.4*	>96	*86.3*	*72.7-93.5*	*86.8*	*72.9-93.8*	*80.8*	*66.2-89.6*
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	>96	95.1	90.1-97.6	94.0	88.2-97.0	89.7	81.5-94.4	>96	97.8	92.6-99.3	96.9	91.1-98.9	92.4	84.4-96.4
Lymphomas and hematopoietic neoplasms	12.0	52.8	47.6-57.8	45.5	40.3-50.6	35.1	29.7-40.6	13.9	51.7	45.9-57.2	44.3	38.5-50.0	32.4	26.5-38.4
Lymphoma	12.0	52.7	47.4-57.6	45.2	40.0-50.4	34.9	29.5-40.4	12.7	51.3	45.5-56.9	44.2	38.4-49.9	33.2	27.2-39.2
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	>96	94.5	83.6-98.2	94.6	83.6-98.3	95.0	83.4-98.6	>96	95.7	68.0-99.5	*90.9*	*64.4-97.9*	*91.7*	*62.6-98.4*
Tumours of sellar region	>96	97.4	96.2-98.2	96.5	95.0-97.5	95.1	92.8-96.7	>96	97.3	96.3-98.1	96.5	95.2-97.4	95.2	93.3-96.6
Unclassified tumours	47.7	65.6	63.3-67.8	61.6	59.2-63.9	54.1	51.1-56.9	70.7	71.7	69.8-73.5	68.2	66.1-70.1	61.2	58.6-63.6
Total	70.6	71.2	70.4-72.0	62.7	61.8-63.6	55.6	54.6-56.6	>96	79.5	78.8-80.1	73.7	72.9-74.4	67.4	66.4-68.3

Notes: 100.0* indicates that the estimated net survival rate is greater than 100%.

Table 4: Median Survival Length (MSL), 1- and 5-year net survival rate (NSR) by histology group and sex for people with primary malignant and non-malignant brain and other central nervous system tumours, ages 15-99, Canada (excluding Quebec), 2010-2017

	Malignant										Non-malignant							
	Males					Females					Males				Females			
		1-year		5-year			1-year		5-year		1-year		5-year		1-year		5-year	
Histology group (**major**/specific)	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI
Tumours of neuroepithelial tissue	11.9	50.1	48.7-51.5	21.2	20.1-22.4	12.6	52.1	50.4-53.7	22.45	21.0-23.9	96.4	93.2-98.1	91.4	86.3-94.7	96.2	92.3-98.1	90.5	85.0-94.1
Pilocytic astrocytoma	>96	95.4	87.7-98.3	91.7	82.6-96.1	>96	95.5	85.7-98.7	84.8	72.1-92.0								
Diffuse astrocytoma	39.3	67.2	60.8-72.7	43.8	37.5-49.9	34.3	74.4	67.3-80.2	45.8	37.6-53.6								
Anaplastic astrocytoma	18.9	66.5	60.0-72.2	34.5	27.2-41.8	27.4	70.3	63.0-76.4	39.2	31.8-46.4								
Unique astrocytoma variants	25.3	52.9	35.9-67.3	40.9	23.3-57.7	31.9	77.8	52.9-90.6	-	-	100.0*	-	100.0*	-	100.0*	-	100.0*	-
Glioblastoma	8.3	38.6	36.9-40.3	4.7	3.9-5.5	7.8	39.3	37.3-41.3	5.2	4.2-6.2								
Oligodendroglioma	>96	94.1	89.7-96.7	86.7	80.1-91.3	>96	94.4	88.9-97.3	85.8	77.8-91.1								
Anaplastic oligodendroglioma	63.5	80.6	74.1-85.6	55.1	47.0-62.5	60.0	79.5	71.2-85.6	55.4	45.3-64.3								
Oligoastrocytic tumours	71.0	80.7	72.5-86.6	52.4	44.4-59.8	71.0	84.5	75.8-90.3	53.4	44.6-61.4								
Ependymal tumours	>96	90.0	82.4-94.4	82.2	72.4-88.8	>96	95.5	88.6-98.3	80.7	70.6-87.7	93.7	87.1-97.0	89.8	79.3-95.1	96.2	87.4-98.9	96.5	85.0-99.2
Glioma malignant, NOS	14.2	49.8	43.6-55.7	30.6	25.2-36.3	11.4	48.9	41.8-55.5	29.1	23.0-35.4								
Choroid plexus tumours	>96	-	-	-	-	-	-	-	-	-	92.3	52.6-99.0	93.4	45.3-99.4	100.0*	-	100.0*	-
Neuronal and mixed neuronal-glial tumours	>96	79.9	62.7-89.8	69.0	49.6-82.2	39.1	83.6	63.9-93.1	48.5	28.5-65.9	98.2	93.5-99.5	92.2	85.1-96.0	95.7	89.2-98.3	85.3	76.0-91.2
Tumours of the pineal region	49.5	100.0*	-	-	-	-	100.0*	-	-	-	100.0*	-	-	-	-	-	-	-
Embryonal tumours	56.9	77.7	66.1-85.8	54.0	41.0-65.2	>96	80.9	62.1-91.0	58.8	39.5-73.8	-	-	-	-	-	-	-	-
Other neuroepithelial tumours	>96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	-	-	-	-	-	-	-	-	-	-	98.1	96.7-98.9	98.3	95.0-99.5	99.0	97.8-99.6	98.4	95.8-99.4
Tumours of meninges	34.1	82.3	72.1-89.1	43.9	32.5-54.8	81.4	81.9	72.6-88.3	60.1	49.3-69.2	90.7	89.3-92.0	82.5	80.0-84.7	94.0	93.2-94.7	87.3	85.9-88.7
Meningioma	34.1	84.7	72.3-91.8	47.4	32.5-60.9	72.7	82.9	71.6-90.0	59.2	46.1-70.1	90.11	88.5-91.5	81.3	78.6-83.7	93.9	93.0-94.6	87.1	85.6-88.5
Mesenchymal tumours	35.2	95.5	61.6-99.6	-	-	>96	79.1	56.3-90.9	67.9	44.7-83.0	95.6	77.9-99.2	92.4	68.1-98.4	91.9	75.0-97.6	85.9	67.5-94.3
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	-	-	-	-	-	-	-	-	-	-	96.7	91.8-98.7	93.8	85.2-97.5	97.8	92.6-99.3	94.0	86.2-97.5
Lymphomas and hematopoietic neoplasms	12.0	52.8	47.6-57.8	35.1	29.7-40.6	13.9	52.1	46.4-57.5	32.6	26.7-38.6	-	-	-	-	-	-	-	-
Lymphoma	12.0	52.7	47.4-57.6	34.9	29.5-40.4	12.7	51.6	45.8-57.1	33.1	27.2-39.2								
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	>96	93.4	80.7-97.9	93.7	80.5-98.1	-	-	-	-	-	100.0*	-	100.0*	-	100.0*	-	100.0*	-
Tumours of sellar region	-	-	-	-	-	-	-	-	-	-	97.46	96.3-98.3	95.1	92.8-96.6	97.4	96.3-98.1	95.2	93.3-96.6
Unclassified tumours	2.1	20.7	16.3-25.4	14.2	10.3-18.7	2.4	19.9	15.8-24.4	11.8	8.4-15.8	72.6	70.4-74.7	58.5	55.4-61.5	78.0	76.2-79.7	66.1	63.4-68.6
Total	11.5	49.4	48.1-50.7	22.6	21.5-23.8	11.8	50.2	48.7-51.7	23.5	22.2-24.8	88.9	88.1-89.7	82.1	80.8-83.4	91.2	90.6-91.8	84.8	83.7-85.7

Notes: 100.0* indicates the estimated net survival rate is greater than 100%. MSL = median survival length; NSR = net survivial rate. The MSL of non-malignant tumours is not shown in this table due to the length limitation. Except for the MSL of non-malignant unclassified tumours in males is 74.2 months, other non-malignant tumours in both males and females are greater than 96 months. Tumours defined as malignant are blacked out in the non-maligant section.

Table 5: 1- and 5-year net survival rate (NSR) by histology and age group for people with primary central nervous system tumours, Canada (excluding Quebec), 2010-2017

	0 to 14 years				15 to 39 years				40 to 64 years				65 to 99 years			
	1-year		5-year		1-year		5-year		1-year		5-year		1-year		5-year	
Histology group (**major**/specific)	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI
Tumours of neuroepithelial tissue	87.0	84.5-89.2	76.3	73.3-79.1	92.2	90.7-93.5	74.2	71.8-76.5	63.2	61.7-64.7	25.0	23.6-26.4	26.5	25.0-28.0	5.7	4.9-6.6
Pilocytic astrocytoma	100.0*	-	100.0*	-	98.0	91.9-99.5	92.0	84.3-96.0	93.3	79.6-97.9	*89.8*	*74.0-96.2*	-	-	-	-
Diffuse astrocytoma	*84.5*	*68.7-92.7*	*74.4*	*58.6-85.0*	93.5	88.2-96.5	77.6	69.6-83.7	71.6	64.5-77.6	38.7	31.7-45.6	28.0	19.1-37.5	4.3	1.0-11.7
Anaplastic astrocytoma	-	-	*19.2*	*5.0-40.3*	87.3	80.3-91.9	66.3	56.8-74.1	71.0	63.7-77.2	28.9	21.5-36.6	39.4	29.9-48.7	11.4	4.6-21.6
Unique astrocytoma variants	*89.6*	*64.3-97.3*	*85.0*	*60.2-94.9*	91.5	75.8-97.2	*89.0*	*72.7-95.8*	*62.3*	*41.2-77.7*	-	-	-	-	-	-
Glioblastoma	*43.8*	*28.5-58.1*	*10.3*	*2.9-23.3*	78.9	73.4-83.4	28.0	21.9-34.5	52.7	50.8-54.7	6.1	5.1-7.2	22.7	21.2-24.3	1.7	1.2-2.4
Oligodendroglioma	-	-	-	-	99.4	94.6-99.9	93.1	85.6-96.7	93.8	88.8-96.6	85.8	78.9-90.5	68.9	47.4-83.1	-	-
Anaplastic oligodendroglioma	-	-	-	-	94.5	85.9-97.9	*77.4*	*65.5-85.7*	83.7	77.5-88.4	56.5	48.2-63.9	47.9	33.7-60.7	19.5	8.6-33.6
Oligoastrocytic tumours	-	-	-	-	96.8	90.0-99.0	75.5	66.8-82.2	81.2	72.9-87.2	47.3	39.2-55.0	44.1	24.9-61.7	5.8	1.1-16.9
Ependymal tumours	96.3	88.9-98.8	79.3	68.3-86.8	99.3	94.0-99.9	93.0	86.5-96.5	95.0	90.8-97.3	88.7	82.7-92.7	83.7	72.6-90.6	74.1	58.3-84.7
Glioma malignant, NOS	71.6	63.0-78.6	54.3	45.6-62.2	87.2	79.2-92.2	69.3	60.1-76.9	66.8	58.4-73.9	37.3	29.3-45.2	20.3	15.3-25.9	6.4	3.6-10.4
Choroid plexus tumours	100.0*	-	*92.1*	*71.6-98.0*	100.0*	-	-	-	*94.6*	*64.4-99.3*	*95.7*	*55.0-99.7*	-	-	-	-
Neuronal and mixed neuronal-glial	98.8	91.1-99.8	98.8	90.6-99.9	98.3	94.5-99.5	95.2	90.6-97.6	91.1	83.2-95.4	80.5	70.0-87.7	81.9	62.7-91.9	-	-
Tumours of the pineal region	-	-	-	-	100.0*	-	100.0*	-	100.0*	-	-	-	-	-	-	-
Embryonal tumours	86.9	80.9-91.1	72.7	65.5-78.8	90.6	80.2-95.7	*67.1*	*53.8-77.3*	*78.6*	*60.0-89.2*	*54.8*	*34.7-71.1*	-	-	-	-
Other neuroepithelial tumours	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	100.0*	-	100.0*	-	99.3	97.6-99.8	98.4	96.0-99.4	99.2	98.3-99.7	98.6	96.8-99.4	96.5	93.6-98.1	98.1	83.5-99.8
Tumours of meninges	*86.9*	*64.6-95.6*	*72.7*	*51.0-85.9*	98.3	96.8-99.1	97.0	95.0-98.2	97.2	96.6-97.8	92.1	91.0-93.2	87.4	86.1-88.7	76.2	73.7-78.5
Meningioma	100.0*	-	100.0*	-	98.8	97.1-99.5	98.1	96.0-99.1	97.2	96.6-97.8	92.5	91.4-93.6	87.4	86.0-88.7	75.9	73.3-78.2
Mesenchymal tumours	-	-	-	-	*87.4*	*58.3-96.7*	-	-	96.4	84.3-99.2	*82.2*	*68.7-90.3*	84.1	62.9-93.7	81.3	53.6-93.34
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-			-	-
Other neoplasms related to the meninges	-	-	-	-	100.0*	-	98.0	90.0-99.6	97.3	92.9-99.0	87.7	79.6-92.7	89.8	78.6-95.3	89.5	68.5-96.8
Lymphomas and hematopoietic neoplasms	-	-	-	-	*73.8*	*56.7-85.0*	*67.2*	*49.0-80.2*	70.8	64.8-75.9	50.5	43.4-57.2	37.9	33.0-42.8	19.2	14.8-24.1
Lymphoma	-	-	-	-	*74.4*	*56.5-85.8*	*67.8*	*49.0-80.9*	70.8	64.8-75.9	50.5	43.3-57.2	37.7	32.8-42.6	19.8	15.4-24.7
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
Germ cell tumours, cysts, and heterotopias	91.2	80.1-96.3	89.3	77.6-95.1	94.7	84.2-98.3	93.1	81.9-97.5	*93.8*	*60.0-99.2*	*95.6*	*41.8-99.8*	-	-	-	-
Tumours of sellar region	98.2	87.6-99.7	94.9	84.7-98.3	99.7	98.7-99.9	98.9	97.5-99.5	98.3	97.4-98.8	96.8	95.4-97.8	94.3	92.2-95.8	89.6	85.1-92.8
Unclassified tumours	93.4	87.6-96.5	92.7	86.7-96.2	96.8	94.9-98.0	94.5	92.1-96.2	84.5	82.3-86.5	75.8	73.2-78.2	56.8	54.8-58.7	42.9	40.2-45.6
Total	88.7	86.6-90.4	80.2	77.7-82.4	95.9	95.2-96.5	88.0	86.9-89.0	84.0	83.3-84.7	68.0	67.1-68.9	60.5	59.5-61.4	46.8	45.6-48.1

Notes: 100.0* indicates the estimated net survival rate is greater than 100%. NSR = net survivial rate.

Table 6: Median Survival Length (MSL), 1- and 5-year net survival rates (NSR) by histology and age group for people with primary malignant brain and other central nervous system tumours, Canada (excluding Quebec), 2010-2017

	0 to 14 years					15 to 39 years					40 to 64 years					65 to 99 years				
		1-year		5-year			1-year		5-year			1-year		5-year			1-year		5-year	
Histology group (**major**/specific)	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI	MSL (month)	NSR (%)	95% CI	NSR (%)	95% CI
Tumours of neuroepithelial tissue	>96	85.2	82.3-87.7	72.8	69.3-76.0	>96	91.0	89.2-92.5	69.7	66.9-72.3	15.8	61.4	59.8-63.0	21.6	20.2-23.0	4.9	25.6	24.1-27.1	4.4	3.6-5.2
Pilocytic astrocytoma	>96	100.0*	-	100.0*	-	>96	98.0	91.9-99.5	92.0	84.3-96.0	>96	93.3	79.6-97.9	*89.8*	*74.0-96.2*	-	-	-	-	-
Diffuse astrocytoma	>96	*84.5*	*68.7-92.7*	*74.4*	*58.6-85.0*	>96	93.5	88.2-96.5	77.6	69.6-83.7	37.5	71.6	64.5-77.6	38.7	31.7-45.6	4.5	28.0	19.1-37.5	4.3	1.0-11.7
Anaplastic astrocytoma	11.0	-	-	*19.2*	*5.0-40.3*	81.6	87.3	80.3-91.9	66.3	56.8-74.1	18.5	71.0	63.7-77.2	28.9	21.5-36.6	5.4	39.4	29.9-48.7	11.4	4.6-21.6
Unique astrocytoma variants	-	-	-	-	-	>96	*84.6*	*59.4-94.8*	*80.7*	*55.9-92.4*	14.6	-	-	-	-	3.3	-	-	-	-
Glioblastoma	11.1	*43.8*	*28.5-58.1*	*10.3*	*2.9-23.3*	26.2	78.9	73.4-83.4	28.0	21.9-34.5	12.3	52.7	50.8-54.7	6.1	5.1-7.2	4.8	22.7	21.2-24.3	1.7	1.2-2.4
Oligodendroglioma	-	-	-	-	-	>96	99.4	94.6-99.9	93.1	85.6-96.7	>96	93.8	88.8-96.6	85.8	78.9-90.5	17.5	68.9	47.4-83.1	-	-
Anaplastic oligodendroglioma	-	-	-	-	-	>96	94.5	85.9-97.9	*77.4*	*65.5-85.7*	64.0	83.7	77.5-88.4	56.5	48.2-63.9	11.2	47.9	33.7-60.7	19.5	8.6-33.6
Oligoastrocytic tumours	-	-	-	-	-	>96	96.8	90.0-99.0	75.5	66.8-82.2	55.4	81.2	72.9-87.2	47.3	39.2-55.0	7.2	44.1	24.9-61.7	5.8	1.1-16.9
Ependymal tumours	>96	95.9	87.6-98.7	78.7	67.0-86.6	>96	100.0*	-	90.1	79.7-95.3	>96	91.8	84.4-95.8	82.0	72.2-88.6	>96	84.5	69.2-92.6	68.5	48.1-82.3
Glioma malignant, NOS	>96	71.6	63.0-78.6	54.3	45.6-62.2	>96	87.2	79.2-92.2	69.3	60.1-76.9	27.1	66.8	58.4-73.9	37.3	29.3-45.2	3.3	20.3	15.3-25.9	6.4	3.6-10.4
Choroid plexus tumours	-	-	-	-	-	-	-	-	-	-	>96	-	-	-	-	-	-	-	-	-
Neuronal and mixed neuronal-glial tumours	-	-	-	-	-	>96	100.0*	-	*85.4*	*51.7-96.3*	>96	*78.4*	*59.6-89.2*	*58.4*	*39.3-73.4*	24.7	-	-	-	-
Tumours of the pineal region	44.5	-	-	-	-	-	100.0*	-	100.0*	-	-	100.0*	-	-	-	-	-	-	-	-
Embryonal tumours	>96	86.9	80.9-91.1	72.7	65.3-78.8	>96	90.4	79.7-95.6	*66.6*	*53.2-77.0*	40.3	*77.1*	*57.7-88.5*	-	-	-	-	-	-	-
Other neuroepithelial tumours	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	>96	-	-	-	-
Tumours of cranial and spinal nerves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tumours of meninges	44.6	-	-	-	-	>96	*72.2*	*48.3-86.4*	*68.8*	*45.4-83.8*	81.4	85.7	76.4-91.5	*52.2*	*41.4-62.0*	34.1	80.4	68.8-88.1	48.7	35.1-61.0
Meningioma	-	-	-	-	-	>96	-	-	-	-	81.4	85.0	72.8-92.0	*55.0*	*41.2-66.9*	34.1	83.0	70.4-90.5	49.2	33.9-62.8
Mesenchymal tumours	-	-	-	-	-	>96	-	-	-	-	>96	95.8	70.2-99.5	-	-	>96	-	-	-	-
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lymphomas and hematopoietic neoplasms	-	-	-	-	-	>96	*73.8*	*56.7-85.0*	*67.2*	*49.0-80.2*	51.5	71.1	65.2-76.2	50.9	43.8-57.6	5.6	38.0	33.1-42.9	19.1	14.7-24.0
Lymphoma	-	-	-	-	-	>96	*74.4*	*56.5-85.8*	*67.8*	*49.0-80.9*	51.5	71.1	65.2-76.2	50.9	43.7-57.6	5.6	37.6	32.7-42.5	19.5	15.1-24.3
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	>96	*87.7*	*72.9-94.7*	*85.2*	*69.8-93.1*	>96	93.6	81.2-97.9	91.7	78.5-96.9	-	-	-	-	-	>96	-	-	-	-
Tumours of sellar region	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unclassified tumours	>96	-	-	-	-	>96	*72.1*	*53.2-84.4*	*62.4*	*43.2-76.7*	13.7	50.2	40.7-59.0	36.0	27.1-45.0	1.8	10.4	7.8-13.4	5.0	3.2-7.6
Total	>96	84.5	81.7-86.9	72.8	69.4-75.8	>96	89.8	88.0-91.3	70.3	67.7-72.7	16.5	62.3	60.8-63.7	24.4	23.1-25.8	4.5	25.9	24.6-27.2	6.8	6.0-7.7

Notes: 100.0* indicates the estimated net survival rate is greater than 100%. MSL = median survival length; NSR = net survivial rate.

Table 7: 1- and 5-year net survival rates (NSR) by selected histology and age group for people with primary non-malignant brain and other central nervous system tumours, Canada (excluding Quebec), 2010-2017

	0 to 14 years				15 to 39 years				40 to 64 years				65 to 99 years			
	1-year		5-year		1-year		5-year		1-year		5-year		1-year		5-year	
Histology group (**major**/specific)	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI	NSR (%)	95% CI
Tumours of neuroepithelial tissue	98.3	93.1-99.6	96.8	91.4-98.8	98.1	95.4-99.2	94.7	90.9-97.0	96.9	93.1-98.7	90.0	84.0-93.9	86.5	73.2-93.4	78.8	57.8-90.1
Unique astrocytoma variants	*90.0*	*47.3-98.5*	*90.1*	*47.1-98.6*	100.0*	-	100.0*	-	-	-	-	-	-	-	-	-
Ependymal tumours	100.0*	-	-	-	98.4	88.2-99.8	96.7	85.5-99.3	97.4	90.8-99.3	94.7	85.8-98.1	80.8	61.7-91.0	-	-
Choroid plexus tumours	100.0*	-	100.0*	-	100.0*	-	100.0*	-	*94.6*	*64.4-99.3*	*95.7*	*55.0-99.7*	-	-	-	-
Neuronal and mixed neuronal-glial tumours	98.8	91.0-99.8	97.6	90.3-99.4	97.6	93.6-99.1	93.2	88.0-96.2	96.1	87.3-98.9	*83.4*	*70.2-91.1*	96.6	31.6-99.9	-	-
Tumours of cranial and spinal nerves	100.0*	-	100.0*	-	99.8	97.3-100.0	98.9	96.4-99.7	99.1	98.2-99.6	98.7	96.8-99.4	96.3	93.4-98.0	97.7	86.3-99.6
Tumours of meninges	100.0*	-	100.0*	-	99.4	98.1-99.8	97.8	95.9-98.8	97.2	96.5-97.7	92.5	91.4-93.5	87.3	85.9-88.6	76.4	73.9-78.7
Meningioma	100.0*	-	100.0*	-	99.2	97.7-99.7	98.0	95.8-99.1	97.1	96.4-97.7	92.6	91.4-93.6	87.2	85.8-88.5	75.9	73.3-78.3
Mesenchymal tumours	-	-	-	-	100.0*	-	*90.8*	*47.6-98.8*	95.1	79.9-98.9	*89.7*	*73.4-96.2*	88.9	63.5-97.0	-	-
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	-	-	-	-	100.0*	-	98.0	89.9-99.6	98.5	94.0-99.6	91.5	83.9-95.6	91.3	80.2-96.3	94.6	61.3-99.4
Germ cell tumours, cysts, and heterotopias	*94.6*	*67.0-99.2*	*94.7*	*66.7-99.3*	100.0*	-	100.0*	-	100.0*	-	100.0*	-	-	-	-	-
Tumours of sellar region	98.2	87.6-99.7	94.8	84.5-98.3	99.7	98.7-99.9	98.9	97.5-99.5	98.3	97.4-98.9	96.8	95.5-97.8	94.3	92.2-95.9	89.5	85.0-92.7
Unclassified tumours	96.6	91.8-98.6	95.8	90.7-98.2	97.8	96.1-98.7	93.5	91.0-95.4	85.3	83.3-87.2	73.9	71.3-76.4	65.5	63.4-67.5	49.6	46.5-52.6
Total	97.6	95.3-98.8	96.3	93.8-97.8	99.0	98.6-99.4	97.1	96.2-97.7	95.7	95.2-96.1	91.2	90.4-91.9	81.6	80.6-82.6	70.8	69.1-72.4

Notes: 100.0* indicates the estimated net survival rate is greater than 100%. NSR = net survivial rate.

Table 8: Person-based eight-year limited-duration prevalent counts and prevalence proportions (PP, per 100,000) for primary central nervous system tumours by histology group and behaviour, Canada, January 1, 2018

	All primary CNS tumors			Malignant primary CNS tumors			Non-malignant primary CNS tumors		
Histology group	Persons	PP	95% CI of PP	Persons	PP	95% CI of PP	Persons	PP	95% CI of PP
Tumours of neuroepithelial tissue	7495	20.4	19.9-20.8	6265	17.0	16.6-17.5	1230	3.3	3.2-3.5
Pilocytic astrocytoma	655	1.8	1.7-1.9	655	1.8	1.7-1.9			
Diffuse astrocytoma	525	1.4	1.3-1.6	525	1.4	1.3-1.6			
Anaplastic astrocytoma	360	1.0	0.9-1.1	360	1.0	0.9-1.1			
Unique astrocytoma variants	135	0.4	0.3-0.4	70	0.2	0.2-0.2	60	0.2	0.1-0.2
Glioblastoma	1850	5.0	4.8-5.3	1850	5.0	4.8-5.3			
Oligodendroglioma	570	1.6	1.4-1.7	570	1.6	1.4-1.7			
Anaplastic oligodendroglioma	345	0.9	0.8-1.0	345	0.9	0.8-1.0			
Oligoastrocytic tumours	320	0.9	0.8-1.0	320	0.9	0.8-1.0			
Ependymal tumours	870	2.4	2.2-2.5	475	1.3	1.2-1.4	390	1.1	1.0-1.2
Glioma malignant, NOS	550	1.5	1.4-1.6	550	1.5	1.4-1.6			
Choroid plexus tumours	100	0.3	0.2-0.3	10	0.03	0.01-0.1	95	0.3	0.2-0.3
Neuronal and mixed neuronal-glial tumours	735	2.0	1.9-2.2	105	0.3	0.2-0.4	630	1.7	1.6-1.8
Tumours of the pineal region	70	0.2	0.2-0.2	40	0.1	0.1-0.2	30	0.1	0.1-0.1
Embryonal tumours	395	1.1	1.0-1.2	385	1.1	0.9-1.2	10	0.03	0.01-0.1
Other neuroepithelial tumours	10	0.03	0.01-0.1	-	-	-	-	-	-
Tumours of cranial and spinal nerves	4015	10.9	10.6-11.3	20	0.1	0.03-0.1	3995	10.9	10.5-11.2
Tumours of meninges	12430	33.8	33.2-34.4	185	0.5	0.4-0.6	12245	33.3	32.7-33.9
Meningioma	11635	31.6	31.0-32.2	125	0.3	0.3-0.4	11510	31.3	30.7-31.9
Mesenchymal tumours	190	0.5	0.5-0.6	40	0.1	0.1-0.2	150	0.4	0.3-0.5
Primary melanocytic lesions	15	0.04	0.02-0.1	-	-	-	-	-	-
Other neoplasms related to the meninges	590	1.6	1.5-1.7	15	0.04	0.02-0.1	575	1.6	1.4-1.7
Lymphomas and hematopoietic neoplasms	470	1.3	1.2-1.4	470	1.3	1.2-1.4	0	0.0	-
Lymphoma	460	1.3	1.1-1.4	460	1.3	1.1-1.4			
Other hematopoietic neoplasms	10	0.03	0.01-0.1	10	0.03	0.01-0.1	0	0.0	-
Germ cell tumours, cysts, and heterotopias	255	0.7	0.6-0.8	165	0.5	0.4-0.5	95	0.3	0.2-0.3
Tumours of sellar region	6580	17.9	17.5-18.3	15	0.04	0.02-0.1	6560	17.8	17.4-18.3
Unclassified tumours and not classified by CBTRUS	6325	17.2	16.8-17.6	230	0.6	0.6-0.7	6090	16.6	16.1-17.0
Total	37575	102.1	101.1-103.1	7360	20.0	19.5-20.5	30215	82.1	81.2-83.0

Notes: *8-year limited duration includes everyone diagnosed since 2010 and still alive on Jan. 1. 2018.

Table 9: Person-based eight-year limited-duration prevalent counts for primary central nervous system tumours by histology group, behaviour, and sex, Canada, January 1, 2018

	All primary CNS tumors		Malignant primary CNS tumors		Non-malignant primary CNS	
Histology group	Males	Females	Males	Females	Males	Females
Tumours of neuroepithelial tissue	4235	3260	3530	2740	705	520
Pilocytic astrocytoma	345	310	345	310	[redacted]	[redacted]
Diffuse astrocytoma	305	220	305	220	[redacted]	[redacted]
Anaplastic astrocytoma	180	180	180	180	[redacted]	[redacted]
Unique astrocytoma variants	80	50	40	25	40	25
Glioblastoma	1045	800	1045	800	[redacted]	[redacted]
Oligodendroglioma	335	235	335	235	[redacted]	[redacted]
Anaplastic oligodendroglioma	210	135	210	135	[redacted]	[redacted]
Oligoastrocytic tumours	180	140	180	140	[redacted]	[redacted]
Ependymal tumours	495	375	260	215	235	160
Glioma malignant, NOS	300	250	300	250	[redacted]	[redacted]
Choroid plexus tumours	50	55	-	10	45	45
Neuronal and mixed neuronal-glial tumours	425	310	65	40	360	270
Tumours of the pineal region	40	35	20	25	20	10
Embryonal tumours	235	160	230	155	-	-
Other neuroepithelial tumours	5	5	-	-	-	-
Tumours of cranial and spinal nerves	1970	2045	10	15	1960	2030
Tumours of meninges	3720	8710	85	100	3635	8610
Meningioma	3315	8325	55	70	3260	8255
Mesenchymal tumours	85	105	20	25	70	80
Primary melanocytic lesions	10	5	-	-	-	-
Other neoplasms related to the meninges	310	275	10	5	300	270
Lymphomas and hematopoietic neoplasms	265	210	265	210	0	0
Lymphoma	260	205	260	205	[redacted]	[redacted]
Other hematopoietic neoplasms	-	-	-	-	0	0
Germ cell tumours, cysts, and heterotopias	185	70	135	25	50	45
Tumours of sellar region	3355	3220	5	10	3350	3210
Unclassified tumours	2615	3710	135	95	2480	3615
Total	16350	21225	4170	3190	12185	18030

Table 10: Person-based eight-year limited-duration prevalent counts for primary central nervous system tumours by histology, behaviour, and age group, Canada, January 1, 2018

	All primary CNS tumors				Malignant primary CNS tumors				Non-malignant primary CNS tumors			
Histology group	0 to 14	15 to 39	40 to 64	65+	0 to 14	15 to 39	40 to 64	65+	0 to 14	15 to 39	40 to 64	65+
Tumours of neuroepithelial tissue	985	2270	3095	1145	835	1725	2690	1020	150	545	405	125
Pilocytic astrocytoma	275	285	90	10	275	285	90	10				
Diffuse astrocytoma	40	220	220	35	40	220	220	35				
Anaplastic astrocytoma	5	135	165	50	5	135	165	50				
Unique astrocytoma variants	20	85	25	5	-	-	-	-	-	-	-	-
Glioblastoma	15	190	1020	625	15	190	1020	625				
Oligodendroglioma	-	-	330	45	-	-	330	45				
Anaplastic oligodendroglioma	0	80	225	40	0	80	225	40				
Oligoastrocytic tumours	-	-	175	25	-	-	175	25				
Ependymal tumours	115	215	375	160	105	105	180	80	5	110	195	80
Glioma malignant, NOS	130	170	185	65	130	170	185	65				
Choroid plexus tumours	40	20	35	5	10	0	0	0	30	20	35	5
Neuronal and mixed neuronal-glial tumours	95	385	195	55	-	-	50	25	-	-	145	30
Tumours of the pineal region	10	25	30	5	-	-	-	-	-	-	-	-
Embryonal tumours	230	130	-	-	-	-	-	-	-	-	-	-
Other neuroepithelial tumours	-	-	-	-	-	-	-	-	-	-	-	-
Tumours of cranial and spinal nerves	55	580	2130	1255	0	10	10	5	55	570	2120	1250
Tumours of meninges	25	805	5850	5750	5	25	85	70	20	775	5770	5680
Meningioma	15	640	5440	5535	-	-	50	55	10	625	5390	5480
Mesenchymal tumours	5	25	105	60	-	-	25	10	-	-	85	50
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	5	135	300	150	-	-	5	5	-	-	290	145
Lymphomas and hematopoietic neoplasms	-	-	205	230	-	-	205	230	0	0	0	0
Lymphoma	-	-	200	230	-	-	200	230				
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-	0	0	0	0
Germ cell tumours, cysts, and heterotopias	60	145	35	15	40	115	10	0	25	30	25	15
Tumours of sellar region	70	1245	3050	2215	0	5	-	-	70	1240	-	-
Unclassified tumours	230	1045	2200	2850	20	35	95	80	210	1010	2105	2770
Total	1425	6125	16560	13460	900	1945	3095	1415	525	4180	13465	12045

Table 11: Person-based eight-year limited-duration age-standardized prevalence proportions (PP, per 100,000) for primary central nervous system tumours by histology group and region, January 1, 2018

	British		Prairie		Ontario		Atlantic	
Histology group	PP	95% CI of PP	PP	95% CI of PP	PP	95% CI of PP	PP	95% CI of PP
Tumours of neuroepithelial tissue	18.7	17.5-19.9	19.2	18.2-20.3	20.6	19.8-21.4	18.9	17.2-20.8
Pilocytic astrocytoma	1.5	1.1-1.9	1.8	1.5-2.2	1.8	1.6-2.0	2.0	1.4-2.7
Diffuse astrocytoma	0.7	0.5-1.0	1.2	1.0-1.5	1.6	1.4-1.8	2.0	1.4-2.7
Anaplastic astrocytoma	0.2	0.1-0.4	1.4	1.1-1.7	1.0	0.8-1.2	0.7	0.4-1.2
Unique astrocytoma variants	0.3	0.2-0.5	0.4	0.3-0.6	0.4	0.3-0.5	-	-
Glioblastoma	5.7	5.1-6.4	4.2	3.7-4.7	4.6	4.3-5.0	4.7	3.9-5.6
Oligodendroglioma	2.4	2.0-2.9	1.5	1.2-1.8	1.3	1.1-1.5	1.5	1.0-2.1
Anaplastic oligodendroglioma	0.7	0.5-1.0	0.8	0.6-1.1	1.0	0.9-1.2	1.0	0.7-1.6
Oligoastrocytic tumours	1.2	0.9-1.6	1.0	0.8-1.3	0.7	0.6-0.8	0.9	0.6-1.4
Ependymal tumours	1.8	1.5-2.2	2.4	2.0-2.8	2.5	2.2-2.7	1.7	1.2-2.3
Glioma malignant, NOS	1.1	0.8-1.4	1.3	1.1-1.6	1.8	1.6-2.0	0.7	0.4-1.2
Choroid plexus tumours	0.2	0.1-0.4	0.2	0.1-0.4	0.3	0.2-0.4	0.3	0.1-0.7
Neuronal and mixed neuronal-glial tumours	1.6	1.2-2.0	1.9	1.6-2.2	2.2	2.0-2.5	2.1	1.5-2.8
Tumours of the pineal region	0.3	0.1-0.4	0.1	0.1-0.3	0.2	0.1-0.3	0.2	0.1-0.5
Embryonal tumours	1.0	0.8-1.4	1.0	0.8-1.2	1.2	1.0-1.4	1.0	0.6-1.5
Other neuroepithelial tumours	-	-	-	-	0.0	0.0-0.1	-	-
Tumours of cranial and spinal nerves	10.2	9.4-11.1	8.9	8.2-9.7	12.4	11.8-13.0	5.2	4.3-6.1
Tumours of meninges	28.2	26.8-29.6	36.4	35.0-38.0	32.7	31.8-33.7	24.1	22.3-26.0
Meningioma	26.6	25.2-28.0	34.6	33.2-36.1	30.2	29.3-31.1	22.5	20.8-24.4
Mesenchymal tumours	0.4	0.3-0.6	0.4	0.3-0.6	0.6	0.5-0.8	0.3	0.1-0.6
Primary melanocytic lesions	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	1.1	0.8-1.4	1.3	1.1-1.6	1.9	1.7-2.1	1.3	0.9-1.9
Lymphomas and hematopoietic neoplasms	1.4	1.1-1.8	1.3	1.0-1.6	1.1	0.9-1.3	1.00	0.7-1.5
Lymphoma	1.4	1.1-1.8	1.2	1.0-1.5	1.1	0.9-1.2	1.00	0.7-1.5
Other hematopoietic neoplasms	-	-	-	-	-	-	-	-
Germ cell tumours, cysts, and heterotopias	0.9	0.7-1.2	0.5	0.3-0.7	0.8	0.7-1.0	0.7	0.4-1.1
Tumours of sellar region	19.3	18.1-20.5	14.7	13.8-15.7	19.0	18.3-19.7	10.3	9.1-11.7
Unclassified tumours	2.5	2.1-3.0	1.8	1.5-2.2	30.4	29.5-31.3	0.7	0.4-1.2
Total	81.1	78.7-83.6	82.8	80.6-85.1	116.9	115.1-118.7	60.9	57.9-64.0

REFERENCE

Brodbelt, A., Greenberg, D., Winters, T., Williams, M., Vernon, S., Collins, V. P., & (UK) National Cancer Information Network Brain Tumour Group (2015). Glioblastoma in England: 2007-2011. European journal of cancer (Oxford, England : 1990), 51(4), 533–542. https://doi-org/10.1016/j.ejca.2014.12.014

Canadian Cancer Statistics Advisory Committee. (2019). *Canadian Cancer Statistics 2019*. Canadian Cancer Society. cancer.ca/Canadian-Cancer-Statistics-2019-EN

Coviello, E., Seppä, K., Dickman, P. W., & Pokhrel, A. (2015). Estimating Net Survival using a Life-Table Approach. *The Stata Journal*, *15*(1), 173–185. https://doi.org/10.1177/1536867X1501500111

Dickman, PW. Estimating and Modelling relative survival using SAS. Retrieved October 3rd 2019 from: https://www.pauldickman.com/software/sas/sas/.

Dudley, W. N., Wickham, R., & COOMBS, N. (2016). An Introduction to Survival Statistics: Kaplan-Meier Analysis. *Journal of the Advanced Practitioner in Oncology*, *7*(1), 91–100.

Ellison, L. F. (2018). *Progress in net cancer survival in Canada over 20 years*. https://www150.statcan.gc.ca/n1/pub/82-003-x/2018009/article/00002-eng.htm

Forjaz, G., Barnholtz-Sloan, J. S., Kruchko, C., Siegel, R., Negoita, S., Ostrom, Q. T., Dickie, L., Ruhl, J., Van Dyke, A., Patil, N., Cioffi, G., Miller, K. D., Waite, K., & Mariotto, A. B. (2021). An updated histology recode for the analysis of primary malignant and nonmalignant brain and other central nervous system tumors in the Surveillance, Epidemiology, and End Results Program. *Neuro-Oncology Advances*, *3*(1), vdaa175. https://doi.org/10.1093/noajnl/vdaa175

National Cancer Institute. (2021). *Measures of Cancer Survival*. https://surveillance.cancer.gov/survival/measures.html

Ostrom, Q. T., Patil, N., Cioffi, G., Waite, K., Kruchko, C., & Barnholtz-Sloan, J. S. (2020). CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2013-2017. *Neuro-Oncology*, *22*(12 Suppl 2), iv1–iv96. https://doi.org/10.1093/neuonc/noaa200

Pearce, N. (2005). *A short introduction to epidemiology*. Centre for Public Health Research, Massey University. https://courses.cit.cornell.edu/bionb4280/Intro_Epidemiology.pdf

Private Members' Business M-235. (2007). *House of Commons of Canada, 39th Parliament, 1st Session (February 14, 2007)*. https://www.ourcommons.ca/DocumentViewer/en/39-1/house/sitting-110/journals#DOC--2699530

R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing. http://www.R-project.org/

Seppä, K., Hakulinen, T., & Pokhrel, A. (2015). Choosing the net survival method for cancer survival estimation. *European Journal of Cancer (Oxford, England: 1990)*, *51*(9), 1123–1129. https://doi.org/10.1016/j.ejca.2013.09.019

Smith T, Yuan Y, Walker EV, Davis FG. Brain Tumour Registry of Canada (BTRC): Incidence Report 2010-2015. Brain Tumour Registry of Canada (BTRC) A Surveillance Research Collaborative. 2019; https://braintumourregistry.ca/incidence-report/

Smith T, Yuan Y, Walker EV, Davis FG. Brain Tumour Registry of Canada (BTRC): Survival Report 2010-2015. Brain Tumour Registry of Canada (BTRC) A Surveillance Research Collaborative. 2019; https://braintumourregistry.ca/survival-report/

Statistics Canada (2021). Vital Statistics – Death database (CVSD). Government of Canada. http://www23. statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233.

Statistics Canada. (2021). *Canadian Cancer Registry (CCR)*. Ottawa, ON: Statistics Canada. https://www23.statcan.gc.ca/imdb/p2SV. pl?Function=getSurvey&SDDS=3207

Visser, O., Ardanaz, E., Botta, L., Sant, M., Tavilla, A., Minicozzi, P., & EUROCARE-5 Working Group: (2015). Survival of adults with primary malignant brain tumours in Europe; Results of the EUROCARE-5 study. European journal of cancer (Oxford, England : 1990), 51(15), 2231–2241. https://doi-org.login.ezproxy.library.ualberta.ca/10.1016/j.ejca.2015.07.032

Walker EV, Zakaria D, Yuan Y, Yasmin F, Shaw A, Davis FG. Brain Tumour Registry of Canada (BTRC): Incidence (2013-2017) and Mortality (2014-2018) Report. Brain Tumour Registry of Canada (BTRC) A Surveillance Research Collaborative. 2021; https://braintumourregistry.ca/incidence-and-mortality-report/.

APPENDIX

Brain Tumour Registry of Canada (BTRC), brain and other central nervous system tumour histology groupings

Histology Groups	ICD-O-3 Histology and Behavior Code*
Tumours of Neuroepithelial Tissue	
Pilocytic astrocytoma	9421/1,3; 9425/3
Diffuse astrocytoma	9400/3; 9410/3; 9410/3; 9420/3
Anaplastic astrocytoma	9401/3
Unique astrocytoma	9381/3; 9384/1; 9424/3
Glioblastoma	9440/3; 9441/3; 9442/3
Oligodendroglioma	9450/3
Anaplastic oligoodendroglioma	9401/3
Choroid plexus tumours	9390/0,1,3
Oligoastrocytic tumours	9382/3
Ependymal tumours	9383/1; 9391/3; 9392/3; 9393/3; 9394/1
Glioma malignant, Not otherwise specified	9380/3
Neuronal and mixed neuronal-glial tumours	8680/0,1,3; 8681/1; 8690/1; 8693/1,3 9412/1; 9413/0;9442/1; 9492/0 Site C751 excluded; 9493/0 9505/1,3; 9506/1; 9509/1; 9522/3; 9523/3
Tumors of the pineal region	9360/1; 9361/1; 9362/3; 9395/3
Embryonal tumours	8963/3; 9364/3; 9470-9474/3; 9480/3; 9490/3,0 9500-9502/3; 9508/3
Other neuroepithelial tumours	9363/0, 9423/3, 9430/3, 9444/1

Tumors of Cranial and Spinal nerves	9540/0,1,3; 9541,0; 9550/0; 9560/0,1,3; 9561/3; 9562/0; 9570/0; 9571/0,3
Tumours of the Meninges	
Meningioma	9530/0,1,3; 9531/0; 9532/0; 9533/0; 9534/0; 9537/0; 9538/1,3; 9539/1,3
Mesenchymal tumours	8324/0; 8800/0,3; 8801-8806/3; 8810/0,3; 8815/0,3;8824/0,1; 8830/0,1,3; 8831/0; 8835/0; 8836/0 8850/0,1,3; 8851-8852/0,3; 8853/3; 8854/0,3; 8857/0,3 8861/0; 8870/0; 8880/0; 8890/0,1,3; 8897/1 8901-8902/3; 8910/3; 8912/3; 8920/1,3; 8921/3; 8935/0,1;8990/0,1,3 9040/0,3; 9136/1; 9150/0,1,3; 9170/0,3;9180/0,3; 9210/0; 9241/0; 9260/3; 9373/0
Primary melanocytic lesions	8720/3; 8728/0,1,3; 8770-8771/0,3
Other neoplasms related to the meninges	9160/1; 9220/0,1,3; 9231/3; 9240/3; 9243/3; 9370-9372/3; 9535/0
Lymphomas & Hematopoietic Neoplasms	
Lymphoma	9590-9591/3; 9596/3 9650-9655/3; 9659/3; 9661-9665/3; 9667/3; 9670/3; 9671/3; 9673/3; 9675/39680/3; 9684/3; 9687/3; 9690/3; 9691/3; 9695/3; 9698-9699/3 9701/3; 9702/3; 9705/3; 9714/3; 9719/3; 9728/3; 9729/3
Other hematopoietic neoplasms	9727/3; 9731/3; 9733-9734/3; 9740/1,3; 9741/3; 9750/3; 9751-9753/1; 9754-9758/3; 9760/3; 9766/1 9823/3; 9826/3; 9827/3; 9832/3; 9827/3; 9832/3; 9837/3; 9860/3; 9861/3; 9866/3 9930/3; 9970/1
Germ Cell Tumors, Cysts and Heterotopias	8020/3; 8440/0,3 9060-9061/3; 9064-9065/3; 9070-9072/3; 9080/0,1,3; 9081-9083/3; 9084/0,3; 9085/3 9100/3; 9101/3

Tumours of the Sellar Region	8040/0,1; 8140/0,1,3; 8146/0 8270/0,3; 8271/0; 8272/0,3; 8280/0,3; 8281/0,3; 8290/0,3 8300/0,3; 8310/0,3; 8323/0,3 9492/0 Site C751 only; 9582/0; 9350-9352/1
Unclassified Tumours	9120/0,3; 9121/0; 9122/0,3; 9123/0; 9125/0;9130/0,1,3; 9131/0; 9133/1,3; 9140/3 8000/0,1,3; 8001/0,1,3; 8002-8004/3; 8005/0,3; 8010/0, 8010/1,3; 8021/3; 8320/3; 8452/1; 8710/3; 8711/0,3; 8713/0; 8811/3; 8840/0,3; 8896/3; 8980/3 91730/0; 9503/3; 9580/0,3 8050/1; 8246/0; 8272/1; 8683/3; 8712/0; 8720/0; 8726/0; 8772/0; 8821/1; 8858/3 9084/1; 9120-9121/1; 9160/0; 9161/0,3; 9172/0 9350/0,3; 9380/0,1; 9383/3; 9384/0; 9391/0,1; 9393/0; 9394/3; 9400/0,1; 9401/0;9413/1; 9424/0; 9430/0; 9440/1; 9451/0; 9490/1 9505/0; 9522/1; 9531/1,3; 9532/1; 9534/1; 9537/1,3; 9538-9539/0; 9571/1; 9581/3; 9688/3; 9712/3; 9751/3; 9971/3
Notes:*International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.	

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