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CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014–2018

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Abstract

The Central Brain Tumor Registry of the United States (CBTRUS), in collaboration with the Centers for Disease Control and Prevention (CDC) and National Cancer Institute (NCI), is the largest population-based cancer registry focused exclusively on primary brain and other central nervous system (CNS) tumors in the United States (US) and represents the entire US population. This report contains the most up-to-date population-based data on primary brain tumors available and supersedes all previous reports in terms of completeness and accuracy and is **the first CBTRUS Report to provide the distribution of molecular markers for selected brain and CNS tumor histologies**. All rates are age-adjusted using the 2000 US standard population and presented per 100,000 population. The average annual age-adjusted incidence rate (AAAIR) of all malignant and non-malignant brain and other CNS tumors was 24.25 (**Malignant** AAAIR=7.06, **Non-malignant** AAAIR=17.18). This overall rate was higher in females compared to males (26.95 versus 21.35) and non-Hispanics compared to Hispanics (24.68 versus 22.12). The most commonly occurring **malignant** brain and other CNS tumor was glioblastoma (14.3% of all tumors and 49.1% of **malignant tumors**), and the most common **non-malignant** tumor was meningioma (39.0% of all tumors and 54.5% of **non-malignant** tumors). Glioblastoma was more common in males, and meningioma was more common in females. In children and adolescents (age 0–19 years), the incidence rate of all primary brain and other CNS tumors was 6.21. An estimated 88,190 new cases of **malignant** and **non-malignant** brain and other CNS tumors are expected to be diagnosed in the US population in 2021 (25,690 **malignant** and 62,500 **non-malignant**). There were 83,029 deaths attributed to **malignant** brain and other CNS tumors between 2014 and 2018. This represents an average annual mortality rate of 4.43 per 100,000 and an average of 16,606 deaths per year. The five-year relative survival rate following diagnosis of a **malignant** brain and other CNS tumor was 35.6%, for a **non-malignant** brain and other CNS tumors the five-year relative survival rate was 91.8%.

EXECUTIVE SUMMARY

The Central Brain Tumor Registry of the United States (CBTRUS), in collaboration with the CDC and NCI, is the largest population-based registry focused exclusively on primary brain and other central nervous system (CNS) tumors in the United States (US) and represents the entire US population. The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014–2018* contains the most up-to-date population-based data on primary brain

tumors available through the surveillance system in the US and supersedes all previous reports in terms of completeness and accuracy, thereby providing a current comprehensive source for the descriptive epidemiology of these tumors. **This is the first CBTRUS Report to provide the distribution of molecular markers for selected brain and CNS tumor histologies**. All rates are age-adjusted using the 2000 US standard population and presented per 100,000 population.

Incidence

- The average annual age-adjusted incidence rate (AAAIR) of all malignant and non-malignant brain and other CNS tumors was 24.25 per 100,000 between 2014 and 2018.
- This overall rate was higher in females compared to males (26.95 versus 21.35 per 100,000) and non-Hispanics (of any race) compared to Hispanics (24.68 versus 22.12 per 100,000).
- The AAAIR of malignant brain and other CNS tumors was 7.06 per 100,000.
- The AAAIR of non-malignant brain and other CNS tumors was 17.18 per 100,000.
- Approximately 29.1% of all brain and other CNS tumors were malignant and 70.9% were non-malignant, which makes non-malignant tumors more than twice as common as malignant tumors.
- The most commonly occurring malignant brain and other CNS tumor was glioblastoma (14.3% of all tumors and 49.1% of malignant tumors), and the most common non-malignant tumor was meningioma (39% of all tumors and 54.5% of non-malignant tumors). Glioblastoma was more common in males, and meningioma was more common in females.
- In children and adolescents (age 0–19 years), the AAAIR of malignant and non-malignant brain and other CNS tumors was 6.21 per 100,000 between 2014 and 2018. Incidence was higher in females compared to males (6.33 versus 6.10 per 100,000), Whites compared to Blacks (6.42 versus 4.87 per 100,000), and non-Hispanics compared to Hispanics (6.50 versus 5.35 per 100,000).
- An estimated 88,190 new cases of malignant and non-malignant brain and other CNS tumors are expected to be diagnosed in the US in 2021.This includes an expected 25,690 malignant and 62,500 non-malignant tumors.

Mortality

- There were 83,029 deaths attributed to **malignant** brain and other CNS tumors between 2014 and 2018 This represents an average annual mortality rate of 4.43 per 100,000, and an average of 16,606 deaths per year caused by **malignant** brain and other CNS tumors.

Survival

- The five-year relative survival rate following diagnosis of a **malignant** brain and other CNS tumor was 66.9%. Survival following diagnosis with a **malignant** brain and other CNS tumor was highest in persons age 0–14 years (84.1%) and age 15–39 years (84.7%) as compared to those age 40+ years (65.6%).
- The five-year relative survival rate following diagnosis of a **non-malignant** brain and other CNS tumor was 92.1%. Survival following diagnosis with a **non-malignant** brain and other CNS tumor was highest in persons age 15–39 years (98.3%) and age 0–14 years (97.5%) as compared to those age 40+ years (90.7%).

Introduction

The objective of the *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014–2018* is to provide a comprehensive summary of the current descriptive epidemiology of primary brain and other central nervous system (CNS) tumors in the United States (US) population. The Central Brain Tumor Registry of the United States (CBTRUS) obtained the latest available population-based data on all newly diagnosed primary brain and other CNS tumors from the Centers for Disease Control and Prevention's (CDC) National Program of Cancer Registries (NPCR), and the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) program for diagnosis years 2014–2018. Incidence counts and rates of primary malignant and non-malignant brain and other CNS tumors are presented by histology, sex, age, race, Hispanic ethnicity, and geographic location. Mortality rates calculated using the National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS) data from 2014–2018, and relative survival rates, median survival and adjusted hazard ratios (HRs) for selected malignant and non-malignant histologies calculated using NPCR data for the period 2001–2017 (2004–2017 for non-malignant tumors), are also presented. **This report is the first CBTRUS annual Statistical Report to provide the distribution of molecular markers for selected brain and CNS tumor histologies**.

Background

CBTRUS is a unique professional research organization that focuses exclusively on providing high-quality statistical data on the population-based incidence of primary brain and other CNS tumors in the US (for more information on CBTRUS see: http://www.cbtrus.org/about/).[1] CBTRUS was incorporated as a nonprofit 501(c)(3) in 1992 following a study conducted by the American Brain Tumor Association (ABTA) to determine the feasibility of a population-based central registry focused on all primary brain and other CNS tumors in the US.

This report represents the twenty-ninth (29th) anniversary of CBTRUS and the twenty-fourth (24th) statistical report published by CBTRUS. For this tenth (10th) report published as a Supplement to *Neuro-Oncology*, the official journal of the Society for Neuro-Oncology (http://www.

soc-neuro-onc.org), CBTRUS continues its past efforts to provide the most up-to-date population-based incidence rates for all primary brain and other CNS tumors by behavior (malignant, non-malignant), histology, age, sex, race, and Hispanic ethnicity. These data have been organized by clinically relevant histology groupings and reflect the *2016 World Health Organization (WHO) Classification of Tumours of the Central Nervous System*.[2] These data provide important information for allocation and planning of specialty healthcare services such as clinical trials, disease prevention and control programs, and research activities. These data may also lead to clues that will stimulate research into the causes of this group of diseases, which often result in significant morbidity and mortality.

CBTRUS is currently the only population-based site-specific registry in the US that works in partnership with a public cancer surveillance organization, the CDC's NPCR, and from which data are directly received through the NPCR Cancer Surveillance System (NPCR-CSS) Submission Specifications mechanism[3] under a special agreement. Collection of central (state) cancer data was mandated in 1992 by Public Law 102–515, the Cancer Registries Amendment Act.[4] This mandate was expanded to include non-malignant CNS tumors with the 2002 passage of Public Law 107–260, starting January 1, 2004.[5] CBTRUS combines the NPCR data with data from the NCI's SEER program,[6] which was established for national cancer surveillance in the early 1970s. All data from NPCR and SEER originate from tumor registrars who adhere to the Uniform Data Standards (UDS) for malignant and non-malignant brain and other CNS tumors as directed by the North American Association of Cancer Registries (NAACCR) (http://www.naaccr.org). Along with the UDS, there are quality control checks and a system for rating each central cancer registry (CCR) to ensure that these data are as accurate and complete as possible. As a surveillance partner, CBTRUS reports high-quality data on brain and other CNS tumors with histological specificity useful to the communities it serves.

The CBTRUS database is comprised of the largest histology-specific aggregation of population-based data limited to the incidence and survival of primary brain and other CNS tumors in the US, and it is likely the largest histology-specific aggregation of primary brain and other CNS tumor cases in the world. The CBTRUS database now includes both survival data from 42 CCR and incidence data from all 52 CCR in the US and Puerto Rico. There are several other brain-specific registry systems in existence, including the Canadian Brain Tumor Registry,[7] the Austrian Brain Tumor Registry,[8] and the Swedish Brain Tumor Registry,[9] as well as other population-based epidemiological studies of primary brain and other CNS tumors that cover a smaller population base. Due to the demographics of the US as compared to European countries, CBTRUS includes a greater proportion of cases of primary brain and other CNS tumors in non-White persons. Aggregate information on all cancers from all CCR in the US, including primary brain and other CNS tumors, is available from the *United States Cancer Statistics (USCS)*.[10]

The CBTRUS Histology Grouping Scheme

There are over 100 histologically distinct types of primary CNS tumors, each with its own spectrum of clinical presentations, treatments, and outcomes. These histologies are reviewed periodically by neuropathologists and published by the World Health Organization (WHO) in Classification Reports known as "Blue Books". Blue Books are published for all cancer sites by WHO and utilize the International Classification of Diseases for Oncology, third edition (ICD-O-3) for assignment of histology, behavior, and site codes. **Beginning with this 2021 Statistical Report, CBTRUS is using Histology Groupings according to *2016 WHO Classification of Tumours of the Central Nervous System*.**

Anatomic Location of Tumor Sites

Various terms are used to describe the regions of the brain and other CNS. The specific sites used in this report are based on the topography codes found in ICD-O-3 and are broadly based on the categories and site codes defined in the SEER Site/Histology Validation List.[22] CBTRUS groups ICD-O-3 sites C71.8 (Overlapping lesion of the brain) and C71.9 (Brain, NOS) into "Other brain," and C72.8 (Overlapping lesion of brain and central nervous system) and C72.9 (Nervous system, NOS) into "Other nervous system" for display in figures. This report also presents counts and incidence for specific sites separately in its tables. See **Table 1** for the CBTRUS primary site groupings.

Classification by Histology

The ICD-O-3 codes in this current CBTRUS Grouping[11] may include morphology codes that were not previously reported to CBTRUS.[12] Gliomas are tumors that arise from glial or precursor cells and include astrocytoma (including glioblastoma), oligodendroglioma, ependymoma, oligoastrocytoma (mixed glioma), and a few rare histologies. Because there is no standard definition for glioma, **CBTRUS defines glioma as ICD-O-3 histology codes 9380–9384, and 9391–9460 as starred in Table 2**. It is also important to note that the statistics for lymphomas and hematopoietic neoplasms contained in this report refer only to those lymphomas and hematopoietic neoplasms that arise in the brain and other CNS ICD-O-3 topography codes.

This report also utilizes the International Classification of Childhood Cancer (ICCC) grouping system for pediatric brain and other CNS tumors. ICCC categories for this report were generated using the SEER *Main and Extended Classification for ICCC Recode ICD-O-3/WHO 2008*[13] based on the ICCC, Third edition[14,15] and *2007 WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*[16] (See Supplementary Table 1 for more information on this classification scheme). The ICCC was developed to provide a standard classification of childhood tumors for comparing incidence and survival across global geographic regions and time periods.

Classification by Behavior

Primary brain and other CNS tumors can be broadly classified in non-malignant (ICD-O-3 behavior codes of /0 for benign and /1 for uncertain) and malignant (ICD-O-3 behavior code of /3) (**Table 2**). Collection of central (state) cancer data was mandated in 1992 by Public Law 102–515 for all primary malignant tumors (ICD-O-3 behavior code of /3) (**Table 2**), the Cancer Registries Amendment Act.[4] This mandate was expanded to include **non-malignant brain and other CNS tumors** (ICD-O-3 behavior code of /0 and /1) with the 2002 passage of Public Law 107–260, starting January 1, 2004.[5] Collection of metastatic tumors are not included in these public laws, and therefore not included in cancer reporting in the US. CBTRUS reports data on all brain and other CNS tumors irrespective of behavior, whereas many reporting organizations may only publish rates for primary malignant brain and other CNS tumors due to the original mandate that focused only on primary malignant tumors, sometimes using the term cancer to broadly identify these tumors in their reports. **These differences in definition therefore influence the direct comparison of published rates in other surveillance reports.**

Classification by WHO Grade

Unlike other types of cancer which are staged according to the American Joint Commission of Cancer (AJCC) Collaborative Staging (CS) schema, primary brain and other CNS tumors are not staged. They are classified according to the *WHO 2000 Classification of Tumours of the Central Nervous System*[17] which assigns a grade (grade I through grade IV) based on predicted clinical behavior. Though the WHO classification scheme was also updated in 2007[18] and 2016[2] these updated schema were not fully implemented by US CCR until collection year 2018 or reporting year 2021. Updates made in 2007 and 2016 may affect diagnostic practices used in characterization of individual tumors included in this report.

The WHO grading assignments are recorded by cancer registrars as Collaborative Stage Site-Specific Factor (SSF)1 - WHO Grade Classification as directed in the AJCC Chapter 72 on Brain and Spinal Cord[19] (2014–2017), Site-Specific Data Items (SSDI) Grade Pathological (2018+), and SSDI Grade Clinical (2018+). Site-specific factor variables were a required component of cancer registry data collection for brain and other CNS tumors beginning in 2004 for SEER registries, and beginning in 2011 for NPCR registries, and completeness of these variables have improved significantly over time.[20,21] SSDI Grade Pathological, and SSDI Grade Clinical are newly added variables and are available for the first time for reporting in 2021.

Completeness of this variable is defined as having a value equal to WHO grade I, II, III, or IV. Cases where WHO grade is marked as not applicable or not documented are considered incomplete. It is not possible to conclusively determine WHO grade, which is based on the appearance of tumor cells, when a tumor is radiographically confirmed only. Some tumor types (including tumors of the pituitary and lymphomas) are often not assigned a WHO grade. This information may also be assigned but not included in the pathology report.

Comparison with prior CBTRUS grouping scheme

CBTRUS reports data on brain and other CNS tumors according to the clinical standards found in the World Health Organization (WHO) classifications. In 2016, a revised classification entitled *2016 WHO Classification of Tumours of the Central Nervous System* was published. It included new histologies, some of which contained molecular markers necessary for accurate diagnosis. CBTRUS successfully petitioned NAACCR, the surveillance standard setter in the US to include the biomarkers embedded in histologies found in 2016 WHO into the Uniform Data Standards (UDS) guiding US cancer reporting practices. Collection of these biomarkers found in the 2016 WHO began January 1, 2018. CBTRUS presents data using the newly developed 2021 CBTRUS Histology Grouping for the first time with this Report. This grouping scheme was developed by cross-referencing all ICD-O-3 histology and behavior codes using four sources to ensure complete capture of all pertinent brain and other CNS tumor histologies, including obsolete histology terms found in ICD-O-3, These sources included: *2016 WHO Classification of Tumours of the Central Nervous System, 2007 WHO Classification of Tumours of the Central Nervous System*, the *International Classification of Diseases for Oncology Third Edition*, and **Table 2** from the *2020 CBTRUS Statistical Report, Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States, 2013–2017.* The Working Group reviewed sequentially the draft document of the histologies listed under the 2016 WHO Histology Groupings. Corresponding changes were subsequently made and sent to the Neuropathology Team members of the Working Group for final confirmation. Two additional pathologists with expertise in solid tumors and in lymphomas were consulted to help with specific 2016 WHO Histology Groupings. The CBTRUS 2021 Histology Groupings are presented in **Table 2**. **The expected publication of the 2021 WHO Classification will incur additional updating of the CBTRUS 2021 Groupings. CBTRUS plans to work with the UDS Committee to include 2021 WHO Classification changes in cancer reporting mindful that implementation is bound by the UDS timeline.**

Brain Tumor Definition Differences

Currently, NPCR, SEER, and NAACCR report primary brain and other CNS tumors differently from CBTRUS. The definition of primary brain and other CNS tumors used by these organizations in their published incidence and mortality statistics includes tumors located in the following sites with their ICD-O-3 site codes in parentheses: brain, meninges, and other CNS tumors (C70.0–9, C71.0–9, and C72.0–9), but *excludes* lymphoma and leukemia histologies (9590–9989) from all brain and other CNS sites.[23] In contrast, CBTRUS reports data on all tumor morphologies located within the Consensus Conference site definition including lymphoma and other hematopoietic histologies, tumors of the pituitary, as well as olfactory tumors of the nasal cavity [C30.0 (9522–9523)].[12] Additionally, CBTRUS reports data on all primary brain and other CNS tumors irrespective of behavior, whereas many reporting organizations may only publish rates for

malignant brain and other CNS tumors due to the original mandate that focused only on malignant tumors, sometimes using the term cancer to broadly identify these tumors in their reports. **These differences in definition therefore influence the direct comparison of published rates.**

CBTRUS is currently engaged in ongoing collaboration with other cancer registry reporting groups, including SEER, to harmonize brain tumor reporting definitions. Therefore, it is likely that these reporting differences will cease to exist in the future.

Pilocytic astrocytoma is clinically considered and classified as a Grade I, non-malignant (ICD-O-3 behavior code of /1) tumor by the World Health Organization (WHO) guidelines for brain and other central nervous system (CNS) tumors.[2] For the purposes of cancer registration, these tumors have historically been reported as malignant (ICD-O-3 behavior code of /3) tumors both in the US and by the International Agency for Research on Cancer and International Association of Cancer Registries.[24,25] Classification of these tumors as malignant has been followed by CBTRUS in its reporting unless otherwise stated. This practice does not correlate with clinical classification and presents a challenge to correctly report population-based incidence and survival patterns associated with these tumors. Please see a recent publication for additional discussion of the effect of this classification on cancer incidence and survival reporting.[26]

In the US, cancer registries and surveillance groups only collect data on primary CNS tumors (meaning tumors that originate within the brain and spinal cord) and do not collect data on tumors that metastasize to the brain or spinal cord from other primary sites. As a result, **only primary brain and other CNS tumors are included in this report.**

TECHNICAL NOTES

Data Collection

CBTRUS does not collect data directly from patients' medical records. Registration of individual cases (tumors) is conducted by cancer registrars at the institution where diagnosis and/or treatment occur and is then transmitted to the CCR, which further transmits this information to NPCR and/or SEER. Some CCRs also send their data to SEER; data from those CCRs are taken from the NPCR file to eliminate duplicate cases. As noted, data for CBTRUS analyses come from the NPCR and SEER programs. By law, all primary malignant and non-malignant CNS tumors are reportable diseases and CCRs play an essential role in the collection process. Brain and other CNS tumors are reported using the site definition described in Public Law 107–260.[5] These data are population-based and represent a comprehensive documentation of all reported cancers diagnosed within a geographic region for the years included in this report.

CBTRUS obtained de-identified incidence data from 52 CCR (48 NPCR and 4 SEER) that include cases of malignant and non-malignant (benign and uncertain behaviors) primary brain and other CNS tumors. The population-based CCR include 50 state registries, the District of Columbia, and Puerto Rico (**Figure 1**). **Data were requested for all newly-diagnosed primary malignant and non-malignant tumors from 2014 to 2018 at any of the following International Classification of Diseases for Oncology, 3rd Edition (ICD-O-3) anatomic sites: brain, meninges, spinal cord, cranial nerves, and other parts of the central nervous system, pituitary and pineal glands, and olfactory tumors of the nasal cavity (ICD-O-3 site code C30.0 and histology codes 9522–9523 only)** (**Table 1**).[11]

NPCR provided data on 432,693 primary brain and other CNS tumors diagnosed from 2014 to 2018 (**Figure 2**). An additional 13,283 primary brain and CNS tumor case records for the period were obtained from SEER for primary brain and other CNS tumor case records from 2014 to 2018 for Connecticut, Hawaii, Iowa, and New Mexico only. These data were combined into a single dataset of 445,976 records for quality control. A total of 11,939 records (2.7%) were deleted from the final analytic dataset for one or more of the following reasons:

- Records with ICD-O-3 behavior code of /2 (indicates in situ cases, which is not a relevant classification for brain and other CNS tumors).
- Records with an invalid site/histology combination according to the CBTRUS histology grouping scheme
- Possible duplicate records that included a less accurate reporting source than microscopic confirmation, also referred to as histologic confirmation (e.g. radiographic versus microscopic confirmation), possible duplicate record for recurrent disease, or errors in time sequence of diagnosis
- Possible duplicate records for bilateral vestibular schwannoma or meningioma that were merged to one paired-site record.

The final analytic dataset had 434,037 records, which included 431,733 records from the 50 state CCR and the District of Columbia used in the analytic dataset, and an additional 2,264 records from Puerto Rico. Records from Puerto Rico are included only in a supplementary analysis (see Supplemental Material), and these cases are not included in the overall statistics presented in this report.

Age-adjusted incidence rates per 100,000 population for the entire US for selected other cancers were obtained from the United States Cancer Statistics (USCS), produced by the CDC and the NCI, for the purpose of comparison with brain and other CNS tumor incidence rates.[10] This database includes both NPCR and SEER data and represents the entire US population.

De-identified survival data for malignant brain and other CNS tumors were obtained from the US Cancer Statistics program for 42 NPCR registries for the years 2001 to 2017 and for non-malignant brain and other CNS tumors for the years 2004 to 2017. This dataset provides population-based information for 82% of the US population for the years 2001 to 2017 and is a subset of the data used for the incidence calculations presented in this report. Survival information is derived from both active and passive follow-up.

Mortality data used in this report are from the NVSS and include deaths where primary brain or other CNS tumor was listed as primary cause of death on the death

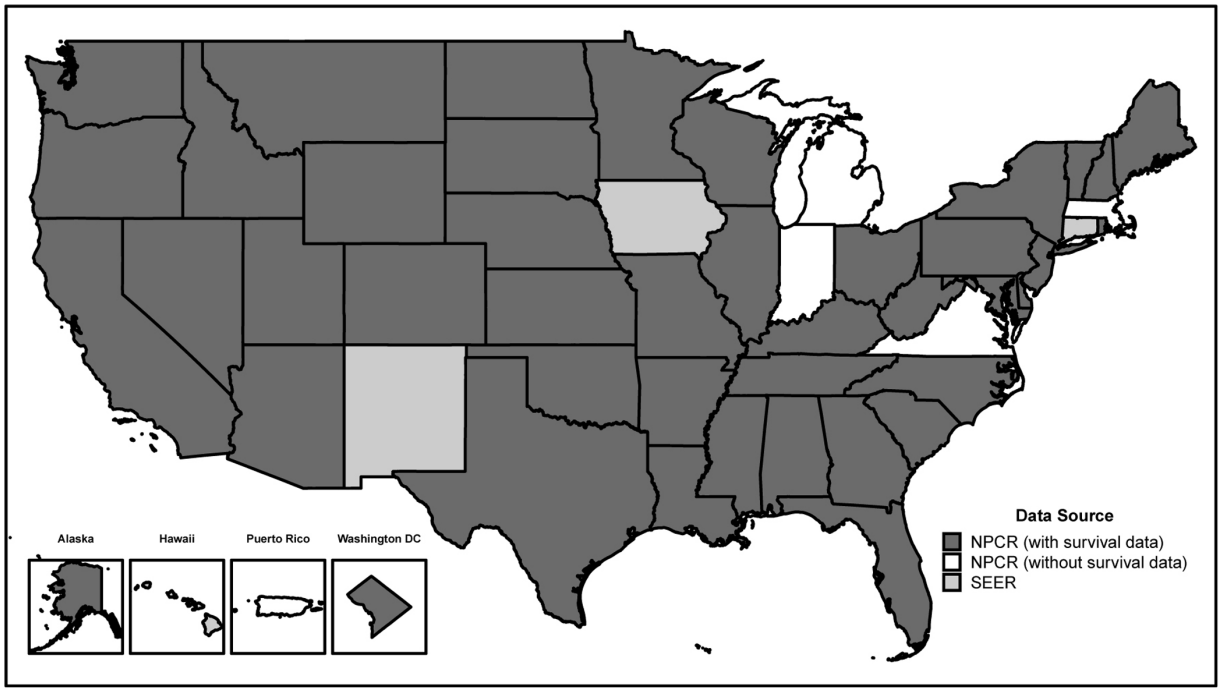
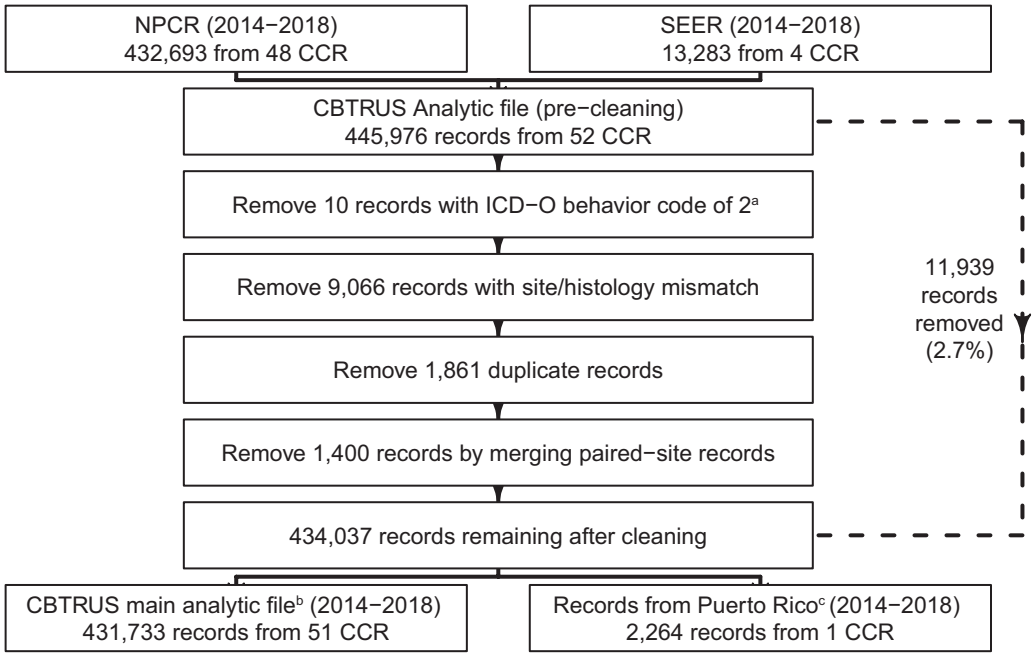


Fig. 1 Availability by Central Cancer Registry for SEER and NPCR Incidence (2014–2018) and Survival Data (2001–2017).



a. ICD–O–3 behavior code of 2 is used to designate in situ cases, which is not a relevant classification for brain and other CNS tumors.
b. Records from 50 state CCR and Washington, DC are used for all tables and figures presented in this report unless otherwise specified.
c. Data from Puerto Rico is presented in Supplementary Figure 4 only.
Abbreviations: CBTRUS=Central Brain Tumor Registry of the United States; CCR=Central Cancer Registry; NPCR=National Program of Cancer Registries; SEER=Surveillience, Epidemiology, and End Results

Fig. 2 Overview of CBTRUS Data Edits Workflow, NPCR and SEER, 2014–2018.

certificate for individuals from all 50 states and the District of Columbia. These data were obtained from NVSS[27] (includes death certification data for 100% of the US population) for malignant brain and other CNS tumors and comparison via SEER*Stat (for malignant brain tumors and comparison cancers). NVSS data are not collected through the cancer registration system. These data represent the primary cause of death listed on each individual death certificate, and as a result, deaths in persons with cancer may be recorded as non-cancer deaths.

Definitions

Measures in Surveillance Epidemiology

The CBTRUS Report presents the following population-based measures: incidence rates, mortality rates, observed survival (median survival time and hazard ratios) and relative survival rates (for more information on definitions of terms and measures used see: https://cbtrus.org/cbtrus-glossary/).

Variable Completeness in Cancer Registration

Obtaining the most accurate and complete cancer registration data possible is essential to generate accurate population-level statistics to guide public health planning. Agencies such as NAACCR and IACR have developed stringent standards for evaluation of cancer registry data quality, and evaluate each specific registry by multiple metrics before including it in analytic datasets.[28,29] While many measures of quality and completeness are assessed across all cancer sites, some variables are pertinent only to specific sites and/or histologies and require special care. In the case of primary brain and other CNS tumors, variables such as WHO grade are not relevant to histologies (e.g. many tumors of the pituitary) that are not assigned a WHO grade. Variables like WHO grade may also not be expected to be found in the patient record for those who had their diagnosis confirmed via radiography as compared to histological examination. The report evaluates the completeness of multiple variables, including: WHO grade (applicable to specific brain and other CNS sites and histologies only) extent of surgical resection, and radiation treatment.

Statistical Methods

Statistical Software

Counts, means, medians, rates, ratios, proportions, and other relevant statistics were calculated using R 4.0 statistical software[30] and/or SEER*Stat 8.3.9.[31] Figures and tables were created in R 4.0.5 using the following packages: flextable, officer, orca, plotly, SEER2R, sf, survminer, tigris, and tidyverse.[32–41] Rates are suppressed when counts are fewer than 16 within a cell but included in totals, except when data are suppressed from only one cell to prevent identification of the number in the suppressed cell. **NOTE: reported percentages may not add up to 100% due to rounding.**

Variable Definitions

CBTRUS presents statistics on the pediatric and adolescent age group 0–19 years as suggested by clinicians for clinical relevance. However, the 0–14 years age group is a standard age category for childhood cancer used by other cancer surveillance organizations and has been included in this report for consistency and comparison purposes.

Race categories in this report are all races: White, Black, American Indian/Alaskan Native (AIAN), and Asian/Pacific Islander (API). Other race, unspecified, and unknown race are included in statistics that are not race-specific. Hispanic ethnicity was defined using the NAACCR Hispanic Identification Algorithm, version 2, data element, which utilizes a combination of cancer registry data fields (Spanish/Hispanic Origin data element, birthplace, race, and surnames) to directly and indirectly classify cases as Hispanic or non-Hispanic.[42]

Estimation of Incidence Rates and Incidence Rate Ratios

Population data for each geographic region were obtained from the SEER program website[43] for the purpose of rate calculation. All rates presented in this statistical report are **age-adjusted**. Crude incidence rates are calculated by dividing the total number of cases by the total population and cannot be compared to crude rates from other populations where the age distribution is different. Age-adjustment is a technique that is used to enable comparison between groups with different age distributions, such as rates between different states. Rates that have been age-adjusted are estimates of what the crude rate would be if the age distribution is equivalent to a standard population. Average annual age-adjusted incidence rates (AAAIR), average annual age-adjusted mortality rates, and 95% confidence intervals (95% CI) were estimated per 100,000 population based on one-year age groups and were standardized to the 2000 US standard population.[44] The age distribution of the 2000 US standard population is presented in Supplementary Table 2. Combined populations for the regions included in this report are also presented in Supplementary Table 3 and Supplementary Table 4.

Incidence rate ratios (IRR) were generated based on these age-adjusted incidence rates. These IRR were used to compare groups, using the formulas described by Fay et al. to calculate p-values.[45] Incidence rate ratios were considered statistically significantly different when the p-value was less than 0.05.

When comparing two rates to one another, it is important to consider whether they are truly different or whether the difference in the estimates may be due to random error. Two methods are used in this report for determining whether two values are 'significantly different,' meaning whether the evidence meets a level of strength (usually a 5% chance of error) where the difference can be assumed to not be due to random error. The first is the use of a 95% confidence interval (CI), which were calculated for all presented rates in this Report. A 95% CI is a range around an estimate, which, if sampling of the population were to be repeated, should contain the 'true' value for the population 95% of the time. If the CI of two estimates do not overlap, these values are considered significantly different with a less than 5% probability of happening by chance. The second method used is the calculation of p-values. A p-value is the probability of finding the observed or more extreme results by chance alone, and a p-value of <0.05 (or

<5% chance of results being due to chance) is conventionally used as a cut-off for considering a value statistically significant. Therefore, a p-value <0.0001 could be interpreted as meaning the observed value (or a more extreme value) had a <0.01% chance of occurring by chance alone, and the difference can be considered statistically significant at the 0.01% level.

Estimation of Expected Numbers of Brain and Other CNS Tumors in 2020 and 2021

Estimated numbers of expected primary malignant and non-malignant brain and other CNS tumors were calculated for 2021 and 2022. To project estimates of newly diagnosed brain and other CNS tumors in 2021 and 2022, age-adjusted annual brain tumor incidence rates were generated for 2000–2018 for malignant tumors, and 2006–2018 for non-malignant tumors. These were generated by state, age, and histologic type. Joinpoint 4.9.0.0[46] was used to fit regression models to these incidence rates,[47] which were used to predict numbers of cases in future years using the parameter from the selected models. Joinpoint regression allows for multiple lines to be fitted to incidence data across time, rather than assuming a consistent trend across the whole period. The points where these lines intersect are called 'joinpoints'. The models allowed for a maximum of two joinpoints (one for non-malignant tumors), a minimum of three observations from a joinpoint to either end of the data, and a minimum of three observations between joinpoints.[48] Modified Bayesian Information Criterion procedures included in Joinpoint were used to select the best fitting model. The overall totals presented are based on total malignant and non-malignant incidence, and the presented stratified rates may not add up to these totals. Estimated numbers of cases are highly dependent on input data. Different patterns of incidence within strata can significantly affect the projected estimates, especially when the number of cases within a stratum is low. For state-specific projections, a model with no joinpoints was used to generate predictions as annual variability within some states was extremely high. As a result, strata-specific estimates may not equal the total estimate presented. **Caution should be used when utilizing these estimates.**

Estimation of Mortality Rates for Brain and Other CNS Tumors

Age-adjusted mortality rates for deaths resulting from all primary malignant brain and other CNS tumors were calculated using the mortality data available in SEER*Stat Online Database provided by NCHS from death certificates per 100,000 population.[49] These data were available for 50 states and the District of Columbia only. In addition to the total age-adjusted rate for the US, age-adjusted rates are presented by sex and state.

Survival Measures Used in This Report

Relative Survival Rates. Relative survival is a way of presenting survival patterns at a population level that is commonly used in cancer statistics reporting. This measure is presented as a percent of people living a period of time (e.g. five years after their diagnosis). Relative survival is calculated using **observed survival** (the percentage of people diagnosed with cancer that live to the period of time for which relative survival is calculated) and **estimated survival** (the percent of the general population of the same age that is expected to survival after being followed for that same period of time). This adjustment for estimated survival attempts to exclude deaths that would otherwise have occurred due to other causes. For example, if five-year relative survival for glioblastoma is 5%, that means that out of every hundred people diagnosed with glioblastoma five will be living five years after diagnosis, excluding deaths due to other causes.

SEER*Stat 8.3.6 statistical software was used to estimate one-, two-, three-, four-, five-, and ten-year relative survival rates for primary **malignant** and **non-malignant** brain and other CNS tumor cases diagnosed between 2004–2017 in 42 NPCR CCRs. This software utilizes life-table (actuarial) methods to compute survival estimates and accounts for current follow-up. Second or later primary tumors, cases diagnosed at autopsy, cases in which race or sex is coded as other or unknown, and cases known to be alive but for whom follow-up time could not be calculated, were excluded from survival data analyses.

Observed Survival with Median Survival Times and Adjusted Hazard Ratios. Median survival time is another way of presenting survival patterns in a population. This measure is calculated using a method called a Kaplan Meier estimator, which is used to estimate the proportion of individuals within a set that are alive at particular time points. The median survival time is the point at which exactly 50% of individuals have either died or been 'censored', meaning that their further survival status is unknown beyond a particular date.

Median survival time for all primary **malignant** brain and other CNS tumors diagnosed between 2001–2017 in 42 NPCR CCRs was calculated by histology using the Kaplan Meier method in R 4.0.5 statistical software[30] overall, as well as by three age groups (0–14 years old, 15–39 years old, and 40+ years old). Second or later primary tumors, cases diagnosed at autopsy, cases in which race or sex is coded as other or unknown, and cases known to be alive but for whom follow-up time could not be calculated, were excluded from survival data analyses. NAACCR data item #1787, survival months presumed alive, was used to ascertain follow-up information.

The hazard ratio is a measure of how often an event (in this case, death) occurs in one group as compared to another group over time. A hazard ratio of one means that survival is equal in both groups, while a ratio of less than one means that survival is better in the comparison group than in the reference group. A ratio of greater than one means that survival is worse in the comparison group than in the reference group.

Cox proportional hazard models were used to test associations between demographic factors and overall survival by histology for malignant brain and other CNS tumors. All models were adjusted for age at diagnosis group (0–14 years [reference], 15–39 years, 40+ years), sex (male [reference], female), and race and ethnicity (White Non-Hispanic [reference], Black Non-Hispanic, AIAN Non-Hispanic, API Non-Hispanic, and Hispanic All Races).

These models were used to estimate hazard ratios associated with each group and corresponding 95% confidence intervals and p-values. Adjusted estimates included all covariates (age at diagnosis, sex, race, and ethnicity) a priori, regardless of individual significance level. The proportional hazards assumption was tested separately by histology, and residuals were examined for all variables.

Estimation of Incidence Time Trends. Joinpoint 4.9.0.0[46] was used to estimate incidence time trends and generate annual percentage changes (APC) and 95% CI. Rather than calculating a single consistent slope of change over an entire period of time, Joinpoint allows for points where the slope of the trend can change during the time period (joinpoints). This method starts with a model that assumes one consistent trend over time, and tests whether the addition of these 'joinpoints' results in a model which has a fit that represents a statistically significant improvement over the model with no joinpoints. These models are tested through use of Monte Carlo permutations, e.g. the program repeats the same analysis multiple times using random samples to identify the 'true' proportion of times that a comparison is statistically significant. The models allowed for a maximum of three joinpoints (two for non-malignant tumors), a minimum of three observations from a joinpoint to either end of the time-period, and a minimum of three observations between joinpoints.[48]

APC is the average percent change in incidence per year over the period included in the trend segment. Time trends analysis methods were used to estimate if the APC was significantly different from 0% (meaning no change in incidence from year to year). The 95% CI is a range around an estimate that, if sampling of the population were to be repeated, should contain the 'true' value for the population 95% of the time. If the 95% CI contains zero, one cannot be confident that the 'true' population APC value is significantly different from 0%. The joinpoint regression program fits a linear regression to annual incidence rates to test significance of changes overtime, with different trends lines connected at 'joinpoints' where there are changes in the direction of incidence trends. The best fitting model was determined through permutation tests, with a minimum of three observations required between two joinpoints, as well as a minimum of three observations required between a joinpoint and either end of the time-period.

Data Interpretation. CBTRUS works diligently to support the broader surveillance efforts aimed at improving the collection and reporting of primary brain and other CNS tumors. CCR data provided to NPCR and SEER and, subsequently, to CBTRUS vary from year-to-year due to ongoing updates in collection and data refinement aimed to improve completeness and accuracy. **Therefore, it is important to note that data from previous CBTRUS Reports cannot be compared to data in this current report, *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014–2018. This current report supersedes all previous reports in terms of coverage of the US population with the most up-to-date population-based information available, making these data the most accurate and timely to reference.***

Several factors should be considered when interpreting the data presented in this report:

- Incident counts of cases represent individual tumors and not persons. A single person could contribute multiple primary tumor cases to the data included in this report. The 431,773 tumors from 50 state CCR and the District of Columbia, included in this report came from 426,029 individuals. Of these 426,029 individuals, there were 5,311 individuals (1.2%) that contributed information on multiple tumors (two or more) to this report.
- Random fluctuations in average annual rates are common, especially for rates based on small case counts. The CBTRUS policy to suppress data in cells with counts of fewer than 16 cases is consistent with the NPCR policy.
- A 2007 policy change guiding the Veterans Health Administration (VHA) may have resulted in probable underreporting of cancer data—especially for men—to CCRs. Recent investigations suggest that underreporting for VHA facilities has diminished over time, and that the Veterans Affairs Central Cancer Registry (VACCR) now captures approximately 87–90% of cases.[50,51] It is important to note that improved reporting to VACCR does not necessarily mean that reporting to the state CCR has improved. The VACCR does not submit data directly to NPCR or SEER.
- Delays in reporting and late ascertainment are a reality and a known issue influencing registry completeness and, consequently, rate underestimations occur, especially for the most recent years.[52,53] The SEER and NPCR programs allow for reporting delay of up to 22–23 months prior to public data release, but additional cases may still be discovered after that point.[54] On average across all cancer sites, the submissions for the most recent diagnosis year are approximately 4% lower than the total number of cases that will eventually be submitted. This problem may be even more likely to occur in the reporting of non-malignant brain and other CNS tumors, where reporting often comes from non-hospital-based sources, such as free-standing clinics or outpatient facilities.
- Type of diagnostic confirmation may also lead to increased reporting delay, with histologically confirmed tumors being subject to less reporting delay than radiographically confirmed tumors. In 2016, a study assessing the incidence of non-malignant brain and other CNS tumors corroborated the large variation in incidence between CCRs reported in this statistical report.[55] The reasons for this variation remain inconclusive but what is consistently noted is the correlation between high incidence and high proportion of non-malignant cases collected without microscopic confirmation or surgery, in other words, clinically diagnosed cases of non-malignant brain tumors. At this current time, given the variation across CCRs, there is potential evidence of underreporting of non-malignant brain and other CNS tumors, the extent to which cannot be quantified at this time.[55]
- Population estimates used for denominators affect incidence rates. CBTRUS has utilized population estimates

based on the 2000 US Census for calculation of incidence and mortality rates in this report, as is standard practice in US cancer registry reporting.[56,57]

CBTRUS editing practices are reviewed, revised, and conducted yearly. These practices are aimed at refining the data for accuracy and clinical relevance and play a role in interpreting these report data. Exclusion of site and histology combinations considered invalid by the consulting neuropathologists who revised the CBTRUS site/histology validation list in 2021 may have the impact of underestimating the incidence of brain and other CNS tumors. Editing changes, such as the Multiple Primary and Histology Rules issued in 2007 and revised in 2018,[58,59] also incorporate updates to the cancer registration coding rules that influence case ascertainment and data collection.[23]

Supplemental Data

CBTRUS has made supplemental additional figures and tables available. These materials are noted in the text as Supplementary Tables and Figures.

Biomarkers. Primary brain and other CNS tumors are a highly heterogeneous group of diseases, and characterization of unique tumor histologies within this group has been refined over time. The development of technologies for characterizing DNA, RNA, and DNA methylation has led to the discovery of several factors (known as 'biomarkers') that can be used to more accurately classify these tumors than histologic appearance alone. See **Table 3** for a brief overview of selected biomarkers for primary brain and other CNS tumors and for discussion of pediatric biomarkers specifically. With the increased recognition of the value of biomarkers for specific brain tumor histologies in classification, the *WHO Classification of Tumours of the Central Nervous System* has included biomarkers in its 2016 revision. However, implementing the collection of these markers in cancer registration is multi-faceted and includes an ongoing educational and training component.

As of 2011, SEER registries began collecting information on three validated biomarkers for primary brain and other CNS tumors as Site Specific Factors (SSF): promoter methylation status of *MGMT* (SSF 4), deletion of the 1p (SSF 5), and deletion of 19q (SSF 6).[60] Starting with diagnosis year 2018, the broad US cancer registry system began collecting information on multiple brain and other CNS markers, including *IDH1/2* mutation, 1p/19q codeletion, medulloblastoma molecular subtypes, and all biomarkers found in 2016 WHO classification. These data are available to CBTRUS for the first time with the 2021 NPCR and SEER data releases for the 2018 diagnosis year only.

Biomarkers for glioma

IDH mutation and 1/19q status. Gliomas, as the most common malignant primary brain and other CNS tumor type, have been subject to the greatest investigation. A recent review has described in detail the current state of glioma biomarker research.[61] One of the earliest discoveries in glioma biomarkers was that oligodendroglioma often had large deletions (missing parts of the chromosome, also known as loss of heterozygosity) in the short arm of chromosome 1 (1p) and the long arm of chromosome 19 (19q).[62] In general, these deletions significantly predict positive response to chemotherapy and radiation treatment in oligodendroglioma and anaplastic oligodendroglioma.[63–65] Mutations to the genes in isocitrate dehydrogenase 1 (*IDH1*) and in isocitrate dehydrogenase 2 (*IDH2*) have also been shown to be associated with improved prognosis in glioma.[66–68] These mutations are common in lower grade gliomas (WHO grade II and WHO grade III), but are rare in glioblastoma.[67] Both of these alterations are thought to occur relatively early in the development of gliomas; the prevalence of this mutation varies by anatomic location in the brain.[69,70] The combination of these two factors can be used to more accurately stratify glioma by prognosis than the previously utilized histological criteria,[68,71] and have been incorporated into the definition of oligodendroglioma and astrocytoma in the 2016 update to the WHO classification.[2]

MGMT methylation. Another alteration that is associated with improved survival in glioma is increased methylation (where methyl molecules are bonded to the DNA) of the promotor region of the gene O-6-methylguanine-DNA methyltransferase (*MGMT*).[72,73] The promoter region of a gene is located upstream of the coding part of the gene and exerts control over whether a gene is transcribed into RNA. Methylation of this region effectively silences the gene and prevents transcription into RNA. *MGMT* is a DNA repair protein, and it is assumed that the decreases in protein levels increase sensitivity to the alkylating chemotherapies (e.g. temozolomide) often used in the treatment of gliomas aimed to combat tumor growth through DNA damage.[74] This alteration is common in glioblastoma and less common in lower grade gliomas.

Other markers. Recent analyses of data generated by The Cancer Genome Atlas (TCGA) have shown that genome-wide DNA methylation predicts improved prognosis in addition to methylation of specific genes.[71] Persons whose tumor has a higher proportion of methylation across the genome are termed to have glioma-CpG island methylator phenotype (G-CIMP).[75] G-CIMP and *MGMT* methylation are correlated,[76] but G-CIMP is much rarer in glioblastoma than *MGMT* methylation.

Diffuse intrinsic pontine glioma (DIPG) is a name given to a group of aggressive tumors of the pons that occurs primarily in children. In the 2016 WHO classification, these tumors are classified as Diffuse midline glioma, H3 K27M-mutant (ICD-O-3 histology code 9385/3). These account for ~75% of brain stem tumors in children. Survival is very poor after diagnoses with these tumors. Due to the location of these tumors, they are often not biopsied and, therefore, have not been molecularly characterized to the extent of many other primary brain and other CNS tumor types. Recently, biopsy and autopsy protocols have allowed for collection of primary tumor samples that have been used for genomic profiling.[77–79] These tumors have been found to be highly heterogeneous. Mutations in histone H3, Activin A receptor, type I (*ACVR1*), tumor protein p53 (*TP53*), platelet-derived growth factor receptor A (*PDGFRA*), phosphatidylinositol 3-kinase catalytic subunit alpha (*PIK3CA*), and Myc (*MYC*)

have been identified as characteristic of these tumors.[78,80,81] A recent review has further summarized recent developments in the genomics of DIPG.[82]

Biomarkers for embryonal tumors

Medulloblastoma subtypes. Medulloblastoma is another tumor type that has been subject to significant molecular analysis. Using an analysis of gene expression (based on quantity of RNA transcribed from a gene), medulloblastoma was able to be subdivided into four distinct subtypes: wingless (*WNT*), sonic hedgehog (*SHH*), group 3 (also called group C), and group 4 (also called group D).[83] These groups are associated with specific age groups, with *SHH* being most common in infants and adults, and all other groups being more common in childhood. Several review articles have elaborated on the details of these subgroups and their implications for diagnosis and treatment.[84–86]

Completeness of molecular markers. Frequency of reported molecular markers for relevant subtypes are shown in **Table 4**.

- Among glioblastoma patients, 237 were coded as 9445/3, Glioblastoma IDH-mutant (2.0%), 8,825 were coded as 9440/3, Glioblastoma IDH-wildtype (74.2%), and 2,512 as 9440/3, Glioblastoma IDH Status Unknown (21.1%). Among those with unknown IDH status, 42 had a test ordered, but no results reported in patient chart (1.7%), while the remaining patients did not have IDH status documented in their patient record, or the information was miscoded/unknown (2,470, 98.3%).
- Frequency of IDH1/2 mutation reporting was high in diffuse astrocytoma (9400/3, 74.1%) and anaplastic astrocytoma (9401/3, 85.3%). Biomarker reporting was complete in 88.9% of oligodendroglioma coded as 9450/3 and 91.9% of anaplastic oligodendroglioma coded as 9451/3.
- For medulloblastoma coded as 9471/3, 80.8% had complete biomarker reporting.

RESULTS

Incidence and Mortality in Comparison to Other Common Neoplasms in the US

AAAIRs for primary brain and other CNS tumors (2014–2018) and a selection of common cancers (USCS, 2014–2018) in the US are shown by age in **Figure 3A** for Children (Age 0–14 Years), Adolescents and Young Adults (Age 15–39 Years), and Older Adults (Age 40+ Years).

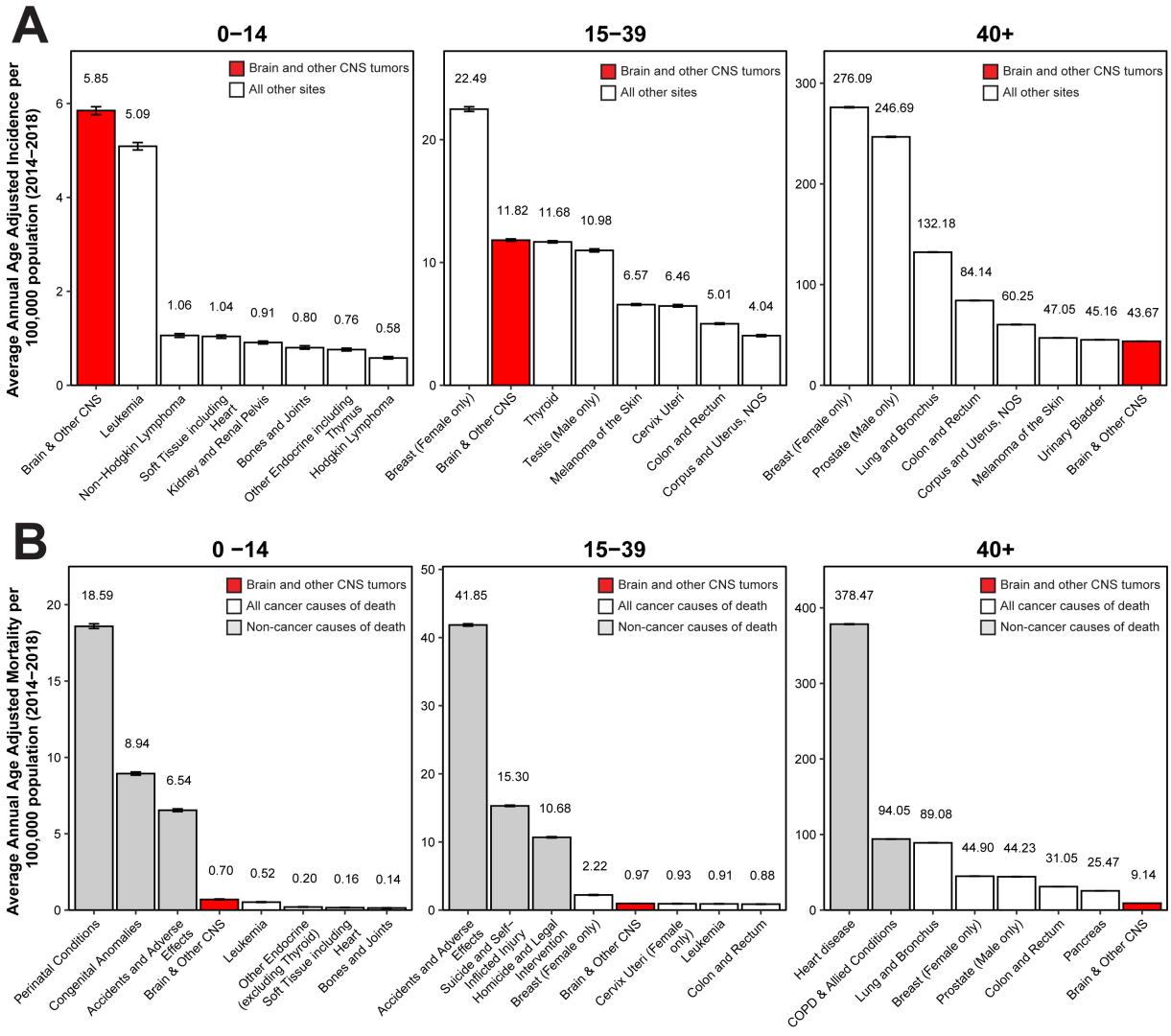
- Brain and other CNS tumors (both malignant and non-malignant) were the most common cancer site in persons age 0–14 years, with an AAAIR of 5.85 per 100,000 population.
- Leukemia was the second most common neoplasm in persons age 0–14 years, with an AAAIR of 5.09 per 100,000
- Brain and other CNS tumors (both malignant and non-malignant) among those age 15–39 years had an AAAIR of 11.82 per 100,000 population. These tumors were the second most common cancer in this age group.
- Breast cancer was the most common cancer among those age 40+ years in the US, with AAAIR of 276.09 per 100,000 (females only) population. The second most common cancer was prostate cancer, which had an incidence rate of 246.69 per 100,000 (males only).
- Brain and other CNS tumors (both malignant and non-malignant) were the eighth most common cancer among persons age 40+ years with an AAAIR of 43.67 per 100,000 population.

Average annual age-adjusted mortality rates for primary malignant brain and other CNS tumors (2014–2018), a selection of common cancers, and the top three non-cancer causes of death in the US are shown by age in **Figure 3B**.

- The most common causes of death in persons age 0–14 years were perinatal conditions (18.59 per 100,000).
- Childhood brain and other CNS cancer, while rare, contributes substantially to cancer related mortality in children 0–14 years old. Malignant brain and other CNS tumors among persons age 0–14 years had an average annual age-adjusted mortality rate of 0.70 per 100,000 and were the fourth most common cause of death from the various causes referenced in this age group, **and the most common cause of cancer death**.
- Accidents and adverse effects were the leading causes of death in persons age 15–39 years (41.85 per 100,000).
- Malignant brain and other CNS tumors among persons age 15–39 years had an average annual age-adjusted mortality rate of 0.97 per 100,000 and were the 12th most common cause of death and 2nd most common cause of cancer death in this age group with where their average annual age-adjusted mortality rate was similar to that of leukemia (0.91 per 100,000). Breast (female only) was the most common cause of cancer death in this age group (2.22 per 100,000).
- Heart disease was the largest contributor to mortality in persons age 40+ years in the US, with an average annual age-adjusted mortality rate of 378.47 per 100,000 for major cardiovascular diseases.
- Malignant brain and other CNS tumors among persons age 40+ years had an average annual age-adjusted mortality rate of 9.14 per 100,000 and were the 26th most common cause of death overall and the 12th most common cause of cancer death. Lung and bronchus was the most common cause of cancer death in this age group (89.08 per 100,000).

Distributions and Incidence by Site, Behavior, Histology, and Year

Counts and rates from the 431,773 brain and other CNS tumors (29.1% malignant, 125,524 cases; 70.9% non-malignant, 306,249 cases shown in **Figure 4**) reported during 2014–2018 by histology and demographic characteristics for all ages are shown in **Table 5**. Counts and rates are shown by histology and behaviors for selected histologies where there is a statistically sufficient number of cases to calculate rates.



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.

Fig. 3 A) Average Annual Age-Adjusted Incidence Rates[a] (AAAIR) with 95% Confidence Intervals of All Primary Brain and Other CNS Tumors in Comparison To Top Eight Highest Incidence Cancers for Children Age 0–14 Years, Adolescents and Young Adults Age 15–39 Years, and Older Adults Age 40+ Years, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018. B) Average Annual Age-Adjusted Mortality Rates[a] with 95% Confidence Intervals of All Primary Brain and Other CNS Tumors in Comparison to Top Five Causes of Cancer Death and Top Three Non-Cancer Causes of Death for Children Age 0–14 Years, Adolescents and Young Adults Age 15–39 Years, and Older Adults Age 40+ Years, CBTRUS Statistical Report: NVSS, 2014–2018.

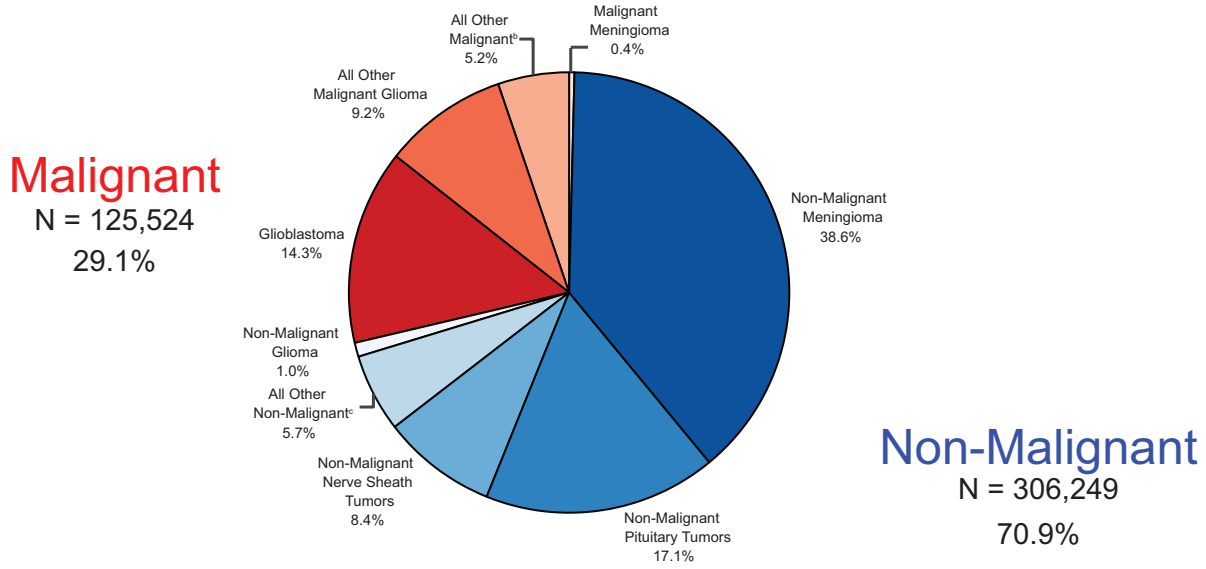
Distribution of Tumors by Site and Histology

The distribution of brain and other CNS tumors by site is shown in **Figure 5A**.

- Overall, the most common tumor site was the meninges, representing 39.2% of all tumors.
- The pituitary and craniopharyngeal duct accounted for 18.1% of all tumors.
- Frontal (7.8%), temporal (5.7%), parietal (3.3%), and occipital lobes (0.9%) accounted for 17.6% of all tumors.
- The cranial nerves and the spinal cord/cauda equina accounted for 9.9% of all tumors.
- For malignant tumors, the frontal (24.4%), temporal (17.5%), parietal (10.4%), and occipital (2.6%) lobes accounted for 54.9% of tumors (**Figure 6A**).
- For non-malignant tumors, 54.5% of all tumors occurred in the meninges (**Figure 7A**).

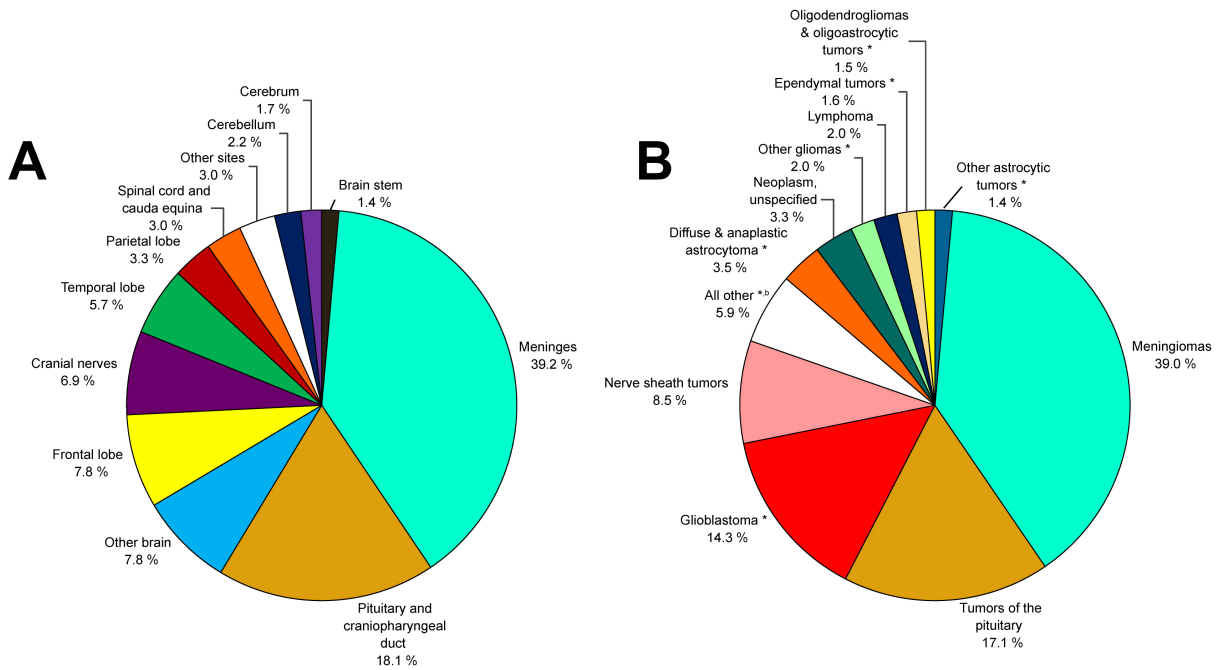
The distribution by brain and other CNS histologies is shown in **Figure 5B**.

- The most frequently reported histology overall was meningiomas (39.0%), followed by tumors of the pituitary (17.1%) and glioblastoma (14.3%).



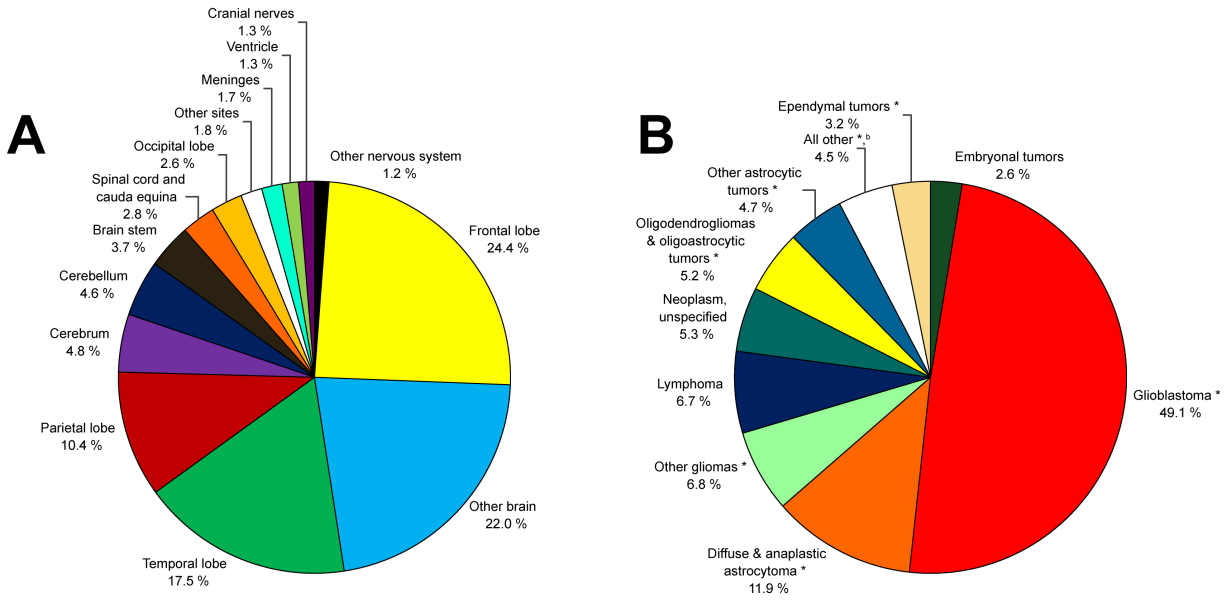
a. Percentages may not add up to 100% due to rounding.
b. Includes histologies with ICD-O-3 behavior code of /3 from choroid plexus tumors, neuronal and mixed neuronal-glial tumors, tumors of the pineal region, embryonal tumors, nerve sheath tumors, mesenchymal tumors, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, neoplasm unspecified, and all other.
c. Includes histologies with ICD-O-3 behavior code of /0 or /1 from neuronal and mixed neuronal-glial tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other hematopoietic neoplasms, germ cell tumors, craniopharyngioma, hemangioma, neoplasm unspecified, and all other.

Fig. 4 Distribution[a] of All Primary Brain and Other CNS Tumors by Behavior (Five-Year Total=431,773; Annual Average Cases=86,355), CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



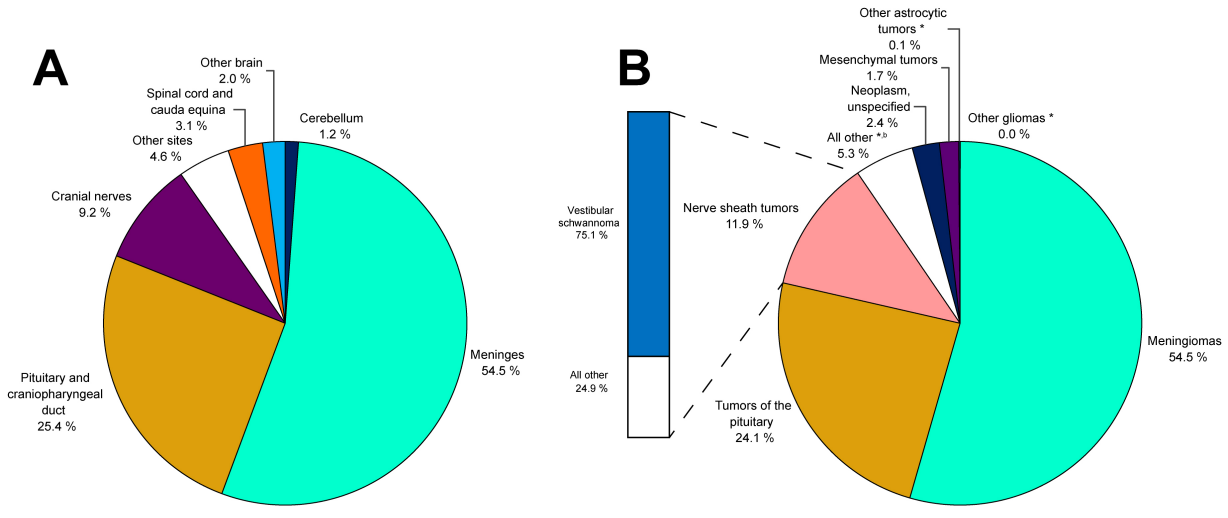
* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other hematopoietic neoplasms, germ cell tumors, craniopharyngioma, hemangioma, all other (Table 2).

Fig. 5 Distribution[a] of All Primary Brain and Other CNS Tumors (Malignant and Non-Malignant Combined; Five-Year Total=431,733; Annual Average Cases=86,355), by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and, 9391-9460 (Table 3).
a. Percentages may not add up to 100% due to rounding.
b. Includes neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, nerve sheath tumors, other tumors of cranial and spinal nerves, meningiomas, mesenchymal tumors, primary melanocytic lesions, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, all other (Table 2).

Fig. 6 Distribution[a] of Malignant Primary Brain and Other CNS Tumors (Five-Year Total=125,524; Annual Average Cases=25,105), by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes ependymal tumors, neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, craniopharyngioma, hemangioma, all other (Table 2).

Fig. 7 Distribution[a] of All Non-Malignant Primary Brain and Other CNS Tumors (Five-Year Total=306,249; Annual Average Cases=61,250), by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

- Tumors of the pituitary and nerve sheath tumors combined accounted for slightly less than one-fourth of all tumors (25.6%), the vast majority of which were non-malignant.

The distribution of malignant and non-malignant brain and other CNS tumors by histology are shown in **Figure 6B** and **Figure 7B**, respectively.

- The most common of all malignant CNS tumors was glioblastoma (49.1%).
- The most common of all non-malignant tumors was meningiomas (54.5%).
- The most common non-malignant nerve sheath tumor (based on multiple sites in the brain and CNS) was vestibular schwannoma (defined by histology code 9560, also formerly called acoustic neuromas) (75.1%). See Supplementary Figure 1 for the distribution of sites at which these tumors occur.

Distribution of Gliomas by Site and Histology

The broad category glioma (ICD-O-3 histology codes 9380–9384, 9391–9460 see **Table 2** for more information) represented approximately 24.5% of all primary brain and other CNS tumors and 80.9% of malignant tumors. The distribution of gliomas by site and histology are shown in **Figure 8A** and **Figure 8B**, respectively.

- The majority of gliomas occurred in the supra-tentorium (frontal, temporal, parietal, and occipital lobes combined, 61.6%). Only a very small proportion of gliomas occurred in areas of the CNS other than the brain.
- Glioblastoma accounted for the majority of gliomas (58.4%).
- Astrocytic tumors, including glioblastoma, accounted for 77.5% of all gliomas.

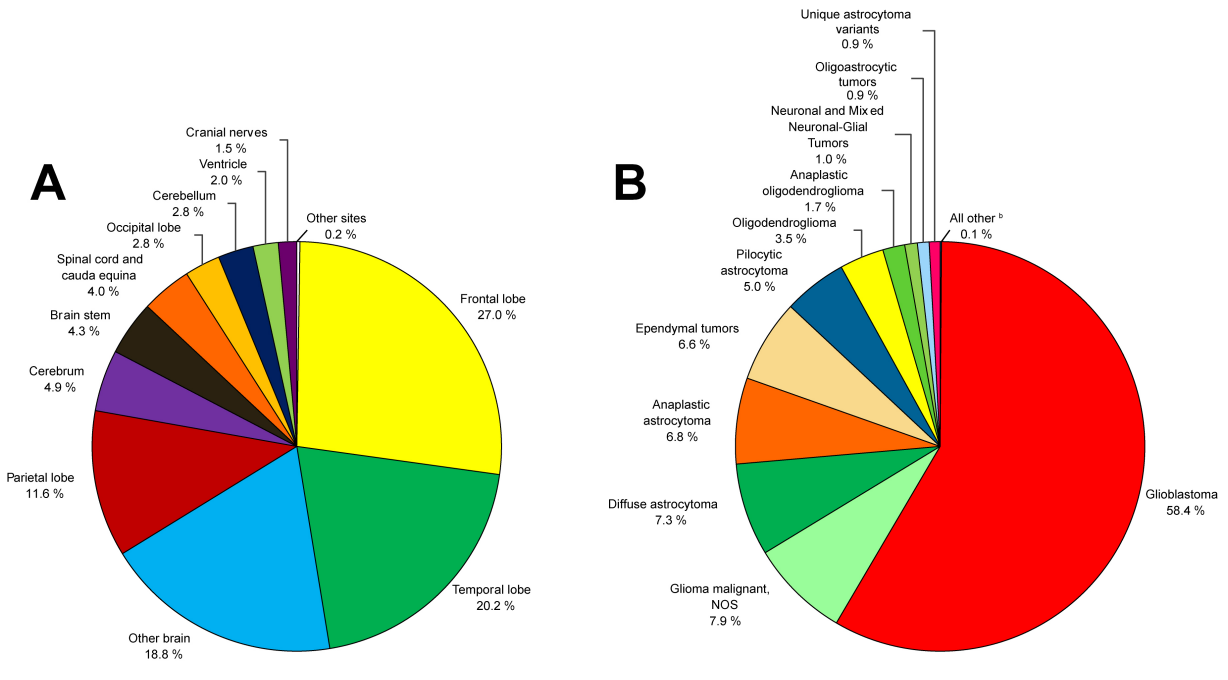
Incidence by Year and Behavior

Figure 9 presents the overall AAAIRs of all primary brain and other CNS tumors by year, 2014–2018, and behavior. Incidence rates for all primary brain and other CNS tumors, 2014–2018, did not differ substantially by year (both overall and by behavior).

Incidence Rates by Histology and Behavior

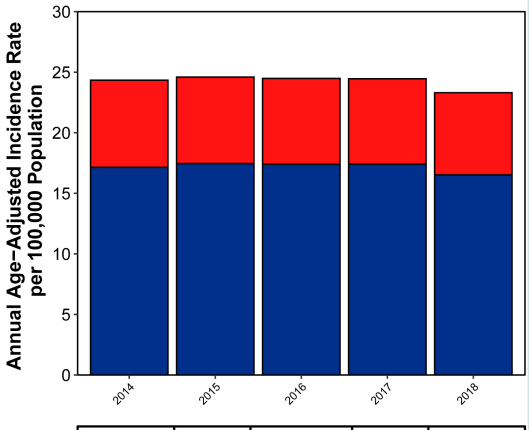
AAAIRs overall by histology and behavior are shown in **Table 5**. Among CBTRUS histologies, incidence rates were highest for tumors of the meninges (9.49 per 100,000 population), followed by tumors of the sellar region (4.55 per 100,000 population), diffuse astrocytic and oligodendroglial tumors (4.52 per 100,000 population), and tumors of the cranial and paraspinal nerves (2.05 per 100,000 population).

- Among CBTRUS specific histologies, incidence rates were highest for meningiomas (9.12 per 100,000 population), tumors of the pituitary (4.36 per 100,000 population), glioblastomas (3.23 per 100,000 population), and nerve sheath tumors (2.05 per 100,000 population).
- The majority of nerve sheath tumors were vestibular schwannoma (1.51 per 100,000, **Table 6**)
- For malignant tumors, the incidence rate was highest for glioblastoma (3.23 per 100,000 population), followed



a. Percentages may not add up to 100% due to rounding.
b. Includes other neuroepithelial tumors, and tumors of the pituitary.

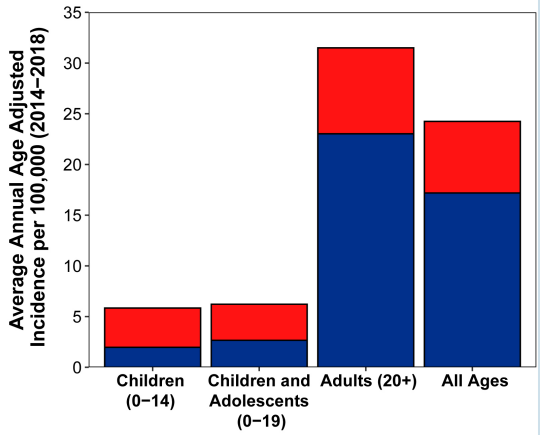
Fig. 8 Distribution[a] of Primary Brain and Other CNS Gliomas (ICD-O-3 histology codes 9380–9384 and 9391–9460) (Five-Year Total=105,729; Annual Average Cases=21,146) by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



	2014	2015	2016	2017	2018
Malignant	7.20	7.16	7.10	7.06	6.78
Non–Malignant	17.15	17.46	17.40	17.41	16.53

a. Rates per 100,000 and age–adjusted to the 2000 United States standard population.

Fig. 9 Annual Age-Adjusted Incidence Rates[a] of All Primary Brain and Other CNS Tumors by Year and Behavior, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



	Children (0–14)	Children and Adolescents (0–19)	Adults (20+)	All Ages
Malignant	3.87	3.56	8.47	7.06
Non–Malignant	1.97	2.66	23.03	17.19

a. Rates per 100,000 and age–adjusted to the 2000 United States standard population.

Fig. 10 Average Annual Age-Adjusted Incidence Rates[a] of All Primary Brain and Other CNS Tumors by Age Group at Diagnosis and Behavior, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

by glioma malignant, NOS (0.53 per 100,000), diffuse astrocytoma (0.46 per 100,000 population) and lymphoma (0.45 per 100,000 population).
- For non-malignant tumors, the incidence rate was highest for non-malignant meningioma (9.03 per 100,000 population), followed by non-malignant tumors of the pituitary (4.36 per 100,000 population).

Distributions and Incidence by Age

Incidence Rates by Age at Diagnosis

The overall AAAIR for 2014–2018 for all primary brain and other CNS tumors was 24.25 per 100,000 population (**Table 5**). The overall incidence rate was 5.85 per 100,000 population for children age 0–14 years, 11.82 per 100,000 population for adolescents and young adults age 15–39 years, and 43.67 per 100,000 population for adults age 40+ years (**Table 7**). The overall incidence rates of tumors by behavior and age group (age 0–14 years, 0–19 years, and 20+ years) are shown in **Figure 10**.

Incidence Rates by Age at Diagnosis and Histology

The AAAIRs by age and histology at diagnosis are shown in **Tables 7–9**, as well as in **Figure 11A** (Age 0–19 Years), and **Figure 11B** (Age 20+Years).

- Incidence rates declined with increasing age for those age 0–19 years, particularly for the gliomas and medulloblastoma.
- Incidence rates of other astrocytic tumors, germ cell tumors, and embryonal tumors were higher in the younger age groups and decreased with advancing age.
- The incidence rate for all brain and other CNS tumors was highest among age 85+ years (88.02 per 100,000 population) and lowest among children and adolescents age 0–19 years (6.29 per 100,000 population).
- Incidence rates of meningioma increased with age.

Median Age at Diagnosis

The median age at diagnosis for all primary brain and other CNS tumors was 61 years (**Table 5**).

- The histology-specific median ages ranged from 8 years for embryonal tumors to 70 years for neoplasm, unspecified.
- Pilocytic astrocytoma, choroid plexus tumors, neuronal and mixed neuronal-glial tumors, tumors of the pineal region, embryonal tumors, and germ cell tumors were histologies with younger median ages at diagnosis compared to other histologies.
- Meningioma and glioblastoma were primarily diagnosed at older ages (median age of 66 and 65 years, respectively).

Distributions and Incidence by Sex

Distribution by Sex and Behavior

- Overall, 41.6% of all tumors diagnosed between 2014 and 2018 occurred in males (179,502 tumors) and 58.4% in females (252,271 tumors) (**Table 5**).

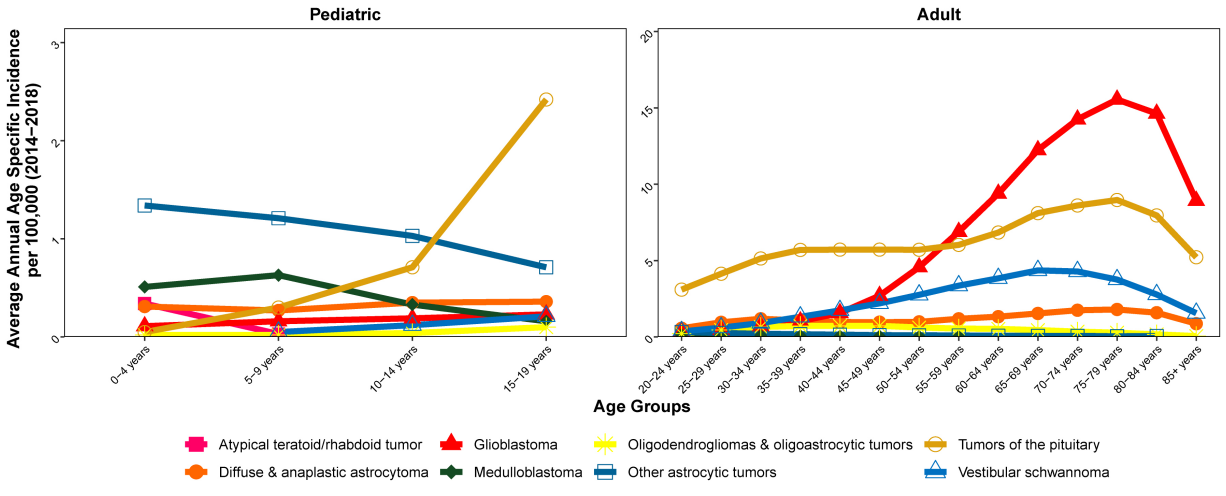


Fig. 11 Age-Adjusted Incidence Rates[a] of Brain and Other CNS Tumors by Selected Histologies and Age Group at Diagnosis A) Age 0–19 Years, B) Age 20+ Years and CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

- Approximately 55.7% of the malignant tumors occurred in males (69,866 tumors between 2014 and 2018) and 44.3% in females (55,658 tumors between 2014 and 2018).
- Approximately 35.8% of the non-malignant tumors occurred in males (109,636 tumors between 2014 and 2018) and 64.2% in females (196,613 tumors between 2014 and 2018).

Incidence Rates by Site and Sex

Incidence counts and average annual age-adjusted rates for brain and other CNS tumors by site and sex are shown in **Table 10**.

- Incidence rates were highest for tumors located in the meninges (9.16 per 100,000 population) and lowest for olfactory tumors of the nasal cavity (0.04 per 100,000 population).
- Incidence rates were higher in females than in males for tumors located in the meninges, pituitary and craniopharyngeal duct, and cranial nerves, while males had higher incidence rates for tumors located in most other locations.

Incidence Rates by Sex and Histology

AAAIRs by sex and histology are shown in **Table 5**. Incidence rates for all primary brain and other CNS tumors combined were higher among females (26.95 per 100,000 population) than males (21.35 per 100,000 population).

- The incidence rate of diffuse astrocytic and oligodendroglial tumors was higher in males (5.51 per 100,000 population) than in females (3.65 per 100,000 population).
- The incidence rate of tumors of meninges was higher in females (12.76 per 100,000 population) than in males (5.79 per 100,000 population).

Incidence rate ratios (male:female) by histology are shown in **Figure 12**.

- Incidence was higher in males for many histologies, such as germ cell tumors (p<0.0001), lymphomas (p<0.0001), and embryonal tumors (p<0.0001), and for most glial tumors.
- In addition to non-malignant (p<0.0001) and malignant (p=0.0815) meningiomas, tumors of the pituitary (p<0.0001) were also more common in females than in males.

Distribution and Incidence Rates by CCR, Age at Diagnosis, Diagnostic Confirmation, and Behavior

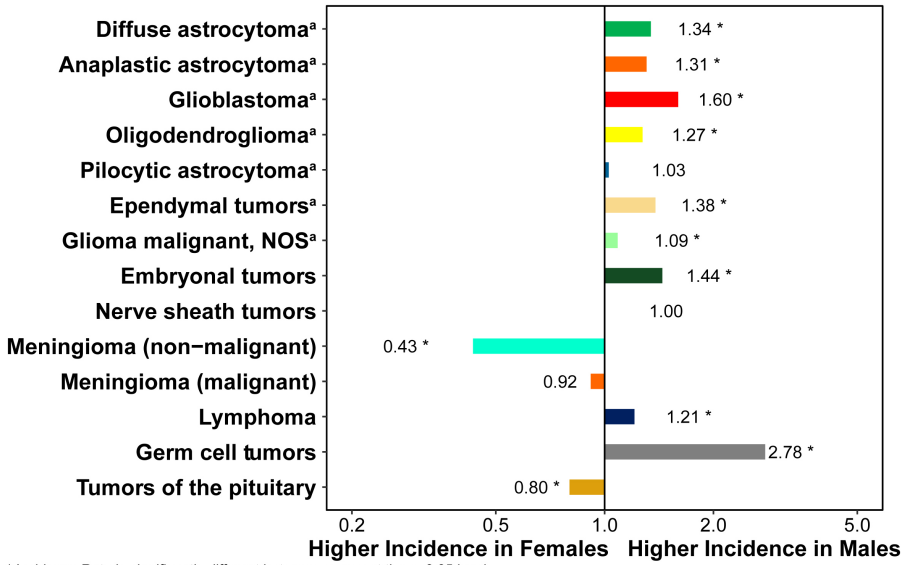
The overall number of reported tumors is listed by CCR in **Table 11**. While most malignant tumors are diagnosed by histologic confirmation (where the patient receives surgery and diagnosis is confirmed by a pathologist), brain and other CNS tumors may also be diagnosed by radiographic confirmation only (where the tumor was visualized on MRI, CT, X-ray, or other imaging technology, but surgery was not performed).

- Approximately 71% of tumors were non-malignant, but there was variation by cancer registry (range: 56.2%-81.4%).
- Overall, 54.1% of tumors were histologically confirmed. A larger proportion of malignant tumors were histologically confirmed (84.2%) compared to non-malignant tumors (41.8%).

- A slight majority of non-malignant brain and other CNS tumors were radiographically confirmed (54.8%).

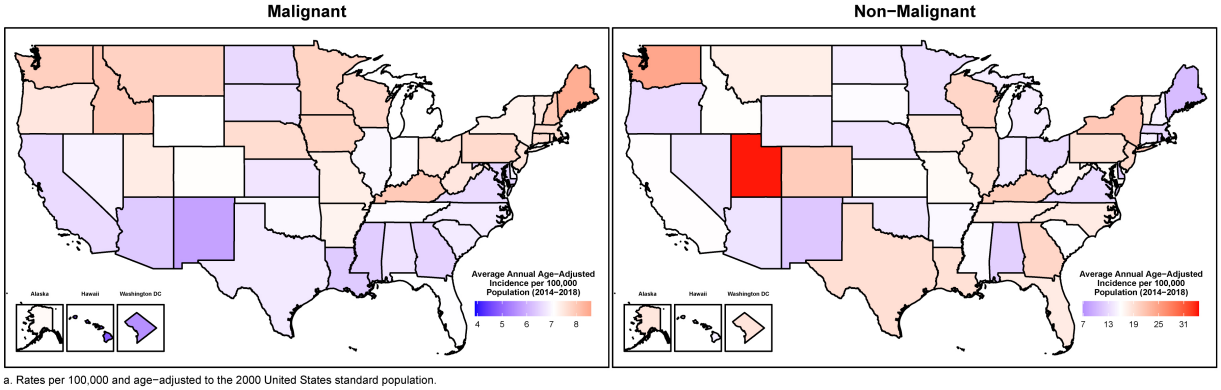
The overall AAAIRs by age, behavior, and CCR are shown in **Table 12** and **Figure 13**.

- There was less variation by region for malignant tumor incidence rates (**Figure 13A**) compared to incidence rates for non-malignant tumors (**Figure 13B**). Regional variations between CCR likely reflect differences in reporting and case ascertainment practices.
- The overall AAAIRs of all tumors (malignant and non-malignant) for each individual CCR ranged from 11.49 to 41.62 per 100,000 population. Please see Supplementary Figure 2 for combined incidence of malignant and non-malignant tumors by CCR.
- AAAIRs of all primary malignant tumors ranged from 4.48 to 8.46 per 100,000 population, and AAAIRs of all primary non-malignant tumors ranged from 7.01 to 34.21 per 100,000 population.
- Among adults 20 years of age and older, CCR-specific incidence rates ranged from 5.79 to 10.05 per 100,000



* Incidence Rate is significantly different between groups at the p<0.05 level.
a. All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).

Fig. 12 Incidence Rate Ratios by Sex (Males:Females) for Selected Primary Brain and Other CNS Tumor Histologies, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.



a. Rates per 100,000 and age−adjusted to the 2000 United States standard population.

Fig. 13 Average Annual Age-Adjusted Incidence Rates[a] of Malignant and Non-Malignant Primary Brain and Other CNS Tumors by Central Cancer Registry, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

population for malignant tumors and from 14.45 to 46.72 per 100,000 population for non-malignant tumors.
- In persons less than 20 years of age, incidence rates ranged from 2.21 to 4.57 per 100,000 population for malignant tumors and from 1.42 to 4.11 per 100,000 population for non-malignant tumors.

Distribution by Histology, WHO Grade, Diagnostic Confirmation, and Treatment Completeness

The distribution of reported tumors with histologically confirmed diagnosis from 2014 to 2018 is listed by histology and reported WHO grade in **Table 13**.

- Overall, 45.5%% of tumors had complete WHO grade information, but there was substantial variation by histology.
- The histologic types with the highest WHO grade completeness were oligoastrocytic tumors (91.6%), anaplastic oligodendroglioma (78.8%), and anaplastic astrocytoma (77.3%).

Distribution of Tumors in Puerto Rico

The distribution of brain and other CNS tumors diagnosed among residents of Puerto Rico by histology is shown in Supplementary Figure 3.

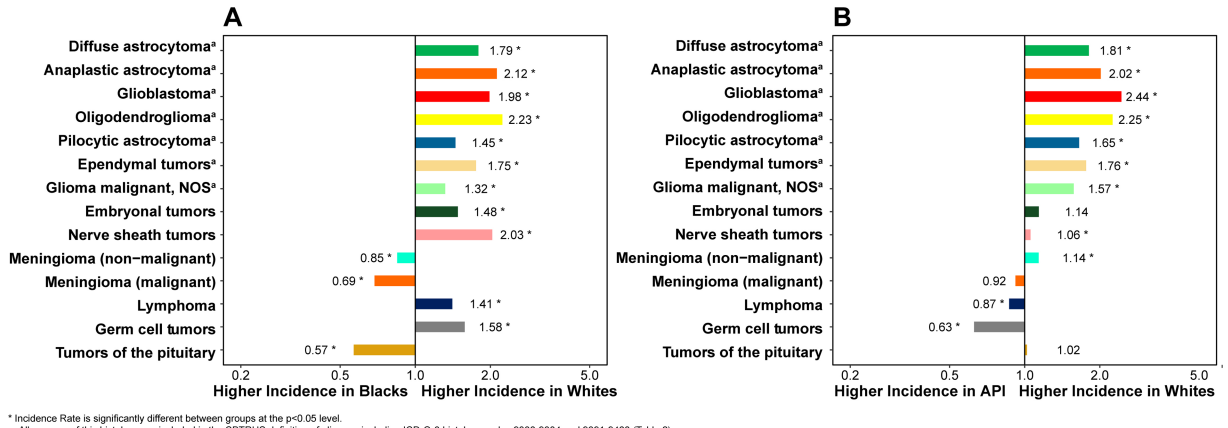
- Overall, 38.6% of tumors were malignant and 61.4% were non-malignant.
- Non-malignant meningioma was the most common tumor type (26.0%), followed by glioblastoma (17.7%).

Incidence Rates by Race and Histology

Incidence rates by race and histology are shown in **Table 14**.
- Incidence rates for all primary brain and other CNS tumors combined were lower for race groups AIAN (14.62 per 100,000 population) compared to Whites (24.24 per 100,000 population), Blacks (24.58 per 100,000 population), and API (19.52 per 100,000 population).
- Incidence rates for non-malignant primary brain and other CNS tumors were highest in Blacks (20.14 per 100,000) compared to Whites (16.69 per 100,000), AIAN (11.08 per 100,000), and API (15.12 per 100,000).
- Incidence rates for malignant primary brain and other CNS tumors were highest in Whites (7.55 per 100,000) compared to Blacks (4.44 per 100,000), AIAN (3.54 per 100,000), and API (4.4 per 100,000).
- Incidence rates of meningioma, tumors of the pituitary, and craniopharyngioma observed for Blacks exceeded those observed for Whites, AIAN, and API.
- The average annual incidence rate for tumors of the cranial and paraspinal nerves in the API group (2.09 per 100,000) was the highest for all racial groups.

Incidence rate ratios (White:Black) for selected histologies are shown in **Figure 14A**.

- Incidence rates for glioblastoma (p<0.0001), all other astrocytoma (p<0.0001), and nerve sheath tumors (p<0.0001) were approximately 2 times greater in Whites than in Blacks.
- Incidence of oligodendroglioma was 2.23 times greater in Whites than in Blacks (p<0.0001).
- Incidence rates for pilocytic astrocytoma (p<0.0001), ependymal tumors (p<0.0001), embryonal tumors (p=0),



* Incidence Rate is significantly different between groups at the p<0.05 level.
a. All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).

Fig. 14 Incidence Rate Ratios by Race (A- Whites:Blacks and B- Whites:Asian Or Pacific Islanders [API]) for Selected Primary Brain and Other CNS Tumor Histologies, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

lymphoma (p=0), and germ cell tumors (p<0.0001) were also higher among Whites than Blacks.
- Incidence rates for non-malignant (p<0.0001) and malignant (p<0.0001) meningioma and tumors of the pituitary (p<0.0001) were higher among Blacks than Whites.

Incidence rate ratios (White:API) for selected histologies are shown in **Figure 14B**.

- Incidence rates for glioblastoma (p<0.0001) were 2.4 times greater in Whites than in API.
- Incidence of nerve sheath tumors (p=0.0173) was 6% higher in Whites than in API.

Incidence Rates by Hispanic Ethnicity and Histology

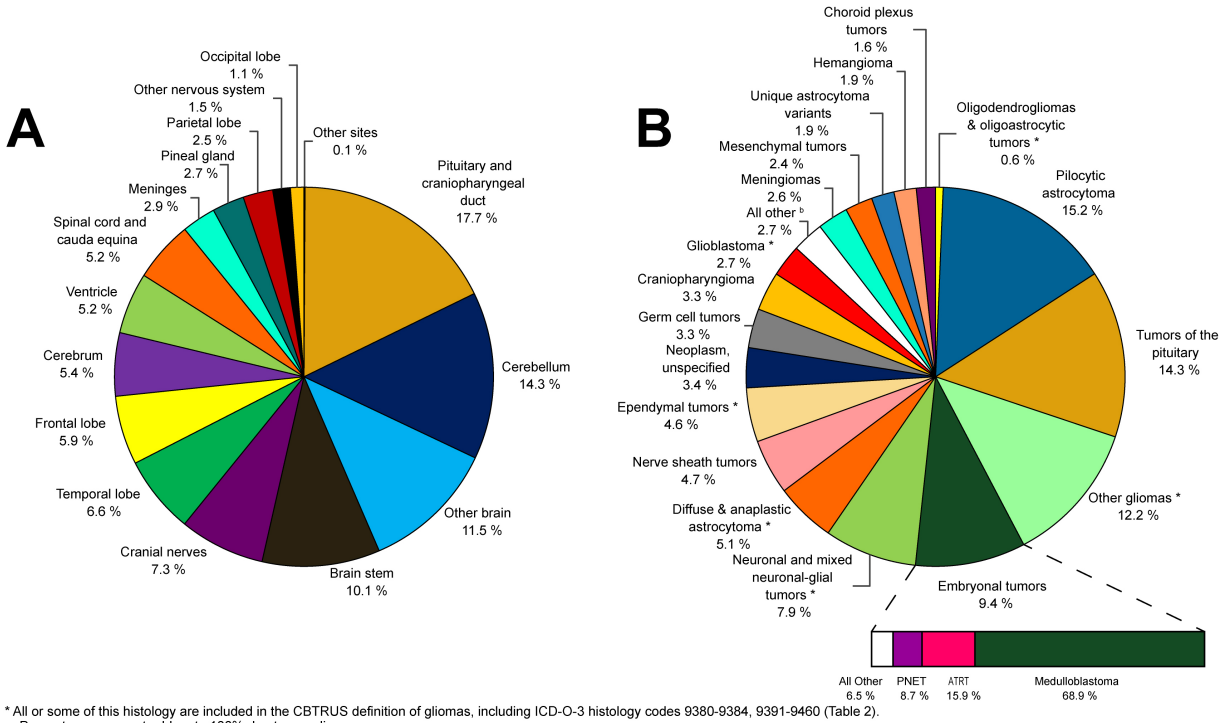
Incidence rates by Hispanic ethnicity and histology are shown in **Table 15**. Incidence rate ratios by Hispanic ethnicity and histology are shown in Supplementary Figure 4.
- The overall incidence rate for primary brain and other CNS tumors was 22.12 per 100,000 population among Hispanics and 24.68 per 100,000 population among non-Hispanics.
- Tumors of the pituitary, lymphoma and other hematopoietic neoplasms were the only histologies that were higher in Hispanics than in non-Hispanics.

While there are several histologies where significant differences in incidence were observed by race and/or ethnicity, in most cases the actual difference in incidence rates is small and may not be biologically significant.

Incidence and Distribution of Primary Brain and Other CNS Tumors in Childhood and Adolescence by Site, Histology, Sex, and Age at Diagnosis

Distribution of Tumors by Site and Histology in Children and Adolescents (Age 0–19 Years)

Brain and other CNS tumors are the most common form of solid tumors in children. and account for the majority of cancer mortality in this age-group. About 6% of the reported brain and other CNS tumors during 2014–2018 occurred in children and adolescents age 0–19 years. The distribution of brain and other CNS tumors for children and adolescents age 0–19 years by site is shown in **Figure 15A**.



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes anaplastic oligodendroglioma, oligoastrocytic tumors, other neuroepithelial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, all other (Table 2).

Fig. 15. Distribution[a] in Children and Adolescents (Age 0–19 Years) of All Primary Brain and CNS Tumors (Five-Year Total=25,485; Annual Average Cases=5,097) by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

- The largest percentages of tumors in childhood and adolescence were located in the pituitary and craniopharyngeal duct (17.7%).
- Frontal, temporal, parietal, and occipital lobes of the brain accounted for 5.9%, 6.6%, 2.5%, and 1.1% of all brain and other CNS tumors in childhood and adolescence, respectively.
- Cerebrum, ventricle, brain stem, and cerebellum tumors accounted for 5.4%, 5.2%, 10.0%, and 14.3% of all brain and other CNS tumors in childhood and adolescence, respectively.
- The cranial nerves and the spinal cord and cauda equina accounted for 7.3% and 5.2% of all brain and other CNS tumors in childhood and adolescence, respectively.

Figure 15B presents the most common brain and other CNS histologies in children and adolescents age 0–19 years.

- For children and adolescents age 0–19 years, pilocytic astrocytoma, other gliomas, and embryonal tumors accounted for 15.2%, 12.2%, and 9.4%, respectively.
- Tumors of the pituitary were the most common nonglial and predominantly non-malignant histology and accounted for 14.3% of all tumors in this age group.
- Gliomas accounted for approximately 45% of tumors in children and adolescents age 0–19 years.
- Medulloblastoma accounted for 68.9% of all embryonal tumors in this age group.

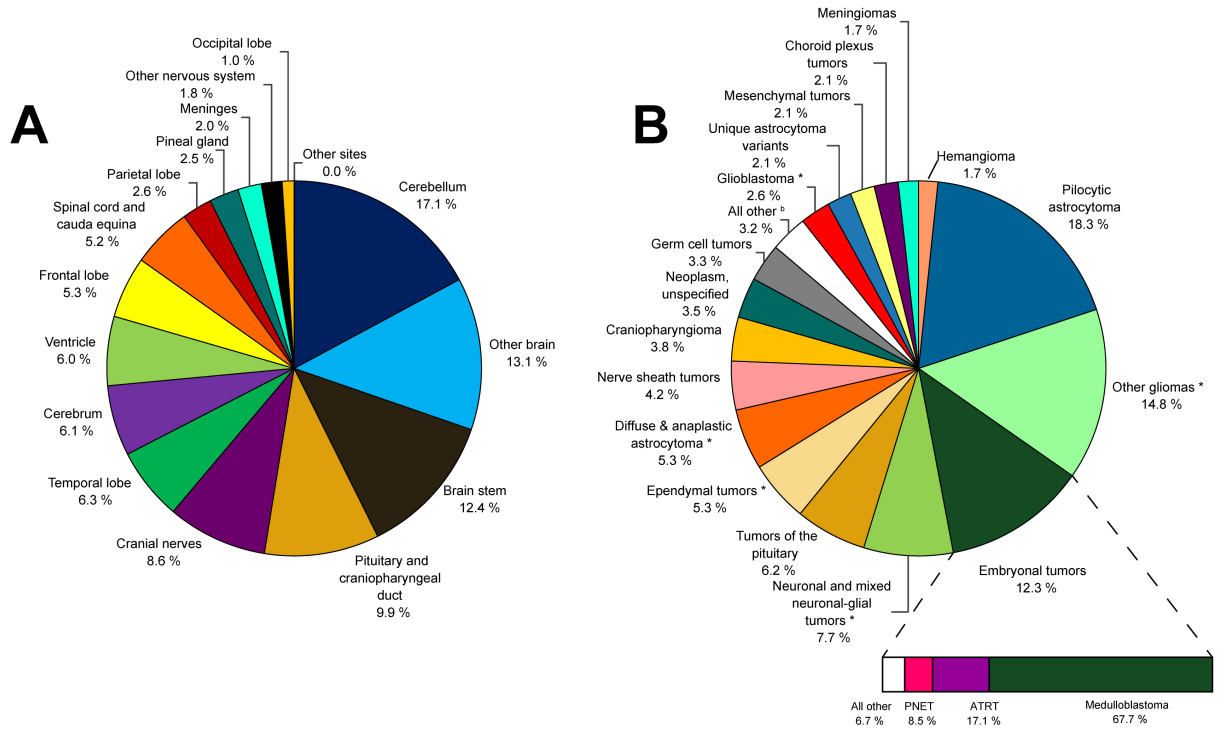
Distribution of Tumors by Site and Histology in Children (Age 0–14 Years)

Approximately 4% of all reported tumors occurred in children age 0–14 years. The distribution of brain and other CNS tumors for children age 0–14 years by site is shown in **Figure 16A**.

- Tumors of the cerebellum (17.1%) comprised the largest proportion of tumors followed by other brain (13.1%), and brain stem (12.3%).

Figure 16B presents the most common brain and other CNS histologies in children age 0–14 years.

- For children age 0–14 years, pilocytic astrocytoma, glioma malignant, NOS, and embryonal tumors accounted for 18.3%, %, and 12.3%, respectively.
- Gliomas accounted for 51.3% of tumors in children age 0–14 years.
- Of embryonal tumors, medulloblastoma, atypical teratoid rhabdoid tumor (ATRT), and primitive neuroectodermal tumor (PNET) accounted for 67.7%, 17.1%, and 8.5%, respectively.



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, other neuroepithelial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, all other (Table 2).

Fig. 16. Distribution[a] in Children and Adolescents (Age 0–14 Years) of All Primary Brain and CNS Tumors (Five-Year Total=17,802; Annual Average Cases=3,560) by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

Distribution of Tumors by Site and Histology in Adolescents (Age 15–19 Years)

About 2% of the reported brain and other CNS tumors during 2014–2018 occurred in adolescents age 15–19 years for a total of 7,724 tumors diagnosed between 2014 and 2018 (**Table 8**). The distribution of these tumors by site is shown in **Figure 17A**.

- 35.7% of these tumors were diagnosed in the pituitary and craniopharyngeal duct.
- The frontal lobe, temporal lobe, occipital lobe, and parietal lobe accounted for 18.5% of tumors in this age group.

The distribution of brain and other CNS tumors in adolescents age 15–19 years by histology is shown in **Figure 17B**.

- The most common histology in adolescents was tumors of the pituitary (33.1%).
- Gliomas accounted for 30.6% of tumors in adolescents. Of these gliomas, the histology pilocytic astrocytoma accounted for 8.2% of all tumors in this age group.

Incidence Rates by Histology and Sex in Children and Adolescents (Age 0–19 Years)

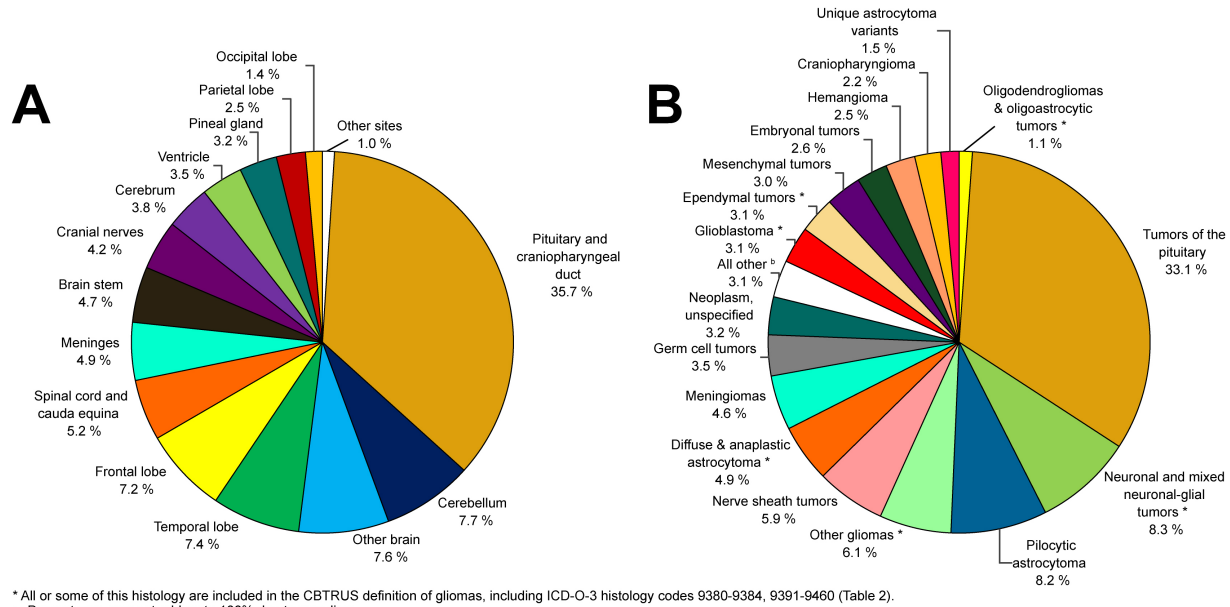
The incidence rates of the most common brain and other CNS tumors in children and adolescents by histology and sex are shown in **Table 16**.

- Average annual incidence rates were highest for other astrocytic tumors (1.07 per 100,000 population) and other gliomas (0.77 per 100,000 population). Among these tumors, the most common histologies were pilocytic astrocytoma (0.95 per 100,000 population), glioma malignant, NOS (0.76 per 100,000 population), and embryonal tumors (0.59 per 100,000 population).
- There were notable differences in incidence rates between males and females for ependymal tumors, embryonal tumors, germ cell tumors, and tumors of the pituitary.

Incidence Rates by Histology and Race/Ethnicity in Children and Adolescents (Age 0–19 Years)

Table 17 shows incidence rates for brain and other CNS tumors by histology and race for children and adolescents age 0–19 years. Incidence rates by histology and ethnicity for children and adolescents age 0–19 years are shown in **Table 18**.

- Incidence rates were highest among White (6.42 per 100,000 population) compared to Blacks (4.87 per 100,000 population), AIAN (3.32 per 100,000 population), and API (5.65 per 100,000 population).
- Incidence rates were highest among Hispanics (6.50 per 100,000 population) compared to non-Hispanics (2.63 per 100,000).



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes anaplastic oligodendroglioma, oligoastrocytic tumors, other neuroepithelial tumors, choroid plexus tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, and all other (Table 2).

Fig. 17 Distribution[a] in Children and Adolescents (Age 15–19 Years) of All Primary Brain and CNS Tumors (Five-Year Total=7,683; Annual Average Cases=1,537) by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

Incidence Rates by Age at Diagnosis and Histology in Children and Adolescents (Age 0–19 Years)

The detailed age-adjusted incidence rates for brain and other CNS tumors by histology for, children and adolescents age 0–19 years overall, and age groups 0–4 years, 5–9 years, 10–14 years, and 15–19 years are shown in **Table 8**.

- Overall, incidence rates for age groups 0–4 years (6.3 per 100,000 population) and 15–19 years (7.32 per 100,000 population) exceeded those observed in age groups 5–9 years (5.59 per 100,000 population) and 10–14 years (5.94 per 100,000 population).
- Individual histology distributions varied substantially within these age groups.
- Incidence rates of pilocytic astrocytoma, glioma malignant, NOS, ependymal tumors, choroid plexus tumors, and embryonal tumors decreased with increasing age.

Incidence Rates by Histology Defined by ICCC in Children and Adolescents (Age 0–19 Years)

Supplementary Table 5 shows the CBTRUS brain and other CNS tumor data for children and adolescents used for this report according to the International Classification of Childhood Cancer (ICCC) grouping system for pediatric cancers (See Supplementary Table 1 for more additional information on the ICCC classification scheme).

Estimated Numbers of Expected Cases

Estimated Numbers of Expected Cases of All Primary Brain and Other CNS Tumors by State

The estimated number of cases of all primary brain and other CNS tumors for 2021 and 2022 by State and Behavior are shown in **Table 19**. Overall total rates by states presented are based on total malignant and non-malignant incidence. Stratified rates may not add up to these totals. Estimated numbers of cases are highly dependent on input data. Different patterns of incidence within strata can substantively affect the projected estimates, and strata-specific estimates may not equal the total estimate presented. Caution should be used when utilizing these estimates.

- The total number of new cases of primary brain and other CNS tumors for all 50 states and the District of Columbia in 2021 is estimated to be 88,190, with 25,690 malignant and 62,500 non-malignant cases.
- For 2022, the estimate is 88,970 new cases of primary brain and other CNS tumors of which 25,930 and 63,040 are expected to be malignant and non-malignant, respectively.

Estimated Number of Expected Cases of All Primary Brain and Other CNS Tumors by Histology and Age at Diagnosis

The estimated number of cases of all primary brain and other CNS tumors for 2021 and 2022 overall and by histology are shown in **Table 20** and including age groups in Supplementary Table 6.

- Meningiomas have the highest number of all estimated new cases, with 36,130 cases projected in 2021 and 37,020 cases projected in 2022
- Glioblastoma has the highest number of cases of all malignant tumors, with 13,160 cases projected in 2021 cases projected in 2021 and 13,430 cases projected in 2022.
- For 2021 and 2022, the highest number of new cases is predicted in those age 65+ years, with 39,630 cases and 40,790 cases, respectively.
- For 2021 and 2022, children age 0–14 years are estimated to have 3,890 and 4,170 new cases of primary brain and other CNS tumors each year, respectively.
- For 2021 and 2022, children age 0–19 years are estimated to have 5,550 and 5,900 new cases of primary brain and other CNS tumors each year, respectively.

Mortality Rates

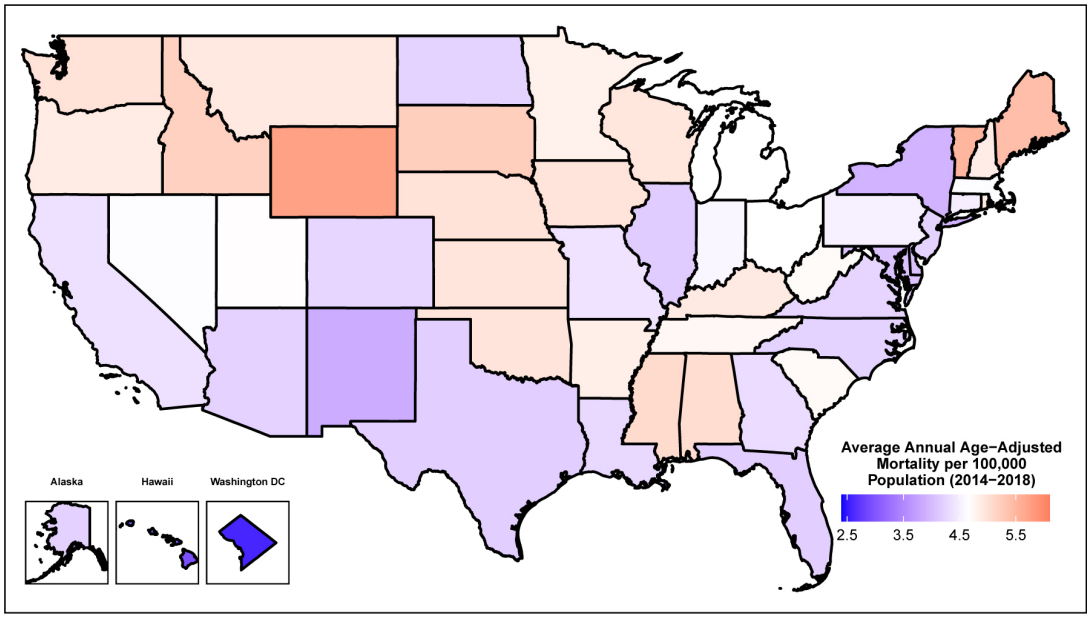
Mortality Rates for Malignant Brain and Other CNS Tumors by State and Sex

Table 21 and **Figure 18** show average annual age-adjusted mortality rates for primary malignant brain and other CNS tumors in the US during 2014–2018 by state and sex.

- The aggregate total number of observed deaths was 83,029, for an average annual age-adjusted mortality rate of 4.43 per 100,000 population.
- There was considerable variation by individual state, which ranged from a low of 2.58 deaths per 100,000 population to a high of 5.74 deaths per 100,000 population. Rates may vary by state for multiple reasons, including demographic variation and procedures for deciding primary cause of death on a death certificate.
- Males had a higher mortality rate for malignant brain and other CNS tumors than females in the US population, with 5.40 per 100,000 population as compared to 3.60 per 100,000 population.

Overall Survival and Relative Survival

Estimates of median survival in months by histology and age group for all individuals diagnosed with primary malignant brain and other CNS tumors regardless of whether



a. Rates per 100,000 and age−adjusted to the 2000 United States standard population.

Fig. 18 Average Annual Age-Adjusted Mortality Rates[a] for Malignant Primary Brain and Other CNS Tumors by Central Cancer Registry, CBTRUS Statistical Report: NVSS, 2014–2018.

individuals received any treatment for their tumor are presented in **Table 22**. Survival curves for the most common histologies are presented by age group in **Figure 19A**.

- Median survival was lowest for glioblastoma (8 months) and highest for oligodendroglioma (199 months, or approximately 16.6 years).
- Median survival was not able to be estimated for pilocytic astrocytoma, unique astrocytoma variants, ependymal tumors, other neuroepithelial tumors, tumors of the pineal region, embryonal tumors, nerve sheath tumors, germ cell tumors, or tumors of the pituitary as >50% of individuals remained alive during the 15 year follow up period.
- Many other published survival estimates (including many of those previously published by CBTRUS) incorporate treatment patterns which may explain differences between these population-level estimates and other published estimates.

Demographic factors such as age at diagnosis, sex, race, and ethnicity are known to have a significant effect on survival time after diagnosis in primary brain and other CNS tumors. Hazard ratios for the effect of age groups, sex, race, and ethnicity are presented in **Table 23** for all individuals regardless of whether they received any treatment for their tumor. Hazard ratio estimates for demographic factors in the five most common histologies are presented by histology in **Figure 19B**.

- AYA had better overall survival as compared to children 0–14 years old in approximately half of the histologies evaluated, while adults 40+ years old had poorer survival.
- Older adults (40+ years old) had poorer survival than children 0–14 years old in nearly every histology.
- Females generally had better survival outcomes as compared to males with the exception of glioblastoma, embryonal tumors, and germ cell tumors.
- Black, non-Hispanic individuals had poorer survival outcomes as compared to white, non-Hispanic individuals with the exception of glioblastoma.
- AIAN, non-Hispanic individuals had poorer survival as compared to white, non-Hispanic individuals in many histologies, though the small size of this population meant that many of these associations were non-significant.
- Being an API, non-Hispanic was associated with improved survival in many histologies as compared to Whites, Non-Hispanics.
- Hispanic ethnicity was associated with improved survival in most histologies.
- Many other published survival estimates (including many of those previously published by CBTRUS[87–89]) incorporate treatment patterns which may explain differences between these population-level estimates and other published estimates.

When interpreting these results, it is important to remember that these models do not incorporate important

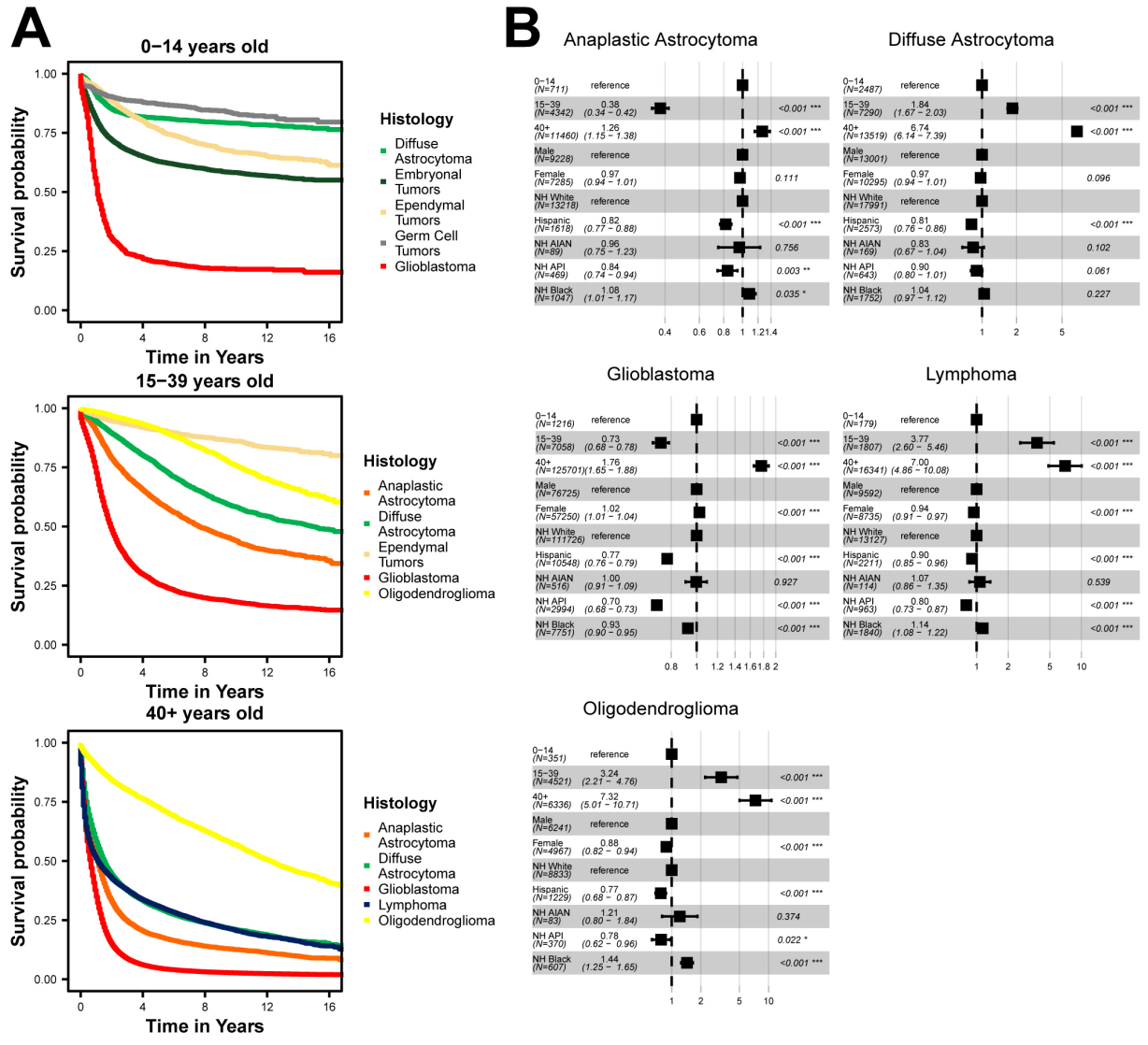


Fig. 19 A) Kaplan-Meier Survival Curves for the Five Most Common Histologies within Age Group at Diagnosis (Age 0–14, 15–39 and 40+) and B) Hazard Ratios And 95% Confidence Intervals for Sex, Age at Diagnosis, Race, and Ethnicity for the Five Most Common Histologies Overall, National, Data provided by CDC's National Program of Cancer Registries, 2001–2017.

factors that affect survival such as treatment patterns, health insurance, or type of facility at which an individual received treatment, all of which may be associated with these demographic factors as well as overall survival.

Relative Survival Rates for Brain and Other CNS Tumors by Site and Behavior

Relative survival estimates by site and behavior are presented in Supplementary Table 7.

- The highest five-year survival was for tumors occurring in the acoustic nerves (99.5%).
- The lowest five-year survival was for tumors of overlapping lesion of brain (21.5%) and the parietal lobe (25.2%).

Relative Survival Rates for Brain and Other CNS Tumors by Histology, Behavior and Age Groups

Relative survival estimates for brain and other CNS tumors by histology, behavior, and age group at diagnosis are presented in **Table 24** and Supplementary Table 8.

- There was large variation in survival estimates depending upon tumor histology; five-year survival rates were 94.7% for pilocytic astrocytoma but were 6.8% for glioblastoma.
- Survival generally decreased with older age at diagnosis; children and young adults generally had better survival outcomes for most histologies.
- Among predominantly non-malignant histologies, five-year survival was lowest in craniopharyngioma and

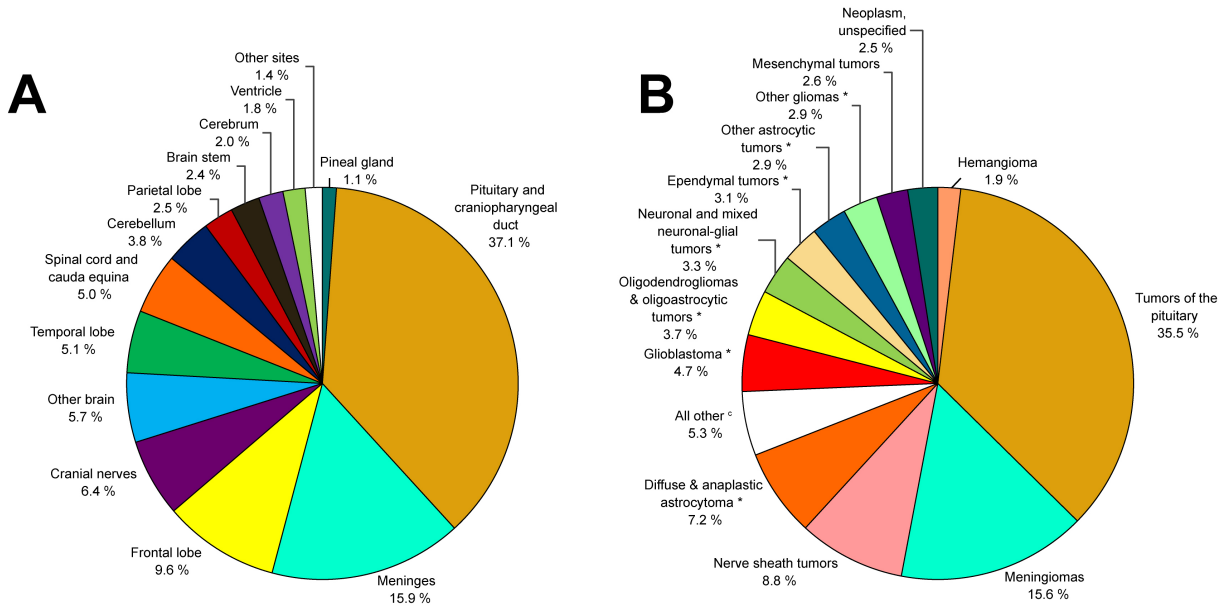
meningioma, which had five-year relative survival of 85.8% and 88.2%, respectively.
- Among predominantly non-malignant histologies, five-year survival was highest in nerve sheath tumors which had five-year relative survival of 99.3%.
- In general, relative survival in most histologies was higher in adolescents and young adults as compared to children and adults.

Descriptive Summary of Adolescent and Young Adult Primary Brain and Other CNS Tumors (Age 15–39 Years)

- There were 62,558 primary brain and other CNS tumors diagnosed in AYA between 2014 and 2018, representing 14.5% of all brain and other CNS tumors (**Table 7**).
- The overall incidence rate in the AYA age group was 11.82 per 100,000 population. Incidence of malignant tumors was 3.25 per 100,000, and incidence of non-malignant tumors was 8.57 per 100,000 (**Table 7**).
- Tumors of the sellar region had the highest incidence (4.28 per 100,000 population) in AYA, followed by tumors of the meninges (2.24 per 100,000 population) (**Table 7**).
- The most common histology in AYA was tumors of the pituitary (4.15 per 100,000 population), followed by meningioma (1.93 per 100,000 population) and nerve sheath tumors (1.06 per 100,000 population) (**Table 7**).
- The majority of AYA brain and other CNS tumors occurred in the pituitary and craniopharyngeal duct (37.1%), followed by the meninges (15.9%) (**Figure 20A**).
- Approximately 17.9% of tumors diagnosed in AYA were located within the frontal, temporal, parietal, and occipital lobes of the brain combined (**Figure 20A**). Cerebrum, ventricle, cerebellum, and brain stem tumors combined accounted for about 10.1% of all tumors.
- The predominately non-malignant tumors of the pituitary (35.5%), meningioma (15.6%), and nerve sheath (8.8%) represented over half of CNS tumors diagnosed in AYA (**Figure 20B**). Glioma accounted for approximately 25.2% of all brain and other CNS tumors in AYA, and about 82.7% of all malignant tumors.
- AYA had higher rates of relative survival than adults greater than 40 years old for all histologic types. Though 1-year relative survival for most tumor types was higher for AYA than children, 5- and 10-year survival were usually higher for children as compared to AYA (**Table 24**).

Descriptive Summary of Spinal Cord Tumors

Although spinal cord tumors account for a relatively small percentage of brain and other CNS tumors, they result in significant morbidity. The most common histologies found in the spinal cord, spinal meninges, and cauda equina are



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Adolescents and Young Adults (AYA) as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/adolescent-young-adult.
c. Includes other neuroepithelial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, craniopharyngioma, and all other (Table 2).

Fig. 20. Distribution[a] in Adolescents and Young Adults[b] (Age 15–39 Years) of All Primary Brain and Other CNS Tumors (Five-Year Total=62,515; Annual Average Cases=12,503) by A) Site and B) Histology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

presented in **Figure 21** for both children (age 0–19 years, **Figure 21A**) and adults (age 20+ years, **Figure 21B**).

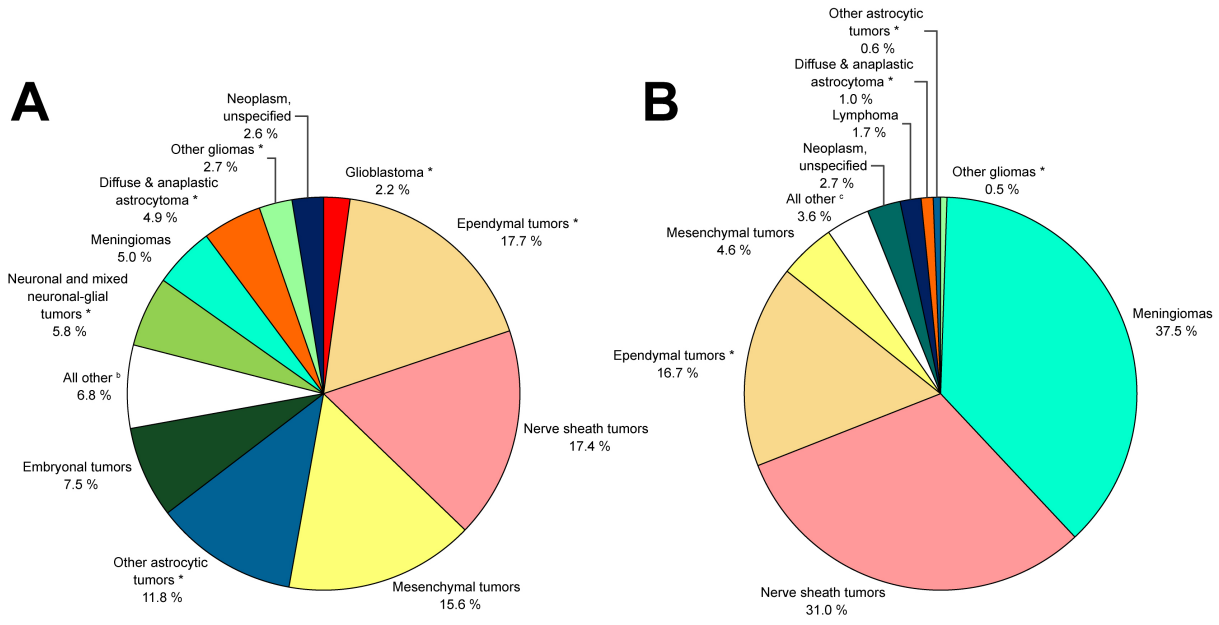
- The predominant histology group for those age 0–19 years was ependymal tumors (17.7%) followed by nerve sheath tumors (17.4%).
- Meningiomas (37.5%) accounted for the largest proportion of spinal cord tumors among those age 20 years and older.
- Five-year survival after diagnosis with a tumor of the spinal cord and cauda equina was 92.9%, with a ten-year relative survival of 91.0% (Supplementary Table 7).

Descriptive Summary of Meningioma, Glioblastoma, and Embryonal Tumors

The data in the CBTRUS Statistical Report 2014–2018 are synthesized to describe three of the most common histologic types: meningioma and glioblastoma for adults, and embryonal tumors for children and adolescents.

Meningioma

- Meningioma was the most frequently reported brain and other CNS tumor, accounting for 39.0% of tumors overall (**Table 5**).
- Most meningiomas (81.2%) were located in the cerebral meninges, 4.2% were located in the spinal meninges, and approximately 14% did not have a specific meningeal site listed.
- Non-malignant meningioma with ICD-O-3 behavior codes /0 (benign) or /1 (uncertain) accounted for 99.0% of meningiomas reported to CBTRUS.
- Of meningioma with documented WHO grade (65.7%), 35.9% of meningioma were WHO grade I, 8.2% were WHO grade II, and 0.7% were WHO grade III (**Table 13**).
- Meningioma was most common in adults age 65 years and older, and one of the least common in children age 0–14 years (**Table 8** and **Table 9**).
- Incidence of meningioma increased with age, with a dramatic increase after age 65 years. Even among the population age 85 years and older, these rates continued to be high (**Table 9**).
- Non-malignant meningiomas overall were 2.3 times more common in females compared to males. Incidence rate ratios were lowest between males and females in persons <20 years old (where incidence rates for males and females were approximately equal), and highest from 35–54, where incidence rates were 3.34 times higher in females (**Figure 12**, Supplementary Figure 5).
- Incidence of meningioma was significantly higher in Blacks than in Whites (**Figure 14**).



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding.
b. Includes oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, unique astrocytoma variants, other neuroepithelial tumors, choroid plexus tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, and all other (Table 2).
c. Includes anaplastic astrocytoma, glioblastoma, oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, unique astrocytoma variants, other neuroepithelial tumors, neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, primary melanocytic lesions, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, and all other (Table 2).

Fig. 21. Distribution[a] of Primary Spinal Cord, Spinal Meninges, and Cauda Equina Tumors by Histology in A) Children and Adolescents (Age 0–19 Years, Five-Year Total=1,433; Annual Average Cases=287) and B) Adults (Age 20+ Years, Five-Year Total=18,822; Annual Average Cases=3,764), CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014–2018.

- Ten-year relative survival for malignant meningioma was 67.5%. Age had a large effect on survival after diagnosis with malignant meningioma: 10-year relative survival was 77.3% for the population age 20–44 years, and 39.7% for age 75+ years (**Table 24**, Supplementary Table 8).
- Ten-year relative survival for non-malignant meningioma was 83.7%. Age had a large effect on survival after diagnosis with non-malignant meningioma: 10-year relative survival was 93.4% in children 0–14, 94.9% in AYA, and 82.9%in adults 40+ years old (**Table 24**).
- Site of meningioma affected survival after diagnosis with meningioma. For non-malignant meningioma, 10-year relative survival was 83.5% for tumors in the cerebral meninges, but 95.6% for tumors in the spinal meninges (Supplementary Figure 6).
- Survival was also higher in malignant meningioma for spinal tumors, where 10-year relative survival was 71.7%, as compared to 58.3% for tumors in the cerebral meninges (Supplementary Figure 6).

Glioblastoma

- Glioblastoma was the third most frequently reported CNS histology and the most common malignant tumor overall. (**Table 5**).
- Glioblastoma accounted for 14.3% of all primary brain and other CNS tumors and 49.1% of primary malignant brain tumors (**Figure 5B**, **Figure 6B**)
- Glioblastoma was more common in older adults and was less common in children (**Table 7**); these tumors comprised approximately 2.7% of all brain and other CNS tumors reported among age 0–19 years (**Figure 15**).
- Incidence of glioblastoma increased with age, with rates highest in individuals age 75 to 84 years (**Table 9**).
- Glioblastoma was 1.6 times more common in males than females (**Figure 12**).
- Glioblastoma was 1.98 times higher among Whites compared to Blacks (**Figure 14**).
- Relative survival estimates for glioblastoma were quite low; 6.8% of patients survived five years post-diagnosis. These survival estimates were somewhat higher for the small number of patients who were diagnosed under age 20 years (**Table 24**, Supplementary Table 8).

Embryonal Tumors

- Embryonal tumors were the most frequently reported brain and other CNS tumor histology in children age 0–4 years, and the fourth most common tumor type overall in children and adolescents age 0–19 years (**Table 8**, **Figure 15**).
- Embryonal tumors accounted for 12.3% of all primary brain and other CNS tumors in children age 0–14 years, 9.4% of tumors in children and adolescents age 0–19 years, and 0.8% of tumors diagnosed overall (**Figure 15B**, **Figure 16B**, **Table 5**).
- Embryonal tumors within the CBTRUS histologic grouping scheme includes multiple different histologies: primitive neuroectodermal tumor (PNET), medulloblastoma, atypical teratoid rhabdoid tumor (ATRT), and several other histologies (**Table 2**).
- Incidence of medulloblastoma decreased with age. Incidence was 0.5 per 100,000 population, 0.61 per 100,000 population, 0.34 per 100,000 population, and 0.16 per 100,000 population in children age groups 0–4, 5–9, 10–14 years, and adolescents age 15–19 years, respectively (**Table 8**).
- Incidence of PNET was 0.13 per 100,000 population, 0.05 per 100,000 population, 0.03 per 100,000 population, and 0.03 per 100,000 population in children age 0–4, 5–9, 10–14 years, and adolescents age 15–19 years, respectively (**Table 8**).
- Incidence of ATRT was 0.33 per 100,000 population and 0.03 per 100,000 population in children age 0–4 and 5–9 years, respectively. There were too few of these cases in older age groups to report (**Table 8**).
- Embryonal tumors were more common in males than females. This difference was greatest in medulloblastoma, which occurred 1.71 times as frequently in males age 0–14 years as compared to females in this age group. Incidence of ATRT and PNET in children age 0–14 years was not significantly different between males and females (Supplementary Figure 7).

Descriptive Summary of Time Trends in Primary Brain and Other CNS Tumors

Time trends in cancer incidence rates are an important measure of the changing burden of cancer in a population over time. Many factors may lead to fluctuations in rates over time, and all of these must be considered when interpreting time trends results. When assessing trends in incidence over time it is critical to use the most recent data available, as delay in reporting may cause small fluctuations in incidence. Time trends analysis methods are used to estimate if the annual percentage change (APC) is significantly different from 0% (meaning no change in incidence from year to year). In addition to assessing statistical significance of changes in incidence over time, the size of this change must also be considered because with datasets as large as CBTRUS very small fluctuations in incidence over time may be statistically significant but not truly represent a large change in proportion of individuals over time.

Incidence rates of cancer overall and many specific cancer histologies, have decreased over time.[90] Overall, changes in incidence rates of **all primary** brain and other CNS tumors between 2000 and 2018 (limited to 2004 and 2018 for non-malignant tumors), have been small. As stated previously, there are many things that can affect incidence rates over time that are not related to 'true' changes in incidence of these tumors such as demographic changes, changes in histologic classification, and changes in cancer registration procedures. The latter is especially applicable to the collection of non-malignant brain and other CNS tumors.

All Malignant Brain and Other CNS Tumors

Please see **Figure 7B** for an overview of histologies included in all malignant brain and other CNS tumors.

- From 2008–2018, there was a slight decrease in overall incidence (APC= -0.8% [95%CI: -1.0%, -0.6%], **Figure 22**, Supplementary Table 9).
- There was a small but statistically significant increase in incidence in children (age 0–14 years, APC=0.6% [95%CI: 0.4%, 0.9%], **Figure 22**, Supplementary Table 9), a small but statistically significant decrease in AYA (age 15–39 years, APC=-0.4% [95%CI: -0.5%, -0.2%], **Figure 22**, Supplementary Table 9) from 2000–2018, and a small but statistically significant decrease in older adults from 2005–2016 (age 40+ years, APC=-0.7% [95%CI: -0.9%, -0.5%], **Figure 22**, Supplementary Table 9).

Glioma

Please see **Figure 9B** for an overview of histologies included in the broad category of glioma.

- For all ages, there was a small but significant decrease in incidence of malignant glioma from 2009–2018 (APC= -0.7% [95%CI: -1.0%, -0.5%], **Figure 23**, Supplementary Table 9).
- For all ages, there was a small but statistically significant decrease in incidence of diffuse astrocytic and oligodendroglial tumors from 2009–2018 (APC=-0.9% [95% CI: -1.1%, -0.7%], **Figure 23**, Supplementary Table 10).
- For all ages, glioblastoma incidence increased significantly from 2000–2004 (APC=1.1% [95% CI:0.1%, 2.1%], **Figure 23**, Supplementary Table 10) with no significant change in incidence after 2004.
- For all ages, incidence of other astrocytic tumors increased significantly from 2003–2013 (APC=1.6% [95% CI: 1.1%, 2.1%], **Figure 23**, Supplementary Table 10), with no significant change from 2013–2018.
- For all ages, incidence of other gliomas increased significantly from 2000–2018 (APC=1.5% [95% CI: 1.0%, 1.9%], **Figure 23**, Supplementary Table 9)
- In children age 0–14 years there was a significant increase in malignant glioma incidence (APC=1.3% [95%CI: 0.8%, 1.7%], **Figure 23**, Supplementary Table 9) from 2000–2018, and no change in malignant glioma incidence in AYA.
- In older adults (age 40+ years) malignant glioma incidence was relatively stable: there was a statistically significant decrease from 2007–2018 (APC= -0.8% [95%CI: -0.9%, -0.6%], **Figure 23**, Supplementary Table 9).

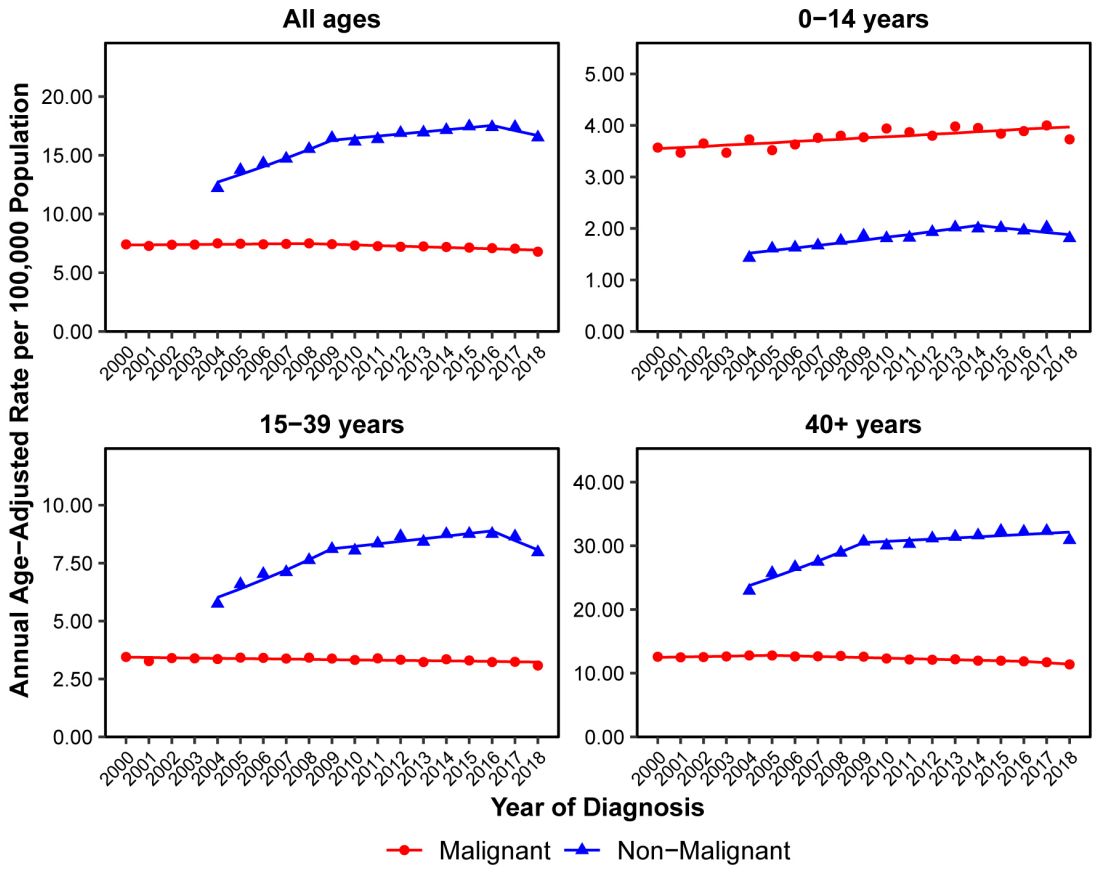


Fig. 22 Annual Age-Adjusted Incidence Rates of All Primary Brain and Other CNS Tumors, and Incidence Trends by Behavior and Age Group at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2000–2018 (varying).

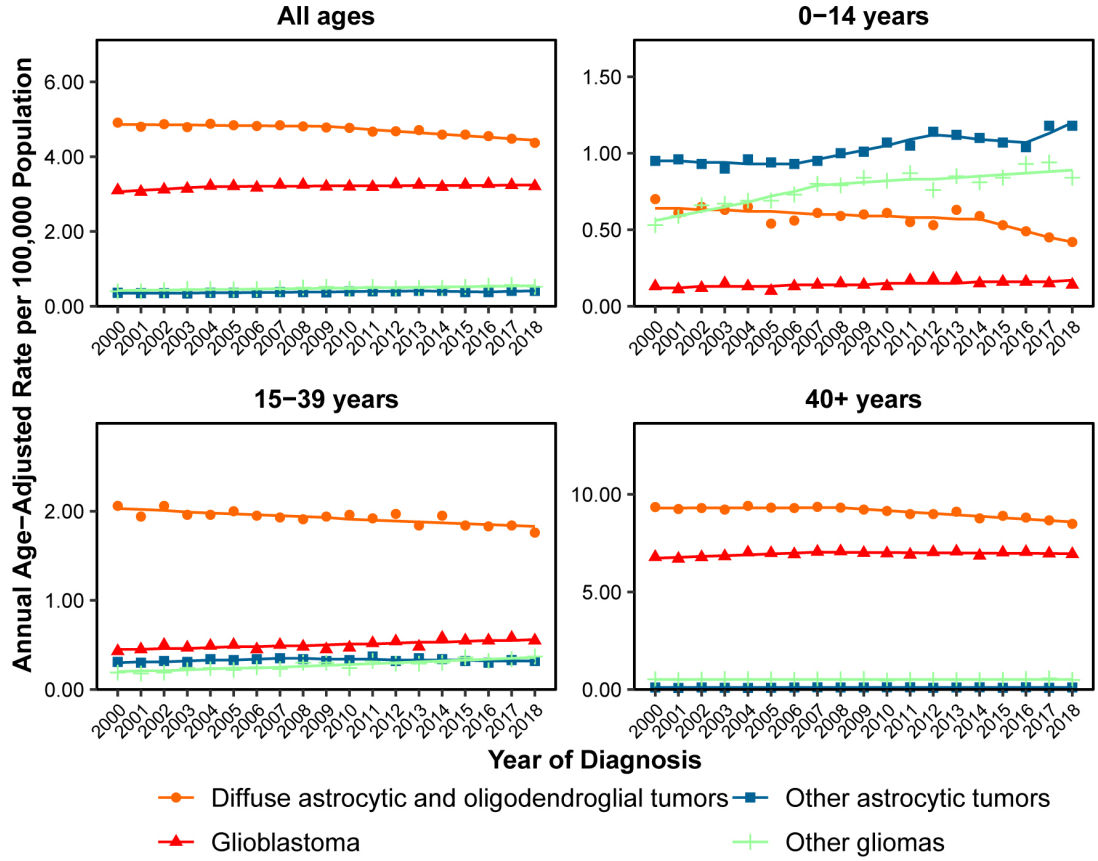


Fig. 23 Annual Age-Adjusted Incidence Rates of Primary Brain and Other CNS Gliomas, and Incidence Trends by Age Group at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2000–2018.

Malignant Meningioma

- There was a significant decrease in incidence from 2000–2007 (APC= -4.0% [95%CI: -5.8%, -2.1%]) and from 2013–2018 (APC= -6.4% [95%CI: -10.1%, -2.6%], **Figure 24B**, Supplementary Table 9).
- Changes were made to histological classification of meningioma in both the 2000 and 2007 revisions of the WHO classification, and gradual uptake of these classification changes may result in changing incidence of these tumors.

All Non-Malignant Brain and Other CNS Tumors

Please see **Figure 8B** for an overview of histologies included in all non-malignant brain and other CNS tumors.

- There was a significant increase in incidence of non-malignant brain tumors from 2004–2009 (APC=5.4% [95%CI: 3.3%, 7.6%], Supplementary Table 11), and *no significant change* between 2009 and 2018.
- There was a small but statistically significant increase in incidence of these tumors in children (2004–2014, APC=3.0% [95%CI: 2.2%, 3.9%], **Figure 22**), in AYA (2004–2011, APC=5.1% [95%CI: 3.4%, 6.8%], **Figure 22**), and older adults (2004–2009, APC=5.1% [95%CI: 3.2%, 7.1%], **Figure 22**).
- When analysis was limited to histologically confirmed tumors only, there was a small but significant increase in incidence of non-malignant brain and other CNS tumors from 2004–2009 (APC=1.7% [95%CI: 0.4%, 3.0%]), followed by a significant decrease from 2009–2018 (APC=-0.9% [95%CI: -1.4%, -0.4%], Supplementary Table 12).
- There was a statistically significant increase in incidence of radiographically confirmed non-malignant tumors from 2004–2009 (APC=9.9% [95%CI: 6.6%, 13.4%]), with smaller but statistically significant increase from 2009–2018 (APC=1.8% [95%CI: 0.8%, 2.8%], Supplementary Table 12).
- *The increases in incidence in the non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.*

Non-Malignant Meningioma

- There was a significant increase of non-malignant meningioma between 2004–2008 (APC=6.0% [95%CI: 3.6%, 8.6%]), followed by a smaller but statistically significant increase from 2008–2018 (APC=1.0% [95%CI: 0.5%, 1.5%], Supplementary Table 11).

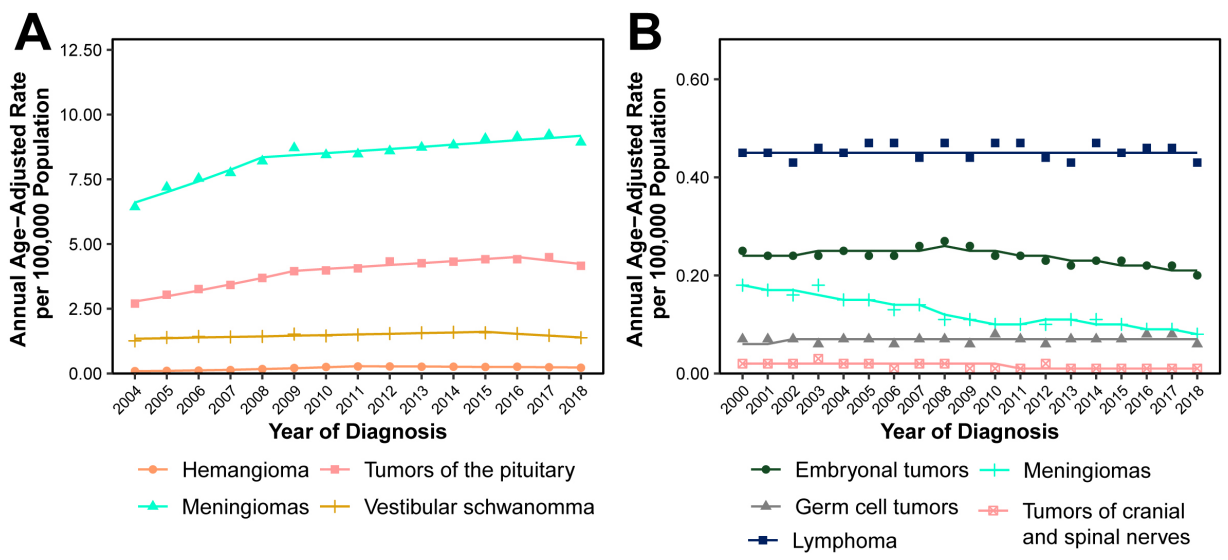


Fig. 24 Annual Age-Adjusted Incidence Rates of Primary Brain and Other CNS Tumors, and Incidence Trends by Histology for Selected A) Non-Malignant and B) Malignant Histologies, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2000–2018 (varying).

- When analysis was limited to microscopically confirmed cases, there was a slight significant decrease in incidence from 2004–2018 (APC=-0.4% [95%CI: -0.8%, -0.1%], Supplementary Table 12)
- There was a significant increase in incidence of radiographically diagnosed cases from 2004–2008 (APC=10.8% [95%CI: 7.0%, 14.6%]), and a smaller but still significant change from 2008–2018 (APC=2.3% [95%CI: 1.6%, 2.9%], Supplementary Table 12).
- *The increases in incidence in these non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.*

Non-Malignant Nerve Sheath Tumors

Vestibular schwannoma (**Table 6**) is the most common type of nerve sheath tumor, representing 75% of all non-malignant nerve sheath tumors (**Figure 7B**).

- There was a small but significant increase in the incidence of non-malignant nerve sheath tumors between 2004–2015 (APC= 1.8% [95%CI: 1.2%, 2.5%]) followed by a significant decrease from 2015–2018 (APC= -4.6% [95%CI: -8.7%, -0.4%], Supplementary Table 11)
- When analysis was limited to histologically confirmed cases only, there was no significant change in incidence from 2004–2018.
- There was a significant increase in incidence of radiographically diagnosed tumors between 2004–2006 (APC=13.7% [95%CI: 5.8%, 22.1%]) and 2006–2015 (APC=3.0% [95%CI: 2.3%, 3.7%]), followed by a significant decrease from 2015–2018 (APC=-5.3% [95%CI: -8.0%, -2.6%], Supplementary Table 12).
- *The increases in incidence in these non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.*

Non-Malignant Tumors of the Pituitary

- There was a significant increase in non-malignant tumors of the pituitary from 2004–2009 (APC=7.9% [95%CI: 5.2%, 10.6%]), and a smaller but significant increase from 2009–2018 (APC=1.1% [95%CI: 0.2%, 2.0%], Supplementary Table 11).
- When analysis was limited to histologically confirmed tumors only, there was a significant increase (APC=4.5% [95%CI: 3.5%, 5.6%]) from 2004–2009, followed by a significant decrease from 2009–2018 (APC=-1.5% [95%CI: -1.8%, -1.1%], Supplementary Table 12).
- There was a significant increase in incidence of radiographically diagnosed tumors of the pituitary from 2004–2012 (APC=9.1% [95%CI: 7.1%, 11.1%], Supplementary Table 12), with no significant change in incidence after 2012.

Strengths and Limitations of Cancer Registry Data

CBTRUS, in collaboration with the CDC and NCI, is the largest population-based registry focused exclusively on primary brain and other CNS tumors in the US and represents cases collected from the entire US population. The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in*

2014–2018 contains the most up-to-date population-based data on all primary brain tumor and other CNS tumors available through the cancer surveillance system in the US.

Registration of individual cases is conducted by cancer registrars at the institution where diagnosis or treatment occurs and is then transmitted to the CCR, which further transmits this information to NPCR and/or SEER. CCRs, both those contributing data to NPCR and to SEER, only report cases to the CDC and NCI for persons who are residents of that particular state, so duplicate records should not occur for persons who may have traveled across state lines for treatment. As a result, the CBTRUS dataset is a complete recording of all cases for the time period examined, 2014–2018, with minimal duplicates.

Currently, there is no publicly available data source for the collection of survival and outcomes data from all geographic regions in the US via the cancer registry system. Survival data used for this report are collected by NPCR for 42 of the 51 CCR in the US—primarily through linkage with death certificate and other administrative records—and by SEER for the remaining CCR—through both active and passive methods—and the feasibility of these data for use in survival studies has been evaluated[91,92] and shown to produce reliable and robust estimates of cancer survival. Use of passive follow-up with record linkage may result in overestimation of survival in some populations, such as those that are more likely to leave the state or country.

No mechanism currently exists for central pathology review of cases within the US cancer registry system, and histology code assignment at case registration is based on histology information contained in the patient's medical record. The *WHO Classification of Tumours of the Central Nervous System* was revised in 1993,[93] 2000,[17] 2007,[18] 2016,[2] and 2021.[94] As of 2018, the US cancer registry system uses the 2016 classification for data abstraction, but tumors included in this report may have been diagnosed using any of the available classifications prior to 2014 due to the variation in adoption of new standards by individual physicians and medical practices. As a result, histologies are reflective of the prevailing criteria for the histology at the time of case registration. This means that despite changes to the histology schema that may occur over time, it is not possible, without additional variables, to go back and reclassify tumors based on the new criteria. In addition to changes in histologic criteria over time, there is significant inter-rater variability in histopathological diagnosis of glioma.[95,96] This also means that incomplete, incorrect, or alternatively stated diagnoses included in a pathology report or other medical record may result in an incorrect reporting of the details of an individual case. For example, an anaplastic oligodendroglioma recorded in a pathology record as oligodendroglioma WHO grade III may be incorrectly recorded as an oligodendroglioma when the accurate category is an anaplastic oligodendroglioma.

US cancer registration requires the reporting of cases that are confirmed by different types of diagnostic procedures, including both histologic confirmation (where surgery was performed and the diagnosis confirmed by a pathologist) and radiographic confirmation (where diagnosis was made based solely on imaging criteria, such as an MRI, CT scan, or X-ray). Only histologic confirmation allows certainty on the assignment of a specific histology as well as for an assignment of a WHO grade. Many tumors have unique characteristics that make them identifiable on imaging, and thereby qualify as a valid type of diagnostic procedure, but it is important to consider the decreased level of certainty of specifying the correct histology in these tumors.

CONCLUDING COMMENT

The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014–2018* comprehensively describes the most up to date (October 2021) population-based incidence, mortality, and relative survival of primary malignant and non-malignant brain and other CNS tumors collected and reported by central cancer registries covering the entire US population. This report aims to serve as a useful resource for researchers, clinicians, patients, and families. CBTRUS continually revises its reports to reflect the current collection and reporting practices of the broader surveillance community in which it works, while integrating the input it receives from the clinical and research communities, especially from neuropathologists, when possible. In keeping with its mission, CBTRUS has revised its histology grouping to be consistent with the 2016 WHO classification and presents clinically relevant biomarker data for the first time. In this way, CBTRUS facilitates communication between the cancer surveillance and the brain tumor research and clinical communities and contributes meaningful insight into the descriptive epidemiology of all primary brain and other CNS tumors in the US.[97]

Supplementary Material (Online Only)

Supplementary Table 1. Main and Extended Classification for ICCC Recode ICD-O-3/WHO 2008, based on ICCC, Third Edition based on ICD-O-3/IARC 2017, for Selected Histologies occurring at brain and other CNS sites.[1,2]
Supplementary Table 2. 2000 U.S. Standard Population
Supplementary Table 3. Average Annual Population[a] for 51 Central Cancer Registries (Including 50 States and District of Columbia) for 2014-2018 by Age, Sex, and Race.
Supplementary Table 4. Average Annual Population[a] for 51 Central Cancer Registries (Including 50 States and District of Columbia) for 2014-2018 by Age, Sex, and Hispanic Ethnicity.
Supplementary Table 5. Five-Year Total, Annual Average Total[a], and Age-Adjusted and Age-Specific Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0-19 Years), All Brain and Other Central Nervous System Tumors: Malignant and Non-Malignant by International Classification of Childhood Cancer (ICCC), CBTRUS Statistical Report: U.S. Cancer Statistics - NPCR and SEER, 2014-2018.
Supplementary Table 6. Estimated Number of Cases[a,b] of Brain and Other Central Nervous System Tumors Overall, by Histologyc, and Age Group at Diagnosis, 2021, 2022.

Supplementary Table 7. One-, Five-, and Ten-Year Relative Survival Rates[a,b] (RS) with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors By Site and Behavior, CBTRUS Statistical Report: NPCR and SEER, 2001-2017 (varying).

Supplementary Table 8. One-, Five-, and Ten-Year Relative Survival Rates[a,b] (RS) with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors By Histology and Behavior, by Age Group at Diagnosis, CBTRUS Statistical Report: NPCR and SEER, 2001-2017 (varying).

Supplementary Table 9. Annual Percent Change (APC) and 95% Confidence Intervals for Malignant Brain and Other Central Nervous System Tumors by Behavior and Age, CBTRUS Statistical Report: U.S. Cancer Statistics - NPCR and SEER, 2000-2018 (varying).

Supplementary Table 10. Annual Percent Change (APC) and 95% Confidence Intervals for Malignant Brain and Other Central Nervous System Tumors by Histology, CBTRUS Statistical Report: U.S. Cancer Statistics - NPCR and SEER, 2000-2018.

Supplementary Table 11. Annual Percent Change (APC) and 95% Confidence Intervals for Non-Malignant Brain and Other Central Nervous System Tumors by Histology, CBTRUS Statistical Report: U.S. Cancer Statistics - NPCR and SEER, 2004-2018.

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Supplementary Figure 1. Distribution[a] of Schwannoma (9560/0) by Site (Five-Year Total=33,856; Annual Average Cases=6,771), CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014-2018.

Supplementary Figure 2. Average Annual Age-Adjusted Incidence Rates[a] of Malignant and Non-Malignant Primary Brain and Other CNS Tumors Combined by Central Cancer Registry, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014-2018.

Supplementary Figure 3. Distribution[a] of All Primary Brain and Other CNS Tumors Diagnosed in Puerto Rico by Behavior (Five-Year Total=2,356; Annual Average Cases=471), CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR, 2014-2018.

Supplementary Figure 4. Incidence Rate Ratios by Ethnicity (Non-Hispanic:Hispanic) for Selected Primary Brain and Other CNS Tumor Histologies, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2014-2018.

Supplementary Figure 5. Incidence Rate Ratios for Meningioma with 95% Confidence Intervals by Behavior, Sex (Males:Females), and Age Group at Diagnosis, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014-2018.

Supplementary Figure 6. Relative Survival Rates for Meningioma by Behavior and Site, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR, 2004-2017.

Supplementary Figure 7. Incidence Rate Ratios in Children (Age 0-14 Years) for Selected Embryonal Histologies by Sex (Males:Females), CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014-2018.

ABBREVIATIONS

AAAIR	–	Average Annual Age-Adjusted Incidence Rate
AAAMR	–	Average Annual Age-Adjusted Mortality Rate
ABTA	–	American Brain Tumor Association
ACVR1	–	Activin A receptor; type I
AIAN	–	American Indian/Alaskan Native
AJCC	–	American Joint Commission on Cancer
APC	–	Annual Percent Change
API	–	Asian or Pacific Islander
AYA	–	Adolescents and Young Adults
ATRT	–	Atypical Teratoid Rhabdoid Tumor
CBTRUS	–	Central Brain Tumor Registry of the United States
CCR	–	Central Cancer Registry
CDC	–	Centers for Disease Control and Prevention
CS	–	Collaborative Staging
CI	–	Confidence Interval
CNS	–	Central Nervous System
DIPG	–	Diffuse Intrinsic Pontine Glioma
G-CIMP	–	glioma-CpG island methylator phenotype
ICD-O-3	–	International Classification of Diseases for Oncology; Third Edition
ICCC	–	International Classification of Childhood Cancer
IDH1/2	–	Isocitrate Dehydrogenase 1/2
MGMT	–	O-6-Methylguanine-DNA Methyltransferase
NAACCR	–	North American Association of Central Cancer Registries
NCHS	–	National Center for Health Statistics
NCI	–	National Cancer Institute
NOS	–	Not Otherwise Specified
NPCR	–	National Program of Cancer Registries
NPCR-CSS	–	NPCR Cancer Surveillance System
NVSS	–	National Vital Statistics System
PDGFRA	–	Platelet-derived Growth Factor Receptor A
PI3KCA	–	Phosphatidylinositol 3-Kinase Catalytic subunit Alpha
PNET	–	Primitive Neuroectodermal Tumor
SEER	–	Surveillance; Epidemiology; and End Results
SHH	–	Sonic Hedgehog
SSF	–	Site Specific Factors
TCGA	–	The Cancer Genome Atlas
TP53	–	Tumor Protein p53
RUCC	–	Rural Urban Continuum Codes
UDS	–	Uniform Data Standards
US	–	United States
USCS	–	United States Cancer Statistics
VACCR	–	Veterans Affairs Central Cancer Registry
VHA	–	Veteran's Health Administration
WHO	–	World Health Organization
WNT	–	Wingless

CBTRUS Mission

CBTRUS is a not-for-profit corporation committed to providing a resource for gathering and disseminating current epidemiologic data on all primary brain and other central nervous system tumors, benign and malignant, for the purposes of accurately describing their incidence and survival patterns, evaluating diagnosis and treatment, facilitating etiologic studies, establishing awareness of the disease, and ultimately, for the prevention of all brain tumors.

Disclaimer

CBTRUS is a not-for-profit corporation which gathers and disseminates epidemiologic data on primary brain and other central nervous system tumors to facilitate research and establish awareness of the disease. CBTRUS makes no representations or warranties, and gives no other assurances or guarantees, express or implied, with respect to the accuracy or completeness of the data presented. The information provided in this report is not intended to assist in the evaluation, diagnosis, or treatment of individual diseases. Persons with questions regarding individual diseases should contact their own physician to obtain medical assistance. The contents in this report are solely the responsibility of the authors and do not necessarily represent the official views of either the CDC or of the NCI.

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Selected CBTRUS Scientific Publications

Cote DJ, et al. "Glioma incidence and survival variations by county-level socioeconomic measures." Cancer. 2019 Oct 1;125(19):3390–3400. doi: 10.1002/cncr.32328. PMID: 31206646; PMCID: PMC6744292.

This analysis of glioma incidence and survival based on county-levels of SES identifies a significant association between both increased incidence and improved survival for individuals with glioma in higher SES counties.

Dong M, et al. "Sex Differences in Cancer Incidence and Survival: A Pan-Cancer Analysis." Cancer Epidemiol Biomarkers Prev. 2020 Jul;29(7):1389–1397. doi: 10.1158/1055–9965.EPI-20–0036. PMID: 32349967.

This analysis uses a pan-cancer approach to interrogate sex differences in cancer incidence and survival, with a special focus on brain and other CNS tumors.

Kruchko C, et al. "Cancer collection efforts in the United States provide clinically relevant data on all primary brain and other CNS tumors." Neurooncol Pract. 2019 Sep;6(5):330–339. doi: 10.1093/nop/npz029. PMID: 31555447; PMCID: PMC6753356.

A summary of cancer registration efforts and data sources in the United States.

Kruchko C, et al. "The CBTRUS story: providing accurate population-based statistics on brain and other central nervous system tumors for everyone." Neuro Oncol. 2018 Feb 19;20(3):295–298. doi: 10.1093/neuonc/noy006. PMID: 29471448; PMCID: PMC5817957.

A summary of the history and mission of the Central Brain Tumor Registry of the United States.

Ostrom QT, et al. "Alex's Lemonade Stand Foundation Infant and Childhood Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2007–2011." Neuro Oncol. 2015 Jan;16 Suppl 10(Suppl 10):x1-x36. doi: 10.1093/neuonc/nou327. PMID: 25542864; PMCID: PMC4277295.

This special report, funded by Alex's Lemonade Stand Foundation, presents incidence and survival statistics for children 0–14 using histology groupings that were re-organized to be a more accurate representation of clinical behavior in pediatric brain tumors.

Ostrom QT, et al. "American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008–2012." Neuro Oncol. 2016 Jan;18 Suppl 1(Suppl 1):i1-i50. doi: 10.1093/neuonc/nov297. PMID: 26705298; PMCID: PMC4690545.

This special report, funded by the American Brain Tumor Association, presents incidence and survival statistics for adolescents and young adults (ages 15–39).

Ostrom QT, Kruchko C, Barnholtz-Sloan JS. Pilocytic astrocytomas: where do they belong in cancer reporting? Neuro Oncol. 2020 Feb 20;22(2):298–300. doi: 10.1093/neuonc/noz202. PMID: 31637436; PMCID: PMC7442407.

This letter describes the history of inclusion of pilocytic astrocytoma in cancer registry reporting, and the effect of varying behavior classification for these tumors on incidence and survival patterns.

Patil N, et al. "Epidemiology of Brainstem High-Grade Gliomas in Children and Adolescents in the United States, 2000–2017." Neuro Oncol. 2020 Dec 21:noaa295. doi: 10.1093/neuonc/noaa295. PMID: 33346835.

This manuscript details the descriptive epidemiology, including incidence, survival and prevalence, for gliomas of the brain stem in children and adolescents.

Truitt G, et al. "Partnership for defining the impact of 12 selected rare CNS tumors: a report from the CBTRUS and the NCI-CONNECT." J Neurooncol. 2019 Aug;144(1):53–63. doi: 10.1007/s11060-019-03215-x. PMID: 31209773.

This analysis, completed in collaboration with the National Cancer Institute's NCI-CONNECT program, presents incidence, survival, and prevalence estimates for a selection of rare tumor histologies that are the focus of the NCI-CONNECT program.

Wang, G, et al. "Importance of the intersection of age and sex to understand variation in incidence and survival for primary malignant gliomas." Neuro Oncol.

This manuscript assesses the relationship between age and sex on primary malignant glioma incidence and survival.

Zhang AS, et al. "Complete prevalence of malignant primary brain tumors registry data in the United States compared with other common cancers, 2010." Neuro Oncol. 2017 May 1;19(5):726–735. doi: 10.1093/neuonc/now252. PMID: 28039365; PMCID: PMC5464453.

This analysis presents a novel statistical method for estimating complete prevalence from geographically-limited cancer survival statistics, and includes age-specific survival estimates for the most common brain and CNS tumor histologies.

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Table 1 Central Brain Tumor Registry of the United States (CBTRUS), Brain and Other Central Nervous System Tumor Site Groupings

Site	ICD-O-3[a] Site Code
Frontal lobe of brain	C71.1
Temporal lobe of brain	C71.2
Parietal lobe of brain	C71.3
Occipital lobe of brain	C71.4
Cerebrum	C71.0
Ventricle	C71.5
Cerebellum	C71.6
Brain stem	C71.7
Other brain	C71.8-C71.9
Overlapping lesion of brain	*C71.8*
Brain, NOS	*C71.9*
Spinal cord and cauda equina	C72.0-C72.1
Spinal cord	*C72.0*
Cauda equina	*C72.1*
Cranial nerves	C72.2-C72.5
Olfactory nerve	*C72.2*
Optic nerve	*C72.3*
Acoustic nerve	*C72.4*
Cranial nerve, NOS	*C72.5*
Other nervous system	C72.8-C72.9
Overlapping lesion of brain and central nervous system	*C72.8*
Nervous system, NOS	*C72.9*
Meninges (cerebral & spinal)	C70.0-C70.9
Cerebral meninges	*C70.0*
Spinal meninges	*C70.1*
Meninges, NOS	*C70.9*
Pituitary and craniopharyngeal duct	C75.1-C75.2
Pituitary gland	*C75.1*
Craniopharyngeal duct	*C75.2*
Pineal gland	C75.3
Olfactory tumors of the nasal cavity[b]	C30.0

[a] *International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.*
[b] *ICD-O-3 histology codes 9522–9523 only.*
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Table 2 Central Brain Tumor Registry of the United States (CBTRUS), 2021 Brain and Other Central Nervous System Tumor Histology Groupings

Histology	ICD-O-3[a] Histology Codes[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant	Non-Malignant
Diffuse Astrocytic and Oligodendroglial Tumors			
Diffuse astrocytoma*	9381, 9400, 9410, 9411, 9420, 9442	9381/3, 9400/3, 9410/3, 9411/3, 9420/3	9442/1
Anaplastic astrocytoma*	9401	9401/3	*None*
Glioblastoma*	9440, 9441, 9442/3, 9445[c]	9440/3, 9441/3, 9442/3, 9445/3	*None*
Oligodendroglioma*	9450	9450/3	*None*
Anaplastic oligodendroglioma*	9451, 9460	9451/3, 9460/3	*None*
Oligoastrocytic tumors*	9382	9382/3	*None*
Other Astrocytic Tumors			
Pilocytic astrocytoma*	9421, 9425 c	9421/1, 9425/3	*None*
Unique astrocytoma variants*	9384, 9424, 9431 c	9424/3	9384/1, 9431/1
Ependymal tumors*	9383, 9391 (excluding site C75.1 for behavior /1), 9392- 9394, 9396 c	9391/3, 9392/3, 9393/3, 9396/3	9383/1, 9391/1 (excluding site C75.1), 9394/1
Other Gliomas			
Glioma malignant, NOS*	9380, 9385 [c]	9380/3, 9385/3	*None*
Other neuroepithelial tumors*	9423, 9430, 9444	9423/3, 9430/3	9444/1
Neuronal and Mixed Neuronal-Glial Tumors*	8680, 8681, 8690, 8693, 9412, 9413, 9442/1, 9490, 9492 (excluding site C75.1), 9493, 9505, 9506, 9509 c, 9522 (site C30.0 only), 9523 (site C30.0 only)	8680/3, 8693/3, 9490/3, 9505/3, 9509/3, 9522/3 (site C30.0 only), 9523/3 (site C30.0 only)	8680/0,1, 8681/1, 8690/1, 8693/1, 9412/1, 9413/0, 9442/1, 9490/0, 9492/0 (excluding site C75.1), 9493/0, 9505/0,1, 9506/1, 9509/1
Choroid Plexus Tumors	9390	9390/3	9390/0,1
Tumors of the Pineal Region	9360, 9361, 9362, 9395 c	9362/3, 9395/3	9360/1, 9361/1
Embryonal Tumors	8963, 9364, 9470-9478 c, 9480, 9500, 9501/3, 9502/3, 9508	8963/3, 9364/3, 9470/3, 9471/3, 9472/3, 9473/3, 9474/3, 9475/3, 9476/3, 9477/3, 9478/3, 9480/3, 9500/3, 9501/3, 9502/3, 9508/3	*None*
Tumors of Cranial and Paraspinal Nerves			
Nerve sheath tumors	9540, 9541, 9550, 9560, 9561, 9570, 9571	9540/3, 9560/3, 9561/3, 9571/3	9540/0,1, 9541/0, 9550/0, 9560/0,1, 9570/0, 9571/0
Other tumors of cranial and paraspinal nerves	9562, 9563	*None*	9562/0, 9563/0
Tumors of Meninges			
Meningioma	9530-9535, 9537- 9539	9530/3, 9538/3, 9539/3	9530/0,1, 9531/0, 9532/0, 9533/0, 9534/0, 9535/0, 9537/0, 9538/1, 9539/1

Table 2 Continued

Histology	ICD-O-3[a] Histology Codes[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant	Non-Malignant
Mesenchymal tumors	8324, 8710, 8711, 8800-8806, 8810, 8811, 8815, 8821, 8824, 8825, 8830, 8831, 8835, 8836, 8840, 8850-8854, 8857, 8861, 8870, 8880, 8890, 8897, 8900-8902, 8910, 8912, 8920, 8921, 8935, 8990, 9040, 9120, 9125, 9130, 9131, 9133, 9136, 9150, 9161, 9170, 9180, 9210, 9220, 9231, 9240, 9241, 9243, 9260, 9370-9373	8710/3, 8711/3, 8800/3, 8801/3, 8802/3, 8803/3, 8804/3, 8805/3, 8806/3, 8810/3, 8811/3, 8815/3 c, 8825/3, 8830/3, 8840/3, 8850/3, 8851/3, 8852/3, 8853/3, 8854/3, 8857/3, 8890/3, 8900/3, 8901/3, 8902/3, 8910/3, 8912/3, 8920/3, 8921/3, 8935/3 , 8990/3, 9040/3, 9120/3, 9130/3, 9150/3, 9170/3, 9180/3, 9220/3, 9231/3, 9240/3, 9243/3, 9260/3, 9370/3, 9371/3, 9372/3	8324/0, 8711/0, 8800/0, 8810/0, 8811/0, 8815/0,1 c, 8821/1, 8824/0,1, 8825/0,1, 8830/0,1, 8831/0, 8835/1, 8836/1, 8840/0, 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, 9120/0, 9125/0, 9130/0,1, 9131/0, 9136/1, 9150/0,1, 9161/0,1, 9170/0, 9180/0, 9210/0, 9220/0, 9241/0, 9373/0
Primary melanocytic lesions	8720, 8728, 8770	8720/3, 8728/3, 8770/3	8728/0,1, 8770/0
Other neoplasms related to the meninges	*None*	*None*	*None*
Lymphomas and Hematopoietic Neoplasms			
Lymphoma	9590, 9591, 9596, 9650-9655, 9659, 9661-9665, 9667, 9670, 9671, 9673, 9675, 9680, 9684, 9687, 9688, 9690, 9691, 9695, 9698, 9699, 9701, 9702, 9705, 9712, 9714, 9715, 9719, 9724, 9727-9729, 9735, 9737, 9738, 9750, 9751, 9755, 9756, 9811-9819, 9823, 9826, 9827, 9831, 9832, 9837, 9861, 9866, 9930, 9965, 9966, 9967, 9970, 9971, 9975	9590/3, 9591/3, 9596/3, 9650/3, 9651/3, 9652/3, 9653/3, 9654/3, 9655/3, 9659/3, 9661/3, 9662/3, 9663/3, 9664/3, 9665/3, 9667/3, 9670/3, 9671/3, 9673/3, 9675/3, 9680/3, 9684/3, 9687/3, 9688/3, 9690/3, 9691/3, 9695/3, 9698/3, 9699/3, 9701/3, 9702/3, 9705/3, 9712/3, 9714/3, 9715/3, 9719/3, 9724/3, 9727/3, 9728/3, 9729/3, 9735/3, 9737/3, 9738/3, 9750/3, 9751/3, 9755/3, 9756/3, 9811/3, 9812/3, 9813/3, 9814/3, 9815/3, 9816/3, 9817/3, 9818/3, 9819/3, 9823/3, 9826/3, 9827/3, 9831/3, 9837/3, 9861/3, 9866/3, 9930/3, 9965/3, 9966/3, 9967/3, 9971/3, 9975/3	9750/1, 9751/1, 9766/1, 9970/1
Other hematopoietic neoplasms	9731, 9733, 9734, 9740, 9741, 9749, 9752-9754, 9757-9758, 9759, 9760, 9766, 9860,	9731/3, 9733/3, 9734/3, 9740/3, 9741/3, 9749/3, 9753/3, 9754/3, 9756/3, 9757/3, 9758/3, 9759/3, 9760/3, 9766/3, 9823/3, 9826/3, 9827/3, 9832/3, 9860/3	9740/1, 9752/1, 9753/1, 9766/1
Germ Cell Tumors	8440, 9060, 9061, 9064, 9065, 9070-9072, 9080-9083, 9084/3, 9085, 9100, 9101	8440/3, 9060/3, 9061/3, 9064/3, 9065/3, 9070/3, 9071/3, 9072/3, 9080/3, 9081/3, 9082/3, 9083/3, 9084/3, 9085/3, 9100/3, 9101/3	8440/0, 9080/0,1
Tumors of Sellar Region			
Tumors of the pituitary	8040 (site C75.1 only), 8140 (site C75.1 only), 8146 (site C75.1 only), 8246, 8260 (site C75.1 only), 8270-8272, 8280, 8281, 8290, 8300, 8310, 8323, 9391/1 (site C75.1 only), 9432 (site C75.1 only), 9492 (site C75.1 only), 9580, 9582	8140/3, 8246/3, 8260/3, 8270/3, 8272/3, 8280/3, 8281/3, 8290/3, 8300/3, 8310/3, 8323/3, 9580/3	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, 9391/1 (site C75.1 only), 9432/1, 9492/0 (site C75.1 only), 9580/0, 9582/0

Table 2 Continued

Histology	ICD-O-3[a] Histology Codes[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant	Non-Malignant
Craniopharyngioma	9350-9352	*None*	9350/1, 9351/1, 9352/1
Unclassified Tumors			
Hemangioma	9121-9123, 9133, 9140	9133/3, 9140/3	9121/0, 9122/0, 9123/0, 9133/1
Neoplasm, unspecified	8000-8005, 8010, 8020, 8021	8000/3, 8001/3, 8002/3, 8003/3, 8004/3, 8005/3, 8010/3, 8020/3, 8021/3	8000/0,1, 8001/0,1, 8005/0, 8010/0
All other	8320, 8452, 8713, 8896, 8963, 8980, 9084/0, 9173, 9363, 9503	8320/3, 8452/3, 8896/3, 8980/3, 9503/3	8452/1, 8713/0, 9084/0, 9173/0, 9363/0

[a]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[b]See the CBTRUS website for additional information about the specific histology codes included in each group: http://www.cbtrus.org.
[c]Added starting with diagnosis year 2018.
*All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Table 3 Summary of Biomarkers Identified for Primary Brain and Other CNS Tumors and Collection Status in Central Cancer Registries

Histology	Gene or Marker	Outcome	Collected by US Cancer Registry System
Glioma (especially oligodendroglial tumors)[a-e]	Large deletions (missing parts of the chromosome) in the short arm of chromosome 1 (1p) and the long arm of chromosome 19 (19q)	Improved response to chemotherapy and radiation, and increased survival	Yes Site-specific factor (SSF) 5 (2011–2017), SSF 6 (2011–2017) Site-Specific Data Items (SSDI): Chromosome 19q Status (2018+), SSDI: Chromosome 1p Status (2018+)
Glioma (especially low grade astrocytomas and oligodendroglial tumors)[d-f]	Protein-truncating mutation in isocitrate dehydrogenase 1 (*IDH1*) or in isocitrate dehydrogenase 2 (*IDH2*)	Increased survival time	Yes SSDI: Brain Molecular Markers (2018+)
Glioma (especially IDH mutated glioma)[d,g,h]	Loss of function mutation in alpha thalassemia/mental retardation syndrome X-linked (*ATRX*)	Increased survival time	No
Glioblastoma[e,i–m]	Methylation of the promoter of O-6-methylguanine-DNA methyltransferase (*MGMT*)	Limits ability of the tumor cells to repair DNA damage caused by chemotherapy and radiation; results in increased survival time	Yes SSF 4 (2011–2017), SSDI: MGMT (2018+)
	Glioma-CpG island methylator phenotype (G-CIMP), Genome-wide DNA methylation	Significantly increased survival time	No
	Amplification of epidermal growth factor receptor (*EGFR*)	Activates the RTK/RAS/PI3K pathway, leading to increased proliferation. Associated with poorer survival.	No
Glioma (oligodendroglial tumors and IDH wild type glioblastoma)[e,n,o]	Mutation of promotor of Telomerase reverse transcriptase (*TERT*)	Facilitates increased telomere lengthening, and decreases survival in IDH wild type glioma	No
Glioma (particularly pediatric lower grade gliomas)[p]	Mutation or fusion of B-Raf (*BRAF*)	Activates the RAS/MAPK pathway. Fusion leads to improved survival.	No
Medulloblastoma[q–u]	WNT-activated	Low prevalence of metastatic disease Highest five-year survival	Yes, Began in collection year 2018 (January 1), SSDI: Brain Molecular Markers (2018+)
	SHH-activated and *TP53*-mutant	Occur primary in older children, very poor prognosis	Yes, Began in collection year 2018 (January 1), SSDI: Brain Molecular Markers (2018+)
	SHH-activated and TP53-wildtype	Most common in adolescents and young children, good prognosis	Yes, Began in collection year 2018 (January 1), SSDI: Brain Molecular Markers (2018+)
	non-WNT/non-SHH, Group 3 subtype (also known as Group C)	Increased prevalence of metastatic disease, Poorest five-year survival	
	non-WNT/non-SHH, Group 4 subtype (also known as Group D)	Increased prevalence of metastatic disease, Moderate five-year survival	
Embryonal tumor[v,w]	C19MC amplification and presence of multilayered rosettes	Highly aggressive, with average survival of 12 months after diagnosis	Yes, Began in collection year 2018 (January 1), SSDI: Brain Molecular Markers (2018+)

For more information please see:

[a]Cairncross JG, et al. Specific genetic predictors of chemotherapeutic response and survival in patients with anaplastic oligodendrogliomas. *J Natl Cancer Inst.* 1998; 90(19):1473–1479.

[b]Vogelbaum MA, et al. Phase II trial of pre-irradiation and concurrent temozolomide in patients with newly diagnosed anaplastic oligodendrogliomas and mixed anaplastic oligoastrocytomas: long term results of RTOG BR0131. *Journal of neuro-oncology.* 2015; 124(3):413–420.

Table 3 Continued

[c]van den Bent MJ, et al. Adjuvant procarbazine, lomustine, and vincristine chemotherapy in newly diagnosed anaplastic oligodendroglioma: long-term follow-up of EORTC brain tumor group study 26951. *J. Clin. Oncol.* 2013; 31(3):344–350.
[d]The Cancer Genome Atlas Research Network, et al. Comprehensive, Integrative Genomic Analysis of Diffuse Lower-Grade Gliomas. *N. Engl. J. Med.* 2015; 372(26):2481–2498.
[e]Ceccarelli M, et al. Molecular Profiling Reveals Biologically Discrete Subsets and Pathways of Progression in Diffuse Glioma. *Cell.* 2016; 164(3):550–563.
[f]Yan H, et al. IDH1 and IDH2 mutations in gliomas. *N. Engl. J. Med.* 2009; 360(8):765–773.
[g]Jiao Y, et al. Frequent ATRX, CIC, FUBP1 and IDH1 mutations refine the classification of malignant gliomas. *Oncotarget.* 2012; 3(7):709–722.
[h]Wiestler B, et al. ATRX loss refines the classification of anaplastic gliomas and identifies a subgroup of IDH mutant astrocytic tumors with better prognosis. *Acta Neuropathol.* 2013; 126(3):443–451.
[i]Hegi ME, et al. MGMT gene silencing and benefit from temozolomide in glioblastoma. *N. Engl. J. Med.* 2005; 352(10):997–1003.
[j]Stupp R, et al. Chemoradiotherapy in malignant glioma: standard of care and future directions. *J. Clin. Oncol.* 2007; 25(26):4127–4136.
[k]Hegi ME, et al. Correlation of O6-methylguanine methyltransferase (MGMT) promoter methylation with clinical outcomes in glioblastoma and clinical strategies to modulate MGMT activity. *J. Clin. Oncol.* 2008; 26(25):4189–4199.
[l]Noushmehr H, et al. Identification of a CpG island methylator phenotype that defines a distinct subgroup of glioma. *Cancer Cell.* 2010; 17(5):510–522.
[m]Maire CL, Ligon KL. Molecular pathologic diagnosis of epidermal growth factor receptor. *Neuro Oncol.* 2014; 16 Suppl 8:viii1-6.
[n]Arita H, et al. Upregulating mutations in the TERT promoter commonly occur in adult malignant gliomas and are strongly associated with total 1p19q loss. *Acta Neuropathol.* 2013; 126(2):267–276.
[o]Eckel-Passow JE, et al. Glioma Groups Based on 1p/19q, IDH, and TERT Promoter Mutations in Tumors. *N. Engl. J. Med.* 2015; 372(26):2499–2508.
[p]Hawkins C, et al. BRAF-KIAA1549 fusion predicts better clinical outcome in pediatric low-grade astrocytoma. *Clin. Cancer Res.* 2011; 17(14):4790–4798.
[q]Kool M, et al. Molecular subgroups of medulloblastoma: an international meta-analysis of transcriptome, genetic aberrations, and clinical data of WNT, SHH, Group 3, and Group 4 medulloblastomas. *Acta Neuropathol.* 2012; 123(4):473–484.
[r]Northcott PA, et al. Molecular subgroups of medulloblastoma. *Expert Rev. Neurother.* 2012; 12(7):871–884.
[s]Northcott PA, et al. Medulloblastomics: the end of the beginning. *Nat. Rev. Cancer.* 2012; 12(12):818–834.
[t]Northcott PA, et al. The whole-genome landscape of medulloblastoma subtypes. *Nature.* 2017; 547(7663):311–317.
[u]Zhukova N, et al. Subgroup-specific prognostic implications of TP53 mutation in medulloblastoma. *J. Clin. Oncol.* 2013; 31(23):2927–2935.
[v]Ceccom J, et al. Embryonal tumor with multilayered rosettes: diagnostic tools update and review of the literature. *Clin. Neuropathol.* 2014; 33(1):15–22.
[w]Korshunov A, et al. Embryonal tumor with abundant neuropil and true rosettes (ETANTR), ependymoblastoma, and medulloepithelioma share molecular similarity and comprise a single clinicopathological entity. *Acta Neuropathol.* 2014; 128(2):279–289.
Abbreviations: SSF-Site-Specific Factor; SSDI-Site-Specific Data Item

Table 4 Distribution of Brain Molecular Markers for Select Histologically-Confirmed Glioma and Embryonal Tumor Histologies, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2018

Histology	Frequency (%)
Diffuse Astrocytoma	
9400/3: Diffuse astrocytoma, IDH-mutant[a]	564 (43.2%)
9400/3: Diffuse astrocytoma, IDH-wildtype[a]	404 (30.9%)
9400/3: Diffuse astrocytoma, IDH Status Unknown	338 (25.9%)
Anaplastic Astrocytoma	
9401/3: Anaplastic astrocytoma, IDH-mutant[a]	581 (42.6%)
9401/3: Anaplastic astrocytoma, IDH-wildtype[a]	581 (42.6%)
9401/3: Anaplastic astrocytoma, IDH Status Unknown	201 (14.7%)
Glioblastoma	
9440/3: Glioblastoma, IDH-wildtype[a]	8,825 (74.2%)
9440/3: Glioblastoma, IDH Status Unknown	2,512 (21.1%)
9441/3: Giant cell glioblastoma	83 (0.7%)
9442/3: Gliosarcoma	238 (2%)
9445/3: Glioblastoma, IDH-mutant[b]	237 (2%)
Oligodendroglioma	
9450/3: Oligodendroglioma, IDH-mutant and 1 p/19q co-deleted[a]	582 (88.9%)
9450/3: Oligodendroglioma, NOS	73 (11.1%)
Anaplastic Oligodendroglioma	
9451/3: Anaplastic oligodendroglioma, IDH-mutant and 1 p/19q co-deleted[a]	295 (91.9%)
9451/3: Oligodendroglioma, anaplastic	26 (8.1%)
Medulloblastoma	
9470/3: Medulloblastoma, NOS	211 (50.1%)
9471/3: Desmoplastic nodular medulloblastoma	20 (4.8%)
9471/3: Medulloblastoma, SHH-activated and TP53-wildtype[a]	84 (20%)
9474/3: Large cell medulloblastoma	36 (8.6%)
9475/3: Medulloblastoma, WNT-activated, NOS[b]	--
9476/3: Medulloblastoma, SHH-activated and TP53-mutant[b]	--
9477/3: Medulloblastoma, non-WNT/non-SHH[b]	51 (12.1%)

[a]Collected in NAACCR Item #3816, Brain Molecular Markers.
[b]New ICD-O-3 codes implemented in 2018.
-- Cases and rates are not presented when fewer than 16 cases were reported for the specific category.

Table 5 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, Behavior, and Sex, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER,2014–2018

Histology	Total					Male				Female			
	5-Year Total	Annual Average	% of all tumors	Median Age	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**83,124**	**16,625**	**19.3**	**62**	**4.52 (4.49–4.55)**	**47,749**	**9,550**	**100.0**	**5.51 (5.46–5.56)**	**35,375**	**7,075**	**100.0**	**3.65 (3.61–3.69)**
Diffuse astrocytoma	7,729	1,546	1.8	46	0.46 (0.45–0.48)	4,336	867	100.0	0.54 (0.52–0.55)	3,393	679	100.0	0.40 (0.39–0.41)
Anaplastic astrocytoma	7,175	1,435	1.7	53	0.42 (0.41–0.43)	3,938	788	100.0	0.48 (0.46–0.49)	3,237	647	100.0	0.36 (0.35–0.38)
Glioblastoma	61,699	12,340	14.3	65	3.23 (3.20–3.26)	35,874	7,175	100.0	4.04 (4.00–4.09)	25,825	5,165	100.0	2.53 (2.50–2.56)
Oligodendroglioma	3,706	741	0.9	43	0.23 (0.23–0.24)	2,054	411	100.0	0.26 (0.25–0.27)	1,652	330	100.0	0.21 (0.20–0.22)
Anaplastic oligodendroglioma	1,839	368	0.4	49	0.11 (0.11–0.12)	1,014	203	99.8	0.12 (0.12–0.13)	825	165	100.0	0.10 (0.09–0.10)
Oligoastrocytic tumors	976	195	0.2	43	0.06 (0.06-0.06)	533	107	100.0	0.07 (0.06–0.07)	443	89	99.8	0.05 (0.05–0.06)
Other Astrocytic Tumors	**6,213**	**1,243**	**1.4**	**12**	**0.42 (0.41–0.43)**	**3,218**	**644**	**93.5**	**0.43 (0.41–0.44)**	**2,995**	**599**	**94.8**	**0.41 (0.40–0.43)**
Pilocytic astrocytoma	5,303	1,061	1.2	11	0.36 (0.35–0.37)	2,728	546	100.0	0.36 (0.35–0.38)	2,575	515	100.0	0.36 (0.34–0.37)
Unique astrocytoma variants	910	182	0.2	17	0.06 (0.06-0.06)	490	98	57.3	0.06 (0.06–0.07)	420	84	62.6	0.06 (0.05–0.06)
Malignant	*544*	*109*	*0.1*	--	*0.04 (0.03–0.04)*	*281*	*56*	--	*0.04 (0.03–0.04)*	*263*	*53*	--	*0.03 (0.03–0.04)*
Non-Malignant	*366*	*73*	*0.1*	--	*0.02 (0.02–0.03)*	*209*	*42*	--	*0.03 (0.02–0.03)*	*157*	*31*	--	*0.02 (0.02–0.03)*
Ependymal Tumors	**6,926**	**1,385**	**1.6**	**45**	**0.42 (0.41–0.43)**	**3,989**	**798**	**54.8**	**0.49 (0.48–0.51)**	**2,937**	**587**	**60.6**	**0.36 (0.34–0.37)**
Malignant	*3,967*	*793*	*0.9*	--	*0.24 (0.24–0.25)*	*2,187*	*437*	--	*0.27 (0.26–0.28)*	*1,780*	*356*	--	*0.22 (0.21–0.23)*
Non-Malignant	*2,959*	*592*	*0.7*	--	*0.18 (0.17–0.18)*	*1,802*	*360*	--	*0.22 (0.21–0.23)*	*1,157*	*231*	--	*0.14 (0.13–0.14)*
Other Gliomas	**8,575**	**1,715**	**2.0**	**36**	**0.53 (0.52–0.54)**	**4,326**	**865**	**99.6**	**0.55 (0.54–0.57)**	**4,249**	**850**	**99.6**	**0.51 (0.50–0.53)**
Glioma malignant, NOS	8,471	1,694	2.0	36	0.53 (0.51–0.54)	4,289	858	100.0	0.55 (0.53–0.57)	4,182	836	100.0	0.51 (0.49–0.52)
Other neuroepithelial tumors	104	21	<0.1	30	0.01 (0.01-0.01)	37	7	56.8	0.00 (0.00–0.01)	67	13	73.1	0.01 (0.01-0.01)
Neuronal and Mixed Neuronal-Glial Tumors	***5,150***	***1,030***	***1.2***	***26***	***0.33 (0.32–0.34)***	***2,753***	***551***	***19.8***	***0.35 (0.34–0.37)***	***2,397***	***479***	***18.1***	***0.31 (0.30–0.32)***
Malignant	*978*	*196*	*0.2*	--	*0.06 (0.05–0.06)*	*545*	*109*	--	*0.07 (0.06–0.07)*	*433*	*87*	--	*0.05 (0.04–0.05)*
Non-Malignant	*4,172*	*834*	*1.0*	--	*0.27 (0.26–0.28)*	*2,208*	*442*	--	*0.29 (0.27–0.30)*	*1,964*	*393*	--	*0.26 (0.25–0.27)*
Choroid Plexus Tumors	**847**	**169**	**0.2**	**20**	**0.05 (0.05–0.06)**	**429**	**86**	**17.2**	**0.06 (0.05–0.06)**	**418**	**84**	**13.6**	**0.05 (0.05–0.06)**
Malignant	*131*	*26*	*0.0*	--	*0.01 (0.01-0.01)*	*74*	*15*	--	*0.01 (0.01-0.01)*	*57*	*11*	--	*0.01 (0.01-0.01)*

Table 5 Continued

Histology	Total					Male				Female			
	5-Year Total	Annual Average	% of all tumors	Median Age	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)
Non-Malignant	*716*	*143*	*0.2*	--	*0.05 (0.04–0.05)*	*355*	*71*	--	*0.05 (0.04–0.05)*	*361*	*72*	--	*0.05 (0.04–0.05)*
Tumors of the Pineal Region	**743**	**149**	**0.2**	**32**	**0.05 (0.04–0.05)**	**319**	**64**	**67.1**	**0.04 (0.04-0.04)**	**424**	**85**	**49.1**	**0.05 (0.05–0.06)**
Malignant	*422*	*84*	*0.1*	--	*0.03 (0.02–0.03)*	*214*	*43*	--	*0.03 (0.02–0.03)*	*208*	*42*	--	*0.03 (0.02–0.03)*
Non-Malignant	*321*	*64*	*0.1*	--	*0.02 (0.02-0.02)*	*105*	*21*	--	*0.01 (0.01–0.02)*	*216*	*43*	--	*0.03 (0.02–0.03)*
Embryonal Tumors	**3,252**	**650**	**0.8**	**8**	**0.22 (0.21–0.23)**	**1,947**	**389**	**100.0**	**0.26 (0.25–0.27)**	**1,305**	**261**	**99.8**	**0.18 (0.17–0.19)**
Tumors of Cranial and Paraspinal Nerves	**36,684**	**7,337**	**8.5**	**57**	**2.05 (2.03–2.07)**	**17,651**	**3,530**	**0.6**	**2.06 (2.03–2.09)**	**19,033**	**3,807**	**0.5**	**2.05 (2.02–2.08)**
Nerve sheath tumors	36,647	7,329	8.5	57	2.05 (2.03–2.07)	17,629	3,526	0.6	2.06 (2.03–2.09)	19,018	3,804	0.5	2.05 (2.02–2.08)
Malignant	*208*	*42*	<0.1	--	*0.01 (0.01-0.01)*	*107*	*21*	--	*0.01 (0.01–0.02)*	*101*	*20*	--	*0.01 (0.01-0.01)*
Non-Malignant	*36,439*	*7,288*	*8.4*	--	*2.04 (2.02–2.06)*	*17,522*	*3,504*	--	*2.04 (2.01–2.08)*	*18,917*	*3,783*	--	*2.04 (2.01–2.07)*
Other tumors of cranial and paraspinal nerves	37	7	<0.1	55	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--
Tumors of Meninges	**174,568**	**34,914**	**40.4**	**66**	**9.49 (9.44–9.53)**	**48,596**	**9,719**	**2.5**	**5.79 (5.74–5.84)**	**125,972**	**25,194**	**1.1**	**12.76 (12.69–12.84)**
Meningiomas	168,432	33,686	39.0	66	9.12 (9.08–9.17)	45,494	9,099	1.7	5.41 (5.36–5.46)	122,938	24,588	0.8	12.41 (12.34–12.49)
Malignant	*1,699*	*340*	*0.4*	--	*0.09 (0.09–0.10)*	*754*	*151*	--	*0.09 (0.08–0.09)*	*945*	*189*	--	*0.10 (0.09–0.10)*
Non-Malignant	*166,733*	*33,347*	*38.6*	--	*9.03 (8.99–9.08)*	*44,740*	*8,948*	--	*5.33 (5.27–5.38)*	*121,993*	*24,399*	--	*12.32 (12.25–12.39)*
Mesenchymal tumors	6,003	1,201	1.4	51	0.35 (0.34–0.36)	3,029	606	13.4	0.37 (0.35–0.38)	2,974	595	12.2	0.34 (0.33–0.36)
Malignant	*769*	*154*	*0.2*	--	*0.05 (0.04–0.05)*	*405*	*81*	*100.0*	*0.05 (0.04–0.05)*	*364*	*73*	--	*0.04 (0.04–0.05)*
Non-Malignant	*5,234*	*1,047*	*1.2*	--	*0.31 (0.30–0.32)*	*2,624*	*525*	*<0.1*	*0.32 (0.31–0.33)*	*2,610*	*522*	--	*0.30 (0.29–0.31)*
Primary melanocytic lesions	133	27	<0.1	60	0.01 (0.01-0.01)	73	15	76.7	0.01 (0.01-0.01)	60	12	55.0	0.01 (0.00–0.01)
Lymphomas and Hematopoietic Neoplasms	**8,558**	**1,712**	**2.0**	**67**	**0.46 (0.45–0.47)**	**4,359**	**872**	**99.9**	**0.50 (0.49–0.52)**	**4,199**	**840**	**99.7**	**0.42 (0.40–0.43)**
Lymphoma	8,478	1,696	2.0	67	0.45 (0.44–0.46)	4,317	863	99.9	0.50 (0.48–0.52)	4,161	832	99.8	0.41 (0.40–0.43)
Other hematopoietic neoplasms	80	16	<0.1	61	0.00 (0.00–0.01)	42	8	97.6	0.00 (0.00–0.01)	38	8	94.7	0.00 (0.00–0.01)
Germ Cell Tumors	**1,252**	**250**	**0.3**	**15**	**0.08 (0.08–0.09)**	**936**	**187**	**89.1**	**0.12 (0.11–0.13)**	**316**	**63**	**79.4**	**0.04 (0.04–0.05)**
Malignant	*1,085*	*217*	*0.3*	--	*0.07 (0.07–0.08)*	*834*	*167*	--	*0.11 (0.10–0.12)*	*251*	*50*	--	*0.04 (0.03–0.04)*
Non-Malignant	*167*	*33*	<0.1	--	*0.01 (0.01-0.01)*	*102*	*20*	--	*0.01 (0.01–0.02)*	*65*	*13*	--	*0.01 (0.01-0.01)*
Tumors of Sellar Region	**77,084**	**15,417**	**17.9**	**51**	**4.55 (4.52–4.59)**	**34,600**	**6,920**	**0.3**	**4.11 (4.07–4.16)**	**42,484**	**8,497**	**0.1**	**5.08 (5.03–5.13)**
Tumors of the pituitary	73,945	14,789	17.1	51	4.36 (4.33–4.40)	32,991	6,598	0.2	3.92 (3.87–3.96)	40,954	8,191	0.1	4.90 (4.85–4.95)

Table 5 Continued

Histology	Total					Male				Female			
	5-Year Total	Annual Average	% of all tumors	Median Age	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)	5-Year Total	Annual Average	% Malignant[c]	Rate (95% CI)
Malignant	*125*	*25*	<0.1	--	*0.01 (0.01-0.01)*	*80*	*16*	--	*0.01 (0.01-0.01)*	*45*	*9*	--	*0.00 (0.00–0.01)*
Non-Malignant	*73,820*	*14,764*	*17.1*	--	*4.36 (4.32–4.39)*	*32,911*	*6,582*	--	*3.91 (3.86–3.95)*	*40,909*	*8,182*	--	*4.89 (4.84–4.94)*
Craniopharyngioma	3,139	628	0.7	44	0.19 (0.18–0.20)	1,609	322	0.6	0.20 (0.19–0.21)	1,530	306	0.2	0.18 (0.17–0.19)
Unclassified Tumors	**18,797**	**3,759**	**4.4**	**65**	**1.07 (1.05–1.08)**	**8,630**	**1,726**	**37.7**	**1.07 (1.05–1.10)**	**10,167**	**2,033**	**34.7**	**1.07 (1.05–1.09)**
Hemangioma	4,141	828	1.0	49	0.25 (0.24–0.26)	1,909	382	0.1	0.24 (0.23–0.25)	2,232	446	0.1	0.26 (0.25–0.27)
Neoplasm, unspecified	14,093	2,819	3.3	70	0.78 (0.77–0.80)	6,420	1,284	50.0	0.80 (0.78–0.82)	7,673	1,535	45.4	0.78 (0.76–0.79)
Malignant	*6,692*	*1,338*	*1.5*	--	*0.36 (0.35–0.37)*	*3,209*	*642*	--	*0.40 (0.39–0.41)*	*3,483*	*697*	--	*0.33 (0.32–0.34)*
Non-Malignant	*7,401*	*1,480*	*1.7*	--	*0.42 (0.41–0.43)*	*3,211*	*642*	--	*0.40 (0.39–0.41)*	*4,190*	*838*	--	*0.45 (0.43–0.46)*
All other	563	113	0.1	34	0.04 (0.03–0.04)	301	60	13.0	0.04 (0.03–0.04)	262	52	16.8	0.03 (0.03–0.04)
Malignant	*83*	*17*	<0.1	--	*0.01 (0.00–0.01)*	*39*	*8*	--	*0.01 (0.00–0.01)*	*44*	*9*	--	*0.01 (0.00–0.01)*
Non-Malignant	*480*	*96*	*0.1*	--	*0.03 (0.03-0.03)*	*262*	*52*	--	*0.03 (0.03–0.04)*	*218*	*44*	--	*0.03 (0.02–0.03)*
TOTAL[e]	**431,773**	**86,355**	**100.0**	**61**	**24.25 (24.17–24.32)**	**179,502**	**35,900**	**38.9**	**21.35 (21.25–21.46)**	**252,271**	**50,454**	**22.1**	**26.95 (26.85–27.06)**
Malignant	***125,524***	***25,105***	***29.1***	--	***7.06 (7.02–7.10)***	***69,866***	***13,973***	--	***8.28 (8.22–8.34)***	***55,658***	***11,132***	--	***5.98 (5.93–6.03)***
Non-Malignant	***306,249***	***61,250***	***70.9***	--	***17.19 (17.12–17.25)***	***109,636***	***21,927***	--	***13.07 (12.99–13.15)***	***196,613***	***39,323***	--	***20.97 (20.88–21.07)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Assigned behavior code of /3 (see Table 2).
[d]Assigned behavior code of /0 or /1 (see Table 2).
[e]Refers to all brain tumors including histologies not presented in this table.
-- Counts and rates are not presented when **fewer than 16 cases** were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 6 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Selected Non-Malignant Histologies by Sex, Age Group at Diagnosis, Race, and Hispanic Ethnicity and Histology, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Group	Vestibular Schwannoma[c]			Pituitary Adenoma[d]			WHO Grade I Meningioma[e]			WHO Grade II Meningioma[f]		
	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	95% CI
Sex												
Male	12,874	2,575	1.49 (1.46–1.51)	28,821	5,764	3.41 (3.37–3.45)	13,080	2,616	1.52 (1.49–1.55)	3,913	783	0.46 (0.44–0.47)
Female	14,478	2,896	1.54 (1.51–1.57)	35,408	7,082	4.21 (4.17–4.26)	35,173	7,035	3.71 (3.67–3.75)	5,358	1,072	0.57 (0.56–0.59)
Age Groups												
0–14 years	197	39	0.06 (0.06–0.07)	926	185	0.30 (0.28–0.32)	99	20	0.03 (0.03–0.04)	69	14	0.02 (0.02–0.03)
15–39 years	3,655	731	0.70 (0.68–0.73)	18,452	3,690	3.45 (3.40–3.50)	4,115	823	0.82 (0.80–0.85)	1,044	209	0.20 (0.19–0.21)
40–64 years	14,440	2,888	2.59 (2.54–2.63)	27,344	5,469	5.19 (5.12–5.25)	24,426	4,885	4.40 (4.34–4.46)	4,443	889	0.80 (0.78–0.82)
65+ years	9,060	1,812	3.65 (3.57–3.72)	17,507	3,501	7.18 (7.07–7.29)	19,613	3,923	8.05 (7.94–8.16)	3,715	743	1.54 (1.49–1.59)
Race												
White	23,537	4,707	1.61 (1.58–1.63)	45,899	9,180	3.40 (3.37–3.43)	38,684	7,737	2.60 (2.58–2.63)	7,077	1,415	0.48 (0.47–0.49)
Black	1,496	299	0.69 (0.65–0.73)	12,835	2,567	6.04 (5.94–6.15)	6,223	1,245	2.96 (2.88–3.03)	1,452	290	0.69 (0.65–0.72)
American Indian/Alaska Native	159	32	0.77 (0.65–0.90)	541	108	2.61 (2.38–2.84)	313	63	1.65 (1.47–1.86)	52	10	0.28 (0.21–0.38)
Asian or Pacific Islander	1,525	305	1.46 (1.39–1.54)	3,583	717	3.45 (3.33–3.56)	2,402	480	2.36 (2.26–2.46)	548	110	0.54 (0.49–0.58)
Hispanic Ethnicity												
Non-Hispanic	25,058	5,012	1.59 (1.57–1.62)	53,707	10,741	3.70 (3.67–3.73)	43,175	8,635	2.70 (2.68–2.73)	8,396	1,679	0.53 (0.52–0.54)
Hispanic	2,294	459	1.00 (0.96–1.05)	10,522	2,104	4.29 (4.20–4.38)	5,078	1,016	2.36 (2.29–2.43)	875	175	0.40 (0.38–0.43)
TOTAL	**27,352**	**5,470**	**1.51 (1.49–1.53)**	**64,229**	**12,846**	**3.78 (3.75–3.81)**	**48,253**	**9,651**	**2.65 (2.63–2.68)**	**9,271**	**1,854**	**0.51 (0.50–0.52)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]ICD-O-3 histology code 9560/0 and ICD-O-3 topography code C72.4 and C72.5.
[d]ICD-O-3 histology code 8272/0 and ICD-O-3 topography code C75.1.
[e]ICD-O-3 histology codes 9530/0, 9531/0, 9532/0, 9533/0, 9534/0, and 9537/0.
[f]ICD-O-3 histology codes 9530/1, 9531/1, 9532/1, 9533/1, 9534/1, 9537/1, 9538/1, and 9539/1.
-Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval

Table 7 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals of All Brain and Other Central Nervous System Tumors by Histology, and NCI Age at Diagnosis Groups, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	Children[c] (0–14)			AYA[d] (15–39)			Older Adults (40+)		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**1,514**	**303**	**0.50 (0.47–0.52)**	**9,791**	**1,958**	**1.84 (1.81–1.88)**	**71,819**	**14,364**	**8.73 (8.66–8.79)**
Diffuse astrocytoma	685	137	0.22 (0.21–0.24)	2,562	512	0.47 (0.46–0.49)	4,482	896	0.58 (0.56–0.59)
Anaplastic astrocytoma	250	50	0.08 (0.07–0.09)	1,965	393	0.37 (0.35–0.38)	4,960	992	0.63 (0.61–0.65)
Glioblastoma	461	92	0.15 (0.14–0.17)	2,920	584	0.56 (0.54–0.58)	58,318	11,664	6.97 (6.91–7.03)
Oligodendroglioma	78	16	0.03 (0.02–0.03)	1,456	291	0.28 (0.26–0.29)	2,172	434	0.30 (0.29–0.31)
Anaplastic oligodendroglioma	--	--	--	--	--	--	1,331	266	0.18 (0.17–0.19)
Oligoastrocytic tumors	--	--	--	--	--	--	556	111	0.07 (0.07–0.08)
Other Astrocytic Tumors	**3,626**	**725**	**1.19 (1.15–1.23)**	**1,838**	**368**	**0.34 (0.32–0.35)**	**749**	**150**	**0.10 (0.10–0.11)**
Pilocytic astrocytoma	3,250	650	1.07 (1.03–1.10)	1,463	293	0.27 (0.26–0.28)	590	118	0.08 (0.08–0.09)
Unique astrocytoma variants	376	75	0.12 (0.11–0.14)	375	75	0.07 (0.06–0.08)	159	32	0.02 (0.02–0.03)
Malignant	*146*	*29*	*0.05 (0.04–0.06)*	*270*	*54*	*0.05 (0.04–0.06)*	*128*	*26*	*0.02 (0.01–0.02)*
Non-Malignant	*230*	*46*	*0.08 (0.07–0.09)*	*105*	*21*	*0.02 (0.02-0.02)*	*31*	*6*	*0.00 (0.00–0.01)*
Ependymal Tumors	**941**	**188**	**0.31 (0.29–0.33)**	**1,922**	**384**	**0.36 (0.34–0.38)**	**4,063**	**813**	**0.53 (0.51–0.55)**
Malignant	*835*	*167*	*0.27 (0.25–0.29)*	*1,024*	*205*	*0.19 (0.18–0.20)*	*2,108*	*422*	*0.28 (0.26–0.29)*
Non-Malignant	*106*	*21*	*0.03 (0.03–0.04)*	*898*	*180*	*0.17 (0.16–0.18)*	*1,955*	*391*	*0.25 (0.24–0.26)*
Other Gliomas	**2,658**	**532**	**0.87 (0.84–0.91)**	**1,832**	**366**	**0.34 (0.32–0.36)**	**4,085**	**817**	**0.52 (0.50–0.54)**
Glioma malignant, NOS	2,632	526	0.86 (0.83–0.90)	1,797	359	0.33 (0.32–0.35)	4,042	808	0.51 (0.50–0.53)
Other neuroepithelial tumors	26	5	0.01 (0.01-0.01)	35	7	0.01 (0.00–0.01)	43	9	0.01 (0.00–0.01)
Neuronal and Mixed Neuronal-Glial Tumors	***1,371***	***274***	***0.45 (0.43–0.47)***	***2,069***	***414***	***0.38 (0.36–0.40)***	***1,710***	***342***	***0.23 (0.22–0.24)***
Malignant	*100*	*20*	*0.03 (0.03–0.04)*	*203*	*41*	*0.04 (0.03–0.04)*	*675*	*135*	*0.09 (0.08–0.09)*
Non-Malignant	*1,271*	*254*	*0.42 (0.39–0.44)*	*1,866*	*373*	*0.34 (0.33–0.36)*	*1,035*	*207*	*0.14 (0.13–0.15)*
Choroid Plexus Tumors	**369**	**74**	**0.12 (0.11–0.13)**	**211**	**42**	**0.04 (0.03–0.04)**	**267**	**53**	**0.03 (0.03–0.04)**
Malignant	*102*	*20*	*0.03 (0.03–0.04)*	--	--	--	--	--	--
Non-Malignant	*267*	*53*	*0.09 (0.08–0.10)*	--	--	--	--	--	--
Tumors of the Pineal Region	**147**	**29**	**0.05 (0.04–0.06)**	**290**	**58**	**0.05 (0.05–0.06)**	**306**	**61**	**0.04 (0.04–0.05)**
Malignant	*127*	*25*	*0.04 (0.03–0.05)*	*166*	*33*	*0.03 (0.03-0.03)*	*129*	*26*	*0.02 (0.01–0.02)*
Non-Malignant	*20*	*4*	*0.01 (0.00–0.01)*	*124*	*25*	*0.02 (0.02–0.03)*	*177*	*35*	*0.02 (0.02–0.03)*
Embryonal Tumors	**2,196**	**439**	**0.72 (0.69–0.75)**	**760**	**152**	**0.14 (0.13–0.15)**	**296**	**59**	**0.04 (0.04–0.05)**
Medulloblastoma	*1,486*	*297*	*0.49 (0.46–0.51)*	*635*	*127*	*0.11 (0.11–0.12)*	*157*	*31*	*0.02 (0.02–0.03)*
Primitive neuroectodermal tumors	*187*	*37*	*0.06 (0.05–0.07)*	*79*	*16*	*0.01 (0.01–0.02)*	*85*	*17*	*0.01 (0.01-0.01)*

Table 7 Continued

Histology	Children[c] (0–14)			AYA[d] (15–39)			Older Adults (40+)		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Atypical teratoid/rhabdoid tumor	*376*	*75*	*0.12 (0.11–0.14)*	--	--	--	--	--	--
All other embryonal	*147*	*29*	*0.05 (0.04–0.06)*	--	--	--	--	--	--
Tumors of Cranial and Paraspinal Nerves	**748**	**150**	**0.25 (0.23–0.26)**	**5,530**	**1,106**	**1.06 (1.03–1.09)**	**30,406**	**6,081**	**3.77 (3.73–3.82)**
Nerve sheath tumors	748	150	0.25 (0.23–0.26)	--	--	--	30,377	6,075	3.77 (3.73–3.81)
Malignant	--	--	--	--	--	--	*151*	*30*	*0.02 (0.02-0.02)*
Non-Malignant	--	--	--	--	--	--	*30,226*	*6,045*	*3.75 (3.71–3.80)*
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	29	6	0.00 (0.00–0.01)
Tumors of Meninges	**698**	**140**	**0.23 (0.21–0.25)**	**11,414**	**2,283**	**2.24 (2.20–2.28)**	**162,456**	**32,491**	**20.08 (19.98–20.18)**
Meningiomas	311	62	0.10 (0.09–0.11)	9,772	1,954	1.93 (1.89–1.97)	158,349	31,670	19.56 (19.46–19.66)
Malignant	*18*	*4*	*0.01 (0.00–0.01)*	*115*	*23*	*0.02 (0.02–0.03)*	*1,566*	*313*	*0.19 (0.18–0.20)*
Non-Malignant	*293*	*59*	*0.10 (0.09–0.11)*	*9,657*	*1,931*	*1.91 (1.87–1.95)*	*156,783*	*31,357*	*19.37 (19.27–19.47)*
Mesenchymal tumors	--	--	--	--	--	--	4,003	801	0.51 (0.50–0.53)
Malignant	--	--	--	--	--	--	*522*	*104*	*0.07 (0.06–0.07)*
Non-Malignant	--	--	--	--	--	--	*3,481*	*696*	*0.45 (0.43–0.46)*
Primary melanocytic lesions	--	--	--	--	--	--	104	21	0.01 (0.01–0.02)
Lymphomas and Hematopoietic Neoplasms	**88**	**18**	**0.03 (0.02–0.04)**	**549**	**110**	**0.10 (0.10–0.11)**	**7,921**	**1,584**	**0.96 (0.94–0.99)**
Lymphoma	88	18	0.03 (0.02–0.04)	--	--	--	7,848	1,570	0.96 (0.93–0.98)
Other hematopoietic neoplasms	--	--	--	--	--	--	73	15	0.01 (0.01-0.01)
Germ Cell Tumors	**583**	**117**	**0.19 (0.18–0.21)**	**602**	**120**	**0.11 (0.10–0.12)**	**67**	**13**	**0.01 (0.01-0.01)**
Malignant	*497*	*99*	*0.16 (0.15–0.18)*	*563*	*113*	*0.10 (0.09–0.11)*	*25*	*5*	*0.00 (0.00–0.01)*
Non-Malignant	*86*	*17*	*0.03 (0.02–0.03)*	*39*	*8*	*0.01 (0.01-0.01)*	*42*	*8*	*0.01 (0.00–0.01)*
Tumors of Sellar Region	**1,771**	**354**	**0.58 (0.56–0.61)**	**22,908**	**4,582**	**4.28 (4.23–4.34)**	**52,405**	**10,481**	**6.76 (6.70–6.82)**
Tumors of the pituitary	1,096	219	0.36 (0.34–0.38)	22,200	4,440	4.15 (4.10–4.21)	50,649	10,130	6.54 (6.48–6.60)
Malignant	--	--	--	--	--	--	*105*	*21*	*0.01 (0.01–0.02)*
Non-Malignant	--	--	--	--	--	--	*50,544*	*10,109*	*6.52 (6.47–6.58)*
Craniopharyngioma	675	135	0.22 (0.21–0.24)	708	142	0.13 (0.12–0.14)	1,756	351	0.22 (0.21–0.23)
Unclassified Tumors	**1,098**	**220**	**0.36 (0.34–0.38)**	**2,842**	**568**	**0.53 (0.51–0.55)**	**14,857**	**2,971**	**1.86 (1.83–1.89)**
Hemangioma	294	59	0.10 (0.09–0.11)	1,175	235	0.22 (0.21–0.23)	2,672	534	0.35 (0.33–0.36)
Neoplasm, unspecified	621	124	0.20 (0.19–0.22)	1,544	309	0.29 (0.28–0.30)	11,928	2,386	1.48 (1.45–1.51)
Malignant	*168*	*34*	*0.06 (0.05–0.06)*	*346*	*69*	*0.07 (0.06–0.07)*	*6,178*	*1,236*	*0.76 (0.74–0.78)*
Non-Malignant	*453*	*91*	*0.15 (0.14–0.16)*	*1,198*	*240*	*0.22 (0.21–0.24)*	*5,750*	*1,150*	*0.72 (0.70–0.74)*

Table 7 Continued

Histology	Children[c] (0–14)			AYA[d] (15–39)			Older Adults (40+)		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
All other	183	37	0.06 (0.05–0.07)	123	25	0.02 (0.02–0.03)	257	51	0.03 (0.03–0.04)
Malignant	*57*	*11*	*0.02 (0.01–0.02)*	--	--	--	--	--	--
Non-Malignant	*126*	*25*	*0.04 (0.03–0.05)*	--	--	--	--	--	--
TOTAL[e]	**17,808**	**3,562**	**5.85 (5.76–5.93)**	**62,558**	**12,512**	**11.82 (11.73–11.92)**	**351,407**	**70,281**	**43.67 (43.53–43.82)**
Malignant	***11,834***	***2,367***	***3.88 (3.82–3.96)***	***17,364***	***3,473***	***3.25 (3.20–3.30)***	***96,364***	***19,273***	***11.79 (11.72–11.87)***
Non-Malignant	***5,974***	***1,195***	***1.96 (1.91–2.01)***	***45,194***	***9,039***	***8.57 (8.49–8.65)***	***255,043***	***51,009***	***31.88 (31.76–32.01)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[d]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya.
[e]Refers to all brain tumors including histologies not presented in this table.
-- Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: AYA, Adolescents and Young Adults; CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 8 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0–19 Years), Brain and Other Central Nervous System Tumors by Histology, and Age Group at Diagnosis, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	0–19 Years			0–4 Years			5–9 Years			10–14 Years			15–19 Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**2,248**	**450**	**0.55 (0.53–0.57)**	**445**	**89**	**0.45 (0.41–0.49)**	**467**	**93**	**0.46 (0.42–0.50)**	**602**	**120**	**0.58 (0.54–0.63)**	**734**	**147**	**0.70 (0.65–0.75)**
Diffuse astrocytoma	946	189	0.23 (0.22–0.25)	246	49	0.25 (0.22–0.28)	183	37	0.18 (0.15–0.21)	256	51	0.25 (0.22–0.28)	261	52	0.25 (0.22–0.28)
Anaplastic astrocytoma	365	73	0.09 (0.08–0.10)	60	12	0.06 (0.05–0.08)	89	18	0.09 (0.07–0.11)	101	20	0.10 (0.08–0.12)	115	23	0.11 (0.09–0.13)
Glioblastoma	700	140	0.17 (0.16–0.18)	104	21	0.11 (0.09–0.13)	161	32	0.16 (0.14–0.19)	196	39	0.19 (0.16–0.22)	239	48	0.23 (0.20–0.26)
Oligodendroglioma	164	33	0.04 (0.03–0.05)	20	4	0.02 (0.01–0.03)	21	4	0.02 (0.01–0.03)	37	7	0.04 (0.03–0.05)	86	17	0.08 (0.07–0.10)
Anaplastic oligo-dendroglioma	22	4	0.01 (0.00–0.01)	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	51	10	0.01 (0.01–0.02)	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**4,371**	**874**	**1.07 (1.04–1.10)**	**1,331**	**266**	**1.34 (1.27–1.41)**	**1,231**	**246**	**1.21 (1.14–1.28)**	**1,064**	**213**	**1.03 (0.97–1.09)**	**745**	**149**	**0.71 (0.66–0.76)**
Pilocytic astrocytoma	3,877	775	0.95 (0.92–0.98)	1,227	245	1.23 (1.17–1.31)	1,109	222	1.09 (1.02–1.15)	914	183	0.88 (0.83–0.94)	627	125	0.60 (0.55–0.64)
Unique astrocytoma variants	494	99	0.12 (0.11–0.13)	104	21	0.11 (0.09–0.13)	122	24	0.12 (0.10–0.14)	150	30	0.15 (0.12–0.17)	118	24	0.11 (0.09–0.13)
Malignant	*227*	*45*	*0.06 (0.05–0.06)*	--	--	--	*46*	*9*	*0.05 (0.03–0.06)*	*88*	*18*	*0.09 (0.07–0.11)*	*81*	*16*	*0.08 (0.06–0.10)*
Non-Malignant	*267*	*53*	*0.07 (0.06–0.07)*	--	--	--	*76*	*15*	*0.07 (0.06–0.09)*	*62*	*12*	*0.06 (0.05–0.08)*	*37*	*7*	*0.04 (0.02–0.05)*
Ependymal Tumors	**1,176**	**235**	**0.29 (0.27–0.30)**	**456**	**91**	**0.46 (0.42–0.50)**	**242**	**48**	**0.24 (0.21–0.27)**	**243**	**49**	**0.23 (0.21–0.27)**	**235**	**47**	**0.22 (0.20–0.25)**
Malignant	*985*	*197*	*0.24 (0.23–0.26)*	*439*	*88*	*0.44 (0.40–0.48)*	*211*	*42*	*0.21 (0.18–0.24)*	*185*	*37*	*0.18 (0.15–0.21)*	*150*	*30*	*0.14 (0.12–0.17)*
Non-Malignant	*191*	*38*	*0.05 (0.04–0.05)*	*17*	*3*	*0.02 (0.01–0.03)*	*31*	*6*	*0.03 (0.02–0.04)*	*58*	*12*	*0.06 (0.04–0.07)*	*85*	*17*	*0.08 (0.06–0.10)*
Other Gliomas	**3,133**	**627**	**0.77 (0.74–0.79)**	**914**	**183**	**0.92 (0.86–0.98)**	**1,002**	**200**	**0.98 (0.92–1.05)**	**742**	**148**	**0.72 (0.67–0.77)**	**475**	**95**	**0.45 (0.41–0.49)**
Glioma malignant, NOS	3,093	619	0.75 (0.73–0.78)	--	--	--	--	--	--	--	--	--	--	--	--

Table 8 Continued

Histology	0–19 Years			0–4 Years			5–9 Years			10–14 Years			15–19 Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Other neuroepithelial tumors	34	7	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	2,012	402	0.49 (0.47–0.51)	373	75	0.38 (0.34–0.42)	375	75	0.37 (0.33–0.41)	623	125	0.60 (0.55–0.65)	641	128	0.61 (0.56–0.66)
Malignant	*140*	*28*	*0.03 (0.03–0.04)*	*39*	*8*	*0.04 (0.03–0.05)*	*24*	*5*	*0.02 (0.02–0.04)*	*37*	*7*	*0.04 (0.03–0.05)*	*40*	*8*	*0.04 (0.03–0.05)*
Non-Malignant	*1,872*	*374*	*0.46 (0.44–0.48)*	*334*	*67*	*0.34 (0.30–0.38)*	*351*	*70*	*0.35 (0.31–0.38)*	*586*	*117*	*0.57 (0.52–0.61)*	*601*	*120*	*0.57 (0.53–0.62)*
Choroid Plexus Tumors	**416**	**83**	**0.10 (0.09–0.11)**	**261**	**52**	**0.26 (0.23–0.30)**	**51**	**10**	**0.05 (0.04–0.07)**	**57**	**11**	**0.05 (0.04–0.07)**	**47**	**9**	**0.04 (0.03–0.06)**
Malignant	*104*	*21*	*0.03 (0.02–0.03)*	*83*	*17*	*0.08 (0.07–0.10)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*312*	*62*	*0.08 (0.07–0.08)*	*178*	*36*	*0.18 (0.15–0.21)*	--	--	--	--	--	--	--	--	--
Tumors of the Pineal Region	**213**	**43**	**0.05 (0.05–0.06)**	**58**	**12**	**0.06 (0.04–0.08)**	**51**	**10**	**0.05 (0.04–0.07)**	**38**	**8**	**0.04 (0.03–0.05)**	**66**	**13**	**0.06 (0.05–0.08)**
Malignant	*176*	*35*	*0.04 (0.04–0.05)*	--	--	--	--	--	--	--	--	--	*41*	*8*	*0.04 (0.03–0.05)*
Non-Malignant	*37*	*7*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--	*17*	*3*	*0.02 (0.01–0.03)*
Embryonal Tumors	**2,397**	**479**	**0.59 (0.56–0.61)**	**1,065**	**213**	**1.07 (1.01–1.14)**	**731**	**146**	**0.72 (0.67–0.77)**	**400**	**80**	**0.39 (0.35–0.43)**	**201**	**40**	**0.19 (0.17–0.22)**
Medulloblastoma	*1,652*	*330*	*0.41 (0.39–0.43)*	*505*	*101*	*0.51 (0.46–0.55)*	*636*	*127*	*0.63 (0.58–0.68)*	*345*	*69*	*0.33 (0.30–0.37)*	*166*	*33*	*0.16 (0.13–0.18)*
Primitive neuroectodermal tumors	*208*	*42*	*0.05 (0.04–0.06)*	*107*	*21*	*0.11 (0.09–0.13)*	*45*	*9*	*0.04 (0.03–0.06)*	*35*	*7*	*0.03 (0.02–0.05)*	*21*	*4*	*0.02 (0.01–0.03)*
Atypical teratoid/ rhabdoid tumor	*382*	*76*	*0.09 (0.08–0.10)*	*332*	*66*	*0.34 (0.30–0.37)*	--	--	--	--	--	--	--	--	--
All other embryonal	*155*	*31*	*0.04 (0.03–0.04)*	*121*	*24*	*0.12 (0.10–0.15)*	--	--	--	--	--	--	--	--	--
Tumors of Cranial and Paraspinal Nerves	**1,202**	**240**	**0.29 (0.28–0.31)**	**255**	**51**	**0.26 (0.23–0.29)**	**206**	**41**	**0.20 (0.18–0.23)**	**287**	**57**	**0.28 (0.25–0.31)**	**454**	**91**	**0.43 (0.39–0.47)**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 8 Continued

Histology	0–19 Years			0–4 Years			5–9 Years			10–14 Years			15–19 Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,291**	**258**	**0.31 (0.30–0.33)**	**251**	**50**	**0.25 (0.22–0.29)**	**156**	**31**	**0.15 (0.13–0.18)**	**291**	**58**	**0.28 (0.25–0.32)**	**593**	**119**	**0.56 (0.52–0.61)**
Meningiomas	667	133	0.16 (0.15–0.17)	--	--	--	--	--	--	163	33	0.16 (0.13–0.18)	356	71	0.34 (0.30–0.38)
Malignant	*27*	*5*	*0.01 (0.00–0.01)*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*640*	*128*	*0.15 (0.14–0.17)*	--	--	--	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	611	122	0.15 (0.14–0.16)	179	36	0.18 (0.15–0.21)	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**135**	**27**	**0.03 (0.03–0.04)**	**19**	**4**	**0.02 (0.01–0.03)**	**34**	**7**	**0.03 (0.02–0.05)**	**35**	**7**	**0.03 (0.02–0.05)**	**47**	**9**	**0.04 (0.03–0.06)**
Lymphoma	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**849**	**170**	**0.21 (0.19–0.22)**	**109**	**22**	**0.11 (0.09–0.13)**	**156**	**31**	**0.15 (0.13–0.18)**	**318**	**64**	**0.31 (0.28–0.34)**	**266**	**53**	**0.25 (0.22–0.28)**
Malignant	*752*	*150*	*0.18 (0.17–0.20)*	*71*	*14*	*0.07 (0.06–0.09)*	*126*	*25*	*0.12 (0.10–0.15)*	--	--	--	--	--	--
Non-Malignant	*97*	*19*	*0.02 (0.02–0.03)*	*38*	*8*	*0.04 (0.03–0.05)*	*30*	*6*	*0.03 (0.02–0.04)*	--	--	--	--	--	--
Tumors of Sellar Region	**4,484**	**897**	**1.08 (1.05–1.12)**	**194**	**39**	**0.20 (0.17–0.23)**	**612**	**122**	**0.60 (0.56–0.65)**	**965**	**193**	**0.93 (0.87–0.99)**	**2,713**	**543**	**2.58 (2.48–2.68)**
Tumors of the pituitary	3,639	728	0.88 (0.85–0.91)	48	10	0.05 (0.04–0.06)	308	62	0.30 (0.27–0.34)	740	148	0.71 (0.66–0.76)	2,543	509	2.42 (2.32–2.51)
Craniopharyngioma	845	169	0.21 (0.19–0.22)	146	29	0.15 (0.12–0.17)	304	61	0.30 (0.27–0.33)	225	45	0.22 (0.19–0.25)	170	34	0.16 (0.14–0.19)
Unclassified Tumors	**1,570**	**314**	**0.38 (0.36–0.40)**	**375**	**75**	**0.38 (0.34–0.42)**	**314**	**63**	**0.31 (0.28–0.35)**	**409**	**82**	**0.39 (0.36–0.43)**	**472**	**94**	**0.45 (0.41–0.49)**
Hemangioma	486	97	0.12 (0.11–0.13)	72	14	0.07 (0.06–0.09)	87	17	0.09 (0.07–0.11)	135	27	0.13 (0.11–0.15)	192	38	0.18 (0.16–0.21)

Table 8 Continued

Histology	0–19 Years			0–4 Years			5–9 Years			10–14 Years			15–19 Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Neoplasm, unspecified	868	174	0.21 (0.20–0.23)	191	38	0.19 (0.17–0.22)	182	36	0.18 (0.15–0.21)	248	50	0.24 (0.21–0.27)	247	49	0.23 (0.21–0.27)
Malignant	*219*	*44*	*0.05 (0.05–0.06)*	*71*	*14*	*0.07 (0.06–0.09)*	*52*	*10*	*0.05 (0.04–0.07)*	*45*	*9*	*0.04 (0.03–0.06)*	*51*	*10*	*0.05 (0.04–0.06)*
Non-Malignant	*649*	*130*	*0.16 (0.15–0.17)*	*120*	*24*	*0.12 (0.10–0.14)*	*130*	*26*	*0.13 (0.11–0.15)*	*203*	*41*	*0.20 (0.17–0.22)*	*196*	*39*	*0.19 (0.16–0.21)*
All other	216	43	0.05 (0.05–0.06)	112	22	0.11 (0.09–0.14)	45	9	0.04 (0.03–0.06)	26	5	0.02 (0.02–0.04)	33	7	0.03 (0.02–0.04)
Malignant	*65*	*13*	*0.02 (0.01–0.02)*	*36*	*7*	*0.04 (0.03–0.05)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*151*	*30*	*0.04 (0.03–0.04)*	*76*	*15*	*0.08 (0.06–0.10)*	--	--	--	--	--	--	--	--	--
TOTAL[c]	**25,497**	**5,099**	**6.21 (6.14–6.29)**	**6,106**	**1,221**	**6.15 (6.00–6.31)**	**5,628**	**1,126**	**5.53 (5.39–5.68)**	**6,074**	**1,215**	**5.87 (5.72–6.02)**	**7,689**	**1,538**	**7.31 (7.14–7.47)**
Malignant	***14,586***	***2,917***	***3.57 (3.51–3.62)***	***4,502***	***900***	***4.54 (4.40–4.67)***	***3,903***	***781***	***3.83 (3.71–3.96)***	***3,429***	***686***	***3.32 (3.21–3.43)***	***2,752***	***550***	***2.61 (2.52–2.71)***
Non-Malignant	***10,911***	***2,182***	***2.65 (2.60–2.70)***	***1,604***	***321***	***1.62 (1.54–1.70)***	***1,725***	***345***	***1.70 (1.62–1.78)***	***2,645***	***529***	***2.55 (2.45–2.65)***	***4,937***	***987***	***4.69 (4.56–4.82)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Refers to all brain tumors including histologies not presented in this table.
--Counts and rates are not presented when **fewer than 16 cases** were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 9 Five-Year Total, Average Annual Age-Adjusted and Age-Specific Incidence Rates[a] with 95% Confidence Intervals for Adults (Age 20+ Years), Brain and Other Central Nervous System Tumors by Histology, and Age Group at Diagnosis, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	20–34 Years			35–44 Years			45–54 Years			55–64 Years			65–74 Years			75–84 Years			85+ Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**6,130**	**1,226**	**1.86 (1.81–1.91)**	**6,190**	**1,238**	**3.05 (2.98–3.13)**	**11,336**	**2,267**	**5.22 (5.12–5.32)**	**20,324**	**4,065**	**9.79 (9.65–9.92)**	**21,474**	**4,295**	**15.25 (15.05–15.46)**	**12,289**	**2,458**	**17.17 (16.87–17.48)**	**3,133**	**627**	**9.87 (9.53–10.22)**
Diffuse astrocytoma	1,699	340	0.51 (0.49–0.54)	1,064	213	0.52 (0.49–0.56)	1,013	203	0.48 (0.45–0.51)	1,171	234	0.57 (0.54–0.60)	1,078	216	0.76 (0.72–0.81)	606	121	0.85 (0.78–0.92)	152	30	0.48 (0.41–0.56)
Anaplastic astrocytoma	1,330	266	0.40 (0.38–0.42)	1,029	206	0.51 (0.48–0.54)	1,074	215	0.50 (0.47–0.53)	1,402	280	0.68 (0.64–0.71)	1,234	247	0.88 (0.83–0.93)	618	124	0.87 (0.80–0.94)	123	25	0.39 (0.32–0.46)
Glioblastoma	1,624	325	0.49 (0.47–0.52)	2,626	525	1.30 (1.25–1.35)	7,822	1,564	3.57 (3.49–3.65)	16,643	3,329	8.00 (7.88–8.12)	18,582	3,716	13.21 (13.02–13.40)	10,870	2,174	15.18 (14.90–15.47)	2,832	566	8.92 (8.60–9.26)
Oligodendroglioma	916	183	0.28 (0.26–0.30)	883	177	0.43 (0.41–0.46)	820	164	0.39 (0.36–0.42)	553	111	0.27 (0.25–0.29)	257	51	0.17 (0.15–0.20)	94	19	0.13 (0.11–0.16)	19	4	0.06 (0.04–0.09)
Anaplastic oligodendroglioma	308	62	0.09 (0.08–0.11)	371	74	0.18 (0.17–0.20)	443	89	0.21 (0.19–0.23)	401	80	0.19 (0.18–0.21)	215	43	0.15 (0.13–0.17)	--	--	--	--	--	--
Oligoastrocytic tumors	253	51	0.08 (0.07–0.09)	217	43	0.11 (0.09–0.12)	164	33	0.08 (0.07–0.09)	154	31	0.08 (0.06–0.09)	108	22	0.08 (0.06–0.09)	--	--	--	--	--	--
Other Astrocytic Tumors	**904**	**181**	**0.27 (0.25–0.29)**	**339**	**68**	**0.17 (0.15–0.19)**	**241**	**48**	**0.11 (0.10–0.13)**	**182**	**36**	**0.09 (0.08–0.10)**	**117**	**23**	**0.08 (0.07–0.10)**	**--**	**--**	**--**	**--**	**--**	**--**
Pilocytic astrocytoma	693	139	0.21 (0.19–0.22)	267	53	0.13 (0.12–0.15)	188	38	0.09 (0.08–0.10)	144	29	0.07 (0.06–0.08)	94	19	0.07 (0.05–0.08)	--	--	--	--	--	--
Unique astrocytoma variants	211	42	0.06 (0.05–0.07)	72	14	0.04 (0.03–0.04)	53	11	0.02 (0.02–0.03)	38	8	0.02 (0.01–0.03)	23	5	0.02 (0.01–0.02)	--	--	--	--	--	--
Malignant	156	31	0.05 (0.04–0.05)	55	11	0.03 (0.02–0.04)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	55	11	0.02 (0.01–0.02)	17	3	0.01 (0.00–0.01)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ependymal Tumors	**1,157**	**231**	**0.35 (0.33–0.37)**	**1,045**	**209**	**0.52 (0.49–0.55)**	**1,178**	**236**	**0.55 (0.52–0.59)**	**1,171**	**234**	**0.57 (0.54–0.60)**	**862**	**172**	**0.60 (0.56–0.64)**	**304**	**61**	**0.42 (0.38–0.48)**	**33**	**7**	**0.10 (0.07–0.15)**

Table 9 Continued

Histology	20–34 Years			35–44 Years			45–54 Years			55–64 Years			65–74 Years			75–84 Years			85+ Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Malignant	605	121	0.18 (0.17–0.20)	532	106	0.26 (0.24–0.29)	607	121	0.29 (0.26–0.31)	611	122	0.30 (0.27–0.32)	447	89	0.32 (0.29–0.35)	--	--	--	--	--	--
Non-Malignant	552	110	0.17 (0.15–0.18)	513	103	0.25 (0.23–0.28)	571	114	0.27 (0.25–0.29)	560	112	0.27 (0.25–0.30)	415	83	0.29 (0.26–0.32)	--	--	--	--	--	--
Other Gliomas	**1,041**	**208**	**0.31 (0.30–0.33)**	**618**	**124**	**0.30 (0.28–0.33)**	**724**	**145**	**0.34 (0.31–0.37)**	**860**	**172**	**0.42 (0.39–0.45)**	**879**	**176**	**0.63 (0.59–0.67)**	**796**	**159**	**1.11 (1.03–1.19)**	**524**	**105**	**1.65 (1.51–1.80)**
Glioma malignant, NOS	1,020	204	0.31 (0.29–0.33)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	21	4	0.01 (0.00–0.01)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	**1,128**	**226**	**0.34 (0.32–0.36)**	**569**	**114**	**0.28 (0.26–0.30)**	**513**	**103**	**0.24 (0.22–0.26)**	**474**	**95**	**0.23 (0.21–0.25)**	**299**	**60**	**0.21 (0.18–0.23)**	**127**	**25**	**0.18 (0.15–0.21)**	**28**	**6**	**0.09 (0.06–0.13)**
Malignant	101	20	0.03 (0.02–0.04)	131	26	0.06 (0.05–0.08)	172	34	0.08 (0.07–0.09)	193	39	0.09 (0.08–0.11)	153	31	0.11 (0.09–0.13)	--	--	--	--	--	--
Non-Malignant	1,027	205	0.31 (0.29–0.33)	438	88	0.21 (0.19–0.24)	341	68	0.16 (0.15–0.18)	281	56	0.14 (0.12–0.15)	146	29	0.10 (0.09–0.12)	--	--	--	--	--	--
Choroid Plexus Tumors	**121**	**24**	**0.04 (0.03–0.04)**	**79**	**16**	**0.04 (0.03–0.05)**	**62**	**12**	**0.03 (0.02–0.04)**	**86**	**17**	**0.04 (0.03–0.05)**	**48**	**10**	**0.03 (0.02–0.04)**	**30**	**6**	**0.04 (0.03–0.06)**	**--**	**--**	**--**
Tumors of the Pineal Region	**177**	**35**	**0.05 (0.05–0.06)**	**98**	**20**	**0.05 (0.04–0.06)**	**97**	**19**	**0.05 (0.04–0.06)**	**83**	**17**	**0.04 (0.03–0.05)**	**62**	**12**	**0.04 (0.03–0.06)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	101	20	0.03 (0.02–0.04)	33	7	0.02 (0.01–0.02)	49	10	0.02 (0.02–0.03)	32	6	0.02 (0.01–0.02)	28	6	0.02 (0.01–0.03)	--	--	--	--	--	--
Non-Malignant	76	15	0.02 (0.02–0.03)	65	13	0.03 (0.02–0.04)	48	10	0.02 (0.02–0.03)	51	10	0.02 (0.02–0.03)	34	7	0.02 (0.02–0.03)	--	--	--	--	--	--
Embryonal Tumors	**468**	**94**	**0.14 (0.13–0.15)**	**148**	**30**	**0.07 (0.06–0.08)**	**96**	**19**	**0.05 (0.04–0.06)**	**78**	**16**	**0.04 (0.03–0.05)**	**35**	**7**	**0.03 (0.02–0.04)**	**--**	**--**	**--**	**--**	**--**	**--**

Table 9 Continued

Histology	20–34 Years			35–44 Years			45–54 Years			55–64 Years			65–74 Years			75–84 Years			85+ Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Tumors of Cranial and Paraspinal Nerves	**3,109**	**622**	**0.94 (0.91–0.98)**	**4,403**	**881**	**2.18 (2.12–2.25)**	**7,049**	**1,410**	**3.27 (3.19–3.35)**	**9,424**	**1,885**	**4.56 (4.47–4.65)**	**7,815**	**1,563**	**5.49 (5.37–5.62)**	**3,085**	**617**	**4.31 (4.16–4.47)**	**597**	**119**	**1.88 (1.73–2.04)**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**5,839**	**1,168**	**1.79 (1.75–1.84)**	**12,257**	**2,451**	**6.08 (5.98–6.19)**	**24,525**	**4,905**	**11.37 (11.23–11.51)**	**36,592**	**7,318**	**17.65 (17.46–17.83)**	**43,056**	**8,611**	**30.81 (30.52–31.11)**	**32,713**	**6,543**	**45.57 (45.08–46.07)**	**18,295**	**3,659**	**57.63 (56.80–58.47)**
Meningiomas	4,833	967	1.49 (1.45–1.53)	11,428	2,286	5.68 (5.57–5.78)	23,500	4,700	10.89 (10.75–11.03)	35,428	7,086	17.08 (16.90–17.26)	42,135	8,427	30.17 (29.88–30.46)	32,254	6,451	44.93 (44.44–45.42)	18,187	3,637	57.29 (56.46–58.13)
Malignant	62	12	0.02 (0.01–0.02)	103	21	0.05 (0.04–0.06)	217	43	0.10 (0.09–0.11)	400	80	0.19 (0.18–0.21)	440	88	0.32 (0.29–0.35)	316	63	0.44 (0.39–0.49)	134	27	0.42 (0.35–0.50)
Non-Malignant	4,771	954	1.47 (1.43–1.51)	11,325	2,265	5.62 (5.52–5.73)	23,283	4,657	10.79 (10.65–10.93)	35,028	7,006	16.89 (16.71–17.07)	41,695	8,339	29.85 (29.56–30.14)	31,938	6,388	44.49 (44.00–44.98)	18,053	3,611	56.87 (56.04–57.71)
Mesenchymal tumors	--	--	--	--	--	--	1,006	201	0.47 (0.44–0.50)	1,132	226	0.55 (0.52–0.58)	898	180	0.63 (0.59–0.67)	439	88	0.61 (0.56–0.67)	--	--	--
Malignant	--	--	--	--	--	--	136	27	0.06 (0.05–0.08)	158	32	0.08 (0.07–0.09)	102	20	0.07 (0.06–0.09)	62	12	0.09 (0.07–0.11)	--	--	--
Non-Malignant	--	--	--	--	--	--	870	174	0.41 (0.38–0.43)	974	195	0.47 (0.44–0.50)	796	159	0.56 (0.52–0.60)	377	75	0.53 (0.48–0.58)	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	19	4	0.01 (0.00–0.01)	32	6	0.02 (0.01–0.02)	23	5	0.02 (0.01–0.02)	20	4	0.03 (0.02–0.04)	--	--	--
Lymphomas and Hematopoietic Neoplasms	**320**	**64**	**0.10 (0.09–0.11)**	**427**	**85**	**0.21 (0.19–0.23)**	**941**	**188**	**0.43 (0.40–0.46)**	**1,919**	**384**	**0.92 (0.88–0.96)**	**2,646**	**529**	**1.90 (1.83–1.97)**	**1,779**	**356**	**2.49 (2.37–2.61)**	**391**	**78**	**1.23 (1.11–1.36)**
Lymphoma	--	--	--	--	--	--	--	--	--	1,900	380	0.91 (0.87–0.95)	2,624	525	1.88 (1.81–1.96)	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	19	4	0.01 (0.01-0.01)	22	4	0.02 (0.01–0.02)	--	--	--	--	--	--

Table 9 Continued

Histology	20–34 Years			35–44 Years			45–54 Years			55–64 Years			65–74 Years			75–84 Years			85+ Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Germ Cell Tumors	**320**	**64**	**0.10 (0.09–0.11)**	**28**	**6**	**0.01 (0.01–0.02)**	**23**	**5**	**0.01 (0.01–0.02)**	**17**	**3**	**0.01 (0.00–0.01)**	--	--	--	--	--	--	--	--	--
Malignant	296	59	0.09 (0.08–0.10)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	24	5	0.01 (0.00–0.01)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	**14,137**	**2,827**	**4.26 (4.19–4.33)**	**11,939**	**2,388**	**5.89 (5.78–5.99)**	**12,607**	**2,521**	**5.93 (5.83–6.04)**	**13,761**	**2,752**	**6.66 (6.55–6.77)**	**12,195**	**2,439**	**8.61 (8.46–8.77)**	**6,279**	**1,256**	**8.77 (8.56–8.99)**	**1,682**	**336**	**5.30 (5.05–5.56)**
Tumors of the pituitary	13,757	2,751	4.15 (4.08–4.22)	11,588	2,318	5.71 (5.61–5.82)	12,144	2,429	5.72 (5.61–5.82)	13,209	2,642	6.39 (6.28–6.50)	11,816	2,363	8.35 (8.20–8.50)	6,134	1,227	8.57 (8.36–8.79)	1,658	332	5.22 (4.97–5.48)
Malignant	--	--	--	16	3	0.01 (0.00–0.01)	28	6	0.01 (0.01–0.02)	31	6	0.02 (0.01–0.02)	22	4	0.02 (0.01–0.02)	16	3	0.02 (0.01–0.04)	--	--	--
Non-Malignant	--	--	--	11,572	2,314	5.70 (5.60–5.81)	12,116	2,423	5.70 (5.60–5.81)	13,178	2,636	6.38 (6.27–6.49)	11,794	2,359	8.33 (8.18–8.49)	6,118	1,224	8.55 (8.33–8.77)	--	--	--
Craniopharyn-gioma	380	76	0.11 (0.10–0.13)	351	70	0.17 (0.16–0.19)	463	93	0.22 (0.20–0.24)	552	110	0.27 (0.24–0.29)	379	76	0.27 (0.24–0.29)	145	29	0.20 (0.17–0.24)	24	5	0.08 (0.05–0.11)
Unclassified Tumors	**1,677**	**335**	**0.51 (0.48–0.53)**	**1,440**	**288**	**0.71 (0.68–0.75)**	**1,976**	**395**	**0.92 (0.88–0.96)**	**2,624**	**525**	**1.27 (1.22–1.32)**	**2,987**	**597**	**2.14 (2.06–2.22)**	**3,281**	**656**	**4.56 (4.40–4.71)**	**3,242**	**648**	**10.21 (9.86–10.57)**
Hemangioma	705	141	0.21 (0.20–0.23)	583	117	0.29 (0.27–0.31)	667	133	0.31 (0.29–0.34)	727	145	0.35 (0.33–0.38)	532	106	0.37 (0.34–0.41)	328	66	0.46 (0.41–0.51)	113	23	0.36 (0.29–0.43)
Neoplasm, unspecified	903	181	0.27 (0.25–0.29)	810	162	0.40 (0.37–0.43)	1,268	254	0.59 (0.56–0.63)	1,853	371	0.90 (0.85–0.94)	2,396	479	1.73 (1.66–1.80)	2,903	581	4.03 (3.88–4.18)	3,092	618	9.74 (9.40–10.09)
Malignant	196	39	0.06 (0.05–0.07)	209	42	0.10 (0.09–0.12)	434	87	0.20 (0.18–0.22)	839	168	0.40 (0.38–0.43)	1,222	244	0.88 (0.83–0.94)	1,685	337	2.33 (2.22–2.45)	1,888	378	5.95 (5.68–6.22)
Non-Malignant	707	141	0.21 (0.20–0.23)	601	120	0.30 (0.27–0.32)	834	167	0.39 (0.37–0.42)	1,014	203	0.49 (0.46–0.52)	1,174	235	0.84 (0.79–0.89)	1,218	244	1.69 (1.60–1.79)	1,204	241	3.79 (3.58–4.01)

Table 9 Continued

Histology	20–34 Years			35–44 Years			45–54 Years			55–64 Years			65–74 Years			75–84 Years			85+ Years		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
All other	69	14	0.02 (0.02–0.03)	47	9	0.02 (0.02–0.03)	41	8	0.02 (0.01–0.03)	44	9	0.02 (0.02–0.03)	59	12	0.04 (0.03–0.05)	50	10	0.07 (0.05–0.09)	37	7	0.12 (0.08–0.16)
TOTAL[b]	**36,528**	**7,306**	**11.05 (10.94–11.17)**	**39,580**	**7,916**	**19.57 (19.37–19.76)**	**61,368**	**12,274**	**28.53 (28.30–28.75)**	**87,595**	**17,519**	**42.27 (41.99–42.56)**	**92,482**	**18,496**	**65.84 (65.41–66.27)**	**60,781**	**12,156**	**84.76 (84.09–85.44)**	**27,942**	**5,588**	**88.02 (86.99–89.06)**
Malignant	***10,325***	***2,065***	***3.12 (3.06–3.18)***	***8,896***	***1,779***	***4.39 (4.30–4.48)***	***15,027***	***3,005***	***6.94 (6.83–7.05)***	***25,684***	***5,137***	***12.38 (12.22–12.53)***	***27,617***	***5,523***	***19.65 (19.42–19.89)***	***17,291***	***3,458***	***24.14 (23.78–24.50)***	***6,136***	***1,227***	***19.33 (18.85–19.82)***
Non-Malignant	***26,203***	***5,241***	***7.94 (7.84–8.03)***	***30,684***	***6,137***	***15.18 (15.01–15.35)***	***46,341***	***9,268***	***21.59 (21.39–21.79)***	***61,911***	***12,382***	***29.90 (29.66–30.14)***	***64,865***	***12,973***	***46.18 (45.83–46.54)***	***43,490***	***8,698***	***60.63 (60.06–61.20)***	***21,806***	***4,361***	***68.69 (67.79–69.61)***

[a]Rates are per 100,000 and age-adjusted to the 2000 US standard population.
[b]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified.

Table 10 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals of All Brain and Other Central Nervous System Tumors by Site[c] and Sex, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Site	Total				Male				Female			
	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)
Frontal, temporal, parietal, and occipital lobes of the brain	76,010	15,202	17.6%	4.20 (4.17–4.23)	42,464	8,493	23.7%	4.96 (4.92–5.01)	33,546	6,709	13.3%	3.54 (3.50–3.58)
Frontal lobe	*33,535*	*6,707*	7.8%	*1.88 (1.86–1.90)*	*17,851*	*3,570*	9.9%	*2.11 (2.08–2.14)*	*15,684*	*3,137*	6.2%	*1.68 (1.65–1.70)*
Temporal lobe	*24,455*	*4,891*	5.7%	*1.34 (1.33–1.36)*	*14,631*	*2,926*	8.2%	*1.70 (1.67–1.73)*	*9,824*	*1,965*	3.9%	*1.03 (1.01–1.05)*
Parietal lobe	*14,226*	*2,845*	3.3%	*0.77 (0.76–0.79)*	*7,871*	*1,574*	4.4%	*0.91 (0.89–0.93)*	*6,355*	*1,271*	2.5%	*0.65 (0.64–0.67)*
Occipital lobe	*3,794*	*759*	0.9%	*0.21 (0.20–0.21)*	*2,111*	*422*	1.2%	*0.25 (0.23–0.26)*	*1,683*	*337*	0.7%	*0.17 (0.17–0.18)*
Cerebrum	7,424	1,485	1.7%	0.43 (0.42–0.44)	3,986	797	2.2%	0.48 (0.46–0.50)	3,438	688	1.4%	0.38 (0.37–0.40)
Ventricle	4,127	825	1.0%	0.25 (0.25–0.26)	2,268	454	1.3%	0.28 (0.27–0.29)	1,859	372	0.7%	0.23 (0.22–0.24)
Cerebellum	9,401	1,880	2.2%	0.59 (0.58–0.60)	5,066	1,013	2.8%	0.64 (0.63–0.66)	4,335	867	1.7%	0.53 (0.52–0.55)
Brain stem	6,095	1,219	1.4%	0.39 (0.38–0.40)	3,259	652	1.8%	0.41 (0.40–0.43)	2,836	567	1.1%	0.36 (0.35–0.38)
Other brain	33,675	6,735	7.8%	1.87 (1.85–1.89)	17,860	3,572	9.9%	2.13 (2.09–2.16)	15,815	3,163	6.3%	1.64 (1.62–1.67)
Overlapping lesion of brain	*12,757*	*2,551*	3.0%	*0.69 (0.68–0.71)*	*7,212*	*1,442*	4.0%	*0.84 (0.82–0.86)*	*5,545*	*1,109*	2.2%	*0.57 (0.56–0.59)*
Brain, NOS	*20,918*	*4,184*	4.8%	*1.17 (1.16–1.19)*	*10,648*	*2,130*	5.9%	*1.29 (1.26–1.31)*	*10,270*	*2,054*	4.1%	*1.07 (1.05–1.09)*
Spinal cord and cauda equina	12,889	2,578	3.0%	0.76 (0.75–0.78)	6,835	1,367	3.8%	0.83 (0.81–0.85)	6,054	1,211	2.4%	0.70 (0.68–0.72)
Spinal cord	*12,572*	*2,514*	2.9%	*0.74 (0.73–0.76)*	*6,685*	*1,337*	3.7%	*0.81 (0.79–0.83)*	*5,887*	*1,177*	2.3%	*0.68 (0.66–0.70)*
Cauda equina	*381*	*76*	0.1%	*0.02 (0.02-0.02)*	*186*	*37*	0.1%	*0.02 (0.02–0.03)*	*195*	*39*	0.1%	*0.02 (0.02–0.03)*
Cranial nerves	29,908	5,982	6.9%	1.68 (1.66–1.69)	14,071	2,814	7.8%	1.64 (1.61–1.67)	15,837	3,167	6.3%	1.72 (1.69–1.74)
Olfactory nerve	*41*	*8*	0.0%	*0.00 (0.00-0.00)*	*19*	*4*	0.0%	*0.00 (0.00-0.00)*	*22*	*4*	0.0%	*0.00 (0.00-0.00)*
Optic nerve	*1,750*	*350*	0.4%	*0.12 (0.11–0.12)*	*821*	*164*	0.5%	*0.11 (0.10–0.12)*	*929*	*186*	0.4%	*0.13 (0.12–0.14)*
Acoustic nerve	*22,196*	*4,439*	5.1%	*1.22 (1.20–1.24)*	*10,458*	*2,092*	5.8%	*1.20 (1.18–1.23)*	*11,738*	*2,348*	4.7%	*1.24 (1.22–1.26)*
Cranial nerve, NOS	*5,921*	*1,184*	1.4%	*0.33 (0.33–0.34)*	*2,773*	*555*	1.5%	*0.33 (0.31–0.34)*	*3,148*	*630*	1.2%	*0.34 (0.33–0.36)*
Other nervous system	2,579	516	0.6%	0.15 (0.14–0.15)	1,327	265	0.7%	0.16 (0.15–0.17)	1,252	250	0.5%	0.14 (0.13–0.14)
Overlapping lesion of brain and central nervous system	*339*	*68*	0.1%	*0.02 (0.02-0.02)*	*185*	*37*	0.1%	*0.02 (0.02–0.03)*	*154*	*31*	0.1%	*0.02 (0.01–0.02)*
Nervous system, NOS	*2,253*	*451*	0.5%	*0.13 (0.12–0.13)*	*1,150*	*230*	0.6%	*0.14 (0.13–0.15)*	*1,103*	*221*	0.4%	*0.12 (0.11–0.13)*
Meninges	169,047	33,809	39.2%	9.16 (9.12–9.21)	45,909	9,182	25.6%	5.47 (5.41–5.52)	123,138	24,628	48.8%	12.44 (12.37–12.51)
Cerebral meninges	137,656	27,531	31.9%	7.46 (7.42–7.50)	37,698	7,540	21.0%	4.48 (4.44–4.53)	99,958	19,992	39.6%	10.10 (10.04–10.17)
Spinal meninges	7,302	1,460	1.7%	0.39 (0.38–0.40)	1,624	325	0.9%	0.19 (0.18–0.20)	5,678	1,136	2.3%	0.57 (0.55–0.58)
Meninges, NOS	24,089	4,818	5.6%	1.31 (1.29–1.33)	6,587	1,317	3.7%	0.79 (0.77–0.81)	17,502	3,500	6.9%	1.77 (1.74–1.80)
Pituitary and craniopharyngeal duct	78,112	15,622	18.1%	4.61 (4.58–4.65)	34,978	6,996	19.5%	4.16 (4.12–4.21)	43,134	8,627	17.1%	5.16 (5.11–5.21)

Table 10 Continued

Site	Total				Male				Female			
	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)	5-Year Total	Annual Average	% of all tumors	Rate (95% CI)
Pituitary gland	*75,996*	*15,199*	17.6%	*4.49 (4.45–4.52)*	*33,876*	*6,775*	18.9%	*4.02 (3.98–4.07)*	*42,120*	*8,424*	16.7%	*5.04 (4.99–5.09)*
Craniopharyngeal duct	*2,116*	*423*	0.5%	*0.13 (0.12–0.13)*	*1,102*	*220*	0.6%	*0.14 (0.13–0.15)*	*1,014*	*203*	0.4%	*0.12 (0.11–0.13)*
Pineal gland	1,690	338	0.4%	0.11 (0.10–0.11)	1,012	202	0.6%	0.13 (0.12–0.14)	678	136	0.3%	0.08 (0.08–0.09)
Olfactory tumors of the nasal cavity[d]	739	148	0.2%	0.04 (0.04–0.05)	423	85	0.2%	0.05 (0.05–0.06)	316	63	0.1%	0.03 (0.03–0.04)
TOTAL	**431,773**	**86,355**	100.0%	**24.25 (24.17–24.32)**	**179,502**	**35,900**	100.0%	**21.35 (21.25–21.46)**	**252,271**	**50,454**	100.0%	**26.95 (26.85–27.06)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER site/histology validation list.
[d]ICD-O-3 histology codes 9522–9523 only.
-Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval

Table 11 Characteristics of All Brain and Other Central Nervous System Tumors by Central Cancer Registry, Behavior and Diagnostic Confirmation, CBTRUS Statistical Report: U.S. Cancer Statistics - NPCR and SEER, 2014–2018

State	Total				Malignant				Non-Malignant				Average Annual 5-Year Population[a]
	5-Year Total	Annual Average	Histologically Confirmed (%)[b]	Radiographically Confirmed (%)[c]	5-Year Total	% Malignant	Histologically Confirmed (%)	Radiographically Confirmed (%)	5-Year Total	% Malignant	Histologically Confirmed (%)[b]	Radiographically Confirmed (%)[c]	
Alabama	5,220	1,044	59.4%	34.1%	1,852	35.5%	78.1%	6.9%	3,368	64.5%	49.1%	49.0%	4,864,675
Alaska	903	181	46.8%	49.7%	265	29.4%	82.3%	12.5%	638	70.7%	32.1%	65.2%	738,516
Arizona	7,879	1,576	63.2%	32.6%	2,502	31.8%	84.7%	7.6%	5,377	68.2%	53.3%	44.2%	6,946,682
Arkansas	3,817	763	52.0%	43.9%	1,229	32.2%	81.6%	11.1%	2,588	67.8%	37.9%	59.5%	2,990,673
California	46,765	9,353	57.5%	37.7%	13,593	29.1%	84.9%	8.3%	33,172	70.9%	46.3%	49.7%	39,148,760
Colorado	8,131	1,626	48.6%	48.6%	2,078	25.6%	82.0%	13.0%	6,053	74.4%	37.2%	60.8%	5,531,142
Connecticut	4,679	936	66.5%	30.8%	1,581	33.8%	89.1%	7.8%	3,098	66.2%	55.0%	42.5%	3,581,502
Delaware	1,050	210	67.2%	30.4%	389	37.1%	84.3%	11.8%	661	63.0%	57.2%	41.3%	949,495
District of Columbia	801	160	54.7%	41.7%	185	23.1%	86.5%	6.5%	616	76.9%	45.1%	52.3%	684,498
Florida	31,799	6,360	51.9%	44.4%	8,810	27.7%	84.2%	10.4%	22,989	72.3%	39.6%	57.5%	20,598,140
Georgia	14,081	2,816	48.1%	46.3%	3,472	24.7%	83.2%	11.4%	10,609	75.3%	36.6%	57.8%	10,297,481
Hawaii	1,602	320	53.4%	41.0%	384	24.0%	83.9%	9.4%	1,218	76.0%	43.8%	51.0%	1,422,029
Idaho	2,190	438	59.4%	37.5%	728	33.2%	82.6%	13.2%	1,462	66.8%	47.9%	49.6%	1,687,809
Illinois	17,981	3,596	54.3%	43.1%	4,881	27.2%	87.6%	7.9%	13,100	72.9%	41.9%	56.2%	12,821,495
Indiana	7,722	1,544	54.5%	42.4%	2,551	33.0%	85.6%	10.1%	5,171	67.0%	39.1%	58.3%	6,637,427
Iowa	4,612	922	56.2%	41.1%	1,404	30.4%	83.8%	11.2%	3,208	69.6%	44.1%	54.2%	3,132,506
Kansas	3,608	722	52.8%	44.5%	1,071	29.7%	89.0%	8.2%	2,537	70.3%	37.5%	59.8%	2,908,771
Kentucky	7,041	1,408	47.6%	46.7%	1,965	27.9%	79.7%	11.2%	5,076	72.1%	35.1%	60.4%	4,440,197
Louisiana	6,381	1,276	55.0%	39.9%	1,612	25.3%	86.5%	9.4%	4,769	74.7%	44.4%	50.2%	4,663,613
Maine	1,572	314	68.6%	27.8%	689	43.8%	84.3%	9.7%	883	56.2%	56.3%	41.9%	1,332,816
Maryland	7,616	1,523	57.9%	37.6%	2,141	28.1%	85.1%	7.2%	5,475	71.9%	47.2%	49.5%	6,003,437
Massachusetts	7,976	1,595	68.4%	27.8%	2,937	36.8%	87.8%	7.4%	5,039	63.2%	57.0%	39.7%	6,830,192
Michigan	12,331	2,466	57.4%	37.0%	4,030	32.7%	83.7%	7.0%	8,301	67.3%	44.6%	51.5%	9,957,483
Minnesota	6,499	1,300	69.5%	27.6%	2,366	36.4%	87.6%	8.8%	4,133	63.6%	59.2%	38.4%	5,527,354
Mississippi	3,623	725	55.6%	40.9%	1,050	29.0%	85.2%	10.9%	2,573	71.0%	43.6%	53.1%	2,988,761
Missouri	8,263	1,653	53.4%	42.3%	2,534	30.7%	84.8%	9.0%	5,729	69.3%	39.5%	57.0%	6,090,061
Montana	1,547	309	52.8%	43.3%	487	31.5%	80.5%	13.8%	1,060	68.5%	40.1%	56.9%	1,041,730
Nebraska	2,205	441	57.7%	39.1%	795	36.1%	83.0%	11.3%	1,410	64.0%	43.5%	54.7%	1,904,759
Nevada[d]	2,635	527	55.6%	39.6%	881	33.4%	83.0%	8.6%	1,754	66.6%	41.9%	55.1%	2,315,971
New Hampshire	1,843	369	59.7%	37.7%	630	34.2%	90.5%	5.4%	1,213	65.8%	43.8%	54.4%	1,343,623

Table 11 Continued

State	Total				Malignant				Non-Malignant				Average Annual 5-Year Population[a]
	5-Year Total	Annual Average	Histologically Confirmed (%)[b]	Radiographically Confirmed (%)[c]	5-Year Total	% Malignant	Histologically Confirmed (%)	Radiographically Confirmed (%)	5-Year Total	% Malignant	Histologically Confirmed (%)[b]	Radiographically Confirmed (%)[c]	
New Jersey	13,522	2,704	52.7%	42.5%	3,738	27.6%	85.9%	8.8%	9,784	72.4%	40.0%	55.4%	8,881,846
New Mexico	2,033	407	68.4%	24.7%	692	34.0%	87.3%	6.1%	1,341	66.0%	58.7%	34.3%	2,092,433
New York	31,493	6,299	50.9%	45.6%	7,991	25.4%	84.5%	10.6%	23,502	74.6%	39.5%	57.5%	19,618,452
North Carolina	14,020	2,804	53.2%	43.5%	3,839	27.4%	86.0%	9.0%	10,181	72.6%	40.8%	56.5%	10,155,624
North Dakota	822	164	47.2%	49.9%	265	32.2%	83.4%	11.3%	557	67.8%	30.0%	68.2%	752,202
Ohio	13,777	2,755	64.4%	31.1%	4,984	36.2%	86.5%	7.1%	8,793	63.8%	51.8%	44.7%	11,641,879
Oklahoma	4,471	894	57.1%	38.9%	1,505	33.7%	82.0%	10.0%	2,966	66.3%	44.4%	53.6%	3,918,137
Oregon	4,781	956	65.7%	29.5%	1,748	36.6%	83.0%	6.9%	3,033	63.4%	55.8%	42.5%	4,081,947
Pennsylvania	20,070	4,014	48.8%	46.6%	5,787	28.8%	80.9%	9.9%	14,283	71.2%	35.8%	61.5%	12,791,181
Rhode Island	1,171	234	64.6%	31.4%	467	39.9%	86.5%	8.4%	704	60.1%	50.0%	46.7%	1,056,611
South Carolina	6,486	1,297	52.8%	42.5%	1,948	30.0%	84.5%	9.3%	4,538	70.0%	39.3%	56.8%	4,955,925
South Dakota	1,065	213	43.8%	52.5%	322	30.2%	76.1%	16.8%	743	69.8%	29.7%	68.0%	864,286
Tennessee	9,282	1,856	50.7%	46.1%	2,613	28.2%	85.5%	9.2%	6,669	71.9%	37.1%	60.6%	6,651,090
Texas	35,477	7,095	48.6%	45.6%	9,461	26.7%	80.2%	13.4%	26,016	73.3%	37.1%	57.4%	27,885,202
Utah	5,612	1,122	41.7%	57.0%	1,044	18.6%	85.1%	12.5%	4,568	81.4%	31.8%	67.1%	3,045,346
Vermont	930	186	56.5%	40.4%	279	30.0%	88.5%	4.7%	651	70.0%	42.7%	55.8%	624,977
Virginia	9,078	1,816	61.7%	34.3%	3,049	33.6%	85.1%	6.6%	6,029	66.4%	49.9%	48.3%	8,413,764
Washington	12,844	2,569	44.3%	51.3%	3,116	24.3%	81.4%	11.2%	9,728	75.7%	32.4%	64.1%	7,294,337
West Virginia	2,676	535	51.8%	44.2%	820	30.6%	86.0%	9.6%	1,856	69.4%	36.6s%	59.4%	1,829,054
Wisconsin	9,096	1,819	49.1%	47.6%	2,537	27.9%	83.5%	11.8%	6,559	72.1%	35.8%	61.5%	5,778,391
Wyoming	695	139	63.6%	34.5%	227	32.7%	86.3%	10.1%	468	67.3%	52.6%	46.4%	581,835
TOTAL	**431,773**	**86,355**	54.1%	41.7%	**125,524**	29.1%	84.2%	9.5%	**306,249**	70.9%	41.8%	54.8%	**322,296,120**

[a]Population estimates were obtained from the United States Bureau of the Census available on the SEER program website.
[b]Histologic confirmation includes tumors classified as having diagnosis confirmed by: positive histology, positive cytology, positive histology plus – positive immunophenotyping and/or positive genetic studies, or positive microscopic confirmation, method not specified.
[c]Radiographic confirmation includes tumors classified as having diagnosis confirmed by Radiography and/or other imaging techniques without microscopic confirmation.
[d]2014–2017 only
-Counts and rates are not presented when fewer than 16 cases were reported for the specific category, or where the inclusion of the count and rate would allow for back-calculation of suppressed values. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Table 12 Average Annual Age-Adjusted Incidence Rates[a] with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors by Age Group at Diagnosis, Behavior, and Central Cancer Registry, CBTRUS Statistical Report: U.S. Cancer Statistics –NPCR and SEER, 2014–2018

State	All Ages									0–19Years									20+Years								
	All			Malignant			Non-Malignant			All			Malignant			Non-Malignant			All			Malignant			Non-Malignant		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Alabama	5,2120	1,044	18.94 (18.41–19.48)	1,852	370	6.70 (6.39–7.02)	3,368	674	12.25 (11.82–12.68)	322	64	5.25 (4.69–5.86)	224	45	3.67 (3.20–4.18)	98	20	1.58 (1.29–1.93)	4,898	980	24.44 (23.74–25.16)	1,628	326	7.91 (7.52–8.32)	3,270	654	16.54 (15.96–17.13)
Alaska	903	181	25.60 (23.87–27.43)	265	53	7.20 (6.32–8.17)	638	128	18.41 (16.93–19.98)	71	14	7.14 (5.57–9.01)	37	7	3.61 (2.54–4.98)	34	7	3.53 (2.44–4.94)	832	166	33.03 (30.69–35.49)	228	46	8.64 (7.50–9.92)	604	121	24.39 (22.37–26.53)
Arizona	7,879	1,576	20.16 (19.71–20.63)	2,502	500	6.37 (6.12–6.63)	5,377	1,075	13.79 (13.42–14.18)	497	99	5.46 (4.99–5.96)	273	55	3.01 (2.66–3.39)	224	45	2.45 (2.14–2.79)	7,382	1,476	26.08 (25.47–26.70)	2,229	446	7.72 (7.40–8.06)	5,153	1,031	18.36 (17.84–18.88)
Arkansas	3,817	763	22.73 (21.99–23.48)	1,229	246	7.30 (6.89–7.73)	2,588	518	15.43 (14.82–16.05)	239	48	6.08 (5.33–6.90)	140	28	3.56 (3.00–4.21)	99	20	2.51 (2.04–3.06)	3,578	716	29.43 (28.44–30.44)	1,089	218	8.80 (8.27–9.36)	2,489	498	20.62 (19.80–21.47)
California	46,765	9,353	22.66 (22.45–22.87)	13,593	2,719	6.60 (6.49–6.72)	33,172	6,634	16.05 (15.88–16.23)	2,7	540	5.33 (5.13–5.54)	1,552	310	3.07 (2.92–3.22)	1,149	230	2.26 (2.13–2.40)	44,064	8,813	29.63 (29.34–29.91)	12,041	2,408	8.02 (7.88–8.17)	32,023	6,405	21.60 (21.36–21.84)
Colorado	8,131	1,626	28.05 (27.42–28.68)	2,078	416	7.12 (6.81–7.44)	6,053	1,211	20.93 (20.39–21.48)	433	87	6.18 (5.61–6.79)	236	47	3.37 (2.95–3.83)	197	39	2.81 (2.43–3.23)	7,698	1,540	36.84 (36.00–37.70)	1,842	368	8.63 (8.23–9.04)	5,856	1,171	28.22 (27.48–28.97)
Connecticut	4,679	936	22.56 (21.89–23.25)	1,581	316	7.62 (7.24–8.02)	3,098	620	14.94 (14.40–15.50)	272	54	6.29 (5.56–7.09)	156	31	3.70 (3.14–4.33)	116	23	2.60 (2.14–3.12)	4,407	881	29.11 (28.22–30.01)	1,425	285	9.20 (8.71–9.71)	2,982	596	19.91 (19.17–20.66)
Delaware	1,050	210	19.00 (17.82–20.24)	389	78	6.96 (6.26–7.73)	661	132	12.03 (11.09–13.04)	85	17	7.46 (5.96–9.23)	51	10	4.48 (3.34–5.89)	34	7	2.98 (2.06–4.17)	965	193	23.64 (22.11–25.26)	338	68	7.96 (7.11–8.90)	627	125	15.68 (14.41–17.02)
District of Columbia	801	160	24.13 (22.43–25.93)	185	37	5.56 (4.76–6.46)	616	123	18.57 (17.09–20.15)	44	9	6.48 (4.65–8.78)	27	5	3.74 (2.43–5.52)	17	3	2.74 (1.56–4.42)	757	151	31.23 (28.98–33.61)	158	32	6.29 (5.32–7.39)	599	120	24.94 (22.93–27.08)
Florida	31,799	6,360	25.00 (24.71–25.29)	8,810	1,762	7.07 (6.91–7.22)	22,989	4,598	17.93 (17.69–18.18)	1,588	318	6.87 (6.54–7.22)	875	175	3.80 (3.55–4.06)	713	143	3.07 (2.85–3.31)	30,211	6,042	32.29 (31.91–32.67)	7,925	1,587	8.38 (8.19–8.58)	22,276	4,455	23.91 (23.58–24.24)
Georgia	14,081	2,816	26.46 (26.01–26.91)	3,472	694	6.51 (6.29–6.73)	10,609	2,122	19.95 (19.57–20.34)	972	194	6.97 (6.54–7.42)	487	97	3.51 (3.21–3.84)	485	97	3.46 (3.16–3.78)	13,109	2,622	34.30 (33.70–34.90)	2,985	597	7.71 (7.43–8.00)	10,124	2,025	26.59 (26.06–27.12)
Hawaii	1,602	320	19.52 (18.53–20.54)	384	77	4.82 (4.33–5.35)	1,218	244	14.70 (13.85–15.58)	67	13	4.03 (3.12–5.12)	40	8	2.36 (1.68–3.21)	27	5	1.68 (1.10–2.44)	1,535	307	25.74 (24.42–27.12)	344	69	5.81 (5.19–6.48)	1,191	238	19.93 (18.77–21.15)
Idaho	2,190	438	24.16 (23.13–25.23)	730	146	8.04 (7.45–8.66)	1,460	292	16.13 (15.29–17.00)	129	26	5.33 (4.45–6.33)	76	15	3.15 (2.48–3.95)	53	11	2.18 (1.63–2.85)	2,061	412	31.74 (30.34–33.18)	654	131	10.00 (9.23–10.82)	1,407	281	21.74 (20.58–22.94)

Table 12 Continued

State	All Ages									0–19 Years									20+Years								
	All			Malignant			Non-Malignant			All			Malignant			Non-Malignant			All			Malignant			Non-Malignant		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Illinois	17,981	3,596	25.67 (25.29–26.06)	4,881	976	6.99 (6.79–7.19)	13,100	2,620	18.69 (18.36–19.02)	987	197	6.04 (5.67–6.43)	567	113	3.49 (3.21–3.79)	420	84	2.55 (2.31–2.81)	16,994	3,399	33.57 (33.05–34.09)	4,314	863	8.39 (8.14–8.66)	12,680	2,536	25.18 (24.73–25.63)
Indiana	7,722	1,544	21.30 (20.81–21.79)	2,551	510	7.06 (6.79–7.35)	5,171	1,034	14.24 (13.84–14.64)	503	101	5.71 (5.22–6.24)	297	59	3.39 (3.02–3.80)	206	41	2.32 (2.02–2.66)	7,219	1,444	27.57 (26.92–28.23)	2,254	451	8.54 (8.18–8.91)	4,965	993	19.03 (18.49–19.58)
Iowa	4,612	922	25.90 (25.13–26.69)	1,404	281	7.80 (7.39–8.24)	3,208	642	18.10 (17.46–18.77)	269	54	6.53 (5.77–7.35)	148	30	3.61 (3.05–4.24)	121	24	2.92 (2.42–3.49)	4,343	869	33.70 (32.67–34.76)	1,256	251	9.49 (8.95–10.05)	3,087	617	24.21 (23.33–25.12)
Kansas	3,608	722	22.84 (22.08–23.62)	1,071	214	6.76 (6.35–7.19)	2,537	507	16.09 (15.45–16.75)	223	45	5.60 (4.89–6.39)	131	26	3.29 (2.75–3.90)	92	18	2.32 (1.87–2.84)	3,385	677	29.78 (28.75–30.83)	940	188	8.15 (7.62–8.71)	2,445	489	21.63 (20.75–22.53)
Kentucky	7,041	1,408	28.66 (27.97–29.35)	1,965	393	7.98 (7.62–8.35)	5,076	1,015	20.68 (20.10–21.28)	465	93	8.25 (7.52–9.04)	246	49	4.37 (3.84–4.95)	219	44	3.89 (3.39–4.44)	6,576	1,315	36.86 (35.95–37.79)	1,719	344	9.43 (8.97–9.90)	4,857	971	27.44 (26.65–28.24)
Louisiana	6,381	1,276	25.28 (24.65–25.93)	1,612	322	6.38 (6.06–6.71)	4,769	954	18.90 (18.35–19.46)	387	77	6.34 (5.73–7.01)	218	44	3.54 (3.09–4.05)	169	34	2.80 (2.39–3.26)	5,994	1,199	32.90 (32.05–33.77)	1,394	279	7.52 (7.12–7.94)	4,600	920	25.38 (24.63–26.15)
Maine	1,572	314	19.17 (18.17–20.21)	689	138	8.46 (7.80–9.16)	883	177	10.72 (9.97–11.50)	85	17	5.91 (4.72–7.32)	64	13	4.49 (3.45–5.73)	21	4	1.42 (0.88–2.18)	1,487	297	24.51 (23.20–25.87)	625	125	10.05 (9.24–10.92)	862	172	14.45 (13.44–15.52)
Maryland	7,616	1,523	22.92 (22.39–23.45)	2,141	428	6.54 (6.26–6.83)	5,475	1,095	16.38 (15.94–16.83)	405	81	5.40 (4.89–5.96)	235	47	3.15 (2.76–3.58)	170	34	2.26 (1.93–2.62)	7,211	1,442	29.96 (29.25–30.68)	1,906	381	7.90 (7.54–8.27)	5,305	1,061	22.06 (21.45–22.68)
Massachusetts	7,976	1,595	20.55 (20.09–21.02)	2,937	587	7.62 (7.34–7.91)	5,039	1,008	12.93 (12.56–13.31)	457	91	5.71 (5.20–6.26)	281	56	3.56 (3.16–4.01)	176	35	2.15 (1.84–2.49)	7,519	1,504	26.52 (25.91–27.15)	2,656	531	9.25 (8.89–9.62)	4,863	973	17.27 (16.77–17.78)
Michigan	12,331	2,466	21.61 (21.22–22.01)	4,030	806	7.10 (6.88–7.33)	8,301	1,660	14.51 (14.18–14.84)	647	129	5.23 (4.83–5.65)	406	81	3.32 (3.01–3.66)	241	48	1.91 (1.68–2.17)	11,684	2,337	28.20 (27.67–28.74)	3,624	725	8.62 (8.33–8.92)	8,060	1,612	19.58 (19.13–20.03)
Minnesota	6,499	1,300	21.26 (20.73–21.80)	2,366	473	7.83 (7.51–8.16)	4,133	827	13.43 (13.01–13.86)	453	91	6.29 (5.73–6.90)	275	55	3.81 (3.37–4.29)	178	36	2.48 (2.13–2.88)	6,046	1,209	27.29 (26.58–28.00)	2,092	418	9.46 (9.04–9.88)	3,954	791	17.83 (17.26–18.41)
Mississippi	3,623	725	22.08 (21.34–22.83)	1,050	210	6.41 (6.02–6.82)	2,573	515	15.67 (15.05–16.30)	199	40	4.94 (4.28–5.68)	116	23	2.89 (2.39–3.47)	83	17	2.05 (1.63–2.54)	3,424	684	28.97 (27.98–29.98)	934	186	7.82 (7.32–8.36)	2,490	498	21.14 (20.30–22.02)
Missouri	8,263	1,653	23.96 (23.43–24.50)	2,534	507	7.37 (7.08–7.67)	5,729	1,146	16.59 (16.15–17.04)	478	96	6.19 (5.65–6.78)	308	62	4.00 (3.56–4.47)	170	34	2.20 (1.88–2.55)	7,785	1,557	31.11 (30.40–31.83)	2,226	445	8.73 (8.36–9.11)	5,559	1,112	22.38 (21.78–23.00)
Montana	1,547	309	25.39 (24.08–26.76)	487	97	7.84 (7.13–8.61)	1,060	212	17.55 (16.45–18.70)	65	13	5.13 (3.96–6.54)	35	7	2.76 (1.92–3.84)	30	6	2.37 (1.60–3.38)	1,482	296	33.54 (31.77–35.39)	452	90	9.89 (8.95–10.90)	1,030	206	23.65 (22.15–25.23)

Table 12 Continued

State	All Ages									0–19 Years									20+ Years								
	All			Malignant			Non-Malignant			All			Malignant			Non-Malignant			All			Malignant			Non-Malignant		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Nebraska	2,205	441	21.49 (20.57–22.43)	795	159	7.67 (7.13–8.24)	1,410	282	13.82 (13.08–14.58)	185	37	7.06 (6.07–8.15)	108	22	4.08 (3.35–4.93)	77	15	2.97 (2.34–3.71)	2,020	404	27.29 (26.08–28.55)	687	137	9.11 (8.42–9.84)	1,333	267	18.18 (17.19–19.22)
Nevada[b]	2,635	527	20.80 (20.00–21.64)	881	176	6.92 (6.46–7.41)	1,754	351	13.88 (13.22–14.56)	170	34	5.79 (4.95–6.73)	110	22	3.71 (3.05–4.47)	60	12	2.08 (1.59–2.68)	2,465	493	26.84 (25.77–27.95)	771	154	8.22 (7.63–8.84)	1,694	339	18.63 (17.73–19.56)
New Hampshire	1,843	369	23.06 (21.96–24.20)	630	126	7.95 (7.31–8.63)	1,213	243	15.11 (14.23–16.03)	105	21	6.93 (5.66–8.40)	68	14	4.57 (3.54–5.80)	37	7	2.37 (1.66–3.27)	1,738	348	29.55 (28.10–31.04)	562	112	9.31 (8.52–10.16)	1,176	235	20.23 (19.04–21.49)
New Jersey	13,522	2,704	27.04 (26.57–27.51)	3,738	748	7.51 (7.27–7.76)	9,784	1,957	19.53 (19.13–19.93)	764	153	6.98 (6.49–7.49)	405	81	3.72 (3.37–4.10)	359	72	3.26 (2.93–3.62)	12,758	2,552	35.11 (34.49–35.74)	3,333	667	9.04 (8.72–9.36)	9,425	1,885	26.07 (25.54–26.62)
New Mexico	2,033	407	17.31 (16.54–18.11)	692	138	5.82 (5.38–6.28)	1,341	268	11.49 (10.86–12.15)	116	23	4.24 (3.50–5.08)	64	13	2.34 (1.80–2.98)	52	10	1.90 (1.42–2.50)	1,917	383	22.57 (21.53–23.64)	628	125	7.22 (6.65–7.83)	1,289	258	15.35 (14.49–16.25)
New York	31,493	6,299	28.61 (28.29–28.94)	7,991	1,595	7.31 (7.14–7.47)	23,502	4,700	21.30 (21.02–21.59)	1,906	381	8.18 (7.81–8.55)	944	189	4.06 (3.81–4.33)	962	192	4.11 (3.86–4.38)	29,587	5,917	36.83 (36.40–37.26)	7,047	1,409	8.61 (8.40–8.82)	22,540	4,508	28.22 (27.84–28.60)
North Carolina	14,020	2,804	24.82 (24.40–25.25)	3,839	767	6.84 (6.62–7.06)	10,181	2,036	17.98 (17.62–18.34)	751	150	5.83 (5.42–6.26)	454	91	3.54 (3.22–3.88)	297	59	2.29 (2.04–2.56)	13,269	2,654	32.46 (31.89–33.03)	3,386	677	8.17 (7.89–8.45)	9,883	1,977	24.29 (23.80–24.79)
North Dakota	822	164	21.09 (19.62–22.64)	265	53	6.58 (5.79–7.45)	557	111	14.51 (13.28–15.82)	51	10	5.15 (3.82–6.78)	28	6	2.77 (1.84–4.02)	23	5	2.37 (1.50–3.57)	771	154	27.50 (25.52–29.60)	237	47	8.11 (7.08–9.26)	534	107	19.39 (17.71–21.18)
Ohio	13,777	2,755	20.89 (20.53–21.25)	4,984	995	7.55 (7.34–7.77)	8,793	1,759	13.33 (13.04–13.62)	1,000	200	6.81 (6.39–7.24)	604	121	4.13 (3.81–4.47)	396	79	2.68 (2.42–2.96)	12,777	2,555	26.55 (26.07–27.03)	4,380	876	8.93 (8.66–9.21)	8,397	1,679	17.62 (17.23–18.01)
Oklahoma	4,471	894	21.03 (20.40–21.67)	1,505	301	6.99 (6.63–7.36)	2,966	593	14.04 (13.53–14.57)	283	57	5.31 (4.71–5.97)	175	35	3.27 (2.81–3.80)	108	22	2.04 (1.67–2.46)	4,188	838	27.35 (26.50–28.21)	1,330	266	8.48 (8.02–8.96)	2,858	572	18.87 (18.17–19.59)
Oregon	4,781	956	20.57 (19.97–21.18)	1,748	349	7.50 (7.14–7.87)	3,033	607	13.07 (12.59–13.56)	305	61	6.32 (5.63–7.07)	182	36	3.78 (3.25–4.38)	123	25	2.54 (2.11–3.03)	4,476	895	26.30 (25.51–27.11)	1,566	313	8.99 (8.54–9.46)	2,910	582	17.31 (16.66–17.97)
Pennsylvania	20,070	4,014	26.51 (26.13–26.90)	5,787	1,156	7.71 (7.50–7.92)	14,283	2,857	18.80 (18.48–19.13)	986	197	6.46 (6.06–6.88)	601	120	4.00 (3.69–4.33)	385	77	2.46 (2.22–2.72)	19,084	3,817	34.58 (34.07–35.09)	5,186	1,0367	9.20 (8.94–9.47)	13,898	2,780	25.38 (24.94–25.82)
Rhode Island	1,171	234	19.05 (17.93–20.22)	467	93	7.58 (6.88–8.34)	704	141	11.46 (10.60–12.38)	61	12	5.07 (3.87–6.52)	37	7	3.18 (2.24–4.38)	24	5	1.89 (1.21–2.83)	1,110	222	24.67 (23.18–26.22)	430	86	9.35 (8.46–10.32)	680	136	15.31 (14.14–16.56)
South Carolina	6,486	1,297	22.69 (22.12–23.27)	1,944	390	6.82 (6.51–7.14)	4,538	908	15.87 (15.40–16.36)	345	69	5.59 (5.02–6.22)	201	40	3.27 (2.83–3.75)	144	29	2.33 (1.96–2.74)	6,141	1,228	29.57 (28.81–30.35)	1,747	349	8.25 (7.85–8.66)	4,394	879	21.32 (20.67–21.99)

Table 12 Continued

State	All Ages									0–19 Years									20+Years								
	All			Malignant			Non-Malignant			All			Malignant			Non-Malignant			All			Malignant			Non-Malignant		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	95% CI	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
South Dakota	1,065	213	22.32 (20.95–23.76)	322	64	6.68 (5.94–7.48)	743	149	15.65 (14.49–16.86)	48	10	4.08 (3.01–5.42)	--	--	--		--	--	1,017	203	29.66 (27.78–31.62)	289	58	8.24 (7.28–9.29)	728	146	21.42 (19.83–23.11)
Tennessee	9,282	1,856	24.95 (24.43–25.48)	2,613	523	7.04 (6.77–7.33)	6,669	1,334	17.91 (17.47–18.36)	507	101	6.08 (5.56–6.63)	299	60	3.59 (3.19–4.02)	208	42	2.49 (2.16–2.85)	8,775	1,755	32.55 (31.85–33.26)	2,314	463	8.43 (8.08–8.79)	6,461	1,292	24.12 (23.51–24.73)
Texas	35,477	7,095	25.86 (25.59–26.14)	9,461	1,892	6.80 (6.66–6.94)	26,012	5,202	19.06 (18.83–19.30)	2,645	529	6.56 (6.32–6.82)	1,438	288	3.55 (3.37–3.74)	1,207	241	3.02 (2.85–3.19)	32,832	6,566	33.63 (33.26–34.00)	8,023	1,605	8.10 (7.92–8.28)	24,809	4,962	25.52 (25.20–25.85)
Utah	5,612	1,122	41.62 (40.52–42.75)	1,044	209	7.41 (6.96–7.88)	4,568	914	34.21 (33.21–35.24)	312	62	6.26 (5.59–7.00)	160	32	3.17 (2.69–3.70)	152	30	3.10 (2.62–3.63)	5,300	1,060	55.84 (54.32–57.40)	884	177	9.12 (8.52–9.75)	4,416	883	46.72 (45.33–48.15)
Vermont	930	186	25.11 (23.43–26.89)	279	56	7.47 (6.57–8.46)	651	130	17.64 (16.23–19.15)	43	9	6.32 (4.57–8.53)	18	4	2.75 (1.62–4.35)	25	5	3.57 (2.31–5.29)	887	177	32.67 (30.43–35.03)	261	52	9.37 (8.21–10.65)	626	125	23.30 (21.41–25.32)
Virginia	9,078	1,816	19.61 (19.20–20.03)	3,049	610	6.61 (6.37–6.85)	6,029	1,206	13.01 (12.67–13.35)	547	109	5.21 (4.78–5.67)	354	71	3.39 (3.04–3.76)	193	39	1.83 (1.58–2.11)	8,531	1,706	25.40 (24.86–25.96)	2,695	539	7.90 (7.60–8.21)	5,836	1,167	17.51 (17.05–17.97)
Washington	12,844	2,569	32.41 (31.84–32.99)	3,116	623	7.89 (7.61–8.18)	9,728	1,946	24.52 (24.02–25.03)	710	142	7.89 (7.32–8.50)	402	80	4.43 (4.01–4.89)	308	62	3.46 (3.08–3.87)	12,134	2,427	42.27 (41.50–43.05)	2,714	543	9.28 (8.92–9.65)	9,420	1,884	32.99 (32.31–33.68)
West Virginia	2,676	535	24.32 (23.36–25.31)	820	164	7.49 (6.96–8.05)	1,856	371	16.84 (16.04–17.66)	141	28	6.73 (5.66–7.93)	81	16	3.89 (3.09–4.83)	60	12	2.84 (2.17–3.66)	2,535	507	31.40 (30.13–32.71)	739	148	8.94 (8.27–9.64)	1,796	359	22.47 (21.39–23.58)
Wisconsin	9,096	1,819	27.66 (27.08–28.26)	2,537	507	7.73 (7.42–8.04)	6,559	1,312	19.94 (19.44–20.44)	442	88	6.10 (5.55–6.70)	268	54	3.73 (3.30–4.21)	174	35	2.37 (2.03–2.75)	8,654	1,731	36.34 (35.55–37.14)	2,269	453	9.33 (8.94–9.74)	6,385	1,277	27.00 (26.32–27.70)
Wyoming	695	139	21.74 (20.09–23.48)	227	45	7.09 (6.17–8.12)	468	94	14.64 (13.30–16.09)	322	6	4.09 (2.78–5.80)	--	--	--	--	--	--	664	133	28.84 (26.60–31.21)	210	42	9.06 (7.83–10.42)	454	91	19.78 (17.93–21.77)
United States	**431,733**	**86,355**	**24.25 (24.17–24.32)**	**125,524**	**25,105**	**7.06 (7.02–7.10)**	**306,249**	**61,250**	**17.19 (17.12–17.25)**	**25,497**	**5,099**	**6.21 (6.14–6.29)**	**14,548**	**2,910**	**3.56 (3.50–3.61)**	**10,949**	**2,190**	**2.66 (2.61–2.71)**	**406,276**	**81,255**	**31.50 (31.40–31.60)**	**110,976**	**22,195**	**8.47 (8.42–8.52)**	**295, 300**	**59,060**	**23.03 (22.95–23.12)**

[a]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[b]2014–2017 only
- Counts are not presented when fewer than 16 cases were reported for the specific category, or where the inclusion of the count and rate would allow for back-calculation of suppressed values. The suppressed cases are included in the counts and rates for Totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval

Table 13 Distribution of Histologically-Confirmed Brain and Other Central Nervous System Tumors by WHO Grade Completeness, Treatment Information Completeness, and Histology, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	Number of Newly Diagnosed Tumors	Histologically Confirmed (%)[a]	WHO Grade Completeness (%)[b]			Assigned WHO Grade[c]				Radiation Information Completeness[d] (%)	Surgical Extent of Resection Information Completeness[e](%)
			Complete	Incomplete	Not Applicable	WHO Grade I	WHO Grade II	WHO Grade III	WHO Grade IV		
Diffuse Astrocytic and Oligodendroglial Tumors	**83,124**	**94.2%**	**90.6%**	**9.3%**	**0.1%**	**0.5%**	**11.2%**	**13.5%**	**74.9%**	**63.2%**	**99.6%**
Diffuse astrocytoma	7,729	92.2%	84.5%	15.4%	0.1%	3.0%	70.4%	16.4%	10.2%	47.7%	99.4%
Anaplastic astrocytoma	7,175	99.3%	94.7%	5.3%	0.1%	0.1%	2.0%	89.6%	8.3%	73.8%	99.6%
Glioblastoma	61,699	93.5%	90.6%	9.3%	0.1%	0.2%	0.2%	0.7%	98.9%	65.4%	99.7%
Oligodendroglioma	3,706	96.8%	92.6%	7.4%	0.0%	1.5%	89.3%	6.6%	2.6%	37.6%	99.5%
Anaplastic oligodendroglioma	1,839	99.1%	94.5%	5.5%	0.0%	0.0%	3.2%	89.5%	7.3%	69.3%	99.5%
Oligoastrocytic tumors	976	98.6%	93.3%	6.7%	0.0%	1.1%	47.1%	42.5%	9.2%	60.0%	99.8%
Other Astrocytic Tumors	**6,213**	**87.1%**	**86.6%**	**13.0%**	**0.4%**	**85.6%**	**10.6%**	**3.1%**	**0.7%**	**7.2%**	**99.6%**
Pilocytic astrocytoma	5,303	88.8%	87.3%	12.3%	0.4%	94.4%	4.5%	0.8%	0.3%	5.5%	99.6%
Unique astrocytoma variants	910	77.3%	82.0%	17.9%	0.1%	22.9%	53.9%	19.9%	3.3%	17.2%	99.4%
Malignant	*544*	*98.3%*	*85.1%*	*14.7%*	*0.2%*	*2.4%*	*68.2%*	*25.2%*	*4.2%*	*27.4%*	*99.3%*
Non-Malignant	*366*	*45.9%*	*72.0%*	*28.0%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*1.0%*	*100.0%*
Ependymal Tumors	**6,926**	**87.2%**	**87.0%**	**13.0%**	**0.1%**	**36.3%**	**47.9%**	**14.7%**	**1.0%**	**24.2%**	**99.8%**
Malignant	*3,967*	*93.5%*	*89.3%*	*10.6%*	*0.1%*	*2.6%*	*72.8%*	*23.2%*	*1.4%*	*36.0%*	*99.9%*
Non-Malignant	*2,959*	*78.9%*	*83.2%*	*16.7%*	*0.0%*	*93.9%*	*5.6%*	*0.3%*	*0.3%*	*7.9%*	*99.6%*
Other Gliomas	**8,575**	**39.3%**	**51.5%**	**47.4%**	**1.1%**	**12.6%**	**24.9%**	**21.1%**	**41.4%**	**27.2%**	**99.0%**
Glioma malignant, NOS	8,471	38.6%	51.3%	47.5%	1.2%	12.7%	23.9%	20.9%	42.5%	27.1%	99.0%
Other neuroepithelial tumors	104	95.2%	56.6%	43.4%	0.0%	10.7%	55.4%	25.0%	8.9%	36.3%	99.0%
Neuronal and Mixed Neuronal-Glial Tumors	5,150	92.2%	64.3%	20.1%	15.6%	81.4%	14.6%	3.1%	0.9%	14.2%	94.4%
Malignant	*978*	*98.4%*	*22.2%*	*6.7%*	*71.1%*	*28.6%*	*7.5%*	*51.6%*	*12.4%*	*56.5%*	*73.9%*
Non-Malignant	*4,172*	*90.8%*	*75.7%*	*23.8%*	*0.5%*	*84.4%*	*15.0%*	*0.3%*	*0.2%*	*4.3%*	*99.7%*
Choroid Plexus Tumors	**847**	**87.5%**	**76.8%**	**23.1%**	**0.1%**	**64.2%**	**19.2%**	**15.7%**	**0.9%**	**4.5%**	**99.7%**
Malignant	*131*	*97.7%*	*80.5%*	*18.8%*	*0.8%*	*6.7%*	*1.9%*	*86.5%*	*4.8%*	*13.9%*	*100.0%*
Non-Malignant	*716*	*85.6%*	*76.0%*	*24.0%*	*0.0%*	*76.9%*	*23.1%*	*0.0%*	*0.0%*	*2.7%*	*99.7%*
Tumors of the Pineal Region	**743**	**79.1%**	**42.2%**	**0.0%**	**57.8%**	**--**	--	--	--	**39.1%**	**76.2%**
Malignant	*422*	*98.1%*	*43.4%*	*0.0%*	*56.6%*	**--**	--	--	--	*63.2%*	*76.6%*
Non-Malignant	*321*	*54.2%*	*39.2%*	*0.0%*	*60.8%*	**--**	--	--	--	*7.7%*	*75.3%*
Embryonal Tumors	**3,252**	**98.2%**	**81.1%**	**18.2%**	**0.7%**	**0.4%**	**0.2%**	**1.4%**	**98.0%**	**61.4%**	**99.5%**

Table 13 Continued

Histology	Number of Newly Diagnosed Tumors	Histologically Confirmed (%)[a]	WHO Grade Completeness (%)[b]			Assigned WHO Grade[c]				Radiation Information Completeness[d] (%)	Surgical Extent of Resection Information Completeness[e](%)
			Complete	Incomplete	Not Applicable	WHO Grade I	WHO Grade II	WHO Grade III	WHO Grade IV		
Tumors of Cranial and Paraspinal Nerves	**36,684**	**49.0%**	**39.3%**	**60.7%**	**0.0%**	**99.3%**	**0.4%**	**0.1%**	**0.1%**	**15.9%**	**99.4%**
Nerve sheath tumors	36,647	49.0%	39.3%	60.7%	0.0%	99.3%	0.4%	0.1%	0.1%	15.9%	99.4%
Malignant	*208*	*81.3%*	*22.5%*	*77.5%*	*0.0%*	*57.9%*	*15.8%*	*18.4%*	*7.9%*	*33.3%*	*99.4%*
Non-Malignant	*36,439*	*48.8%*	*39.5%*	*60.5%*	*0.0%*	*99.6%*	*0.3%*	*0.0%*	*0.1%*	*15.9%*	*99.4%*
Other tumors of cranial and paraspinal nerves	37	40.5%	33.3%	66.7%	0.0%	100.0%	0.0%	0.0%	0.0%	2.9%	100.0%
Tumors of Meninges	**174,568**	**38.7%**	**79.4%**	**20.5%**	**0.1%**	**79.8%**	**18.0%**	**2.0%**	**0.1%**	**6.6%**	**99.6%**
Meningiomas	168,432	37.5%	81.3%	18.7%	0.0%	80.0%	18.3%	1.6%	0.1%	6.4%	99.6%
Malignant	*1,699*	*78.8%*	*86.2%*	*13.8%*	*0.0%*	*19.1%*	*17.3%*	*62.4%*	*1.2%*	*36.6%*	*98.4%*
Non-Malignant	*166,733*	*37.1%*	*81.2%*	*18.8%*	*0.0%*	*81.4%*	*18.3%*	*0.2%*	*0.1%*	*6.1%*	*99.6%*
Mesenchymal tumors	6,003	73.3%	54.2%	45.0%	0.8%	75.4%	11.5%	12.0%	1.1%	11.9%	99.5%
Malignant	*769*	*96.0%*	*41.8%*	*54.1%*	*4.1%*	*11.6%*	*16.4%*	*65.6%*	*6.4%*	*48.0%*	*98.8%*
Non-Malignant	*5,234*	*69.9%*	*56.7%*	*43.1%*	*0.2%*	*85.0%*	*10.8%*	*4.0%*	*0.3%*	*6.4%*	*99.7%*
Primary melanocytic lesions	133	87.2%	11.2%	82.8%	6.0%	61.5%	23.1%	0.0%	15.4%	40.0%	98.3%
Lymphomas and Hematopoietic Neoplasms	**8,558**	**94.9%**	**2.2%**	**96.8%**	**1.0%**	**92.0%**	**1.1%**	**2.9%**	**4.0%**	**18.9%**	**99.0%**
Lymphoma	8,478	94.9%	2.1%	97.1%	0.7%	91.9%	1.2%	2.9%	4.0%	18.6%	99.1%
Other hematopoietic neoplasms	80	92.5%	2.7%	68.9%	28.4%	100.0%	0.0%	0.0%	0.0%	49.2%	89.2%
Germ Cell Tumors	**1,252**	**85.4%**	**7.6%**	**43.1%**	**49.3%**	**14.6%**	**6.3%**	**6.3%**	**72.9%**	**57.7%**	**90.3%**
Malignant	*1,085*	*87.6%*	*7.9%*	*40.3%*	*51.8%*	*4.7%*	*7.0%*	*7.0%*	*81.4%*	*65.2%*	*90.0%*
Non-Malignant	*167*	*70.7%*	*5.0%*	*66.4%*	*28.6%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*7.7%*	*92.4%*
Tumors of Sellar Region	**77,084**	**45.5%**	**10.3%**	**0.4%**	**89.3%**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**2.8%**	**75.7%**
Tumors of the pituitary	73,945	43.8%	7.6%	0.0%	92.4%	100.0%	0.0%	0.0%	0.0%	2.0%	75.2%
Malignant	*125*	*64.0%*	*8.0%*	*0.0%*	*92.0%*	--	--	--	--	*18.6%*	*68.8%*
Non-Malignant	*73,820*	*43.8%*	*7.6%*	*0.0%*	*92.4%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*2.0%*	*75.2%*
Craniopharyngioma	3,139	83.8%	35.6%	4.3%	60.0%	100.0%	0.0%	0.0%	0.0%	21.3%	81.2%
Unclassified Tumors	**18,797**	**17.1%**	**5.9%**	**85.7%**	**8.4%**	**63.4%**	**7.4%**	**6.9%**	**22.3%**	**3.7%**	**94.6%**
Hemangioma	4,141	29.7%	3.1%	96.7%	0.2%	92.1%	7.9%	0.0%	0.0%	1.7%	99.1%
Neoplasm, unspecified	14,093	11.9%	7.4%	77.3%	15.3%	59.1%	9.1%	10.0%	21.8%	4.5%	90.6%
Malignant	*6,692*	*8.1%*	*8.5%*	*86.3%*	*5.2%*	*15.6%*	*15.6%*	*22.2%*	*46.7%*	*8.3%*	*87.6%*

Table 13 Continued

Histology	Number of Newly Diagnosed Tumors	Histologically Confirmed (%)[a]	WHO Grade Completeness (%)[b]			Assigned WHO Grade[c]				Radiation Information Completeness[d] (%)	Surgical Extent of Resection Information Completeness[e] (%)
			Complete	Incomplete	Not Applicable	WHO Grade I	WHO Grade II	WHO Grade III	WHO Grade IV		
Non-Malignant	*7,401*	*15.5%*	*6.8%*	*73.1%*	*20.0%*	*89.2%*	*4.6%*	*1.5%*	*4.6%*	*2.6%*	*92.1%*
All other	563	52.8%	9.7%	87.6%	2.7%	40.7%	0.0%	3.7%	55.6%	5.7%	98.7%
Malignant	*83*	*97.6%*	*28.9%*	*66.3%*	*4.8%*	*27.3%*	*0.0%*	*4.5%*	*68.2%*	*33.8%*	*98.8%*
Non-Malignant	*480*	*45.0%*	*2.3%*	*95.8%*	*1.9%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.3%*	*98.6%*
TOTAL	**431,773**	**54.5%**	**64.5%**	**20.1%**	**15.5%**	**39.7%**	**14.4%**	**8.1%**	**37.7%**	**19.5%**	**95.7%**
Malignant	***125,524***	***85.6%***	***79.4%***	***18.7%***	***1.9%***	***5.9%***	***13.5%***	***14.1%***	***66.5%***	***52.0%***	***99.0%***
Non-Malignant	***306,249***	***41.8%***	***52.2%***	***21.2%***	***26.6%***	***84.0%***	***15.6%***	***0.3%***	***0.1%***	***6.3%***	***92.9%***

[a]Histologic confirmation includes tumors classified as diagnosis confirmed by positive histology, positive cytology, positive histology plus – positive immunophenotyping and/or positive genetic studies, or positive microscopic confirmation, method not specified.
[b]Completeness is defined as having an assigned code that corresponds with a WHO grade as defined by the American Joint Commission on Cancer's Collaborative Staging schema, SSDI Clinical Grade (2018+ only) or SSDI Pathological Grade (2018+ only).
[c]Grade as recorded in the American Joint Commission on Cancer's Collaborative Staging schema, SSDI Clinical Grade (2018+ only) or SSDI Pathological Grade (2018+ only).
[d]Radiation is defined using a recoded variable based on NAACCR Item #1360 (http://datadictionary.naaccr.org/default.aspx?c=10#136). Completeness is defined as having a value other than 'none' or 'unknown.'
[e]Surgery is defined using a recoded variable based on NAACCR Item #1290.
(http://datadictionary.naaccr.org/default.aspx?c=10#1290). Please see the SEER site-specific surgery codes for more information on coding for this variable. (https://seer.cancer.gov/archive/tools/SEER2003.surg.prim.site.codes.pdf). Completeness is defined as having a value other than 'unknown.'
- Percentages are not presented when category is not applicable.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; CNS, central nervous system; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; WHO, World Health Organization

Table 14 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors by Histology, and Race[c], CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	White			Black			American Indian/Alaska Native			Asian or Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**74,287**	**14,857**	**4.93 (4.90–4.97)**	**5,277**	**1,055**	**2.45 (2.38–2.52)**	**411**	**82**	**2.08 (1.87–2.30)**	**2,232**	**446**	**2.22 (2.12–2.31)**
Diffuse astrocytoma	6,635	1,327	0.50 (0.49–0.52)	619	124	0.28 (0.26–0.30)	53	11	0.24 (0.18–0.31)	308	62	0.30 (0.27–0.34)
Anaplastic astrocytoma	6,358	1,272	0.46 (0.45–0.48)	470	94	0.21 (0.20–0.24)	36	7	0.16 (0.11–0.22)	226	45	0.22 (0.19–0.25)
Glioblastoma	55,570	11,114	3.52 (3.49–3.55)	3,807	761	1.78 (1.72–1.84)	266	53	1.43 (1.25–1.62)	1,448	290	1.46 (1.38–1.53)
Oligodendroglioma	3,249	650	0.26 (0.25–0.27)	229	46	0.11 (0.09–0.12)	40	8	0.18 (0.13–0.25)	119	24	0.11 (0.09–0.13)
Anaplastic oligodendroglioma	1,602	320	0.12 (0.12–0.13)	101	20	0.05 (0.04–0.06)	--	--	--	94	19	0.09 (0.07–0.11)
Oligoastrocytic tumors	873	175	0.07 (0.06–0.07)	51	10	0.02 (0.02–0.03)	--	--	--	37	7	0.03 (0.02–0.05)
Other Astrocytic Tumors	**4,987**	**997**	**0.44 (0.43–0.46)**	**751**	**150**	**0.32 (0.30–0.34)**	**56**	**11**	**0.21 (0.16–0.28)**	**290**	**58**	**0.31 (0.27–0.35)**
Pilocytic astrocytoma	4,275	855	0.38 (0.37–0.39)	636	127	0.27 (0.25–0.29)	--	--	--	233	47	0.25 (0.22–0.28)
Unique astrocytoma variants	712	142	0.06 (0.06–0.07)	115	23	0.05 (0.04–0.06)	--	--	--	57	11	0.06 (0.04–0.08)
Malignant	*445*	*89*	*0.04 (0.03–0.04)*	*50*	*10*	*0.02 (0.02–0.03)*	--	--	--	*34*	*7*	*0.03 (0.02–0.05)*
Non-Malignant	*267*	*53*	*0.02 (0.02–0.03)*	*65*	*13*	*0.03 (0.02–0.04)*	--	--	--	*23*	*5*	*0.03 (0.02–0.04)*
Ependymal Tumors	**5,892**	**1,178**	**0.46 (0.44–0.47)**	**593**	**119**	**0.26 (0.24–0.29)**	**50**	**10**	**0.22 (0.16–0.29)**	**265**	**53**	**0.26 (0.23–0.29)**
Malignant	*3,303*	*661*	*0.26 (0.25–0.27)*	*389*	*78*	*0.17 (0.15–0.19)*	*21*	*4*	*0.09 (0.05–0.14)*	*173*	*35*	*0.17 (0.15–0.20)*
Non-Malignant	*2,589*	*518*	*0.20 (0.19–0.20)*	*204*	*41*	*0.09 (0.08–0.11)*	*29*	*6*	*0.13 (0.09–0.19)*	*92*	*18*	*0.09 (0.07–0.11)*
Other Gliomas	**7,054**	**1,411**	**0.55 (0.54–0.57)**	**942**	**188**	**0.42 (0.40–0.45)**	**58**	**12**	**0.26 (0.19–0.33)**	**368**	**74**	**0.38 (0.34–0.43)**
Glioma malignant, NOS	6,974	1,395	0.55 (0.53–0.56)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	80	16	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--

Table 14 Continued

Histology	White			Black			American Indian/Alaska Native			Asian or Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Neuronal and Mixed Neuronal-Glial Tumors	***4,200***	***840***	***0.35 (0.34–0.36)***	***547***	***109***	***0.24 (0.22–0.26)***	***41***	***8***	***0.17 (0.12–0.23)***	***268***	***54***	***0.27 (0.24–0.30)***
Malignant	*829*	*166*	*0.06 (0.06–0.07)*	*72*	*14*	*0.03 (0.03–0.04)*	--	--	--	*53*	*11*	*0.05 (0.04–0.07)*
Non-Malignant	*3,371*	*674*	*0.29 (0.28–0.30)*	*475*	*95*	*0.20 (0.19–0.22)*	--	--	--	*215*	*43*	*0.21 (0.19–0.25)*
Choroid Plexus Tumors	**697**	**139**	**0.06 (0.05–0.06)**	**85**	**17**	**0.04 (0.03–0.04)**	**--**	**--**	**--**	**35**	**7**	**0.04 (0.03–0.05)**
Malignant	*99*	*20*	*0.01 (0.01-0.01)*	*19*	*4*	*0.01 (0.00–0.01)*	--	--	--	--	--	--
Non-Malignant	*598*	*120*	*0.05 (0.05-0.05)*	*66*	*13*	*0.03 (0.02–0.04)*	--	--	--	--	--	--
Tumors of the Pineal Region	**576**	**115**	**0.05 (0.04–0.05)**	**113**	**23**	**0.05 (0.04–0.06)**	**--**	**--**	**--**	**34**	**7**	**0.03 (0.02–0.05)**
Malignant	*305*	*61*	*0.02 (0.02–0.03)*	*82*	*16*	*0.03 (0.03–0.04)*	--	--	--	--	--	--
Non-Malignant	*271*	*54*	*0.02 (0.02-0.02)*	*31*	*6*	*0.01 (0.01–0.02)*	--	--	--	--	--	--
Embryonal Tumors	**2,568**	**514**	**0.23 (0.22–0.24)**	**377**	**75**	**0.16 (0.14–0.17)**	**39**	**8**	**0.15 (0.11–0.21)**	**194**	**39**	**0.21 (0.18–0.24)**
Tumors of Cranial and Paraspinal Nerves	**31,140**	**6,228**	**2.16 (2.13–2.18)**	**2,280**	**456**	**1.05 (1.00–1.09)**	**237**	**47**	**1.13 (0.98–1.29)**	**2,181**	**436**	**2.09 (2.00–2.18)**
Nerve sheath tumors	31,108	6,222	2.16 (2.13–2.18)	--	--	--	--	--	--	--	--	--
Malignant	*169*	*34*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*30,939*	*6,188*	*2.14 (2.12–2.17)*	--	--	--	--	--	--	--	--	--
Other tumors of cranial and paraspinal nerves	32	6	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**141,220**	**28,244**	**9.27 (9.22–9.32)**	**22,197**	**4,439**	**11.00 (10.85–11.15)**	**1,067**	**213**	**6.01 (5.64–6.41)**	**7,867**	**1,573**	**8.16 (7.98–8.35)**
Meningiomas	136,178	27,236	8.90 (8.85–8.95)	21,542	4,308	10.70 (10.56–10.85)	1,023	205	5.81 (5.44–6.20)	7,570	1,514	7.87 (7.69–8.05)
Malignant	*1,326*	*265*	*0.09 (0.08–0.09)*	*247*	*49*	*0.12 (0.11–0.14)*	--	--	--	*90*	*18*	*0.09 (0.08–0.12)*
Non-Malignant	*134,852*	*26,970*	*8.81 (8.77–8.86)*	*21,295*	*4,259*	*10.58 (10.43–10.73)*	--	--	--	*7,480*	*1,496*	*7.78 (7.60–7.96)*
Mesenchymal tumors	4,927	985	0.37 (0.35–0.38)	--	--	--	--	--	--	--	--	--
Malignant	*625*	*125*	*0.05 (0.04–0.05)*	--	--	--	--	--	--	--	--	--

Table 14 Continued

Histology	White			Black			American Indian/Alaska Native			Asian or Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Non-Malignant	*4,302*	*860*	*0.32 (0.31–0.33)*	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	115	23	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Malignant	*77*	*15*	*0.01 (0.00–0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*38*	*8*	*0.00 (0.00-0.00)*	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**7,172**	**1,434**	**0.46 (0.45–0.47)**	**701**	**140**	**0.33 (0.31–0.36)**	**53**	**11**	**0.29 (0.21–0.38)**	**505**	**101**	**0.52 (0.47–0.56)**
Lymphoma	7,112	1,422	0.46 (0.44–0.47)	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	60	12	0.00 (0.00–0.01)	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**958**	**192**	**0.08 (0.08–0.09)**	**133**	**27**	**0.06 (0.05–0.07)**	**--**	**--**	**--**	**123**	**25**	**0.13 (0.11–0.15)**
Malignant	*831*	*166*	*0.07 (0.07–0.08)*	*113*	*23*	*0.05 (0.04–0.06)*	--	--	--	--	--	--
Non-Malignant	*127*	*25*	*0.01 (0.01-0.01)*	*20*	*4*	*0.01 (0.01-0.01)*	--	--	--	--	--	--
Tumors of Sellar Region	**55,182**	**11,036**	**4.11 (4.08–4.15)**	**15,328**	**3,066**	**7.19 (7.08–7.31)**	**669**	**134**	**3.20 (2.96–3.47)**	**4,262**	**852**	**4.10 (3.97–4.22)**
Tumors of the pituitary	52,913	10,583	3.94 (3.90–3.97)	14,701	2,940	6.91 (6.80–7.03)	644	129	3.09 (2.84–3.35)	4,099	820	3.93 (3.81–4.06)
Malignant	*88*	*18*	*0.01 (0.01-0.01)*	*28*	*6*	*0.01 (0.01–0.02)*	--	--	--	--	--	--
Non-Malignant	*52,825*	*10,565*	*3.93 (3.90–3.97)*	*14,673*	*2,935*	*6.90 (6.79–7.02)*	--	--	--	--	--	--
Craniopharyngioma	2,269	454	0.18 (0.17–0.18)	627	125	0.28 (0.26–0.30)	25	5	0.12 (0.07–0.17)	163	33	0.16 (0.14–0.19)
Unclassified Tumors	**15,553**	**3,111**	**1.08 (1.06–1.09)**	**2,042**	**408**	**1.01 (0.97–1.06)**	**140**	**28**	**0.78 (0.65–0.93)**	**770**	**154**	**0.82 (0.76–0.88)**
Hemangioma	3,391	678	0.26 (0.25–0.27)	434	87	0.20 (0.18–0.22)	--	--	--	220	44	
Neoplasm, unspecified	11,721	2,344	0.78 (0.77–0.80)	1,534	307	0.78 (0.74–0.82)	101	20	0.60 (0.48–0.74)	523	105	0.57 (0.52–0.62)
Malignant	*5,757*	*1,151*	*0.37 (0.36–0.38)*	*571*	*114*	*0.30 (0.28–0.33)*	*49*	*10*	*0.30 (0.21–0.40)*	*225*	*45*	*0.26 (0.22–0.29)*
Non-Malignant	*5,964*	*1,193*	*0.42 (0.41–0.43)*	*963*	*193*	*0.48 (0.45–0.51)*	*52*	*10*	*0.30 (0.22–0.40)*	*298*	*60*	*0.31 (0.28–0.35)*
All other	441	88	0.04 (0.03–0.04)	74	15	0.03 (0.03–0.04)	--	--	--	27	5	0.03 (0.02–0.04)
Malignant	*61*	*12*	*0.01 (0.00–0.01)*	--	--	--	--	--	--	--	--	--

Table 14 Continued

Histology	White			Black			American Indian/Alaska Native			Asian or Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Non-Malignant	*380*	*76*	*0.03 (0.03-0.03)*	--	--	--	--	--	--	--	--	--
TOTAL[d]	**351,486**	**70,297**	**24.24 (24.16–24.32)**	**51,366**	**10,273**	**24.58 (24.36–24.80)**	**2,848**	**570**	**14.62 (14.06–15.20)**	**19,394**	**3,879**	**19.52 (19.24–19.80)**
Malignant	***109,206***	***21,841***	***7.55 (7.51–7.60)***	***9,622***	***1,924***	***4.44 (4.35–4.53)***	***720***	***144***	***3.54 (3.27–3.82)***	***4,314***	***863***	***4.40 (4.27–4.53)***
Non-Malignant	***242,280***	***48,456***	***16.69 (16.62–16.76)***	***41,744***	***8,349***	***20.14 (19.94–20.34)***	***2,128***	***426***	***11.08 (10.59–11.59)***	***15,080***	***3,016***	***15.12 (14.88–15.37)***

[a]Annual average cases are calculated by dividing the five- year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Individuals with unknown race were excluded (N = 6,679).
[d]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 15 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for All Brain and Other Central Nervous System Tumors by Histology, Hispanic Ethnicity[c], and Race, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**75,728**	**15,146**	**4.69 (4.66–4.73)**	**7,396**	**1,479**	**3.43 (3.35–3.51)**	**6,803**	**1,361**	**3.47 (3.38–3.56)**	**190**	**38**	**1.93 (1.64–2.25)**
Diffuse astrocytoma	6,864	1,373	0.49 (0.48–0.51)	865	173	0.34 (0.31–0.36)	777	155	0.34 (0.31–0.36)	23	5	0.15 (0.09–0.24)
Anaplastic astrocytoma	6,490	1,298	0.45 (0.43–0.46)	685	137	0.28 (0.26–0.30)	622	124	0.28 (0.26–0.30)	23	5	0.19 (0.12–0.30)
Glioblastoma	56,647	11,329	3.33 (3.30–3.36)	5,052	1,010	2.51 (2.44–2.58)	4,669	934	2.54 (2.47–2.62)	135	27	1.51 (1.25–1.81)
Oligodendroglioma	3,251	650	0.25 (0.24–0.26)	455	91	0.17 (0.15–0.19)	420	84	0.17 (0.16–0.19)	--	--	--
Anaplastic oligodendroglioma	1,604	321	0.11 (0.11–0.12)	235	47	0.09 (0.08–0.11)	218	44	0.10 (0.08–0.11)	--	--	--
Oligoastrocytic tumors	872	174	0.06 (0.06–0.07)	104	21	0.04 (0.03–0.05)	97	19	0.04 (0.03–0.05)	--	--	--
Other Astrocytic Tumors	**5,194**	**1,039**	**0.46 (0.44–0.47)**	**1,019**	**204**	**0.30 (0.28–0.32)**	**905**	**181**	**0.30 (0.28–0.32)**	**28**	**6**	**0.15 (0.10–0.23)**
Pilocytic astrocytoma	4,455	891	0.39 (0.38–0.40)	848	170	0.25 (0.23–0.27)	750	150	0.25 (0.23–0.27)	--	--	--
Unique astrocytoma variants	739	148	0.06 (0.06–0.07)	171	34	0.06 (0.05–0.06)	155	31	0.06 (0.05–0.07)	--	--	--
Malignant	*447*	*89*	*0.04 (0.03–0.04)*	*97*	*19*	*0.03 (0.03–0.04)*	*90*	*18*	*0.03 (0.03–0.04)*	--	--	--
Non-Malignant	*292*	*58*	*0.03 (0.02–0.03)*	*74*	*15*	*0.02 (0.02–0.03)*	*65*	*13*	*0.02 (0.02–0.03)*	--	--	--
Ependymal Tumors	**5,921**	**1,184**	**0.43 (0.42–0.45)**	**1,005**	**201**	**0.37 (0.35–0.39)**	**904**	**181**	**0.37 (0.34–0.39)**	**21**	**4**	**0.15 (0.09–0.24)**
Malignant	*3,324*	*665*	*0.25 (0.24–0.26)*	*643*	*129*	*0.23 (0.21–0.25)*	*589*	*118*	*0.23 (0.21–0.25)*	--	--	--
Non-Malignant	*2,597*	*519*	*0.18 (0.18–0.19)*	*362*	*72*	*0.14 (0.12–0.16)*	*315*	*63*	*0.13 (0.12–0.15)*	--	--	--
Other Gliomas	**7,441**	**1,488**	**0.56 (0.55–0.58)**	**1,134**	**227**	**0.41 (0.39–0.44)**	**1,006**	**201**	**0.41 (0.38–0.44)**	**40**	**8**	**0.34 (0.23–0.49)**
Glioma malignant, NOS	7,357	1,471	0.56 (0.54–0.57)	1,114	223	0.41 (0.38–0.43)	989	198	0.40 (0.38–0.43)	40	8	0.34 (0.23–0.49)
Other neuroepithelial tumors	84	17	0.01 (0.01-0.01)	20	4	0.01 (0.00–0.01)	17	3	0.01 (0.00–0.01)	--	--	--

Table 15 Continued

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Neuronal and Mixed Neuronal-Glial Tumors	**4,425**	**885**	**0.35 (0.34–0.36)**	**725**	**145**	**0.24 (0.22–0.25)**	**644**	**129**	**0.23 (0.22–0.25)**	**23**	**5**	**0.12 (0.08–0.19)**
Malignant	*852*	*170*	*0.06 (0.05–0.06)*	*126*	*25*	*0.05 (0.04–0.06)*	*113*	*23*	*0.05 (0.04–0.06)*	--	--	--
Non-Malignant	*3,573*	*715*	*0.29 (0.28–0.30)*	*599*	*120*	*0.19 (0.17–0.20)*	*531*	*106*	*0.19 (0.17–0.20)*	--	--	--
Choroid Plexus Tumors	**692**	**138**	**0.06 (0.05–0.06)**	**155**	**31**	**0.05 (0.04–0.06)**	**143**	**29**	**0.05 (0.04–0.06)**	**--**	**--**	**--**
Malignant	*106*	*21*	*0.01 (0.01-0.01)*	*25*	*5*	*0.01 (0.00–0.01)*	*24*	*5*	*0.01 (0.01-0.01)*	--	--	--
Non-Malignant	*586*	*117*	*0.05 (0.04–0.05)*	*130*	*26*	*0.04 (0.04–0.05)*	*119*	*24*	*0.04 (0.04–0.05)*	--	--	--
Tumors of the Pineal Region	**642**	**128**	**0.05 (0.05-0.05)**	**101**	**20**	**0.03 (0.03–0.04)**	**93**	**19**	**0.04 (0.03–0.04)**	**--**	**--**	**--**
Malignant	*353*	*71*	*0.03 (0.03-0.03)*	*69*	*14*	*0.02 (0.02–0.03)*	*64*	*13*	*0.02 (0.02–0.03)*	--	--	--
Non-Malignant	*289*	*58*	*0.02 (0.02-0.02)*	*32*	*6*	*0.01 (0.01–0.02)*	*29*	*6*	*0.01 (0.01–0.02)*	--	--	--
Embryonal Tumors	**2,546**	**509**	**0.23 (0.22–0.24)**	**706**	**141**	**0.21 (0.19–0.22)**	**638**	**128**	**0.21 (0.19–0.23)**	**20**	**4**	**0.09 (0.06–0.15)**
Tumors of Cranial and Paraspinal Nerves	**33,334**	**6,667**	**2.16 (2.14–2.18)**	**3,350**	**670**	**1.42 (1.37–1.48)**	**3,014**	**603**	**1.42 (1.36–1.47)**	**80**	**16**	**0.71 (0.55–0.90)**
Nerve sheath tumors	33,304	6,661	2.16 (2.13–2.18)	--	--	--	--	--	--	80	16	0.71 (0.55–0.90)
Malignant	*169*	*34*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*33,135*	*6,627*	*2.15 (2.12–2.17)*	--	--	--	--	--	--	*80*	*16*	*0.71 (0.55–0.90)*
Other tumors of cranial and paraspinal nerves	30	6	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**157,188**	**31,438**	**9.62 (9.57–9.66)**	**17,380**	**3,476**	**8.86 (8.72–8.99)**	**15,801**	**3,160**	**8.82 (8.67–8.96)**	**475**	**95**	**5.50 (4.98–6.06)**
Meningiomas	151,893	30,379	9.25 (9.20–9.29)	16,539	3,308	8.53 (8.39–8.66)	15,038	3,008	8.48 (8.34–8.63)	463	93	5.41 (4.89–5.96)
Malignant	*1,488*	*298*	*0.09 (0.09-0.09)*	*211*	*42*	*0.11 (0.09–0.12)*	*198*	*40*	*0.11 (0.09–0.13)*	--	--	--
Non-Malignant	*150,405*	*30,081*	*9.16 (9.11–9.20)*	*16,328*	*3,266*	*8.42 (8.28–8.55)*	*14,840*	*2,968*	*8.37 (8.23–8.52)*	*457*	*91*	*5.33 (4.82–5.88)*
Mesenchymal tumors	5,175	1,035	0.36 (0.35–0.37)	--	--	--	--	--	--	--	--	--
Malignant	*657*	*131*	*0.05 (0.04–0.05)*	--	--	--	--	--	--	--	--	--

Table 15 Continued

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Non-Malignant	*4,518*	*904*	*0.32 (0.31–0.33)*	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	120	24	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Malignant	*81*	*16*	*0.01 (0.00–0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*39*	*8*	*0.00 (0.00-0.00)*	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**7,518**	**1,504**	**0.45 (0.44–0.46)**	**1,040**	**208**	**0.52 (0.49–0.56)**	**974**	**195**	**0.54 (0.50–0.58)**	**19**	**4**	**0.19 (0.11–0.30)**
Lymphoma	7,449	1,490	0.45 (0.44–0.46)	--	--	--	--	--	--	19	4	0.19 (0.11–0.30)
Other hematopoietic neoplasms	69	14	0.00 (0.00–0.01)	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**960**	**192**	**0.08 (0.08–0.09)**	**292**	**58**	**0.09 (0.08–0.10)**	**262**	**52**	**0.09 (0.08–0.10)**	**--**	**--**	**--**
Malignant	*826*	*165*	*0.07 (0.07–0.08)*	*259*	*52*	*0.08 (0.07–0.09)*	*232*	*46*	*0.08 (0.07–0.09)*	--	--	--
Non-Malignant	*134*	*27*	*0.01 (0.01-0.01)*	*33*	*7*	*0.01 (0.01–0.02)*	*30*	*6*	*0.01 (0.01–0.02)*	--	--	--
Tumors of Sellar Region	**64,407**	**12,881**	**4.47 (4.44–4.51)**	**12,677**	**2,535**	**5.10 (5.01–5.20)**	**11,317**	**2,263**	**5.05 (4.96–5.15)**	**406**	**81**	**3.37 (3.02–3.74)**
Tumors of the pituitary	61,761	12,352	4.28 (4.24–4.31)	12,184	2,437	4.93 (4.83–5.02)	10,873	2,175	4.87 (4.78–4.97)	388	78	3.26 (2.91–3.63)
Malignant	*102*	*20*	*0.01 (0.01-0.01)*	*23*	*5*	*0.01 (0.01–0.02)*	*19*	*4*	*0.01 (0.01–0.02)*	--	--	--
Non-Malignant	*61,659*	*12,332*	*4.27 (4.24–4.31)*	*12,161*	*2,432*	*4.91 (4.82–5.01)*	*10,854*	*2,171*	*4.86 (4.77–4.96)*	*388*	*78*	*3.26 (2.91–3.63)*
Craniopharyngioma	2,646	529	0.20 (0.19–0.20)	493	99	0.18 (0.16–0.20)	444	89	0.18 (0.16–0.20)	18	4	0.11 (0.06–0.18)
Unclassified Tumors	**16,472**	**3,294**	**1.07 (1.05–1.09)**	**2,325**	**465**	**1.08 (1.03–1.13)**	**2,109**	**422**	**1.08 (1.03–1.13)**	**61**	**12**	**0.60 (0.44–0.79)**
Hemangioma	3,483	697	0.25 (0.24–0.26)	658	132	0.26 (0.24–0.28)	604	121	0.26 (0.24–0.28)	--	--	--
Neoplasm, unspecified	12,533	2,507	0.79 (0.77–0.80)	1,560	312	0.78 (0.74–0.83)	1,409	282	0.78 (0.74–0.83)	38	8	0.44 (0.29–0.61)
Malignant	*6,085*	*1,217*	*0.36 (0.35–0.37)*	*607*	*121*	*0.35 (0.32–0.38)*	*562*	*112*	*0.35 (0.32–0.38)*	--	--	--
Non-Malignant	*6,448*	*1,290*	*0.42 (0.41–0.43)*	*953*	*191*	*0.44 (0.41–0.47)*	*847*	*169*	*0.43 (0.40–0.46)*	--	--	--

Table 15 Continued

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
All other	456	91	0.03 (0.03–0.04)	107	21	0.04 (0.03–0.05)	96	19	0.04 (0.03–0.05)	--	--	--
Malignant	*67*	*13*	*0.01 (0.00–0.01)*	*16*	*3*	*0.00 (0.00–0.01)*	--	--	--	--	--	--
Non-Malignant	*389*	*78*	*0.03 (0.03-0.03)*	*91*	*18*	*0.04 (0.03–0.04)*	--	--	--	--	--	--
TOTAL[d]	**382,468**	**76,494**	**24.68 (24.60–24.77)**	**49,305**	**9,861**	**22.12 (21.91–22.32)**	**44,613**	**8,923**	**22.07 (21.86–22.29)**	**1,377**	**275**	**13.24 (12.48–14.04)**
Malignant	***112,174***	***22,435***	***7.31 (7.26–7.35)***	***13,350***	***2,670***	***5.77 (5.66–5.87)***	***12,213***	***2,443***	***5.83 (5.72–5.94)***	***337***	***67***	***3.02 (2.67–3.40)***
Non-Malignant	***270,294***	***54,059***	***17.38 (17.31–17.45)***	***35,955***	***7,191***	***16.35 (16.17–16.53)***	***32,400***	***6,480***	***16.24 (16.06–16.43)***	***1,040***	***208***	***10.22 (9.55–10.93)***

[a]Annual average cases are calculated by dividing the five-ear total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Hispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).
[d]Refers to all brain tumors including histologies not presented in this table
- Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified.

Table 16 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors in Children and Adolescents (Age 0–19 Years), Brain and Other Central Nervous System Tumors by Histology, and Sex, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	Total			Male			Female		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**2,248**	**450**	**0.55 (0.53–0.57)**	**1,229**	**246**	**0.59 (0.55–0.62)**	**1,019**	**204**	**0.51 (0.48–0.54)**
Diffuse astrocytoma	946	189	0.23 (0.22–0.25)	517	103	0.25 (0.23–0.27)	429	86	0.21 (0.19–0.23)
Anaplastic astrocytoma	365	73	0.09 (0.08–0.10)	210	42	0.10 (0.09–0.12)	155	31	0.08 (0.07–0.09)
Glioblastoma	700	140	0.17 (0.16–0.18)	386	77	0.18 (0.17–0.20)	314	63	0.16 (0.14–0.17)
Oligodendroglioma	164	33	0.04 (0.03–0.05)	81	16	0.04 (0.03–0.05)	83	17	0.04 (0.03–0.05)
Anaplastic oligodendroglioma	22	4	0.01 (0.00–0.01)	--	--	--	--	--	--
Oligoastrocytic tumors	51	10	0.01 (0.01–0.02)	--	--	--	--	--	--
Other Astrocytic Tumors	**4,371**	**874**	**1.07 (1.04–1.10)**	**2,258**	**452**	**1.08 (1.04–1.13)**	**2,113**	**423**	**1.06 (1.01–1.10)**
Pilocytic astrocytoma	3,877	775	0.95 (0.92–0.98)	1,983	397	0.95 (0.91–0.99)	1,894	379	0.95 (0.90–0.99)
Unique astrocytoma variants	494	99	0.12 (0.11–0.13)	275	55	0.13 (0.12–0.15)	219	44	0.11 (0.10–0.13)
Malignant	*227*	*45*	*0.06 (0.05–0.06)*	*118*	*24*	*0.06 (0.05–0.07)*	*109*	*22*	*0.05 (0.04–0.07)*
Non-Malignant	*267*	*53*	*0.07 (0.06–0.07)*	*157*	*31*	*0.08 (0.06–0.09)*	*110*	*22*	*0.06 (0.05–0.07)*
Ependymal Tumors	**1,176**	**235**	**0.29 (0.27–0.30)**	**664**	**133**	**0.32 (0.29–0.34)**	**512**	**102**	**0.25 (0.23–0.28)**
Malignant	*985*	*197*	*0.24 (0.23–0.26)*	*551*	*110*	*0.26 (0.24–0.29)*	*434*	*87*	*0.22 (0.20–0.24)*
Non-Malignant	*191*	*38*	*0.05 (0.04–0.05)*	*113*	*23*	*0.05 (0.04–0.06)*	*78*	*16*	*0.04 (0.03–0.05)*
Other Gliomas	**3,133**	**627**	**0.77 (0.74–0.79)**	**1,568**	**314**	**0.75 (0.71–0.79)**	**1,565**	**313**	**0.78 (0.75–0.82)**
Glioma malignant, NOS	3,099	620	0.76 (0.73–0.79)	--	--	--	--	--	--
Other neuroepithelial tumors	34	7	0.01 (0.01-0.01)	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	***2,012***	***402***	***0.49 (0.47–0.51)***	***1,110***	***222***	***0.53 (0.50–0.56)***	***902***	***180***	***0.45 (0.42–0.48)***
Malignant	*140*	*28*	*0.03 (0.03–0.04)*	*74*	*15*	*0.04 (0.03–0.04)*	*66*	*13*	*0.03 (0.03–0.04)*
Non-Malignant	*1,872*	*374*	*0.46 (0.44–0.48)*	*1,036*	*207*	*0.49 (0.46–0.53)*	*836*	*167*	*0.42 (0.39–0.45)*
Choroid Plexus Tumors	**416**	**83**	**0.10 (0.09–0.11)**	**238**	**48**	**0.11 (0.10–0.13)**	**178**	**36**	**0.09 (0.08–0.10)**
Malignant	*104*	*21*	*0.03 (0.02–0.03)*	*63*	*13*	*0.03 (0.02–0.04)*	*41*	*8*	*0.02 (0.01–0.03)*
Non-Malignant	*312*	*62*	*0.08 (0.07–0.08)*	*175*	*35*	*0.08 (0.07–0.10)*	*137*	*27*	*0.07 (0.06–0.08)*
Tumors of the Pineal Region	**213**	**43**	**0.05 (0.05–0.06)**	**107**	**21**	**0.05 (0.04–0.06)**	**106**	**21**	**0.05 (0.04–0.06)**
Malignant	*176*	*35*	*0.04 (0.04–0.05)*	*91*	*18*	*0.04 (0.03–0.05)*	*85*	*17*	*0.04 (0.03–0.05)*
Non-Malignant	*37*	*7*	*0.01 (0.01-0.01)*	*16*	*3*	*0.01 (0.00–0.01)*	*21*	*4*	*0.01 (0.01–0.02)*
Embryonal Tumors	**2,397**	**479**	**0.59 (0.56–0.61)**	**1,431**	**286**	**0.69 (0.65–0.72)**	**966**	**193**	**0.48 (0.45–0.51)**
Medulloblastoma	*1,652*	*330*	*0.41 (0.39–0.43)*	*1,058*	*212*	*0.51 (0.48–0.54)*	*594*	*119*	*0.30 (0.27–0.32)*
Primitive neuroectodermal tumors	*208*	*42*	*0.05 (0.04–0.06)*	*107*	*21*	*0.05 (0.04–0.06)*	*101*	*20*	*0.05 (0.04–0.06)*

Table 16 Continued

Histology	Total			Male			Female		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Atypical teratoid/rhabdoid tumor	*382*	*76*	*0.09 (0.08–0.10)*	*191*	*38*	*0.09 (0.08–0.11)*	*191*	*38*	*0.10 (0.08–0.11)*
All other embryonal	*155*	*31*	*0.04 (0.03–0.04)*	*75*	*15*	*0.04 (0.03–0.04)*	*80*	*16*	*0.04 (0.03–0.05)*
Tumors of Cranial and Paraspinal Nerves	**1,202**	**240**	**0.29 (0.28–0.31)**	**651**	**130**	**0.31 (0.29–0.33)**	**551**	**110**	**0.27 (0.25–0.30)**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,291**	**258**	**0.31 (0.30–0.33)**	**622**	**124**	**0.30 (0.27–0.32)**	**669**	**134**	**0.33 (0.31–0.36)**
Meningiomas	667	133	0.16 (0.15–0.17)	324	65	0.15 (0.14–0.17)	343	69	0.17 (0.15–0.19)
Malignant	*27*	*5*	*0.01 (0.00–0.01)*	--	--	--	--	--	--
Non-Malignant	*640*	*128*	*0.15 (0.14–0.17)*	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**135**	**27**	**0.03 (0.03–0.04)**	**78**	**16**	**0.04 (0.03–0.05)**	**57**	**11**	**0.03 (0.02–0.04)**
Lymphoma	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**849**	**170**	**0.21 (0.19–0.22)**	**596**	**119**	**0.28 (0.26–0.31)**	**253**	**51**	**0.13 (0.11–0.14)**
Malignant	*752*	*150*	*0.18 (0.17–0.20)*	*532*	*106*	*0.25 (0.23–0.28)*	*220*	*44*	*0.11 (0.10–0.13)*
Non-Malignant	*97*	*19*	*0.02 (0.02–0.03)*	*64*	*13*	*0.03 (0.02–0.04)*	*33*	*7*	*0.02 (0.01–0.02)*
Tumors of Sellar Region	**4,484**	**897**	**1.08 (1.05–1.12)**	**1,420**	**284**	**0.68 (0.64–0.71)**	**3,064**	**613**	**1.51 (1.46–1.57)**
Tumors of the pituitary	3,639	728	0.88 (0.85–0.91)	946	189	0.45 (0.42–0.48)	2,693	539	1.33 (1.28–1.38)
Malignant	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--
Craniopharyngioma	845	169	0.21 (0.19–0.22)	474	95	0.23 (0.21–0.25)	371	74	0.19 (0.17–0.21)
Unclassified Tumors	**1,570**	**314**	**0.38 (0.36–0.40)**	**808**	**162**	**0.39 (0.36–0.41)**	**762**	**152**	**0.38 (0.35–0.41)**
Hemangioma	486	97	0.12 (0.11–0.13)	262	52	0.12 (0.11–0.14)	224	45	0.11 (0.10–0.13)

Table 16 Continued

Histology	Total			Male			Female		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Neoplasm, unspecified	868	174	0.21 (0.20–0.23)	439	88	0.21 (0.19–0.23)	429	86	0.21 (0.19–0.24)
Malignant	*219*	*44*	*0.05 (0.05–0.06)*	*113*	*23*	*0.05 (0.04–0.06)*	*106*	*21*	*0.05 (0.04–0.06)*
Non-Malignant	*649*	*130*	*0.16 (0.15–0.17)*	*326*	*65*	*0.16 (0.14–0.17)*	*323*	*65*	*0.16 (0.14–0.18)*
All other	216	43	0.05 (0.05–0.06)	107	21	0.05 (0.04–0.06)	109	22	0.05 (0.04–0.07)
Malignant	*65*	*13*	*0.02 (0.01–0.02)*	*31*	*6*	*0.01 (0.01–0.02)*	*34*	*7*	*0.02 (0.01–0.02)*
Non-Malignant	*151*	*30*	*0.04 (0.03–0.04)*	*76*	*15*	*0.04 (0.03–0.05)*	*75*	*15*	*0.04 (0.03–0.05)*
TOTAL[d]	**25,497**	**5,099**	**6.21 (6.14–6.29)**	**12,780**	**2,556**	**6.10 (6.00–6.21)**	**12,717**	**2,543**	**6.33 (6.22–6.44)**
Malignant	***14,586***	***2,917***	***3.57 (3.51–3.62)***	***7,933***	***1,587***	***3.80 (3.71–3.88)***	***6,653***	***1,331***	***3.32 (3.25–3.41)***
Non-Malignant	***10,911***	***2,182***	***2.65 (2.60–2.70)***	***4,847***	***969***	***2.31 (2.24–2.38)***	***6,064***	***1,213***	***3.00 (2.93–3.08)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified.

Table 17 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0–19 Years), Brain and Other Central Nervous System Tumors by Histology, and Race[c], CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	White			Black			American Indian/Alaska Native			Asian/Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**1,774**	**355**	**0.57 (0.55–0.60)**	**280**	**56**	**0.41 (0.37–0.46)**	**23**	**5**	**0.30 (0.19–0.46)**	**120**	**24**	**0.47 (0.39–0.56)**
Diffuse astrocytoma	744	149	0.24 (0.22–0.26)	110	22	0.16 (0.13–0.19)	--	--	--	54	11	0.21 (0.16–0.28)
Anaplastic astrocytoma	291	58	0.09 (0.08–0.11)	49	10	0.07 (0.05–0.10)	--	--	--	17	3	0.07 (0.04–0.11)
Glioblastoma	547	109	0.18 (0.16–0.19)	94	19	0.14 (0.11–0.17)	--	--	--	38	8	0.15 (0.11–0.21)
Oligodendroglioma	131	26	0.04 (0.04–0.05)	19	4	0.03 (0.02–0.04)	--	--	--	--	--	--
Anaplastic oligodendroglioma	16	3	0.01 (0.00–0.01)	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	45	9	0.01 (0.01–0.02)	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**3,494**	**699**	**1.14 (1.10–1.17)**	**534**	**107**	**0.78 (0.72–0.85)**	**41**	**8**	**0.54 (0.38–0.73)**	**209**	**42**	**0.82 (0.71–0.94)**
Pilocytic astrocytoma	3,118	624	1.01 (0.98–1.05)	461	92	0.67 (0.61–0.74)	--	--	--	178	36	0.70 (0.60–0.81)
Unique astrocytoma variants	376	75	0.12 (0.11–0.14)	73	15	0.11 (0.08–0.14)	--	--	--	31	6	0.12 (0.08–0.17)
Malignant	*185*	*37*	*0.06 (0.05–0.07)*	*24*	*5*	*0.04 (0.02–0.05)*	--	--	--	--	--	--
Non-Malignant	*191*	*38*	*0.06 (0.05–0.07)*	*49*	*10*	*0.07 (0.05–0.10)*	--	--	--	--	--	--
Ependymal Tumors	**932**	**186**	**0.30 (0.28–0.32)**	**149**	**30**	**0.22 (0.18–0.25)**	**--**	**--**	**--**	**56**	**11**	**0.22 (0.17–0.28)**
Malignant	*768*	*154*	*0.25 (0.23–0.27)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*164*	*33*	*0.05 (0.04–0.06)*	--	--	--	--	--	--	--	--	--
Other Gliomas	**2,432**	**486**	**0.79 (0.76–0.82)**	**431**	**86**	**0.63 (0.57–0.69)**	**28**	**6**	**0.36 (0.24–0.53)**	**172**	**34**	**0.67 (0.58–0.78)**
Glioma malignant, NOS	2,406	481	0.78 (0.75–0.82)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	26	5	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	***1,580***	***316***	***0.51 (0.49–0.54)***	***269***	***54***	***0.40 (0.35–0.45)***	***20***	***4***	***0.26 (0.16–0.40)***	***109***	***22***	***0.43 (0.35–0.52)***
Malignant	*113*	*23*	*0.04 (0.03–0.04)*	*18*	*4*	*0.03 (0.02–0.04)*	--	--	--	--	--	--
Non-Malignant	*1,467*	*293*	*0.47 (0.45–0.50)*	*251*	*50*	*0.37 (0.33–0.42)*	--	--	--	--	--	--
Choroid Plexus Tumors	**325**	**65**	**0.11 (0.09–0.12)**	**56**	**11**	**0.08 (0.06–0.11)**	**--**	**--**	**--**	--	--	--
Malignant	*76*	*15*	*0.02 (0.02–0.03)*	*17*	*3*	*0.02 (0.01–0.04)*	--	--	--	--	--	--
Non-Malignant	*249*	*50*	*0.08 (0.07–0.09)*	*39*	*8*	*0.06 (0.04–0.08)*	--	--	--	--	--	--
Tumors of the Pineal Region	**140**	**28**	**0.05 (0.04–0.05)**	**53**	**11**	**0.08 (0.06–0.10)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	*110*	*22*	*0.04 (0.03–0.04)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*30*	*6*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Embryonal Tumors	**1,856**	**371**	**0.61 (0.58–0.63)**	**292**	**58**	**0.42 (0.38–0.48)**	**29**	**6**	**0.37 (0.25–0.54)**	**159**	**32**	**0.62 (0.53–0.73)**
Medulloblastoma	*1,298*	*260*	*0.42 (0.40–0.45)*	*176*	*35*	*0.26 (0.22–0.30)*	--	--	--	--	--	--
Primitive neuroectodermal tumors	*159*	*32*	*0.05 (0.04–0.06)*	*32*	*6*	*0.05 (0.03–0.07)*	--	--	--	--	--	--

Table 17 Continued

Histology	White			Black			American Indian/Alaska Native			Asian/Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Atypical teratoid/rhabdoid tumor	*280*	*56*	*0.09 (0.08–0.10)*	*58*	*12*	*0.08 (0.06–0.11)*	--	--	--	*30*	*6*	*0.12 (0.08–0.17)*
All other embryonal	*119*	*24*	*0.04 (0.03–0.05)*	*26*	*5*	*0.04 (0.02–0.05)*	--	--	--	--	--	--
Tumors of Cranial and Paraspinal Nerves	**935**	**187**	**0.30 (0.28–0.32)**	**141**	**28**	**0.21 (0.17–0.24)**	**--**	**--**	**--**	**79**	**16**	**0.31 (0.25–0.39)**
Nerve sheath tumors	933	187	0.30 (0.28–0.32)	141	28	0.21 (0.17–0.24)	--	--	--	79	16	0.31 (0.25–0.39)
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,005**	**201**	**0.32 (0.30–0.34)**	**168**	**34**	**0.25 (0.21–0.29)**	**--**	**--**	**--**	**66**	**13**	**0.26 (0.20–0.33)**
Meningiomas	521	104	0.17 (0.15–0.18)	98	20	0.14 (0.12–0.17)	--	--	--	--	--	--
Malignant	*24*	*5*	*0.01 (0.00–0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*497*	*99*	*0.16 (0.15–0.17)*	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	473	95	0.15 (0.14–0.17)	--	--	--	--	--	--	37	7	0.15 (0.10–0.20)
Malignant	*57*	*11*	*0.02 (0.01–0.02)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*416*	*83*	*0.13 (0.12–0.15)*	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**97**	**19**	**0.03 (0.03–0.04)**	**16**	**3**	**0.02 (0.01–0.04)**	**--**	**--**	**--**	**20**	**4**	**0.08 (0.05–0.12)**
Lymphoma	97	19	0.03 (0.03–0.04)	16	3	0.02 (0.01–0.04)	--	--	--	20	4	0.08 (0.05–0.12)
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**643**	**129**	**0.21 (0.19–0.23)**	**90**	**18**	**0.13 (0.11–0.16)**	**--**	**--**	**--**	**86**	**17**	**0.34 (0.27–0.42)**
Malignant	*572*	*114*	*0.19 (0.17–0.20)*	--	--	*0.11 (0.09–0.14)*	--	--	--	--	--	--
Non-Malignant	*71*	*14*	*0.02 (0.02–0.03)*	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	**3,405**	**681**	**1.09 (1.05–1.13)**	**654**	**131**	**0.96 (0.88–1.03)**	**52**	**10**	**0.70 (0.52–0.91)**	**240**	**48**	**0.94 (0.83–1.07)**
Tumors of the pituitary	2,783	557	0.89 (0.85–0.92)	501	100	0.73 (0.67–0.80)	--	--	--	196	39	0.77 (0.67–0.89)
Craniopharyngioma	622	124	0.20 (0.19–0.22)	153	31	0.22 (0.19–0.26)	--	--	--	44	9	0.17 (0.13–0.23)
Unclassified Tumors	**1,228**	**246**	**0.40 (0.37–0.42)**	**192**	**38**	**0.28 (0.24–0.32)**	**18**	**4**	**0.23 (0.14–0.37)**	**90**	**18**	**0.36 (0.29–0.44)**
Hemangioma	404	81	0.13 (0.12–0.14)	44	9	0.06 (0.05–0.09)	--	--	--	--	--	--
Neoplasm, unspecified	662	132	0.21 (0.20–0.23)	114	23	0.17 (0.14–0.20)	--	--	--	57	11	0.23 (0.17–0.29)
Malignant	*158*	*32*	*0.05 (0.04–0.06)*	*37*	*7*	*0.05 (0.04–0.07)*	--	--	--	--	--	--
Non-Malignant	*504*	*101*	*0.16 (0.15–0.18)*	*77*	*15*	*0.11 (0.09–0.14)*	--	--	--	--	--	--
All other	162	32	0.05 (0.04–0.06)	34	7	0.05 (0.03–0.07)	--	--	--	--	--	--
Malignant	*47*	*9*	*0.02 (0.01–0.02)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*115*	*23*	*0.04 (0.03–0.04)*	--	--	--	--	--	--	--	--	--

Table 17 Continued

Histology	White			Black			American Indian/Alaska Native			Asian/Pacific Islander		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
TOTAL[d]	**19,846**	**3,969**	**6.42 (6.33–6.51)**	**3,325**	**665**	**4.87 (4.70–5.04)**	**253**	**51**	**3.32 (2.93–3.76)**	**1,438**	**288**	**5.65 (5.36–5.95)**
Malignant	***11,398***	***2,280***	***3.70 (3.64–3.77)***	***1,865***	***373***	***2.73 (2.61–2.86)***	***140***	***28***	***1.82 (1.53–2.15)***	***832***	***166***	***3.26 (3.05–3.49)***
Non-Malignant	***8,448***	***1,690***	***2.72 (2.66–2.78)***	***1,460***	***292***	***2.14 (2.03–2.25)***	***113***	***23***	***1.50 (1.23–1.80)***	***606***	***121***	***2.38 (2.20–2.58)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Individuals with unknown race were excluded (N = 623).
[d]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when **fewer than 16 cases** were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified.

Table 18 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0–19 Years), Brain and Other Central Nervous System Tumors by Histology, Hispanic Ethnicity[c], and Race, CBTRUS Statistical Report: U.S. Cancer Statistics – NPCR and SEER, 2014–2018

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**1,843**	**369**	**0.59 (0.57–0.62)**	**405**	**81**	**0.40 (0.37–0.45)**	**367**	**73**	**0.41 (0.37–0.46)**	**--**	**--**	**--**
Diffuse astrocytoma	798	160	0.26 (0.24–0.28)	148	30	0.15 (0.12–0.17)	131	26	0.15 (0.12–0.17)	--	--	--
Anaplastic astrocytoma	288	58	0.09 (0.08–0.10)	77	15	0.08 (0.06–0.10)	69	14	0.08 (0.06–0.10)	--	--	--
Glioblastoma	555	111	0.18 (0.16–0.19)	145	29	0.15 (0.12–0.17)	134	27	0.15 (0.13–0.18)	--	--	--
Oligodendroglioma	144	29	0.05 (0.04–0.05)	20	4	0.02 (0.01–0.03)	19	4	0.02 (0.01–0.03)	--	--	--
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**3,590**	**718**	**1.17 (1.13–1.21)**	**781**	**156**	**0.76 (0.71–0.82)**	**701**	**140**	**0.78 (0.72–0.84)**	**18**	**4**	**0.30 (0.18–0.47)**
Pilocytic astrocytoma	3,198	640	1.04 (1.00–1.08)	679	136	0.66 (0.61–0.72)	611	122	0.68 (0.62–0.73)	--	--	--
Unique astrocytoma variants	392	78	0.13 (0.11–0.14)	102	20	0.10 (0.08–0.12)	90	18	0.10 (0.08–0.12)	--	--	--
Malignant	*183*	*37*	*0.06 (0.05–0.07)*	*44*	*9*	*0.04 (0.03–0.06)*	*40*	*8*	*0.05 (0.03–0.06)*	--	--	--
Non-Malignant	*209*	*42*	*0.07 (0.06–0.08)*	*58*	*12*	*0.06 (0.04–0.07)*	*50*	*10*	*0.06 (0.04–0.07)*	--	--	--
Ependymal Tumors	**908**	**182**	**0.29 (0.28–0.31)**	**268**	**54**	**0.26 (0.23–0.30)**	**245**	**49**	**0.27 (0.24–0.31)**	**--**	**--**	**--**
Malignant	*761*	*152*	*0.25 (0.23–0.27)*	*224*	*45*	*0.22 (0.19–0.25)*	*208*	*42*	*0.23 (0.20–0.26)*	--	--	--
Non-Malignant	*147*	*29*	*0.05 (0.04–0.06)*	*44*	*9*	*0.04 (0.03–0.06)*	*37*	*7*	*0.04 (0.03–0.06)*	--	--	--
Other Gliomas	**2,576**	**515**	**0.84 (0.81–0.87)**	**557**	**111**	**0.55 (0.50–0.59)**	**495**	**99**	**0.55 (0.50–0.60)**	**19**	**4**	**0.30 (0.18–0.47)**
Glioma malignant, NOS	--	--	--	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	***1,656***	***331***	***0.53 (0.51–0.56)***	***356***	***71***	***0.36 (0.32–0.39)***	***320***	***64***	***0.36 (0.32–0.40)***	**--**	**--**	**--**
Malignant	*110*	*22*	*0.04 (0.03–0.04)*	*30*	*6*	*0.03 (0.02–0.04)*	*27*	*5*	*0.03 (0.02–0.04)*	--	--	--
Non-Malignant	*1,546*	*309*	*0.50 (0.47–0.52)*	*326*	*65*	*0.33 (0.29–0.36)*	*293*	*59*	*0.33 (0.29–0.37)*	--	--	--
Choroid Plexus Tumors	**324**	**65**	**0.11 (0.09–0.12)**	**92**	**18**	**0.09 (0.07–0.11)**	**85**	**17**	**0.09 (0.07–0.12)**	**--**	**--**	**--**
Malignant	*83*	*17*	*0.03 (0.02–0.03)*	*21*	*4*	*0.02 (0.01–0.03)*	*20*	*4*	*0.02 (0.01–0.03)*	--	--	--
Non-Malignant	*241*	*48*	*0.08 (0.07–0.09)*	*71*	*14*	*0.07 (0.05–0.09)*	*65*	*13*	*0.07 (0.06–0.09)*	--	--	--
Tumors of the Pineal Region	**173**	**35**	**0.06 (0.05–0.06)**	**40**	**8**	**0.04 (0.03–0.05)**	**34**	**7**	**0.04 (0.03–0.05)**	**--**	**--**	**--**
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Embryonal Tumors	**1,877**	**375**	**0.62 (0.59–0.64)**	**520**	**104**	**0.50 (0.46–0.55)**	**472**	**94**	**0.52 (0.47–0.57)**	**18**	**4**	**0.28 (0.16–0.44)**
Medulloblastoma	*1,304*	*261*	*0.43 (0.40–0.45)*	*348*	*70*	*0.34 (0.30–0.38)*	*318*	*64*	*0.35 (0.31–0.39)*	--	--	--
Primitive neuroectodermal tumors	*155*	*31*	*0.05 (0.04–0.06)*	*53*	*11*	*0.05 (0.04–0.07)*	*48*	*10*	*0.05 (0.04–0.07)*	--	--	--

Table 18 Continued

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Atypical teratoid/rhabdoid tumor	*300*	*60*	*0.10 (0.09–0.11)*	*82*	*16*	*0.08 (0.06–0.10)*	*75*	*15*	*0.08 (0.06–0.10)*	--	--	--
All other embryonal	*118*	*24*	*0.04 (0.03–0.05)*	*37*	*7*	*0.04 (0.02–0.05)*	*31*	*6*	*0.03 (0.02–0.05)*	--	--	--
Tumors of Cranial and Paraspinal Nerves	**960**	**192**	**0.31 (0.29–0.33)**	**242**	**48**	**0.24 (0.21–0.27)**	**212**	**42**	**0.24 (0.21–0.27)**	**--**	**--**	**--**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**995**	**199**	**0.32 (0.30–0.34)**	**296**	**59**	**0.30 (0.27–0.33)**	**269**	**54**	**0.31 (0.27–0.34)**	**--**	**--**	**--**
Meningiomas	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**113**	**23**	**0.04 (0.03–0.04)**	**22**	**4**	**0.02 (0.01–0.03)**	**20**	**4**	**0.02 (0.01–0.03)**	**--**	**--**	**--**
Lymphoma	--	--	--	--	--	--	20	4	0.02 (0.01–0.03)	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**636**	**127**	**0.21 (0.19–0.22)**	**213**	**43**	**0.21 (0.19–0.24)**	**193**	**39**	**0.22 (0.19–0.25)**	**--**	**--**	**--**
Malignant	*556*	*111*	*0.18 (0.16–0.19)*	*196*	*39*	*0.20 (0.17–0.23)*	*177*	*35*	*0.20 (0.17–0.23)*	--	--	--
Non-Malignant	*80*	*16*	*0.03 (0.02–0.03)*	*17*	*3*	*0.02 (0.01–0.03)*	*16*	*3*	*0.02 (0.01–0.03)*	--	--	--
Tumors of Sellar Region	**3,256**	**651**	**1.03 (0.99–1.07)**	**1,228**	**246**	**1.26 (1.19–1.34)**	**1,105**	**221**	**1.28 (1.21–1.36)**	**36**	**7**	**0.63 (0.44–0.87)**
Tumors of the pituitary	2,604	521	0.82 (0.79–0.85)	1,035	207	1.07 (1.01–1.14)	927	185	1.08 (1.01–1.15)	--	--	--
Craniopharyngioma	652	130	0.21 (0.20–0.23)	193	39	0.19 (0.16–0.22)	178	36	0.20 (0.17–0.23)	--	--	--
Unclassified Tumors	**1,223**	**245**	**0.39 (0.37–0.42)**	**347**	**69**	**0.35 (0.31–0.38)**	**303**	**61**	**0.34 (0.30–0.38)**	**--**	**--**	**--**
Hemangioma	373	75	0.12 (0.11–0.13)	113	23	0.11 (0.09–0.14)	102	20	0.12 (0.09–0.14)	--	--	--
Neoplasm, unspecified	687	137	0.22 (0.21–0.24)	181	36	0.18 (0.16–0.21)	153	31	0.17 (0.15–0.20)	--	--	--
Malignant	*174*	*35*	*0.06 (0.05–0.07)*	*45*	*9*	*0.04 (0.03–0.06)*	*39*	*8*	*0.04 (0.03–0.06)*	--	--	--
Non-Malignant	*513*	*103*	*0.17 (0.15–0.18)*	*136*	*27*	*0.14 (0.11–0.16)*	*114*	*23*	*0.13 (0.11–0.16)*	--	--	--

Table 18 Continued

Histology	Non-Hispanic			All Hispanic			White Hispanic			Black Hispanic		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
All other	163	33	0.05 (0.05–0.06)	53	11	0.05 (0.04–0.07)	48	10	0.05 (0.04–0.07)	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL[d]	**20,130**	**4,026**	**6.50 (6.41–6.59)**	**5,367**	**1,073**	**5.35 (5.21–5.49)**	**4,821**	**964**	**5.43 (5.28–5.59)**	**160**	**32**	**2.63 (2.23–3.07)**
Malignant	***11,767***	***2,353***	***3.83 (3.76–3.90)***	***2,819***	***564***	***2.77 (2.66–2.87)***	***2,542***	***508***	***2.83 (2.72–2.94)***	***86***	***17***	***1.37 (1.09–1.69)***
Non-Malignant	***8,363***	***1,673***	***2.67 (2.62–2.73)***	***2,548***	***510***	***2.58 (2.48–2.68)***	***2,279***	***456***	***2.61 (2.50–2.72)***	***74***	***15***	***1.26 (0.99–1.58)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Hispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).
[d]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when **fewer than 16 cases** were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified.

Table 19 Estimated Number of Cases[a,b] of Brain and Other Central Nervous System Tumors Overall and by Behavior by State, 2021, 2022

State	2021			2022		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total
Alabama	400	680	1,070	400	700	1,100
Alaska	60	130	190	60	130	190
Arizona	500	1,020	1,520	500	1,030	1,530
Arkansas	270	500	770	270	520	790
California	2,820	5,750	8,580	2,860	5,600	8,470
Colorado	440	1,220	1,660	450	1,250	1,700
Connecticut	320	620	940	320	640	960
Delaware	80	100	180	80	100	180
District of Columbia	--	--	160	--	--	170
Florida	1,810	4,580	6,400	1,840	4,690	6,530
Georgia	710	2,290	3,000	720	2,410	3,130
Hawaii	80	240	320	80	240	320
Idaho	150	300	440	150	310	460
Illinois	1,010	2,610	3,620	1,020	2,670	3,690
Indiana	540	680	1,210	540	590	1,130
Iowa	290	610	890	290	610	900
Kansas	230	520	740	230	530	760
Kentucky	430	1,010	1,450	440	1,030	1,470
Louisiana	340	1,020	1,350	340	1,060	1,400
Maine	140	150	290	140	150	290
Maryland	450	1,180	1,630	450	1,240	1,690
Massachusetts	600	970	1,560	600	1,000	1,600
Michigan	810	1,570	2,380	810	1,590	2,400
Minnesota	500	870	1,370	510	920	1,430
Mississippi	220	520	740	220	530	750
Missouri	520	1,080	1,600	520	1,100	1,620
Montana	100	210	310	100	220	320
Nebraska	170	280	440	170	280	450
Nevada	240	480	720	250	510	750
New Hampshire	130	240	370	140	250	380
New Jersey	770	1,720	2,480	770	1,690	2,450
New Mexico	150	190	340	150	180	320
New York	1,580	4,660	6,240	1,580	4,790	6,370
North Carolina	830	2,050	2,880	850	2,110	2,960
North Dakota	60	120	180	60	130	180
Ohio	1,030	1,520	2,550	1,040	1,510	2,550
Oklahoma	310	470	770	310	440	750
Oregon	370	580	950	380	590	970
Pennsylvania	1,200	2,830	4,030	1,210	2,880	4,090
Rhode Island	90	120	210	90	120	200
South Carolina	420	680	1,100	430	630	1,060
South Dakota	70	160	230	70	170	240
Tennessee	560	1,320	1,890	570	1,350	1,930
Texas	1,990	5,280	7,270	2,020	5,460	7,470
Utah	230	1,100	1,320	230	1,190	1,420

Table 19 Continued

State	2021			2022		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total
Vermont	60	120	180	60	120	180
Virginia	660	1,180	1,840	670	1,200	1,870
Washington	660	2,070	2,730	680	2,160	2,830
West Virginia	160	380	540	160	390	550
Wisconsin	540	1,280	1,820	540	1,310	1,850
Wyoming	--	--	140	--	--	140
United States	**25,690**	**62,500**	**88,190**	**25,930**	**63,040**	**88,970**

[a]Source: Estimation based on CBTRUS NPCR and SEER 2000–2018 data for malignant tumors, and NPCR and SEER 2006–2018 data for non-malignant tumors.
[b]Rounded to the nearest 10. Numbers may not add up due to rounding.
[c]Total estimate is based on histology-specific estimate and may not add up to total by state.
- Estimated number is less than 50. These cases are included in overall rates.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program

Table 20 Estimated Number of Cases[a,b] in the US of Brain and Other Central Nervous System Tumors Overall and by Behavior and Histology [c], 2021, 2022

Histology	2021			2022		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total
Diffuse Astrocytic and Oligodendroglial Tumors	***17,080***	**--**	***17,080***	***17,270***	**--**	***17,280***
Diffuse astrocytoma	1,490	--	1,490	1,480	--	1,480
Anaplastic astrocytoma	1,350	--	1,350	1,320	--	1,320
Glioblastoma	13,160		13,160	13,430		13,430
Oligodendroglioma	690		690	680		680
Anaplastic oligodendroglioma	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--
Other Astrocytic Tumors	**1,170**	**460**	**1,630**	**1,170**	**800**	**1,970**
Pilocytic astrocytoma	1,050	380	1,430	1,040	720	1,770
Unique astrocytoma variants	120	80	200	130	70	200
Ependymal Tumors	**790**	**630**	**1,420**	**780**	**640**	**1,420**
Other Gliomas	**1,850**	**--**	**1,850**	**--**	**--**	**1,900**
Glioma malignant, NOS	--		--	--	--	--
Other neuroepithelial tumors	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	**210**	**890**	**1,100**	**220**	**910**	**1,120**
Neuronal and mixed neuronal-glial tumors	210	890	1,100	220	910	1,120
Choroid Plexus Tumors	**--**	--	**170**	**--**	--	**170**
Tumors of the Pineal Region	**100**	**70**	**160**	**100**	**70**	**170**
Embryonal Tumors	**600**	**--**	**600**	**590**	**--**	**590**
Tumors of Cranial and Paraspinal Nerves	**--**	--	**6,630**	**--**	--	**6,380**
Nerve sheath tumors	--	--	--	--	--	--
Other tumors of cranial and paraspinal nerves		--	--		--	--
Tumors of Meninges	**460**	**36,760**	**37,210**	**440**	**37,620**	**38,060**
Meningiomas	280	35,860	36,130	260	36,770	37,020
Mesenchymal tumors	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**1,800**	**--**	**1,800**	**1,830**	**--**	**1,830**
Lymphoma	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--
Germ Cell Tumors	--	**--**	**260**	--	**--**	**260**
Tumors of Sellar Region	**--**	--	**14,870**	**--**	--	**14,530**
Tumors of the pituitary	--	--	14,230	--	--	13,870
Craniopharyngioma	--	--	650	--	--	650
Unclassified Tumors	**1,340**	**2,070**	**3,410**	**1,340**	**1,960**	**3,300**
Hemangioma	--	--	760	--	--	740
Neoplasm, unspecified	1,320	1,210	2,530	1,320	1,120	2,440
All other	--	--	120	--	--	120
Total	**25,690**	**62,500**	**88,190**	**25,930**	**63,040**	**88,970**

[a]Source: Estimation based on CBTRUS NPCR and SEER 2000–2018 data for malignant tumors, and NPCR and SEER 2006–2018 data for non-malignant tumors.
[b]Rounded to the nearest 10. Numbers may not add up due to rounding.
[c]Total estimate is based on overall estimate. Histology-specific estimates may not add up to total.
-Estimated number is less than 50 or allows for back-calculation of a value less than 50. These cases are included in overall rates.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program

Table 21 Five-Year Total, Average Annual Total[a], and Average Annual Age-Adjusted Mortality Rates[b] for Malignant Brain and Other Central Nervous System Cancer Overall and by State and Sex, United States, 2014-2018[c]

State	Total			Male			Female		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Alabama	1,476	295	5.05 (4.79–5.32)	668	134	4.20 (3.88–4.55)	808	162	6.08 (5.66–6.53)
Alaska	152	30	4.21 (3.53–4.98)	71	14	4.10 (3.16–5.23)	81	16	4.27 (3.32–5.41)
Arkansas	867	173	4.84 (4.52–5.19)	395	79	4.06 (3.66–4.49)	472	94	5.74 (5.22–6.29)
Arizona	1,745	349	4.22 (4.02–4.43)	750	150	3.44 (3.19–3.70)	995	199	5.11 (4.79–5.44)
California	9,221	1,844	4.36 (4.27–4.45)	3,948	790	3.48 (3.37–3.59)	5,273	1,055	5.39 (5.24–5.54)
Colorado	1,281	256	4.26 (4.02–4.51)	571	114	3.63 (3.33–3.95)	710	142	4.96 (4.59–5.36)
Connecticut	986	197	4.48 (4.20–4.78)	417	83	3.52 (3.17–3.89)	569	114	5.68 (5.21–6.19)
District of Columbia	90	18	2.58 (2.06–3.18)	46	9	2.42 (1.76–3.25)	44	9	2.77 (2.00–3.75)
Delaware	246	49	4.07 (3.56–4.64)	101	20	3.07 (2.48–3.77)	145	29	5.27 (4.42–6.24)
Florida	5,814	1,163	4.19 (4.08–4.30)	2,541	508	3.37 (3.24–3.52)	3,273	655	5.11 (4.93–5.29)
Georgia	2,358	472	4.32 (4.15–4.50)	1,041	208	3.51 (3.29–3.73)	1,317	263	5.30 (5.00–5.60)
Hawaii	256	51	2.94 (2.58–3.34)	110	22	2.38 (1.94–2.90)	146	29	3.54 (2.98–4.19)
Idaho	498	100	5.19 (4.74–5.69)	183	37	3.62 (3.10–4.20)	315	63	6.91 (6.15–7.74)
Illinois	3,062	612	4.16 (4.01–4.31)	1,359	272	3.40 (3.22–3.59)	1,703	341	5.06 (4.81–5.31)
Indiana	1,739	348	4.56 (4.34–4.78)	728	146	3.56 (3.30–3.83)	1,011	202	5.71 (5.36–6.09)
Iowa	935	187	4.97 (4.65–5.31)	410	82	4.15 (3.74–4.59)	525	105	5.92 (5.41–6.47)
Kansas	825	165	4.96 (4.62–5.32)	358	72	4.11 (3.68–4.57)	467	93	5.95 (5.41–6.53)
Kentucky	1,286	257	4.90 (4.63–5.18)	566	113	4.01 (3.67–4.36)	720	144	5.92 (5.48–6.39)
Louisiana	1,128	226	4.28 (4.03–4.55)	531	106	3.70 (3.38–4.04)	597	119	4.99 (4.59–5.42)
Maine	497	99	5.41 (4.92–5.94)	196	39	3.97 (3.40–4.62)	301	60	7.03 (6.22–7.92)
Maryland	1,387	277	4.07 (3.85–4.29)	615	123	3.32 (3.06–3.61)	772	154	4.97 (4.62–5.35)
Massachusetts	1,899	380	4.62 (4.41–4.84)	850	170	3.81 (3.55–4.08)	1,049	210	5.63 (5.29–5.99)
Michigan	2,837	567	4.65 (4.48–4.83)	1,217	243	3.69 (3.48–3.91)	1,620	324	5.78 (5.49–6.08)
Minnesota	1,533	307	4.82 (4.58–5.08)	634	127	3.83 (3.53–4.15)	899	180	5.96 (5.56–6.37)
Mississippi	873	175	5.08 (4.74–5.43)	405	81	4.25 (3.84–4.70)	468	94	6.09 (5.54–6.69)
Missouri	1,617	323	4.38 (4.16–4.60)	700	140	3.50 (3.23–3.78)	917	183	5.42 (5.07–5.79)
Montana	325	65	4.91 (4.37–5.51)	133	27	3.99 (3.31–4.78)	192	38	5.93 (5.09–6.88)
Nebraska	541	108	4.99 (4.57–5.44)	222	44	3.93 (3.42–4.51)	319	64	6.18 (5.50–6.92)
Nevada	772	154	4.62 (4.29–4.97)	338	68	3.91 (3.50–4.37)	434	87	5.36 (4.85–5.91)
New Hampshire	416	83	4.87 (4.40–5.39)	179	36	4.07 (3.46–4.75)	237	47	5.88 (5.13–6.72)
New Jersey	2,247	449	4.23 (4.06–4.42)	1,004	201	3.48 (3.27–3.71)	1,243	249	5.14 (4.85–5.44)

Table 21 Continued

State	Total			Male			Female		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
New Mexico	482	96	3.85 (3.50–4.22)	217	43	3.32 (2.88–3.82)	265	53	4.46 (3.93–5.05)
New York	4,550	910	3.92 (3.81–4.04)	2,039	408	3.23 (3.08–3.38)	2,511	502	4.77 (4.58–4.96)
North Carolina	2,483	497	4.23 (4.06–4.40)	1,110	222	3.43 (3.23–3.65)	1,373	275	5.17 (4.90–5.46)
North Dakota	180	36	4.23 (3.62–4.92)	79	16	3.56 (2.80–4.47)	101	20	4.99 (4.04–6.10)
Ohio	3,304	661	4.65 (4.49–4.82)	1,440	288	3.75 (3.55–3.95)	1,864	373	5.70 (5.44–5.98)
Oklahoma	1,107	221	4.97 (4.68–5.28)	499	100	4.14 (3.77–4.53)	608	122	5.94 (5.46–6.44)
Oregon	1,222	244	4.88 (4.60–5.17)	499	100	3.79 (3.45–4.15)	723	145	6.07 (5.62–6.54)
Pennsylvania	3,681	736	4.51 (4.36–4.66)	1,565	313	3.53 (3.35–3.72)	2,116	423	5.67 (5.42–5.92)
Rhode Island	318	64	4.86 (4.32–5.45)	138	28	3.90 (3.26–4.65)	180	36	6.06 (5.18–7.06)
South Carolina	1,423	285	4.72 (4.47–4.98)	641	128	3.93 (3.63–4.26)	782	156	5.65 (5.25–6.08)
South Dakota	267	53	5.22 (4.60–5.92)	107	21	4.07 (3.30–4.96)	160	32	6.61 (5.59–7.76)
Tennessee	1,852	370	4.74 (4.52–4.97)	802	160	3.80 (3.53–4.08)	1,050	210	5.86 (5.50–6.24)
Texas	5,805	1,161	4.19 (4.08–4.30)	2,616	523	3.55 (3.41–3.69)	3,189	638	4.93 (4.76–5.11)
Utah	623	125	4.67 (4.31–5.06)	248	50	3.57 (3.13–4.05)	375	75	5.90 (5.31–6.55)
Vermont	222	44	5.50 (4.77–6.33)	101	20	4.72 (3.80–5.81)	121	24	6.43 (5.29–7.77)
Virginia	2,048	410	4.25 (4.07–4.45)	948	190	3.63 (3.39–3.87)	1,100	220	5.01 (4.71–5.33)
Washington	2,069	414	4.99 (4.77–5.22)	869	174	4.00 (3.73–4.29)	1,200	240	6.08 (5.73–6.44)
West Virginia	572	114	4.70 (4.31–5.12)	254	51	3.91 (3.42–4.45)	318	64	5.59 (4.97–6.27)
Wisconsin	1,721	344	4.94 (4.70–5.18)	716	143	3.86 (3.57–4.17)	1,005	201	6.09 (5.71–6.50)
Wyoming	191	38	5.74 (4.93–6.66)	86	17	4.95 (3.92–6.18)	105	21	6.67 (5.41–8.13)
United States	**83,029**	**16,606**	**4.43 (4.40–4.46)**	**36,261**	**7,252**	**3.60 (3.56–3.63)**	**46,768**	**9,354**	**5.40 (5.35–5.45)**

[a]Annual average deaths are calculated by dividing the five- year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Mortality - All COD, Aggregated with State, Total U.S. (1990–2016) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, released January 2018. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).
- Counts and rates are not presented when fewer than 20 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: NCHS, National Center for Health Statistics; CI, confidence interval.

Table 22. Sixteen-Year Total Deaths, and Median survival in months with 95% Confidence Intervals for Selected Primary Malignant Brain and Other CNS Tumor Histologies, CBTRUS Statistical Report: NPCR, 2001–2017

Histology	N	Deaths	Median Survival (95% CI)
Diffuse astrocytoma	23,296	12,717	59 (57–62)
Anaplastic astrocytoma	16,513	11,468	20 (19–21)
Glioblastoma	133,975	119,145	8 (8-8)
Oligodendroglioma	11,208	3,353	199 (190-**)
Anaplastic oligodendroglioma	5,028	2,340	97 (91–107)
Oligoastrocytic tumors	6,808	3,251	113 (108–121)
Pilocytic astrocytoma	14,442	1,068	** (**-**)
Unique astrocytoma variants	1,285	299	** (**-**)
Ependymal tumors	10,950	2,300	** (**-**)
Glioma malignant, NOS	19,031	8,967	93 (84–102)
Other neuroepithelial tumors	174	53	** (137-**)
Neuronal and mixed neuronal-glial tumors	2,337	735	190 (179-**)
Choroid plexus tumors	359	136	176 (125-**)
Tumors of the pineal region	1,031	360	** (146-**)
Embryonal tumors	9,946	3,847	** (**-**)
Nerve sheath tumors	669	233	** (**-**)
Meningiomas	4,842	2,333	103 (94–110)
Mesenchymal tumors	1,869	741	136 (118–148)
Primary melanocytic lesions	159	118	15 (11–25)
Lymphoma	18,327	12,396	15 (14–16)
Other hematopoietic neoplasms	225	101	138 (87-**)
Germ cell tumors	2,939	440	** (**-**)
Tumors of the pituitary	402	134	** (165-**)
Neoplasm, unspecified	10,276	8,332	3 (3-3)
All other	176	97	23 (17–49)

** cannot be calculated

Abbreviations: AYA, Adolescents and Young Adults; CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 23 Hazards Ratios for Death and 95% Confidence Intervals for Age Group at Diagnosis, Sex, Race, and Ethnicity for Selected Primary Malignant Brain and Other CNS Tumor Histologies, CBTRUS Statistical Report: NPCR and SEER, 2001–2017

Histology	N	Deaths	Age Groups (compared to children ages 0–14 years[a])				Sex (compared to male)		Race & Ethnicity (Compared to White, Non-Hispanic)							
			AYA[b] (15–39) Years		Adults (40+) Years		Female		Black, Non-Hispanic		API, Non-Hispanic		AIAN, Non-Hispanic		Hispanic	
			HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value
Diffuse astrocytoma	23,128	12,665	1.84 (1.67–2.03)	<0.001	6.74 (6.14–7.39)	<0.001	0.97 (0.94–1.01)	0.096	1.04 (0.97–1.12)	0.227	0.90 (0.80–1.01)	0.061	0.83 (0.67–1.04)	0.102	0.81 (0.76–0.86)	<0.001
Anaplastic astrocytoma	16,441	11,434	0.38 (0.34–0.42)	<0.001	1.26 (1.15–1.38)	<0.001	0.97 (0.94–1.01)	0.111	1.08 (1.01–1.17)	0.035	0.84 (0.74–0.94)	0.003	0.96 (0.75–1.23)	0.756	0.82 (0.77–0.88)	<0.001
Glioblastoma	133,535	118,828	0.73 (0.68–0.78)	<0.001	1.76 (1.65–1.88)	<0.001	1.02 (1.01–1.04)	<0.001	0.93 (0.90–0.95)	<0.001	0.70 (0.68–0.73)	<0.001	1.00 (0.91–1.09)	0.927	0.77 (0.76–0.79)	<0.001
Oligodendroglioma	11,122	3,340	3.24 (2.21–4.76)	<0.001	7.32 (5.01–10.71)	<0.001	0.88 (0.82–0.94)	<0.001	1.44 (1.25–1.65)	<0.001	0.78 (0.62–0.96)	0.022	1.21 (0.80–1.84)	0.374	0.77 (0.68–0.87)	<0.001
Anaplastic oligodendroglioma	4,998	2,334	0.76 (0.50–1.15)	0.191	1.63 (1.08–2.46)	0.021	0.90 (0.82–0.97)	0.008	1.29 (1.09–1.52)	0.003	0.83 (0.68–1.03)	0.089	0.95 (0.55–1.64)	0.861	0.78 (0.68–0.90)	<0.001
Oligoastrocytic tumors	6,756	3,237	1.69 (1.24–2.31)	<0.001	3.67 (2.69–5.00)	<0.001	0.93 (0.87–1.00)	0.055	1.30 (1.13–1.50)	<0.001	0.90 (0.74–1.10)	0.292	1.38 (0.94–2.02)	0.098	0.88 (0.78–0.99)	0.036
Pilocytic astrocytoma	14,222	1,062	1.69 (1.45–1.97)	<0.001	7.87 (6.81–9.10)	<0.001	0.86 (0.76–0.97)	0.015	1.40 (1.17–1.69)	<0.001	0.98 (0.66–1.47)	0.936	1.23 (0.64–2.38)	0.535	1.14 (0.95–1.36)	0.164
Unique astrocytoma variants	1,267	298	1.21 (0.87–1.68)	0.256	4.30 (3.11–5.96)	<0.001	0.79 (0.63–0.99)	0.043	0.87 (0.61–1.23)	0.429	1.36 (0.78–2.39)	0.282	1.70 (0.70–4.14)	0.24	0.83 (0.58–1.17)	0.276
Ependymal tumors	10,831	2,297	0.42 (0.37–0.48)	<0.001	0.88 (0.80–0.97)	0.010	0.75 (0.69–0.82)	<0.001	1.26 (1.10–1.44)	<0.001	0.92 (0.71–1.18)	0.493	1.01 (0.62–1.66)	0.966	1.10 (0.98–1.23)	0.120
Glioma malignant, NOS	18,803	8,935	0.76 (0.70–0.82)	<0.001	3.53 (3.35–3.71)	<0.001	1.02 (0.98–1.06)	0.367	1.10 (1.03–1.17)	0.006	0.94 (0.83–1.06)	0.282	0.87 (0.65–1.16)	0.332	1.02 (0.96–1.09)	0.465
Other neuroepithelial tumors	169	52	2.63 (0.72–9.61)	0.144	**	**	0.85 (0.46–1.55)	0.588	0.60 (0.21–1.72)	0.339	1.17 (0.36–3.83)	0.791	**	**	0.66 (0.30–1.48)	0.317
Neuronal and mixed neuronal-glial Tumors	2,304	732	1.39 (1.01–1.90)	0.040	2.13 (1.60–2.83)	<0.001	0.79 (0.68–0.92)	0.002	1.44 (1.14–1.83)	0.002	1.02 (0.72–1.44)	0.922	1.67 (0.74–3.75)	0.217	1.10 (0.87–1.38)	0.431
Choroid plexus tumors	351	135	0.72 (0.41–1.28)	0.263	1.42 (0.91–2.22)	0.123	0.91 (0.65–1.28)	0.577	1.36 (0.81–2.28)	0.248	1.13 (0.52–2.46)	0.754	3.55 (1.25–10.08)	0.018	0.62 (0.40–0.97)	0.036
Tumors of the pineal region	1,016	357	0.72 (0.56–0.93)	0.013	1.10 (0.85–1.43)	0.481	0.74 (0.60–0.91)	0.005	1.11 (0.86–1.43)	0.442	0.51 (0.23–1.16)	0.107	0.89 (0.28–2.79)	0.836	1.02 (0.76–1.38)	0.872
Embryonal tumors	9,854	3,819	0.83 (0.77–0.90)	<0.001	1.96 (1.79–2.16)	<0.001	1.00 (0.93–1.06)	0.903	1.24 (1.12–1.37)	<0.001	1.08 (0.92–1.27)	0.359	0.84 (0.56–1.27)	0.41	0.96 (0.88–1.04)	0.288
Nerve sheath tumors	664	233	1.54 (0.81–2.93)	0.192	1.67 (0.90–3.10)	0.106	0.76 (0.58–0.98)	0.037	1.84 (1.27–2.68)	0.001	0.15 (0.04–0.62)	0.009	**	**	1.10 (0.73–1.64)	0.652
Meningiomas	4,809	2,325	0.76 (0.43–1.33)	0.334	2.41 (1.42–4.07)	0.001	0.73 (0.67–0.79)	<0.001	0.93 (0.83–1.05)	0.227	0.84 (0.68–1.05)	0.130	0.81 (0.42–1.55)	0.518	0.76 (0.65–0.89)	<0.001
Mesenchymal tumors	1,847	736	0.70 (0.51–0.95)	0.022	1.51 (1.15–1.98)	0.003	1.01 (0.87–1.17)	0.882	1.10 (0.86–1.40)	0.455	0.89 (0.63–1.26)	0.510	1.54 (0.76–3.09)	0.23	0.88 (0.71–1.10)	0.259

Table 23 Continued

Histology	N	Deaths	Age Groups (compared to children ages 0–14 years[a])				Sex (compared to male)		Race & Ethnicity (Compared to White, Non-Hispanic)							
			AYA[b] (15–39) Years		Adults (40+) Years		Female		Black, Non-Hispanic		API, Non-Hispanic		AIAN, Non-Hispanic		Hispanic	
			HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value
Primary melanocytic lesions	158	118	0.35 (0.17–0.73)	0.005	0.55 (0.30–1.00)	0.049	0.88 (0.60–1.29)	0.517	1.46 (0.58–3.72)	0.423	0.98 (0.31–3.12)	0.969	**	**	1.53 (0.89–2.61)	0.124
Lymphoma	18,255	12,372	3.77 (2.60–5.46)	<0.001	7.00 (4.86–10.08)	<0.001	0.94 (0.91–0.97)	<0.001	1.14 (1.08–1.22)	<0.001	0.80 (0.73–0.87)	<0.001	1.07 (0.86–1.35)	0.539	0.90 (0.85–0.96)	<0.001
Other hematopoietic neoplasms	223	101	**	**	**	**	1.10 (0.74–1.64)	0.634	0.84 (0.51–1.38)	0.500	1.19 (0.43–3.30)	0.733	1.84 (0.44–7.64)	0.402	0.66 (0.35–1.26)	0.209
Germ cell tumors	2,921	437	1.04 (0.85–1.27)	0.697	3.49 (2.43–5.01)	<0.001	1.54 (1.25–1.90)	<0.001	0.84 (0.59–1.20)	0.345	1.02 (0.73–1.40)	0.925	1.52 (0.56–4.09)	0.408	1.12 (0.89–1.42)	0.324
Tumors of the pituitary	401	134	**	**	**	**	0.75 (0.53–1.07)	0.112	1.70 (1.12–2.57)	0.012	0.58 (0.14–2.35)	0.442	**	**	0.80 (0.44–1.44)	0.453
Neoplasm, unspecified	10,172	8,281	0.68 (0.56–0.82)	<0.001	3.08 (2.63–3.60)	<0.001	1.05 (1.01–1.10)	0.018	0.74 (0.68–0.80)	<0.001	0.81 (0.70–0.93)	0.003	0.77 (0.57–1.03)	0.075	0.70 (0.64–0.76)	<0.001
All other	173	96	0.69 (0.40–1.17)	0.168	0.87 (0.48–1.60)	0.660	0.75 (0.50–1.14)	0.184	0.83 (0.39–1.74)	0.618	1.08 (0.39–3.02)	0.885	1.12 (0.27–4.63)	0.879	0.94 (0.56–1.58)	0.819

[a]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[b]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya.
** Cannot be calculated
Abbreviations: AYA, Adolescents and Young Adults; CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 24 One-, Five-, and Ten-Year Relative Survival Rates[a,b] (RS) with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Histology and Behavior, Overall and by NCI Age Group at Diagnosis, CBTRUS Statistical Report: NPCR and SEER, 2001–2017 (varying)

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Diffuse astrocytoma	0–14[g]	1,964	92.2 (90.9–93.4)	82.2 (80.4–83.9)	80.0 (78.0–81.9)	2,487	91.9 (90.7–92.9)	81.3 (79.7–82.9)	79.3 (77.5–81.0)	--	--	--	--
	15–39[h]	5,987	95.5 (94.9–96.0)	77.6 (76.4–78.8)	60.9 (59.2–62.6)	7,290	94.9 (94.4–95.4)	76.4 (75.3–77.5)	59.1 (57.7–60.5)	--	--	--	--
	40+	10,968	62.5 (61.5–63.4)	33.1 (32.1–34.1)	25.0 (23.9–26.0)	13,519	60.8 (59.9–61.6)	32.0 (31.2–32.9)	23.6 (22.7–24.5)	--	--	--	--
	All ages	18,919	76.0 (75.4–76.6)	52.4 (51.6–53.2)	42.3 (41.4–43.2)	23,296	74.8 (74.2–75.4)	51.4 (50.7–52.1)	41.0 (40.2–41.8)	--	--	--	--
Anaplastic astrocytoma	0–14	616	65.8 (61.9–69.5)	24.5 (20.9–28.2)	18.7 (15.1–22.6)	711	65.3 (61.6–68.7)	24.5 (21.2–27.9)	19.5 (16.2–22.9)	--	--	--	--
	15–39	3,647	92.2 (91.3–93.1)	62.6 (60.8–64.4)	46.0 (43.7–48.3)	4,342	91.1 (90.2–91.9)	60.9 (59.2–62.5)	44.7 (42.8–46.7)	--	--	--	--
	40+	9,501	57.0 (55.9–58.0)	19.7 (18.8–20.6)	14.0 (13.1–15.0)	11,460	55.2 (54.3–56.1)	19.2 (18.4–20.1)	13.8 (13.0–14.6)	--	--	--	--
	All ages	13,764	66.7 (65.9–67.5)	31.3 (30.4–32.2)	22.7 (21.8–23.7)	16,513	65.1 (64.4–65.9)	30.5 (29.7–31.2)	22.2 (21.4–23.0)	--	--	--	--
Glioblastoma	0–14	1,031	56.8 (53.7–59.8)	19.4 (16.9–22.2)	16.4 (13.8–19.1)	1,216	56.3 (53.4–59.1)	20.6 (18.2–23.1)	17.6 (15.3–20.1)	--	--	--	--
	15–39	5,912	76.2 (75.0–77.3)	26.0 (24.8–27.3)	18.2 (16.9–19.5)	7,058	75.3 (74.2–76.3)	26.0 (24.9–27.1)	18.4 (17.3–19.5)	--	--	--	--
	40+	106,806	40.5 (40.2–40.8)	5.6 (5.4–5.8)	3.4 (3.2–3.5)	125,699	38.8 (38.6–39.1)	5.3 (5.1–5.4)	3.3 (3.1–3.4)	--	--	--	--
	All ages	113,749	42.5 (42.2–42.8)	6.8 (6.7–7.0)	4.3 (4.2–4.5)	133,973	40.9 (40.7–41.2)	6.6 (6.4–6.7)	4.3 (4.1–4.4)	--	--	--	--
Oligodendroglioma	0–14	264	97.3 (94.5–98.7)	94.0 (90.2–96.4)	91.7 (87.0–94.8)	351	97.1 (94.7–98.5)	94.2 (91.0–96.2)	91.5 (87.6–94.2)	--	--	--	--
	15–39	3,606	98.6 (98.2–99.0)	92.2 (91.1–93.2)	77.8 (75.8–79.7)	4,521	98.6 (98.2–99.0)	92.0 (91.1–92.9)	77.1 (75.5–78.7)	--	--	--	--
	40+	5,052	92.4 (91.5–93.1)	76.8 (75.4–78.1)	63.4 (61.4–65.3)	6,336	91.5 (90.8–92.2)	75.8 (74.5–77.0)	61.9 (60.2–63.4)	--	--	--	--
	All ages	8,922	95.1 (94.5–95.5)	83.6 (82.7–84.5)	70.2 (68.8–71.6)	11,208	94.6 (94.1–95.0)	83.0 (82.2–83.8)	69.1 (68.0–70.2)	--	--	--	--

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Anaplastic oligodendroglioma	0–14	--	--	--	--	54	84.8 (71.9–92.1)	59.5 (44.2–71.8)	54.1 (38.6–67.3)	--	--	--	--
	15–39	--	--	--	--	1,470	95.4 (94.2–96.4)	77.0 (74.5–79.3)	62.5 (59.4–65.5)	--	--	--	--
	40+	2,785	85.3 (83.9–86.7)	59.2 (57.1–61.3)	45.2 (42.5–47.9)	3,504	83.4 (82.1–84.7)	55.2 (53.3–57.0)	41.9 (39.7–44.1)	--	--	--	--
	All ages	3,988	88.4 (87.3–89.4)	65.1 (63.4–66.8)	50.5 (48.3–52.7)	5,028	87.0 (86.0–87.9)	61.7 (60.2–63.2)	48.3 (46.5–50.1)	--	--	--	--
Oligoastrocytic tumors	0–14	144	91.0 (84.9–94.7)	80.8 (73.2–86.5)	78.9 (70.9–84.9)	184	90.2 (84.9–93.7)	77.9 (71.0–83.3)	76.5 (69.4–82.1)	--	--	--	--
	15–39	2,465	97.6 (96.8–98.1)	80.6 (78.9–82.2)	60.5 (58.0–63.0)	3,022	97.3 (96.7–97.9)	79.3 (77.8–80.8)	59.2 (57.0–61.3)	--	--	--	--
	40+	2,981	82.8 (81.4–84.2)	55.0 (53.1–56.9)	44.1 (41.9–46.3)	3,602	81.9 (80.6–83.2)	53.4 (51.7–55.2)	42.4 (40.4–44.3)	--	--	--	--
	All ages	5,590	89.6 (88.7–90.4)	67.1 (65.8–68.4)	52.4 (50.7–54.0)	6,808	89.0 (88.2–89.8)	65.7 (64.5–66.9)	50.9 (49.4–52.3)	--	--	--	--
Pilocytic astrocytoma	0–14	7,319	98.9 (98.6–99.1)	97.1 (96.6–97.5)	95.7 (95.0–96.3)	8,691	98.8 (98.5–99.0)	96.8 (96.4–97.2)	95.3 (94.7–95.8)	--	--	--	--
	15–39	3,629	98.5 (98.0–98.9)	94.9 (94.0–95.7)	93.1 (91.9–94.1)	4,312	98.4 (97.9–98.7)	94.8 (94.0–95.5)	92.9 (91.9–93.8)	--	--	--	--
	40+	1,214	92.2 (90.4–93.7)	79.6 (76.6–82.2)	77.2 (73.5–80.4)	1,439	91.7 (90.1–93.1)	78.7 (76.1–81.1)	76.8 (73.6–79.6)	--	--	--	--
	All ages	12,162	98.1 (97.8–98.4)	94.7 (94.2–95.1)	93.1 (92.4–93.7)	14,442	98.0 (97.7–98.2)	94.4 (94.0–94.8)	92.8 (92.2–93.3)	--	--	--	--
Unique astrocytoma variants	0–14	892	97.9 (96.6–98.6)	94.6 (92.7–96.0)	91.6 (88.7–93.7)	356	96.0 (93.3–97.6)	86.9 (82.5–90.3)	81.1 (75.2–85.7)	585	98.7 (97.2–99.4)	97.9 (96.2–98.8)	96.2 (93.1–97.9)
	15–39	851	97.1 (95.7–98.1)	87.3 (84.5–89.6)	83.5 (80.1–86.4)	654	97.4 (95.8–98.4)	82.9 (79.3–85.8)	79.5 (75.5–82.9)	291	96.5 (93.5–98.1)	94.4 (90.6–96.7)	91.1 (85.6–94.6)
	40+	308	84.9 (80.1–88.6)	60.4 (53.9–66.4)	54.0 (46.1–61.2)	275	82.7 (77.5–86.8)	54.3 (47.4–60.7)	50.2 (42.4–57.4)	69	91.6 (81.3–96.3)	80.8 (67.6–89.1)	67.1 (47.3–80.9)
	All ages	2,051	95.6 (94.6–96.5)	86.6 (84.8–88.1)	82.9 (80.6–84.9)	1,285	93.9 (92.4–95.1)	78.0 (75.3–80.4)	74.0 (70.9–76.8)	945	97.5 (96.2–98.3)	95.6 (93.9–96.9)	92.7 (89.9–94.7)

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Ependymal tumors	0–14	2,268	95.5 (94.5–96.3)	80.2 (78.3–82.0)	71.5 (68.9–73.8)	2,420	94.5 (93.5–95.4)	76.6 (74.7–78.4)	67.0 (64.6–69.2)	254	99.6 (96.7–100.0)	97.6 (94.0–99.1)	97.6 (94.0–99.1)
	15–39	4,593	98.2 (97.8–98.6)	94.8 (94.0–95.5)	91.6 (90.4–92.6)	3,047	97.1 (96.4–97.7)	91.4 (90.2–92.4)	87.2 (85.7–88.6)	2,023	99.5 (99.0–99.8)	98.9 (98.1–99.4)	97.5 (96.0–98.4)
	40+	8,710	94.9 (94.3–95.3)	90.9 (90.0–91.7)	87.7 (86.3–89.0)	5,483	93.1 (92.4–93.8)	86.8 (85.6–87.9)	83.2 (81.5–84.7)	4,099	96.5 (95.8–97.1)	95.0 (93.8–96.1)	92.6 (90.3–94.3)
	All ages	15,571	96.0 (95.6–96.3)	90.5 (89.9–91.1)	86.5 (85.6–87.3)	10,950	94.5 (94.1–95.0)	85.8 (85.0–86.6)	80.7 (79.7–81.7)	6,376	97.6 (97.1–98.0)	96.4 (95.6–97.1)	94.4 (93.0–95.6)
Glioma malignant, NOS	0–14	5,637	81.9 (80.9–82.9)	69.7 (68.4–70.9)	68.5 (67.2–69.8)	6,625	81.1 (80.1–82.0)	68.3 (67.1–69.4)	67.0 (65.8–68.2)	--	--	--	--
	15–39	3,306	92.1 (91.1–93.0)	79.3 (77.7–80.8)	71.6 (69.4–73.6)	3,835	91.4 (90.5–92.3)	78.0 (76.5–79.4)	70.1 (68.3–71.9)	--	--	--	--
	40+	7,167	52.6 (51.4–53.8)	35.7 (34.4–36.9)	29.5 (28.0–31.0)	8,571	50.9 (49.8–52.0)	33.9 (32.8–35.0)	27.9 (26.6–29.2)	--	--	--	--
	All ages	16,110	71.1 (70.4–71.9)	56.8 (56.0–57.7)	52.3 (51.3–53.2)	19,031	69.8 (69.1–70.4)	55.1 (54.3–55.8)	50.5 (49.7–51.4)	--	--	--	--
Other neuroepithelial tumors	0–14	63	98.4 (88.5–99.8)	92.0 (79.6–97.0)	92.0 (79.6–97.0)	53	98.1 (86.7–99.7)	90.7 (76.6–96.5)	90.7 (76.6–96.5)	--	--	--	--
	15–39	79	96.2 (88.3–98.8)	88.2 (77.2–94.1)	83.8 (71.1–91.3)	63	95.2 (85.5–98.4)	87.4 (74.9–94.0)	79.2 (63.5–88.7)	--	--	--	--
	40+	100	70.5 (59.9–78.7)	50.0 (38.2–60.7)	40.6 (27.4–53.4)	58	67.5 (53.3–78.3)	39.4 (25.3–53.2)	30.9 (16.8–46.2)	52	76.2 (61.1–86.0)	58.0 (40.8–71.8)	51.3 (31.8–67.7)
	All ages	242	86.4 (81.1–90.2)	73.7 (66.8–79.5)	68.4 (60.1–75.3)	174	86.9 (80.7–91.3)	72.5 (64.3–79.1)	66.6 (57.2–74.4)	92	86.9 (77.5–92.6)	75.7 (63.8–84.1)	72.2 (58.5–82.1)
Neuronal and mixed neuronal-glial tumors	0–14	2,916	98.7 (98.1–99.0)	95.8 (94.9–96.5)	94.8 (93.7–95.7)	269	91.3 (87.1–94.1)	80.6 (75.0–85.1)	79.0 (73.1–83.7)	2,703	99.3 (98.9–99.6)	97.1 (96.2–97.7)	96.1 (95.0–96.9)
	15–39	4,544	98.4 (98.0–98.8)	95.4 (94.7–96.1)	92.2 (91.0–93.3)	551	94.7 (92.4–96.3)	78.8 (74.8–82.2)	70.0 (65.0–74.4)	4,073	98.9 (98.5–99.2)	97.6 (96.9–98.1)	95.3 (94.2–96.2)
	40+	3,605	93.5 (92.5–94.3)	85.1 (83.5–86.5)	80.5 (78.2–82.6)	1,491	90.5 (88.8–92.0)	77.0 (74.2–79.5)	68.5 (64.6–72.0)	2,323	94.8 (93.7–95.7)	89.8 (88.0–91.3)	86.7 (84.2–88.9)
	All ages	11,065	96.9 (96.5–97.2)	92.2 (91.5–92.8)	89.2 (88.2–90.0)	2,311	91.6 (90.3–92.7)	77.9 (75.8–79.8)	70.3 (67.6–72.8)	9,099	98.0 (97.6–98.3)	95.4 (94.9–96.0)	93.4 (92.5–94.1)

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Choroid plexus tumors	0–14	877	95.5 (93.8–96.7)	89.7 (87.2–91.7)	87.2 (84.3–89.6)	266	87.1 (82.3–90.7)	65.4 (58.7–71.2)	58.8 (51.5–65.4)	652	98.3 (96.8–99.1)	97.2 (95.4–98.3)	96.4 (94.0–97.8)
	15–39	538	98.0 (96.3–98.9)	96.0 (93.6–97.5)	91.8 (87.8–94.5)	--	--	--	--	501	98.0 (96.2–99.0)	96.8 (94.6–98.1)	94.6 (91.0–96.8)
	40+	617	89.3 (86.3–91.6)	84.1 (80.0–87.5)	80.3 (74.1–85.2)	--	--	--	--	573	90.3 (87.3–92.7)	85.9 (81.6–89.3)	83.6 (77.0–88.5)
	All ages	2,032	94.3 (93.1–95.3)	89.7 (88.0–91.1)	86.4 (84.1–88.4)	359	86.4 (82.2–89.6)	67.0 (61.4–72.0)	57.0 (50.5–63.0)	1,726	95.6 (94.4–96.5)	93.5 (91.9–94.8)	91.8 (89.4–93.6)
Tumors of the pineal region	0–14	347	89.1 (85.2–92.0)	67.7 (61.9–72.8)	60.7 (54.2–66.6)	350	86.0 (81.8–89.3)	61.9 (56.1–67.1)	53.8 (47.5–59.6)	55	98.2 (87.1–99.8)	98.2 (87.1–99.8)	98.2 (87.1–99.8)
	15–39	635	95.2 (93.1–96.6)	86.0 (82.5–88.8)	81.3 (76.9–84.9)	377	92.7 (89.4–94.9)	72.7 (67.2–77.5)	64.2 (57.7–69.9)	313	97.4 (94.8–98.7)	96.9 (93.7–98.5)	95.1 (90.2–97.6)
	40+	676	90.6 (87.9–92.7)	80.8 (76.7–84.3)	71.9 (65.8–77.1)	304	86.5 (82.0–90.0)	70.4 (63.9–75.9)	56.5 (48.4–63.9)	405	92.7 (89.3–95.0)	87.4 (82.2–91.2)	81.9 (73.6–87.9)
	All ages	1,658	92.0 (90.5–93.3)	80.0 (77.6–82.1)	73.1 (70.0–76.1)	1,031	88.6 (86.4–90.4)	68.3 (64.9–71.3)	58.6 (54.7–62.3)	773	95.0 (93.0–96.4)	92.2 (89.2–94.3)	88.7 (84.2–92.0)
Embryonal tumors	0–14	5,567	81.6 (80.5–82.6)	63.4 (62.0–64.7)	58.5 (57.0–60.0)	6,705	81.2 (80.2–82.1)	62.5 (61.3–63.7)	57.8 (56.4–59.1)	--	--	--	--
	15–39	2,011	90.9 (89.5–92.1)	70.7 (68.5–72.9)	60.1 (57.4–62.8)	2,466	90.2 (89.0–91.3)	70.2 (68.2–72.2)	60.1 (57.8–62.4)	--	--	--	--
	40+	732	69.8 (66.3–73.1)	44.9 (40.9–48.8)	36.9 (32.5–41.4)	865	69.8 (66.5–72.8)	45.7 (42.1–49.3)	36.9 (33.0–40.9)	--	--	--	--
	All ages	8,310	82.8 (82.0–83.6)	63.5 (62.4–64.6)	57.0 (55.7–58.2)	10,036	82.4 (81.7–83.2)	63.0 (62.0–64.0)	56.5 (55.4–57.6)	--	--	--	--
Nerve sheath tumors	0–14	2,138	99.8 (99.4–99.9)	98.7 (98.0–99.2)	97.9 (97.0–98.6)	--	--	--	--	2,104	100.0 (1.0–100.0)	99.1 (98.5–99.5)	98.4 (97.5–99.0)
	15–39	12,097	99.3 (99.1–99.4)	98.4 (98.1–98.7)	97.5 (97.0–97.9)	--	--	--	--	11,970	99.5 (99.3–99.6)	98.8 (98.5–99.0)	97.8 (97.3–98.2)
	40+	64,437	99.2 (99.1–99.3)	99.2 (99.1–99.3)	99.2 (99.1–99.3)	461	86.1 (82.3–89.1)	76.7 (71.8–80.9)	74.2 (67.6–79.7)	64,104	99.3 (99.2–99.4)	99.3 (99.2–99.4)	99.3 (99.2–99.4)
	All ages	78,672	99.2 (99.1–99.3)	99.2 (99.1–99.3)	99.2 (99.1–99.3)	669	85.1 (82.0–87.7)	74.7 (70.8–78.2)	71.7 (66.7–76.0)	78,178	99.3 (99.2–99.4)	99.3 (99.2–99.4)	99.3 (99.2–99.4)

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Other tumors of cranial and paraspinal nerves	0–14	--	--	--	--	--	--	--	--	--	--	--	--
	15–39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	--	--	--	--	--	--	--	--	--	--	--	--
	All ages	59	95.8 (83.4–99.0)	91.2 (75.8–97.0)	84.1 (60.5–94.2)	--	--	--	--	59	95.8 (83.4–99.0)	91.2 (75.8–97.0)	84.1 (60.5–94.2)
Meningiomas	0–14	622	97.5 (95.9–98.5)	95.4 (93.2–96.9)	91.7 (88.5–94.1)	58	89.6 (78.3–95.2)	77.8 (64.0–86.8)	72.0 (56.6–82.7)	575	98.4 (96.9–99.2)	96.7 (94.6–98.0)	93.4 (90.1–95.6)
	15–39	21,287	98.7 (98.5–98.9)	96.8 (96.5–97.1)	94.6 (94.1–95.0)	396	94.2 (91.3–96.1)	83.4 (79.0–86.9)	78.0 (72.8–82.4)	20,985	98.8 (98.6–98.9)	97.1 (96.8–97.3)	94.9 (94.4–95.3)
	40+	319,101	92.7 (92.6–92.8)	87.3 (87.1–87.5)	82.6 (82.2–82.9)	4,388	83.4 (82.2–84.6)	65.9 (64.1–67.6)	59.0 (56.7–61.2)	315,698	92.8 (92.7–93.0)	87.6 (87.4–87.8)	82.9 (82.5–83.2)
	All ages	341,010	93.1 (93.0–93.2)	88.0 (87.8–88.1)	83.4 (83.1–83.7)	4,842	84.4 (83.2–85.5)	67.5 (65.8–69.2)	60.8 (58.7–62.9)	337,258	93.2 (93.1–93.3)	88.2 (88.0–88.4)	83.7 (83.4–84.0)
Mesenchymal tumors	0–14	1,113	97.6 (96.5–98.4)	93.9 (92.1–95.3)	91.7 (89.1–93.7)	182	85.4 (79.3–89.9)	68.9 (61.2–75.4)	61.3 (52.6–68.9)	964	99.3 (98.3–99.7)	97.6 (96.1–98.5)	96.1 (93.7–97.6)
	15–39	4,028	98.2 (97.7–98.6)	95.7 (95.0–96.4)	93.3 (92.1–94.3)	510	92.4 (89.7–94.5)	79.5 (75.3–83.0)	72.1 (67.1–76.4)	3,630	98.8 (98.4–99.1)	97.5 (96.8–98.0)	95.4 (94.2–96.3)
	40+	9,736	94.2 (93.6–94.7)	89.3 (88.4–90.2)	83.6 (82.1–85.1)	1,190	86.9 (84.7–88.8)	68.1 (64.8–71.3)	51.1 (46.8–55.2)	8,745	95.0 (94.4–95.5)	91.8 (90.9–92.6)	87.5 (85.9–88.9)
	All ages	14,877	95.5 (95.1–95.9)	91.4 (90.8–92.0)	86.9 (85.9–87.9)	1,882	88.3 (86.6–89.7)	71.4 (69.0–73.8)	58.3 (55.1–61.3)	13,339	96.3 (95.9–96.7)	93.8 (93.1–94.3)	90.3 (89.2–91.3)
Primary melanocytic lesions	0–14	--	--	--	--	--	--	--	--	--	--	--	--
	15–39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	159	67.9 (59.6–74.8)	44.7 (35.7–53.2)	26.4 (15.4–38.7)	113	59.1 (49.1–67.8)	32.2 (22.9–41.9)	16.6 (7.3–29.0)	64	85.2 (72.7–92.3)	60.1 (43.3–73.4)	37.2 (18.3–56.3)
	All ages	221	67.5 (60.7–73.5)	46.7 (39.0–54.0)	30.8 (21.9–40.1)	159	56.1 (47.9–63.6)	32.9 (25.1–40.9)	20.7 (12.7–30.1)	88	88.1 (78.4–93.6)	67.5 (53.9–77.8)	48.6 (32.1–63.3)
Lymphoma	0–14	158	91.5 (85.8–95.0)	85.3 (78.2–90.2)	78.4 (67.9–85.8)	179	91.4 (86.1–94.7)	85.3 (78.7–89.9)	80.4 (72.0–86.5)	--	--	--	--
	15–39	1,430	66.6 (64.0–69.0)	58.6 (55.8–61.2)	53.8 (50.6–56.9)	1,809	62.2 (59.8–64.4)	53.4 (51.0–55.8)	49.3 (46.6–51.8)	--	--	--	--
	40+	13,843	53.7 (52.9–54.6)	35.5 (34.6–36.4)	27.3 (26.1–28.4)	16,365	53.1 (52.3–53.9)	34.1 (33.3–35.0)	25.4 (24.4–26.4)	--	--	--	--
	All ages	15,431	55.3 (54.5–56.1)	38.3 (37.4–39.2)	30.5 (29.5–31.6)	18,353	54.4 (53.6–55.1)	36.7 (35.9–37.5)	28.6 (27.7–29.5)	--	--	--	--

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Other hematopoietic neoplasms	0–14	--	--	--	--	--	--	--	--	--	--	--	--
	15–39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	139	81.6 (73.5–87.4)	65.0 (54.9–73.4)	61.0 (49.9–70.3)	176	81.8 (74.7–87.0)	63.4 (54.6–71.0)	58.7 (48.7–67.4)	--	--	--	--
	All ages	155	83.5 (76.1–88.8)	65.5 (56.1–73.5)	61.8 (51.5–70.6)	199	83.9 (77.6–88.6)	65.4 (57.3–72.4)	61.3 (52.1–69.3)	--	--	--	--
Germ cell tumors	0–14	1,304	93.4 (91.9–94.7)	89.1 (87.1–90.8)	86.0 (83.5–88.2)	1,344	92.8 (91.2–94.1)	87.2 (85.1–89.0)	83.4 (80.8–85.6)	168	93.3 (88.0–96.3)	92.6 (87.1–95.8)	92.6 (87.1–95.8)
	15–39	1,380	95.1 (93.7–96.1)	89.0 (87.0–90.7)	87.0 (84.7–88.9)	1,507	94.1 (92.8–95.2)	87.9 (86.0–89.6)	85.4 (83.2–87.4)	116	99.2 (93.0–99.9)	93.4 (85.8–97.0)	90.8 (81.9–95.4)
	40+	183	91.8 (86.2–95.2)	83.6 (75.6–89.1)	80.6 (70.1–87.8)	87	81.6 (71.1–88.6)	65.7 (53.1–75.6)	61.5 (47.0–73.1)	113	98.2 (89.8–99.7)	92.6 (81.6–97.1)	89.1 (75.8–95.3)
	All ages	2,867	94.1 (93.2–94.9)	88.7 (87.3–89.9)	86.2 (84.6–87.7)	2,938	93.2 (92.2–94.0)	86.9 (85.6–88.2)	83.9 (82.2–85.4)	397	96.5 (93.9–98.0)	92.7 (88.9–95.3)	91.0 (86.4–94.1)
Tumors of the pituitary	0–14	2,158	99.9 (99.5–100.0)	99.5 (98.9–99.7)	99.1 (98.2–99.5)	--	--	--	--	2,156	99.9 (99.5–100.0)	99.5 (98.9–99.7)	99.1 (98.2–99.5)
	15–39	47,300	99.7 (99.6–99.8)	99.3 (99.2–99.4)	98.7 (98.5–98.9)	--	--	--	--	47,235	99.7 (99.6–99.8)	99.3 (99.2–99.4)	98.7 (98.5–98.9)
	40+	104,717	97.5 (97.4–97.6)	95.7 (95.5–96.0)	93.5 (93.0–93.9)	358	88.0 (83.8–91.2)	78.9 (72.9–83.7)	72.7 (64.4–79.5)	104,428	97.5 (97.4–97.6)	95.8 (95.5–96.0)	93.5 (93.0–94.0)
	All ages	154,175	98.2 (98.1–98.3)	96.9 (96.7–97.1)	95.2 (94.9–95.5)	456	90.2 (86.8–92.8)	81.2 (76.3–85.2)	76.9 (70.3–82.3)	153,819	98.2 (98.1–98.3)	97.0 (96.8–97.1)	95.3 (95.0–95.6)
Craniopharyngioma	0–14	1,688	98.6 (97.9–99.1)	95.7 (94.5–96.7)	92.5 (90.7–94.0)	--	--	--	--	1,681	98.7 (98.0–99.1)	95.8 (94.5–96.7)	92.6 (90.7–94.0)
	15–39	1,745	96.0 (94.9–96.9)	91.2 (89.6–92.6)	87.5 (85.3–89.4)	--	--	--	--	1,743	96.0 (94.9–96.8)	91.2 (89.6–92.6)	87.6 (85.4–89.4)
	40+	3,888	89.0 (87.9–90.0)	78.6 (77.0–80.2)	69.6 (67.1–71.9)	--	--	--	--	3,878	89.0 (87.9–90.0)	78.7 (77.0–80.3)	69.6 (67.1–71.9)
	All ages	7,321	92.9 (92.3–93.5)	85.7 (84.7–86.7)	79.6 (78.2–81.0)	--	--	--	--	7,302	92.9 (92.3–93.5)	85.8 (84.8–86.7)	79.7 (78.2–81.0)

Table 24 Continued

Histology	Age Groups (years)	All				Malignant[c]				Non-Malignant[d]			
		N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Hemangioma	0–14	526	99.6 (98.3–99.9)	98.5 (96.7–99.3)	98.5 (96.7–99.3)	--	--	--	--	526	99.6 (98.3–99.9)	98.5 (96.7–99.3)	98.5 (96.7–99.3)
	15–39	2,412	99.6 (99.2–99.8)	98.7 (97.9–99.2)	96.8 (95.1–97.8)	--	--	--	--	2,406	99.7 (99.3–99.9)	98.8 (98.0–99.2)	96.8 (95.2–97.9)
	40+	4,796	96.2 (95.5–96.8)	92.4 (91.1–93.6)	90.7 (88.3–92.7)	--	--	--	--	4,790	96.2 (95.5–96.8)	92.5 (91.1–93.6)	90.8 (88.4–92.7)
	All ages	7,734	97.5 (97.1–97.9)	94.9 (94.0–95.6)	93.2 (91.8–94.5)	--	--	--	--	7,722	97.5 (97.1–97.9)	94.9 (94.1–95.6)	93.3 (91.8–94.5)
Neoplasm, unspecified	0–14	1,324	88.1 (86.2–89.8)	84.9 (82.7–86.8)	83.2 (80.8–85.4)	371	64.9 (59.7–69.5)	56.8 (51.3–61.8)	53.5 (47.8–58.8)	998	95.5 (94.0–96.6)	94.0 (92.3–95.4)	93.0 (90.8–94.7)
	15–39	3,942	93.5 (92.7–94.2)	90.3 (89.2–91.2)	88.1 (86.8–89.3)	798	79.7 (76.7–82.4)	68.2 (64.6–71.5)	62.9 (58.9–66.6)	3,313	95.9 (95.2–96.5)	94.0 (93.1–94.8)	92.3 (91.0–93.4)
	40+	19,704	54.4 (53.7–55.1)	45.4 (44.6–46.3)	40.4 (39.4–41.5)	9,102	27.6 (26.6–28.5)	17.6 (16.7–18.6)	15.3 (14.3–16.3)	12,289	71.0 (70.1–71.9)	62.3 (61.2–63.4)	55.9 (54.4–57.3)
	All ages	24,970	62.6 (62.0–63.2)	54.9 (54.2–55.7)	50.8 (49.9–51.7)	10,271	33.2 (32.2–34.1)	23.2 (22.3–24.2)	20.6 (19.6–21.6)	16,600	77.6 (76.9–78.3)	70.9 (70.0–71.7)	65.9 (64.8–67.0)
All other	0–14	358	88.8 (85.0–91.7)	84.6 (80.2–88.1)	84.6 (80.2–88.1)	117	57.1 (47.3–65.7)	38.0 (28.3–47.6)	36.1 (26.3–46.0)	260	99.7 (95.2–100.0)	99.7 (95.2–100.0)	99.7 (95.2–100.0)
	15–39	327	97.9 (95.5–99.0)	93.6 (89.9–96.0)	92.0 (87.0–95.1)	--	--	--	--	300	99.1 (96.8–99.7)	97.4 (94.1–98.9)	95.7 (90.3–98.1)
	40+	503	88.8 (85.1–91.6)	85.8 (80.3–89.9)	76.5 (67.9–83.1)	--	--	--	--	484	89.8 (86.1–92.5)	87.4 (81.7–91.4)	78.3 (69.3–85.0)
	All ages	1,188	91.4 (89.5–93.0)	87.6 (85.0–89.8)	83.7 (80.0–86.8)	176	63.9 (56.1–70.7)	41.5 (33.4–49.4)	38.1 (29.8–46.4)	1,044	95.1 (93.3–96.4)	93.6 (91.0–95.5)	89.5 (85.4–92.4)
TOTAL[i]	**0–14**	**41,565**	**91.4 (91.1–91.7)**	**82.8 (82.4–83.2)**	**80.2 (79.7–80.6)**	**32,998**	**87.2 (86.9–87.6)**	**74.8 (74.3–75.3)**	**71.5 (71.0–72.1)**	**13,976**	**99.0 (98.8–99.1)**	**97.5 (97.2–97.8)**	**96.3 (95.9–96.7)**
	15–39	**139,226**	**96.9 (96.8–97.0)**	**90.6 (90.5–90.8)**	**86.4 (86.2–86.7)**	**48,434**	**90.6 (90.3–90.8)**	**71.5 (71.0–71.9)**	**60.9 (60.4–61.4)**	**99,195**	**99.2 (99.1–99.2)**	**98.2 (98.1–98.3)**	**96.9 (96.7–97.1)**
	40+	**702,935**	**82.7 (82.6–82.8)**	**72.2 (72.0–72.3)**	**68.4 (68.2–68.6)**	**215,000**	**49.1 (48.8–49.3)**	**21.0 (20.8–21.2)**	**16.7 (16.5–16.9)**	**522,597**	**94.1 (94.1–94.2)**	**90.3 (90.2–90.5)**	**87.0 (86.8–87.3)**
	All ages	**883,726**	**85.4 (85.3–85.5)**	**75.7 (75.6–75.8)**	**72.0 (71.8–72.1)**	**296,432**	**60.2 (60.0–60.4)**	**35.6 (35.4–35.8)**	**30.5 (30.3–30.7)**	**635,768**	**95.0 (95.0–95.1)**	**91.8 (91.7–91.9)**	**88.9 (88.7–89.1)**

Table 24 Continued

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]Assigned behavior code of /3 (see **Table 2**).
[d]Assigned behavior code of /0 or /1 (see **Table 2**).
[e]Total number of cases that occurred within the included NPCR and SEER registries between 2004 and 2017.
[f]Total number of cases that occurred within the included NPCR and SEER registries between 2001 and 2017.
[g]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric
[h]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya
[i]Total includes histologies not listed in this table. missing - Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380–9384, 9391–9460.
** Confidence interval could not be calculated.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; CI, confidence interval; NOS, not otherwise specified