

CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2015–2019

Quinn T. Ostrom, Ph.D., M.P.H.[†], Mackenzie Price, M.P.H.[†], Corey Neff, M.P.H., Gino Cioffi, M.P.H., Kristin A. Waite, Ph.D., Carol Kruchko, B.A., Jill S. Barnholtz-Sloan, Ph.D.

Central Brain Tumor Registry of the United States, Hinsdale, Illinois, USA (Q.T.O., M.P., C.N., G.C., K.A.W., C.K., J.S.B-S.); Department of Neurosurgery, Duke University School of Medicine, Durham, North Carolina, USA (Q.T.O., M.P., C.N.); The Preston Robert Tisch Brain Tumor Center, Duke University School of Medicine, Durham, North Carolina, USA (Q.T.O.); Duke Cancer Institute, Duke University School of Medicine, Durham, North Carolina, USA (Q.T.O.); Trans Divisional Research Program (TDRP), Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute, Bethesda, Maryland, USA (G.C., K.A.W., J.S.B-S.); Center for Biomedical Informatics & Information Technology (CBIT), National Cancer Institute, Bethesda, Maryland, USA (J.S.B-S.)

[†]These authors contributed equally to this report

Corresponding Authors: Jill S. Barnholtz-Sloan, Ph.D., National Cancer Institute, Shady Grove Campus, 9609 Medical Center Dr., Rockville, MD 20850. Email: jill.barnholtz-sloan@nih.gov; Office Phone: (240) 620-0790, Quinn T. Ostrom, Ph.D., M.P.H., Duke University School of Medicine, DUMC Box 3050, Durham, NC 27710. Email: Quinn.Ostrom@duke.edu. Office Phone: (919) 613-4810

Abstract

The Central Brain Tumor Registry of the United States (CBTRUS), in collaboration with the Centers for Disease Control and Prevention and the National Cancer Institute, 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. 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. 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 24.71 per 100,000 population (**malignant** AAAIR=7.02 and **non-malignant** AAAIR=17.69). This overall rate was higher in females compared to males (27.62 versus 21.60 per 100,000) and non-Hispanic persons compared to Hispanic persons (25.09 versus 22.95 per 100,000). The most commonly occurring **malignant** brain and other CNS histopathology was glioblastoma (14.2% of all tumors and 50.1% of all **malignant** tumors), and the most common **non-malignant** histopathology was meningioma (39.7% of all tumors and 55.4% of all **non-malignant** tumors). Glioblastoma was more common in males, and meningiomas were more common in females. In children and adolescents (ages 0-19 years), the incidence rate of all primary brain and other CNS tumors was 6.20 per 100,000 population. An estimated 93,470 new cases of **malignant** and **non-malignant** brain and other CNS tumors are expected to be diagnosed in the US population in 2022 (26,670 **malignant** and 66,806 **non-malignant**). There were 84,264 deaths attributed to **malignant** brain and other CNS tumors between 2015 and 2019. This represents an average annual mortality rate of 4.41 per 100,000 population and an average of 16,853 deaths per year. The five-year relative survival rate following diagnosis of a **malignant** brain and other CNS tumor was 35.7%, while for **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 Centers for Disease Control and Prevention (CDC) and the National Cancer Institute (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 2015-2019* contains the most up-to-date population-based data on primary brain tumors available through the surveillance system in the United States and supersedes all previous reports in terms of completeness and accuracy, thereby providing a current comprehensive source for the descriptive epidemiology of these tumors. All rates are age-adjusted using the 2000 US standard population and presented per 100,000 population.

New to the CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2015-2019: This is the first CBTRUS report to present incidence rates for selected molecularly-defined brain and other CNS tumor histopathologies for diagnoses in 2018-2019. Completeness of data on selected brain molecular markers (BMM) has improved from 2018 to 2019.

Incidence

- The average annual age-adjusted incidence rate (AAAIR) of all **malignant** and **non-malignant** brain and other CNS tumors was 24.71 per 100,000 population between 2015 and 2019. The AAAIR of **malignant** brain and other CNS tumors was 7.02 per 100,000 population, and the AAAIR of **non-malignant** brain and other CNS tumors was 17.69 per 100,000 population.
- There have been no substantial changes in incidence of **malignant** brain tumors, with the exception of a slight, but significant, increase in the youngest age group (0-14 years).
- The overall incidence rate was higher in females compared to males (27.62 versus 21.60 per 100,000) and non-Hispanic persons (of any race) compared to Hispanic persons (25.09 versus 22.95 per 100,000).
- Approximately 28.3% of all brain and other CNS tumors were **malignant** and 71.7% were **non-malignant**, which makes **non-malignant** tumors more than twice as common as **malignant** tumors for the first time.
- The most commonly occurring **malignant** brain and other CNS tumor histopathology was glioblastoma (14.2% of all tumors and 50.1% of all **malignant** tumors), and the most common **non-malignant** histopathology was meningioma (39.7% of all tumors and 55.4% of all **non-malignant** tumors). Glioblastoma was more common in males, and meningiomas were more common in females.
- In children and adolescents (ages 0-19 years), the AAAIR of **malignant** and **non-malignant** brain and other CNS tumors was 6.20 per 100,000 population between 2015 and 2019.

- In children and adolescents (ages 0-19 years), incidence was higher in females compared to males (6.29 versus 6.10 per 100,000), White persons compared to Black persons (6.39 versus 4.89 per 100,000), and non-Hispanic persons compared to Hispanic persons (6.44 versus 5.47 per 100,000).
- An estimated 93,470 new cases of **malignant** and **non-malignant** brain and other CNS tumors are expected to be diagnosed in the United States in 2022. This includes an expected 26,670 **malignant** and 66,800 **non-malignant** tumors.

Mortality

- There were 84,264 deaths attributed to **malignant** brain and other CNS tumors between 2015 and 2019. This represents an average annual mortality rate of 4.41 per 100,000 population and an average of 16,853 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 35.7%. Survival following diagnosis with a **malignant** brain and other CNS tumor was highest in persons ages 0-14 years (75.1%) and ages 15-39 years (71.7%) as compared to those ages 40+ years (21.0%).
- The five-year relative survival rate following diagnosis of a **non-malignant** brain and other CNS tumor was 91.8%. Survival following diagnosis with a **non-malignant** brain and other CNS tumor was highest in persons ages 15-39 years (98.3%) and ages 0-14 years (97.6%) as compared to those ages 40+ years (90.3%).

Introduction

The objective of the *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2015-2019* is to provide a comprehensive summary of the current descriptive epidemiology of primary brain and other CNS tumors in the US population. Primary brain and other CNS tumors include those tumors that originate from the tissues of the brain or CNS. CBTRUS obtained the latest available population-based data on all the reported 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 2015-2019. Incidence counts and rates of primary malignant and non-malignant brain and other CNS tumors are presented by histopathology, 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 2015-2019, and relative survival rates, median survival, and adjusted hazard ratios for selected

malignant and **non-malignant** histopathologies calculated using NPCR data for the period 2001-2018 (2004-2018 for **non-malignant** tumors) are also presented.

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 United States (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 reported primary brain and other CNS tumors in the United States.

This report represents the thirtieth (30th) anniversary of CBTRUS and the twenty-fifth (25th) statistical report published by CBTRUS. For this eleventh (11th) 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 reported newly-diagnosed primary brain and other CNS tumors by behavior (malignant and non-malignant), histopathology, age, sex, race, Hispanic ethnicity, selected (BMM), and geographic location. These data have been organized by clinically relevant histopathology groupings that reflect the *2016 World Health Organization (WHO) Classification of Tumours of the Central Nervous System*, including selected molecularly-defined histopathologies beginning in diagnosis year 2018.^{2,3} 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 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 United States 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 mechanism⁴ under a special agreement. Collection of central (state) cancer data was mandated in 1992 by Public Law 102-515, the Cancer Registries Amendment Act.⁵ This mandate was expanded to include non-malignant CNS tumors with the 2002 passage of Public Law 107-260, starting January 1, 2004.⁶ CBTRUS combines the NPCR data with data from the NCI's SEER Program,⁷ 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 Central Cancer Registries (NAACCR) (<http://www.naacr.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 histopathological specificity useful to the communities it serves.

The CBTRUS database is comprised of the largest histopathology-specific aggregation of population-based data limited to the incidence and survival of primary brain and other CNS tumors in the United States, and it is likely the largest histopathology-specific aggregation of primary brain and other CNS tumor cases in the world. The CBTRUS database now includes both survival data from 42 CCRs and incidence data from all 52 CCRs in the United States and Puerto Rico (excluding Nevada cases from diagnosis years 2018-2019). Aggregate information on all cancers from all 52 CCRs (excluding Nevada cases from diagnosis years 2018-2019) in the United States, including primary brain and other CNS tumors, is available from the *United States Cancer Statistics (USCS)*.⁸

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 the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) and are broadly based on the categories and site codes defined in the SEER Site/Histology Validation List.⁹ CBTRUS groups ICD-O-3 sites C71.8 (Overlapping lesion of the brain) and C71.9 (Brain, Not Otherwise Specified [NOS]) into Other brain and C72.8 (Overlapping lesion of brain and CNS) 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 Histopathology

There are over 100 distinct types of primary CNS tumors, referred to as 'histopathologies', each with its own spectrum of clinical presentations, treatments, and outcomes. These histopathologies 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 the WHO and utilize the ICD-O-3 for assignment of histopathology, behavior, and site codes. **CBTRUS is using Histopathology Groupings according to 2016 WHO Classification of Tumours of the Central Nervous System.**

The ICD-O-3 codes in this current CBTRUS grouping¹⁰ (**Table 2**) may include morphology codes that were not previously reported to CBTRUS.¹¹ Gliomas are tumors that arise from glial or precursor cells and include glioblastoma, astrocytoma, oligodendroglioma, ependymoma, oligoastrocytoma (mixed glioma), and a few rare histopathologies. As there is no standard definition for gliomas, **CBTRUS defines gliomas as ICD-O-3 histopathology 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*¹² based on the ICCC, Third edition^{13,14} and *2007 WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*¹⁵ (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 as **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.¹⁶ 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, 2004.⁶

Classification by Brain Molecular Markers

Primary brain and other CNS tumors are a highly heterogeneous group of diseases, and characterization of unique tumor histopathologies within this group has been refined over time. The development of technologies for characterizing DNA sequence, RNA abundance as a measure of gene activity, and biochemical alterations that affect gene expression such as DNA methylation have led to the discovery of several factors (known as ‘biomarkers’) that can be used to more accurately classify these tumors than histopathologic 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 histopathologies in classification, the *WHO Classification of Tumours of the Central Nervous System* 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 O-6-Methylguanine-DNA Methyltransferase (*MGMT*) (SSF 4), deletion of 1p (SSF 5), and deletion of 19q (SSF 6).¹⁷ Starting with diagnosis year 2018, the broad US cancer registry system began collecting information on multiple brain and other CNS markers, including isocitrate dehydrogenase 1/2 (*IDH1/2*) mutation,

1p/19q codeletion, medulloblastoma molecular subtypes, and all biomarkers found in 2016 WHO classification using the variable BMM (please see **Supplementary Table 2** for an overview of applicable histopathologies and coding scheme). Additional molecularly-defined histopathologies from 2016 WHO were added using their new ICD-O-3 codes for which collection also began in 2018 (See **Supplementary Table 3** for an overview of codes added in 2018). These data were available to CBTRUS for the first time with the 2021 NPCR and SEER data releases. As such these data are for the 2018 and 2019 diagnosis years only. CBTRUS evaluated the completeness of these markers in their first year (2018) of collection (please see Iorgulescu et al.¹⁸), and completeness of BMM for 2018 and 2019 is shown in **Figure 3**. CBTRUS is actively working to have all biomarkers included in the 2021 WHO classification included in cancer collection practices.

Classification by WHO Grade

Unlike other types of cancer which are staged according to the American Joint Commission of Cancer (AJCC) schema, primary brain and other CNS tumors are not staged. They are classified according to the *WHO Classification of Tumours of the Central Nervous System* which assigns a grade (grade I through grade IV assigned prior to 2021 WHO Classification) based on predicted clinical behavior. The WHO classification scheme was first released in 2000,¹⁹ and though it was updated in 2007²⁰ and 2016,² these updated schema were not fully implemented by US CCRs until diagnosis year 2019 or reporting year 2022. Updates made in 2007 and 2016 may affect diagnostic practices used in characterization of individual tumors included in this report. **Significant changes were made to grading nomenclature and criteria in the 2021 fifth edition of the WHO Classification of Tumours of the Central Nervous System which are not yet reflected in the characterization of tumors included in this report.** As of the 2021 WHO classification, grade is clinically reported using Arabic numerals, but for the purpose of reporting grade for cases collected under prior WHO Classification versions, CBTRUS continues to use Roman numerals.

The WHO grading assignments are recorded by cancer registrars as Collaborative Stage Site-Specific Factor (CS SSF)1 - WHO Grade Classification as directed in the AJCC, Eighth Edition, Chapter 72 on Brain and Spinal Cord²¹ (cases diagnosed from 2011-2017), Site-Specific Data Items (SSDI) Grade Pathological (cases diagnosed in 2018 or later), and SSDI Grade Clinical (cases diagnosed in 2018 or later). SSF 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 were collected through 2017 at which point they were replaced with SSDI. Completeness of these variables have improved significantly over time.^{17,22}

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.

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 histopathologies (ICD-O-3 histopathology codes 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 histopathologies, tumors of the pituitary, and olfactory tumors of the nasal cavity (C30.0 [9522-9523]).¹¹ Additionally, CBTRUS reports data on 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 WHO guidelines for brain and other 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 United States 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 their clinical classification (WHO Classification) and presents a challenge to correctly report population-based incidence and survival patterns associated with these tumors. Please see recent publications for additional discussion of the effect of this classification on cancer incidence and survival reporting.^{26,27}

In the United States, 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 107-260.⁶ 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 CCRs (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 CCRs include 50 state registries, the District of Columbia, and Puerto Rico (**Figure 1**). **Data were requested for all reported primary malignant and non-malignant tumors that were newly diagnosed from 2015 to 2019 at any of the following ICD-O-3 anatomic sites: brain, meninges, spinal cord, cranial nerves, and other parts of the CNS, pituitary and pineal glands, and olfactory tumors of the nasal cavity (ICD-O-3 site code C30.0 and histopathology codes 9522-9523 only) (Table 1).**¹⁰

NPCR provided data on 444,976 primary brain and other CNS tumors diagnosed from 2015 to 2019 (**Figure 2**). An additional 13,832 case records for the period were obtained from SEER for primary brain and other CNS tumor case records from 2015 to 2019 for Connecticut, Hawaii, Iowa, and New Mexico only. These data were combined into a single dataset of 458,808 records for quality control. A total of 10,880 records (2.4%) 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/histopathology combination according to the CBTRUS histopathology grouping scheme.
- Possible duplicate records that included a less accurate reporting source than microscopic confirmation, also referred to as histopathologic 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 meningiomas that were merged to one paired-site record.

The final analytic dataset had 447,928 records, which included 445,792 records from the 50 state CCRs and the

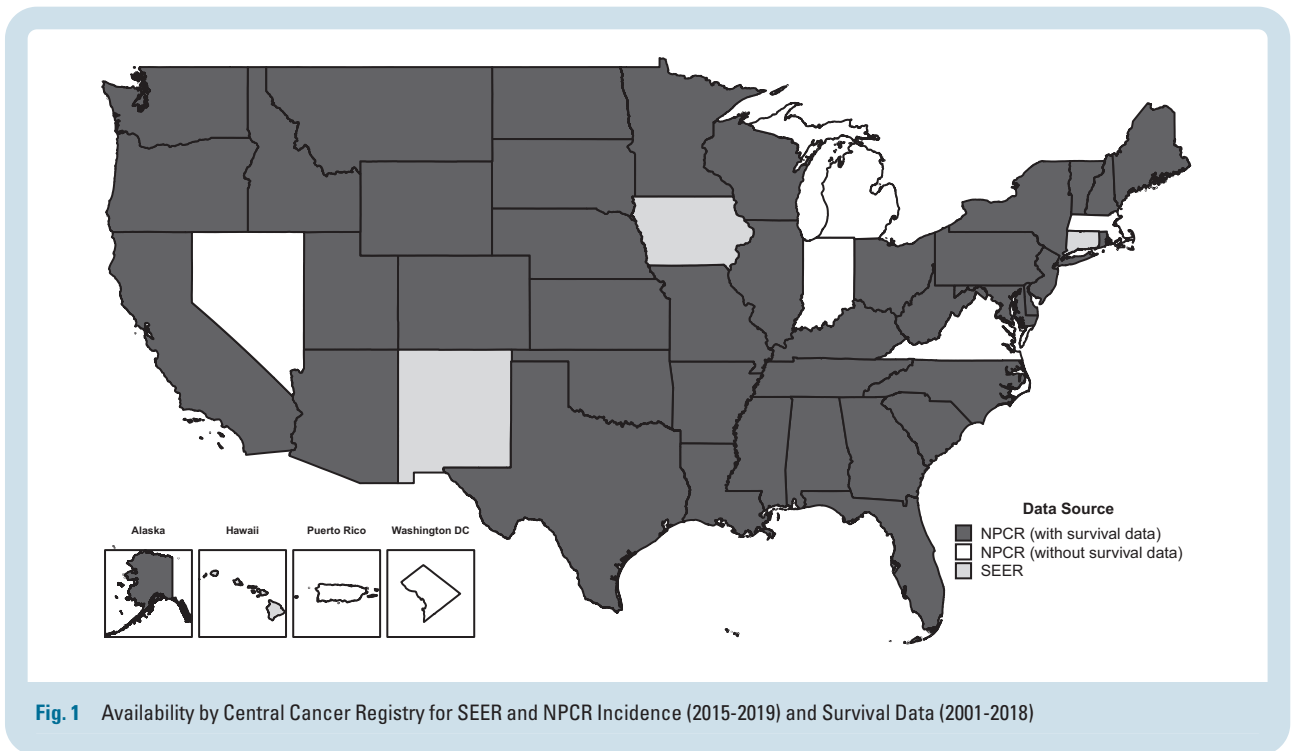


Fig. 1 Availability by Central Cancer Registry for SEER and NPCR Incidence (2015-2019) and Survival Data (2001-2018)

District of Columbia used in the analytic dataset, and an additional 2,136 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. Data were not available from Nevada for diagnosis years 2018 and 2019 due to data quality issues.

Age-adjusted incidence rates per 100,000 population for the entire United States for selected other cancers were obtained from the USCS, produced by the CDC and the NCI, for the purpose of comparison with brain and other CNS tumor incidence rates.⁸ 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 NPCR for 42 CCRs for the years 2001 to 2018 and for non-malignant brain and other CNS tumors for the years 2004 to 2018. This dataset provides population-based information for 82% of the US population for the years 2001 to 2018 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 certificate for individuals from all 50 states and the District of Columbia. These data were obtained from NVSS²⁸ (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.

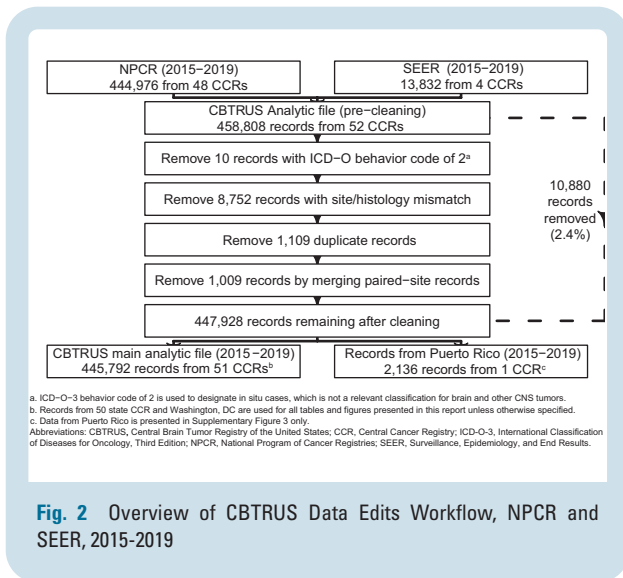
Definitions

Measures in Surveillance Epidemiology

The CBTRUS Statistical 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 International Agency for Cancer Research (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.^{29,30} While many measures of quality and completeness are assessed across all cancer sites, some variables are pertinent only to specific sites and/or histopathologies and require special care. In the case of primary brain and other CNS tumors, variables such as WHO grade are not relevant to certain histopathologies (e.g. many tumors of the pituitary) that are not assigned a WHO grade. Similarly, the BMM variable is applicable only to specific histopathologies. Variables like WHO grade or BMM may also not be expected to be found in the patient record for those who had



their diagnosis confirmed via radiography as compared to histopathological examination. The 2022 CBTRUS Report evaluates the completeness of multiple variables, including: WHO grade (applicable to specific brain and other CNS sites and histopathologies only), BMM (applicable to specific histopathologies 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 4.1.3 statistical software³¹ and/or SEER*Stat 8.4.0.³² Figures and tables were created in R 4.1.3 using the following packages: flextable, officer, orca, plotly, SEER2R, sf, survminer, tigris, and tidyverse.³³⁻⁴² 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.⁴³

Estimation of Incidence Rates and Incidence Rate Ratios

Population data for each geographic region were obtained from the SEER program website⁴⁴ 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 (AAAMR), and 95% confidence intervals (95% CI) were estimated per 100,000 population based on five-year age groups and were standardized to the 2000 US standard population for consistency with other US reporting agencies.⁴⁵

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.⁴⁶ 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% 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 Incidence Time Trends

Joinpoint 4.10.0.0⁴⁷ 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 The best fitting model is selected and may include anywhere from one to four trend periods depending on identified inflection points (maximum of three for non-malignant tumors) and number of years included in the model.

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.

Estimation of Expected Numbers of Brain and Other CNS Tumors in 2022 and 2023

Estimated numbers of expected primary **malignant** and **non-malignant** brain and other CNS tumors were calculated for 2022 and 2023. To project estimates of newly diagnosed brain and other CNS tumors in 2022 and 2023, age-adjusted annual brain tumor case counts were generated for 2000-2019 for **malignant** tumors, and 2006-2019 for **non-malignant** tumors (with the exception of CCR-specific estimates for Nevada, where diagnosis years 2018 and 2019 were not available due to data quality issues). These were generated by state, age, and histopathologic type. Joinpoint 4.10.0.0⁴⁷ was used to fit regression models to these case counts,⁴⁹ 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 CCR-specific projections, a model with no joinpoints was used to generate predictions as annual variability within some groups was extremely high. As a result, strata-specific estimates may not equal the total estimate presented. As these estimates are based on 14-20 years of observed data, projected totals may not be equal to average annual cases estimate from the last five years of data. **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.²⁸ These data were available for 50 states and the District of Columbia only. In addition to the total age-adjusted rate for the United States, 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 survive 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 100 people diagnosed with glioblastoma, five will be living five years after diagnosis, excluding deaths attributed to other causes.

SEER*Stat 8.4.0 statistical software was used to estimate relative survival rates for primary **malignant** and **non-malignant** brain and other CNS tumor cases diagnosed between 2004-2018 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 reported primary **malignant** brain and other CNS tumors diagnosed between 2001-2018 in 42 NPCR CCRs was calculated by histopathology using the Kaplan-Meier method in R 4.1.3 statistical software³¹ 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 either 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 histopathology 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% CI 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 histopathology, and residuals were examined for all variables.

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 to cases from all cancer diagnosis years, as well as changes 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 2015-2019*. 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 445,792 tumors included in this report came from 439,916 individuals. Of these individuals, there were 5,439 individuals (1.2%) that contributed information on multiple tumors (two or more) to this report.
- Data may be excluded from individual CCRs for specific years due to incomplete case ascertainment.
- 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 males—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.^{52,53,54} 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. 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 histopathologically-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 histopathology combinations considered invalid by the consulting neuropathologists who revised the CBTRUS site/histopathology 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.

RESULTS

Incidence and Mortality in Comparison to Other Common Neoplasms in the United States

AAAIRs for primary brain and other CNS tumors (2015-2019) and a selection of common cancers (USCS, 2015-2019) in the United States are presented by age in **Figure 4A** for Children (ages 0-14 years), Adolescents and Young Adults (AYA) (ages 15-39 years), and Older Adults (ages 40+ years).

- Brain and other CNS tumors (both **malignant** and **non-malignant**) were the most common tumor site in persons ages 0-14 years, with an AAAIR of 5.96 per 100,000 population.
- Leukemia was the second most common tumor in persons ages 0-14 years, with an AAAIR of 5.06 per 100,000 population.
- Brain and other CNS tumors (both **malignant** and **non-malignant**) among those ages 15-39 years had an AAAIR of 12.21 per 100,000 population. These tumors were the second most common tumor type in this age group.
- Testicular cancer (males only) was the most common tumor type in males ages 15-39 years with an AAAIR of 10.96 per 100,000.
- Breast cancer (females only) was the most common tumor type among those ages 15-39 years and 40+ years with AAAIRs of 22.77 and 278.77 per 100,000, respectively.
- The second most common tumor type among those ages 40+ years was prostate cancer, which had an incidence rate of 255.06 per 100,000 (males only).
- Brain and other CNS tumors (both **malignant** and **non-malignant**) were the seventh most common tumor type among persons age 40+ years with an AAAIR of 44.82 per 100,000 population.

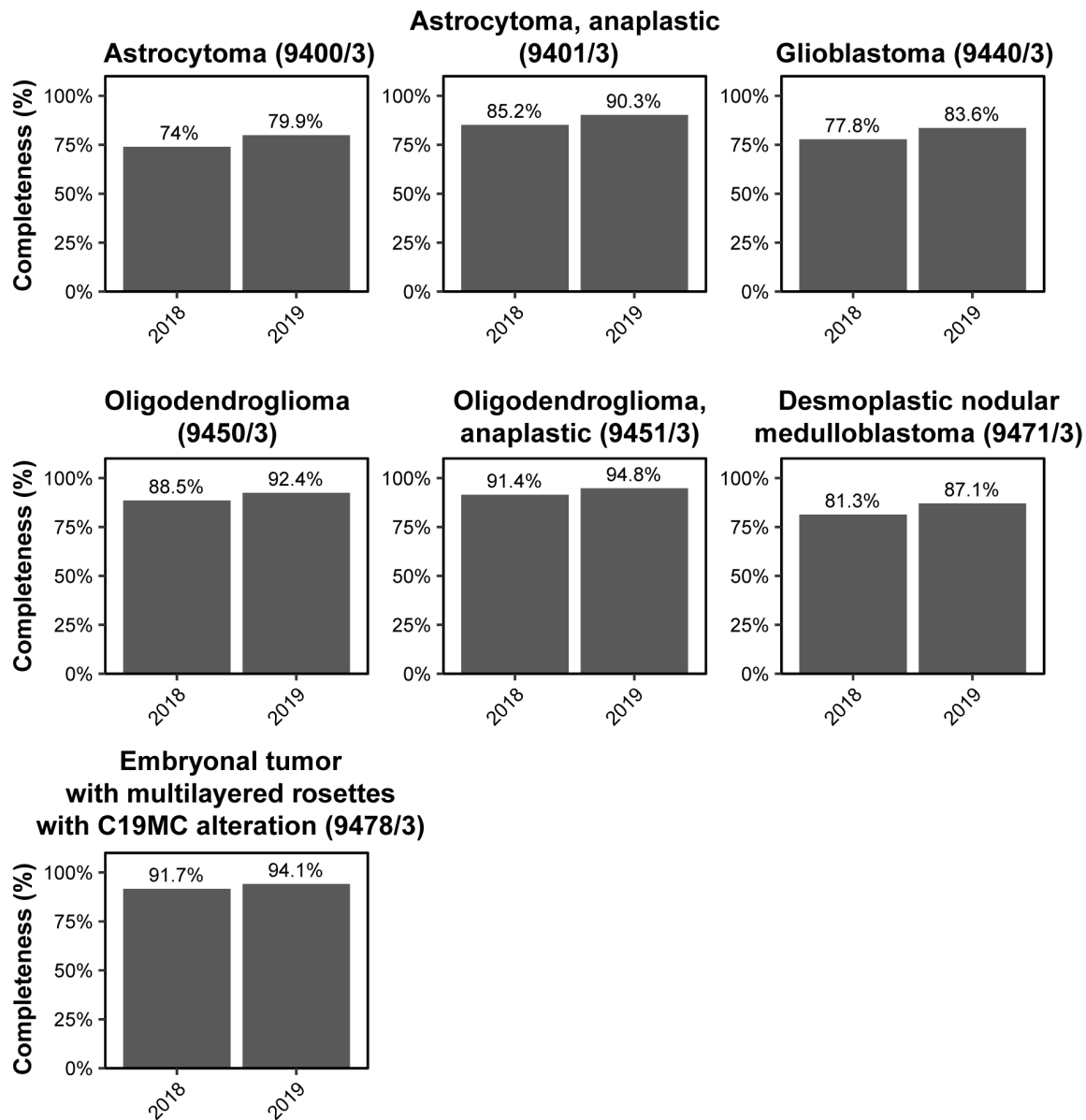
AAAMR for primary **malignant** brain and other CNS tumors (2015-2019), a selection of common cancers, and the top three non-cancer causes of death in the United States are presented by age in **Figure 4B**.

- The most common causes of death in persons ages 0-14 years were perinatal conditions (18.30 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 ages 0-14 years had an AAAMR of 0.69 per 100,000 and were the fourth most common cause of death in this age group, and **the most common cause of cancer death**.
- Accidents and adverse effects were the leading causes of death in persons ages 15-39 years (43.87 per 100,000).
- **Malignant** brain and other CNS tumors among persons ages 15-39 years had an AAAMR of 0.97 per 100,000 and were the 11th most common cause of death in this age group and the second most common cause of cancer death, where their AAAMR was similar to that of leukemia (0.89 per 100,000).
- Breast cancer (female only) was the most common cause of cancer death in this age group (2.25 per 100,000).
- Heart disease was the largest contributor to mortality in persons ages 40+ years in the United States, with an AAAMR of 376.11 per 100,000 for major cardiovascular diseases.
- **Malignant** brain and other CNS tumors among persons ages 40+ years had an AAAMR of 9.11 per 100,000 and were the 26th most common cause of death.
- Lung and bronchus cancer was the most common cause of cancer death in those ages 40+ years (85.03 per 100,000).

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 trend 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 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, miniscule 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 histopathologies have decreased over time.⁶⁰ Overall, changes in incidence rates of all primary brain and other CNS tumors between 2000 and 2019 (limited to 2004 and 2019 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 histopathology classification, and changes in cancer registration procedures. The latter is especially applicable to the collection of **non-malignant** brain and other CNS tumors.



a. Molecular marker data collected via the NAACCR Site-Specific Data Item: Brain Molecular Marker variable (see Supplementary Table 2 for included sites and coding scheme)
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Fig. 3 Completeness of the Brain Molecular Marker Variable^a by Year at Diagnosis for Selected Histopathologies by ICD-O-3 Code, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2018-2019

Malignant Brain and Other CNS Tumors

Please see **Figure 5B** for an overview of histopathologies included in all **malignant** brain and other CNS tumors.

- Overall, there have been no substantial changes in incidence of **malignant** brain tumors from 2000-2019.
- From 2007-2016, there was a slight decrease in overall incidence (APC= -0.5% [95%CI: -0.7%, -0.3%], **Figure 6, Supplementary Table 4**).

- There was a small but statistically significant increase in incidence in children (ages 0-14 years, APC=0.9% [95%CI: 0.6%, 1.2%]), a small but statistically significant decrease in AYA (ages 15-39 years, APC=-0.3% [95%CI: -0.5%, -0.2%]) from 2000-2016, and a small but statistically significant decrease in older adults from 2005-2016 (ages 40+ years, APC=-0.7% [95%CI: -0.8%, -0.5%] **Figure 6, Supplementary Table 4**).

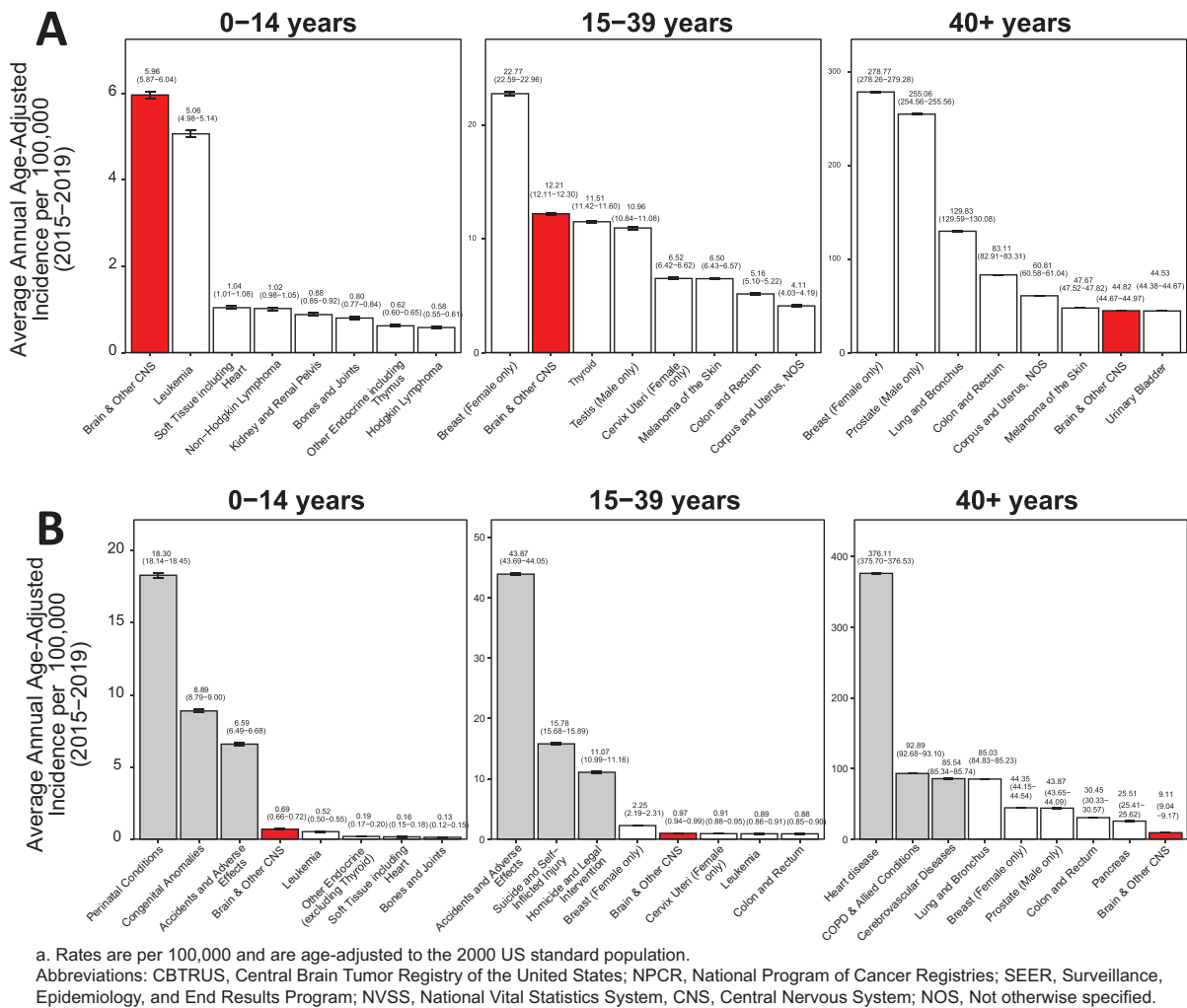


Fig. 4 A) Average Annual Age-Adjusted Incidence Rates^a with 95% Confidence Intervals of All Primary Brain and Other Central Nervous System Tumors in Comparison to Top Eight Highest Incidence Cancers for Children Ages 0-14 Years, Adolescents and Young Adults Ages 15-39 Years, and Older Adults Ages 40+ Years, B) Average Annual Age-Adjusted Mortality Rates^a with 95% Confidence Intervals of All Primary Brain and Other Central Nervous System Tumors in Comparison to Top Five Causes of Cancer Death and Top Three Non-Cancer Causes of Death for Children Ages 0-14 Years, Adolescents and Young Adults Ages 15-39 Years, and Older Adults Ages 40+ Years, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019; and NVSS, 2015-2019

Glioma

Please see **Figure 7B** for an overview of histopathologies included in the broad category of glioma and **Figure 8** for incidence trends of selected glioma histopathologies.

- There was a slight increase in overall incidence of malignant gliomas (behavior codes /3 only) from 2000-2007 (APC=0.3% [95%CI: 0.0%, 0.6%]), followed by a small but significant decrease in incidence from 2007-2016 (APC=-0.4% [95%CI: -0.6%, -0.1%]) and 2016-2019 (APC=-2.1% [95%CI: -3.1%, -1.1%], **Supplementary Table 4**).
- There was a significant increase in incidence in children (ages 0-14 years, APC=1.2% [95%CI: 0.8%, 1.5%]) from

2000-2016, and a significant decrease in incidence in AYA from 2014-2019 (ages 15-39 years, APC=-1.4% [95%CI: 1.2%, 4.0%], **Supplementary Table 4**).

- Incidence in older adults (ages 40+ years) was relatively stable: there was a small but statistically significant decrease from 2007-2019 (APC= -0.7% [95%CI: -0.9%, -0.6%], **Supplementary Table 4**).

Malignant Meningioma

- There was a significant decrease in incidence from 2000-2003 (APC= -1.2% [95%CI: -7.7%, 5.9%]) and from 2014-2019 (APC= -6.9% [95%CI: -10.1%, -3.6%], **Figure 9B**, **Supplementary Table 5**).

- Changes were made to diagnostic and grading criteria for 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.

Non-Malignant Brain and Other CNS Tumors

Please see **Figure 10B** for an overview of histopathologies included in all **non-malignant** brain and other CNS tumors.

- Overall, incidence of **non-malignant** brain tumors increased substantially after collection of these cases began by CCRs in 2004, likely attributed to improvements in collection with each collection year.
- There was a significant increase in incidence of **non-malignant** brain tumors from 2004-2008 (APC=5.9% [95%CI: 3.8%, 8.1%]), and 2008-2016 (APC=1.6% [95% CI: 0.9%, 2.4%]). There was no significant change from 2016-2019 (**Supplementary Table 6**).
- There was a small, but statistically significant, increase in incidence of these **non-malignant** brain tumors in children (2004-2014, APC=3.1% [95%CI: 2.2%, 4.0%]), in AYA (2004-2009, APC=6.2% [95%CI: 4.1%, 8.3%]), and in older adults (2004-2008, APC=5.7% [95%CI: 3.6%, 7.9%], **Supplementary Table 4**).
- Incidence trends varied depending on diagnostic method. When analysis was limited to microscopically-confirmed tumors only, there was a small but significant increase in the incidence of **non-malignant** brain and other CNS tumors from 2004-2008 (APC=2.0% [95%CI: 0.4%, 3.6%]), followed by an insignificant decrease from 2008-2016 (APC=-0.3% [95% CI -0.9%, -0.3%]), and a significant decrease from 2016-2019 (APC= -2.5% [95% CI: -4.8%, -0.2%], **Supplementary Table 7**).
- Radiographically-confirmed tumors experienced substantially higher increases in incidence. There was a statistically significant increase in incidence of radiographically-confirmed **non-malignant** tumors from 2004-2009 (APC=9.4% [95%CI: 7.1%, 11.8%]), with smaller but statistically significant increase from 2009-2016 (APC=2.9% [95%CI: 1.6%, 4.2%], **Supplementary Table 7**).
- *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 Meningiomas

- There was a significant increase of **non-malignant** meningiomas between 2004-2008 (APC=6.0% [95%CI: 3.7%, 8.4%]), followed by a smaller but statistically significant increase from 2008-2019 (APC=1.3% [95%CI: 0.9%, 1.7%]), **Figure 9A**, **Supplementary Table 6**).
- When analysis was limited to microscopically-confirmed cases, there was a slight significant decrease in incidence from 2008-2019 (APC= -0.7% [95% CI: -1.1%, -0.4%], **Supplementary Table 7**).

- There was a significant increase in incidence of radiographically-diagnosed cases from 2004-2008 (APC=10.8% [95%CI: 7.3%, 14.5%]), and a smaller but still significant change from 2008-2019 (APC=2.6% [95%CI: 2.1%, 3.1%], **Supplementary Table 7**).

Non-Malignant Nerve Sheath Tumors and Vestibular Schwannoma

- There was a small but significant increase in the incidence of **non-malignant** nerve sheath tumors between 2004-2016 (APC=1.8% [95%CI: 1.2%, 2.3%]) followed by a significant decrease from 2016-2019 (APC=-5.7% [95%CI: -9.6%, -1.6%], **Supplementary Table 6**).
- When analysis was limited to microscopically-confirmed cases only, there was no significant change in incidence from 2004-2010 (**Supplementary Table 7**).
- There was a significant increase in incidence of radiographically-diagnosed tumors between 2004-2007 (APC=9.1% [95%CI: 4.4%, 14.0%]) and 2007-2015 (APC=3.2% [95%CI: 2.2%, 4.1%]), followed by a significant decrease from 2015-2019 (APC=-4.0% [95%CI: -6.1%, -1.8%], **Supplementary Table 7**).

Non-Malignant Tumors of the Pituitary

- There was a significant increase in **non-malignant** tumors of the pituitary from 2004-2009 (APC=7.3% [95%CI: 5.6%, 9.1%]), and a smaller but significant increase from 2009-2016 (APC=2.3% [95%CI: 1.2%, 3.3%], **Figure 9A**, **Supplementary Table 6**).
- When analysis was limited to microscopically-confirmed tumors only, there was a significant increase (APC=4.4% [95%CI: 3.0%, 5.7%]) from 2004-2009, followed by a significant decrease from 2009-2016 (APC=-0.9% [95%CI: -1.8%, 0.0%], **Supplementary Table 7**).
- There was a significant increase in incidence of radiographically-diagnosed tumors of the pituitary from 2004-2009 (APC=11.4% [95%CI: 8.0%, 14.9%]), and from 2009-2016 (APC= 4.8% [95% CI: 3.0%,6.8%], **Supplementary Table 7**).

Distributions and Incidence by Site, Behavior, and Histopathology

Counts and rates from the 445,792 brain and other CNS tumors (28.3% **malignant**, 126,345 cases; 71.7% **non-malignant**, 319,447 cases shown in **Figure 11**) reported during 2015-2019 overall and by sex for all ages are shown by site in **Table 4** and by histopathology in **Table 5**. Counts and rates are shown by histopathology and behavior for selected histopathologies where there is a statistically sufficient number of cases to calculate rates.

Distribution of Tumors by Site and Histopathology

The distribution of brain and other CNS tumors by site is shown in **Figure 12A** and **Table 4**.

- Overall, the most common tumor site was the meninges, representing 40.2% of all tumors.
- Frontal (7.6%), temporal (5.6%), parietal (3.2%), and occipital lobes (0.9%) accounted for 17.2% of all tumors.
- The cranial nerves (6.8%) and the spinal cord/cauda equina (2.8%) accounted for 9.7% of all tumors.
- The pituitary and craniopharyngeal duct accounted for 18.2% of all tumors.

The distribution by brain and other CNS histopathologies is shown in **Figure 12B** and **Table 5**.

- The most frequently reported histopathologies overall were meningiomas (40.0%), followed by tumors of the pituitary (17.2%) and glioblastoma (14.2%).
- Tumors of the pituitary (17.2%) and nerve sheath tumors (8.3%) combined accounted for slightly more than one-fourth of all tumors (25.5%), the vast majority of which were **non-malignant**.

Distribution of Tumors by Site, Histopathology and Behavior

The distribution of **malignant** and **non-malignant** brain and other CNS tumors by site are shown in **Figure 5A** and **Figure 10A**, respectively.

- For **malignant** tumors, frontal (24.6%), temporal (17.6%), parietal (10.4%), and occipital (2.6%) accounted for 55.2% of tumors (**Figure 5A**).
- For **non-malignant** tumors, 55.4% of all tumors occurred in the meninges (**Figure 10A**).

The distribution of **malignant** and **non-malignant** brain and other CNS tumors by histopathology are shown in **Figure 5B** and **Figure 10B**, respectively, as well as in **Table 5**.

- The most common of all **malignant** CNS tumor histopathologies was glioblastoma (50.1%, **Figure 5B**).
- The most common of all **non-malignant** tumor histopathologies was meningioma (55.4%, **Figure 10B**).
- The most common **non-malignant** nerve sheath tumor (based on multiple sites in the brain and CNS) was vestibular schwannoma (defined by histopathology code 9560, also formerly called acoustic neuromas) (75.7%, **Table 6**).

Distribution of Gliomas by Site and Histopathology

The broad category glioma (ICD-O-3 histopathology codes 9380–9384, 9391–9460 see **Table 2** for more information) represented approximately 24% of all primary brain and other CNS tumors and 80.9% of **malignant** tumors. The distribution of gliomas by site and histopathology are shown in **Figure 7A** and **Figure 7B**, respectively.

- The majority of gliomas occurred in the supra-tentorium (frontal, temporal, parietal, and occipital lobes combined) (61.8%). Only a very small proportion of gliomas occurred in areas of the CNS other than the brain.
- Glioblastoma accounted for the majority of gliomas (59.2%).

- Astrocytic tumors, including glioblastoma, accounted for 78% of all gliomas.

Incidence by Year and Behavior

Figure 13 presents the overall AAIRs of all primary brain and other CNS tumors by year (2015–2019) and behavior. Incidence rates for all primary brain and other CNS tumors, 2015–2019, did not differ substantially by year (both overall and by behavior).

Incidence Rates by Major Histopathology Grouping, Specific Histopathology, and Behavior

AAIRs overall by major histopathology grouping, specific histopathology, and behavior are shown in **Table 5**. Among CBTRUS major histopathology groupings, incidence rates were highest for tumors of the meninges (9.85 per 100,000 population), followed by tumors of the sellar region (4.69 per 100,000 population), diffuse astrocytic and oligodendroglial tumors (4.50 per 100,000 population), and tumors of the cranial and spinal nerves (2.05 per 100,000 population).

- Among CBTRUS specific histopathology groupings, incidence rates were highest for meningiomas (9.51 per 100,000 population), tumors of the pituitary (4.5 per 100,000 population), glioblastoma (3.26 per 100,000 population), and nerve sheath tumors (2.05 per 100,000 population).
- The majority of nerve sheath tumors were vestibular schwannoma (1.52 per 100,000, **Table 6**).
- Of all vestibular schwannoma tumors, 62.5% were located in the acoustic nerve (**Supplementary Figure 1**).
- For **malignant** tumors, the incidence rate was highest for glioblastoma (3.26 per 100,000 population), followed by glioma malignant, NOS (0.54 per 100,000), diffuse astrocytomas (0.46 per 100,000 population) and lymphomas (0.45 per 100,000 population).
- For **non-malignant** tumors, the incidence rate was highest for **non-malignant** meningiomas (9.42 per 100,000 population), followed by **non-malignant** tumors of the pituitary (4.49 per 100,000 population).

Brain Molecular Marker Variable and Other Biomarkers

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 *IDH1* and in *IDH2* have also been shown to be associated

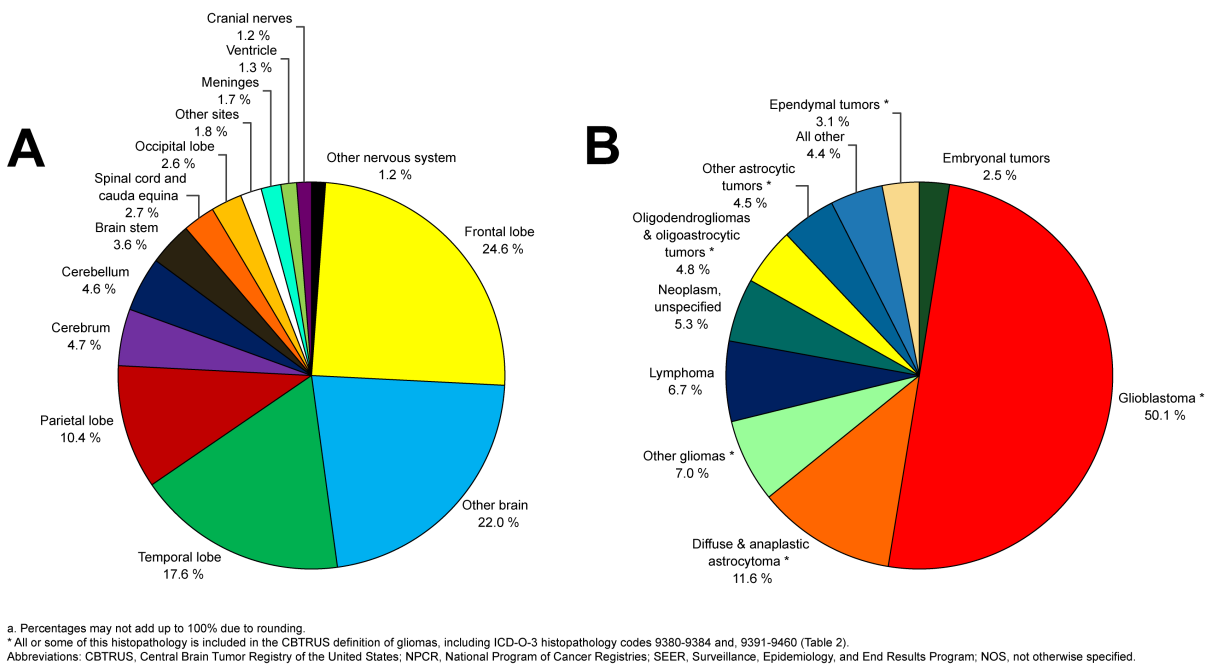


Fig. 5 Distribution^a of Malignant Primary Brain and Other Central Nervous System Tumors (Five-Year Total=126,345; Annual Average Cases=25,269) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2015-2019

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 The combination of these two factors can be used to more accurately stratify glioma by prognosis than the previously utilized histopathological criteria,^{68,69} 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 *MGMT*.^{70,71} *MGMT* is a DNA repair protein, and methylation of its promotor region effectively silences the gene and prevents transcription into RNA. 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.⁷² This alteration is common in glioblastoma and less common in lower grade glioma.

Other Biomarkers

Diffuse intrinsic pontine glioma (DIPG) is a name given to a group of aggressive tumors occurring in 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 histopathology 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.⁷³⁻⁷⁵ 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.^{74,76,77} A recent review has further summarized current developments in the genomics of DIPG.⁷⁸

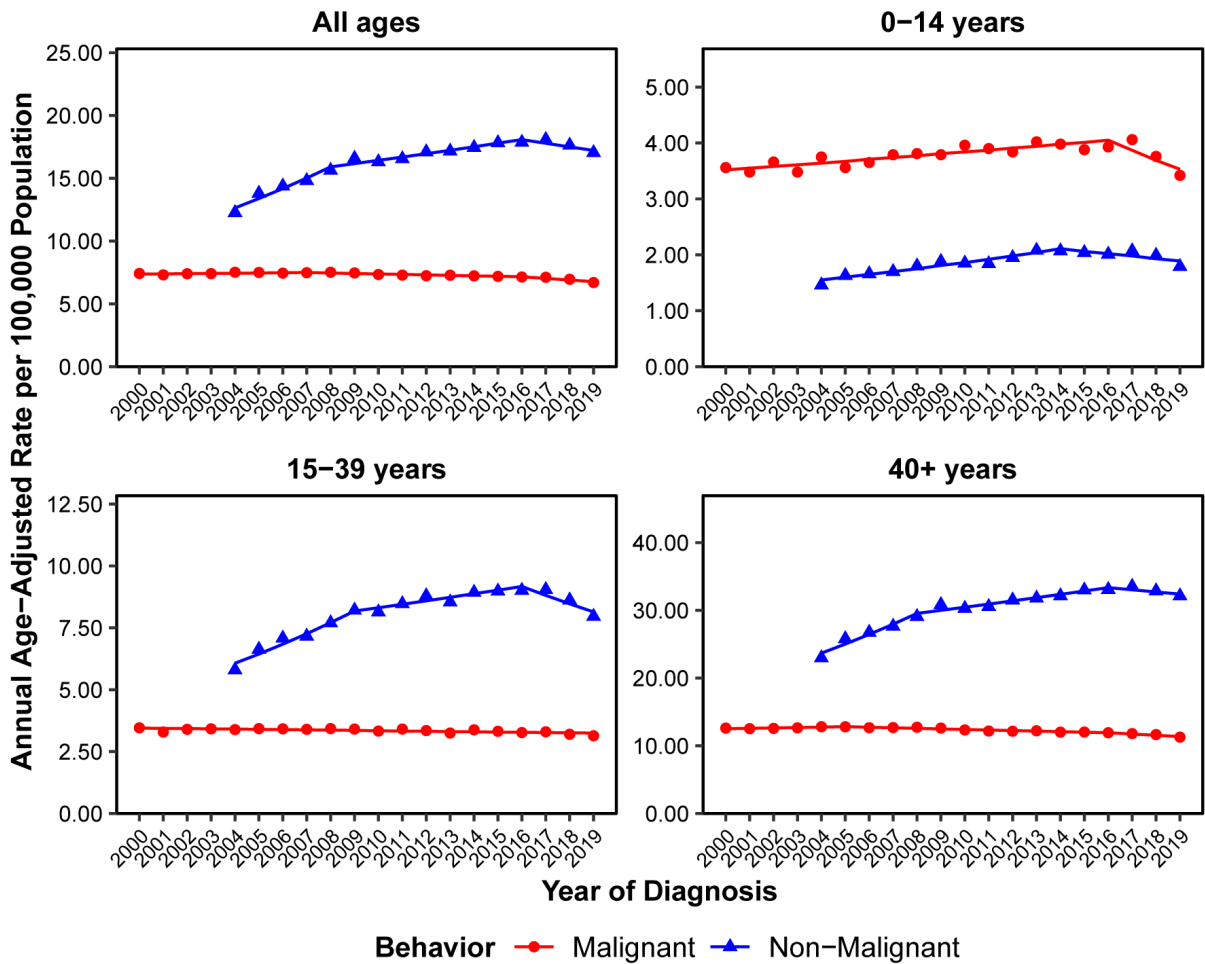
Biomarkers for Embryonal Tumors

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).⁷⁹ 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.⁸⁰⁻⁸²

Completeness of Molecular Markers

The BMM variable and molecularly-defined ICD-O-3 codes are specific to certain histopathologies (please see **Supplementary Tables 2 and 3**). Frequency of reported molecular markers for relevant histopathologies are shown



a. Rates are per 100,000 and are age-adjusted to the 2000 US standard population. Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Fig. 6 Annual Age-Adjusted Incidence Rates^a of All Primary Brain and Other Central Nervous System Tumors and Incidence Trends by Behavior and Age Group at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019 (varying)

in **Table 7**. Completeness of molecular marker reporting using BMM variable is shown in **Figure 3**.

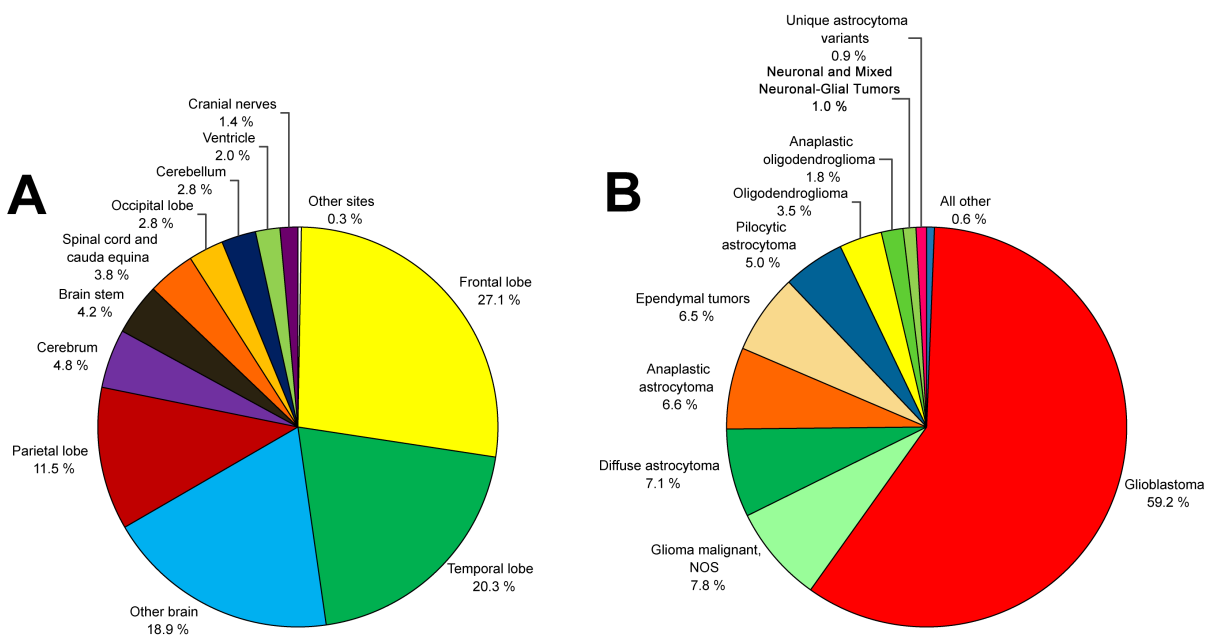
- Among glioblastoma patients, 580 were coded as 9445/3, Glioblastoma *IDH*-mutant (2.4%), 18,579 were coded as 9440/3, Glioblastoma *IDH*-wildtype (76.8%), and 4,398 as 9440/3, Glioblastoma *IDH* Status Unknown (18.2%). Among those with unknown *IDH* status, 74 had a test ordered, but no results reported in patient chart (1.6%), while the remaining patients did not have *IDH* status documented in their patient record, or the information was miscoded/unknown (4,320, 98.2%).
- Frequency of *IDH*-mutation reporting was high in diffuse astrocytoma (9400/3, 76.8%) and anaplastic astrocytoma (9401/3, 87.5%). Biomarker reporting was complete in

90.8% of oligodendroglioma coded as 9450/3 and 93.3% of anaplastic oligodendroglioma coded as 9451/3.

- For medulloblastoma coded as 9471/3, 84.3% had complete biomarker reporting.
- Completeness of biomarker reporting improved for all relevant ICD-O-3 codes from 2018 to 2019.

Frequency and Incidence of Molecularly-Defined Brain and Other CNS Tumor Histopathologies

Beginning in diagnosis year 2018, US cancer registry systems began collecting data on molecularly defined histologies introduced in the 2016 *WHO classification of tumours of the CNS*, including *IDH*-mutation and 1p/19q codeletion status for adult-type diffuse glioma, and medulloblastoma subtypes. Total cases of these histopathologies diagnosed in 2018-2019, age-adjusted



a. Percentages may not add up to 100% due to rounding.

Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; NOS, not otherwise specified.

Fig. 7 Distribution^a of Primary Brain and Other Central Nervous System Gliomas (ICD-0-3 histopathology codes 9380-9384 and 9391-9460) (Five-Year Total=106,808; Annual Average Cases=21,362) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2015-2019

incidence rates, median age of diagnosis, and distribution by sex and race/ethnicity are shown in [Table 8](#).

- The *IDH*-mutant astrocytoma subtype had incidence rate of 0.44 per 100,000 population, while *IDH*-wildtype astrocytoma subtype had an incidence rate of 2.61 per 100,000 population. Median age of diagnosis for these subtypes was 36 and 65 years, respectively.
- When stratified by WHO grade, 61.5% of WHO grade II astrocytoma were *IDH*-mutant, while 49.4% and 3.1% of WHO grade III and IV astrocytoma were *IDH*-mutant ([Figure 14](#)).
- The most common medulloblastoma subtype was *SHH*-activated & *TP53*-wildtype, which had an incidence rate of 0.03 per 100,000 population and a median age of diagnosis of 20 years.
- Non-*WNT*/non-*SHH* medulloblastoma was the second most commonly occurring subtype, with an incidence rate of 0.02 per 100,000 and a median age of diagnosis of 8 years.
- Incidence of the *WNT*-activated medulloblastoma subtype was 0.01 per 100,000 population, with a median age of diagnosis of 10 years. *SHH*-activated and *TP53*-mutant medulloblastoma subtypes were too rare to calculate incidence.
- Molecular subtype data were missing for many medulloblastoma cases, but the completeness of these data is expected to increase in future years.

- Embryonal tumors with multilayered rosettes, C19MC-altered had incidence rates of <0.01 per 100,000 population and a median age of diagnosis of 2 years.
- Diffuse midline glioma, H3 K27M-mutant had an incidence rate of 0.06 per 100,000 population and a median age of diagnosis of 14 years.

Distribution of Spinal Cord Tumors by Age

Although spinal cord tumors account for a relatively small percentage of brain and other CNS tumors, they result in significant morbidity. The most common histopathologies found in the spinal cord, spinal meninges, and cauda equina are presented in [Figure 15](#) for both children (age 0-19 years, [Figure 15A](#)) and adults (ages 20+ years, [Figure 15B](#)).

- The predominant histopathology group for those ages 0-19 years was ependymal tumors (17.6%) followed by nerve sheath tumors (17.3%).
- Meningiomas (37.5%) accounted for the largest proportion of spinal cord tumors among those ages 20 years and older.

Descriptive Summary of Meningiomas

- Meningiomas were the most frequently reported brain and other CNS histopathology, accounting for 40% of tumors overall ([Figure 12](#), [Table 5](#)).

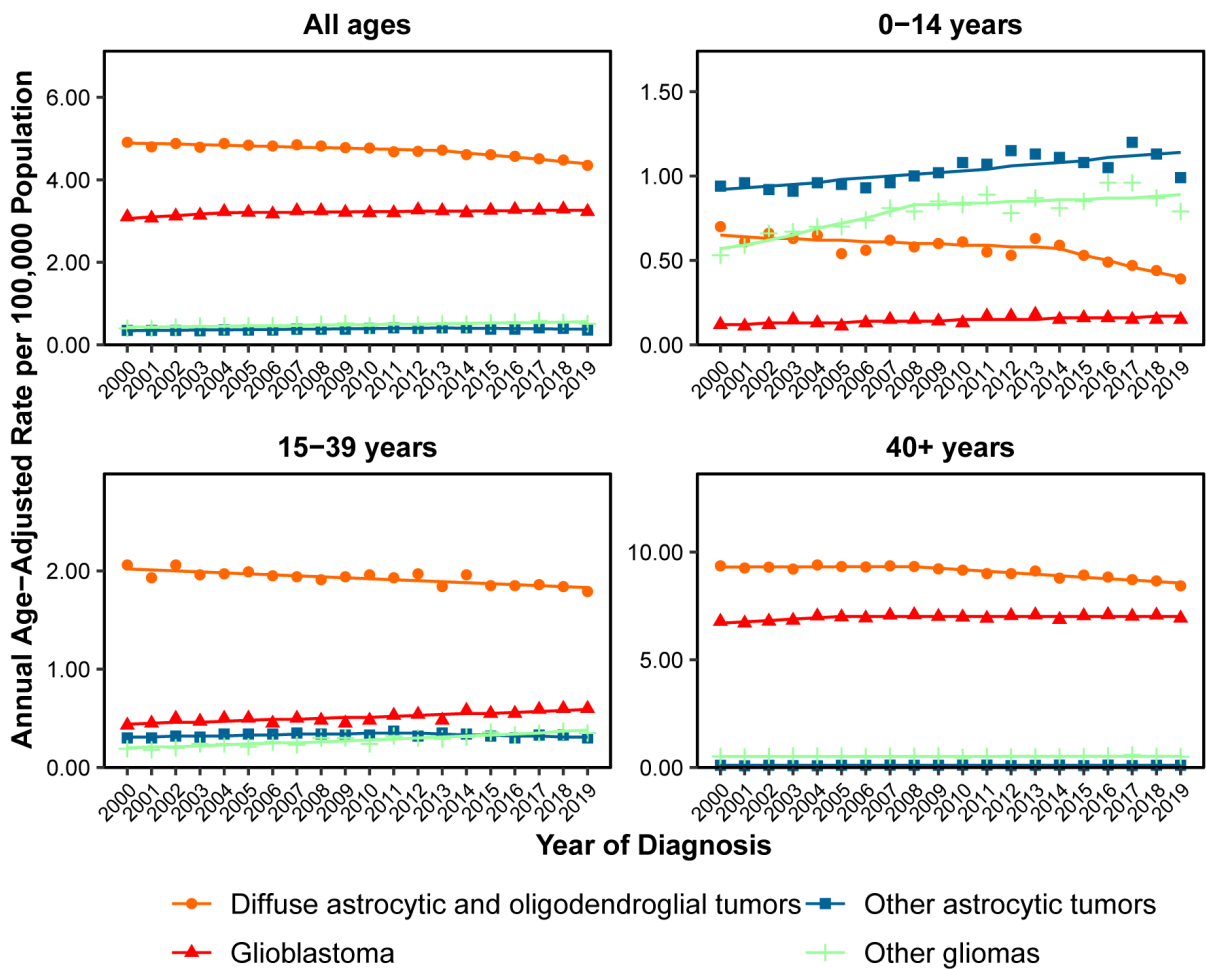


Fig. 8 Annual Age-Adjusted Incidence Rates^a of Primary Brain and Other Central Nervous System Gliomas and Incidence Trends by Age Group at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019

- Most meningiomas (82.0%) were located in the cerebral meninges, 4.2% were located in the spinal meninges, and approximately 13.7% did not have a specific meningeal site listed ([Table 4](#)).
- **Non-malignant** meningiomas with ICD-O-3 behavior codes /0 (benign) or /1 (uncertain) accounted for 99.0% of reported meningiomas.
- Of meningiomas with documented WHO grade (82.2%), 80.1% were WHO grade I, 18.3% were WHO grade II, and 1.5% were WHO grade III ([Table 9](#)).
- Meningiomas were most common in adults ages 65 years and older, and one of the least common in children ages 0-14 years ([Table 10](#), [Supplementary Table 8](#)).
- Incidence of meningiomas increased with age, with a dramatic increase after age 65 years. Even among the population ages 85 years and older, these rates continued to be high ([Supplementary Table 8](#)).
- **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 35-44 ([Figure 16](#), [Supplementary Figure 5](#)).
- Incidence of meningiomas was significantly higher in people who are Black compared to their White counterparts ([Figure 17](#)).
- Ten-year relative survival for **malignant** meningiomas was 60%. Age had a large effect on survival after diagnosis with **malignant** meningioma: 10-year relative survival was 78% for the population ages 20-44 years, and 38.5% for ages 75+ years ([Table 10](#), [Supplementary Table 13](#)).

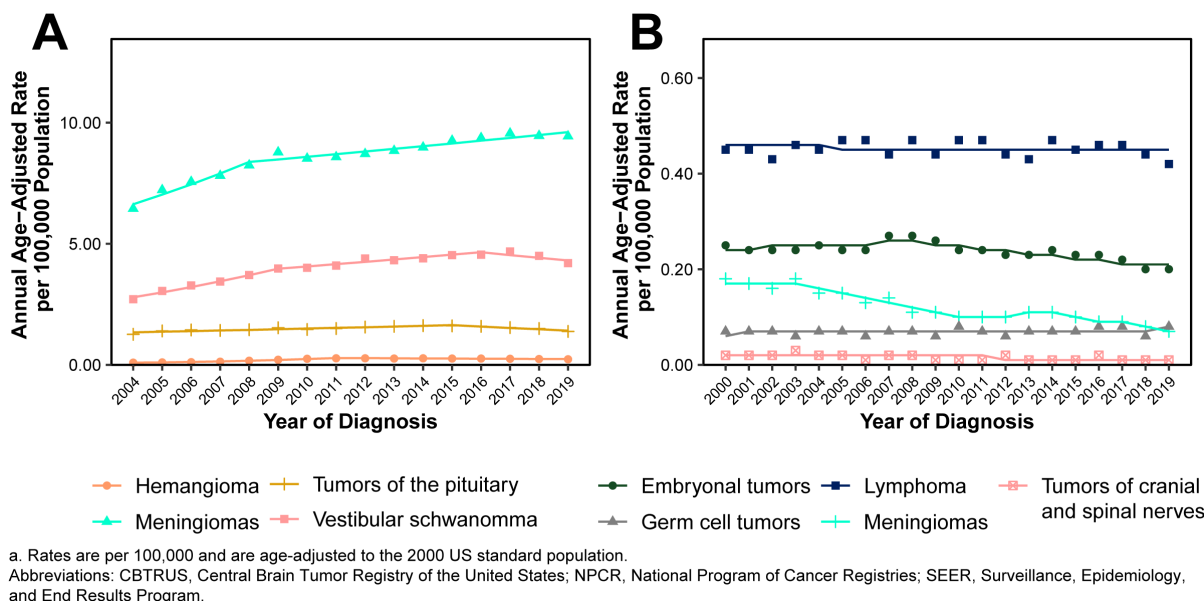


Fig. 9 Annual Age-Adjusted Incidence Rates^a of Primary Brain and Other Central Nervous System Tumors and Incidence Trends by Histopathology for Selected A) Non-Malignant and B) Malignant Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019 (varying)

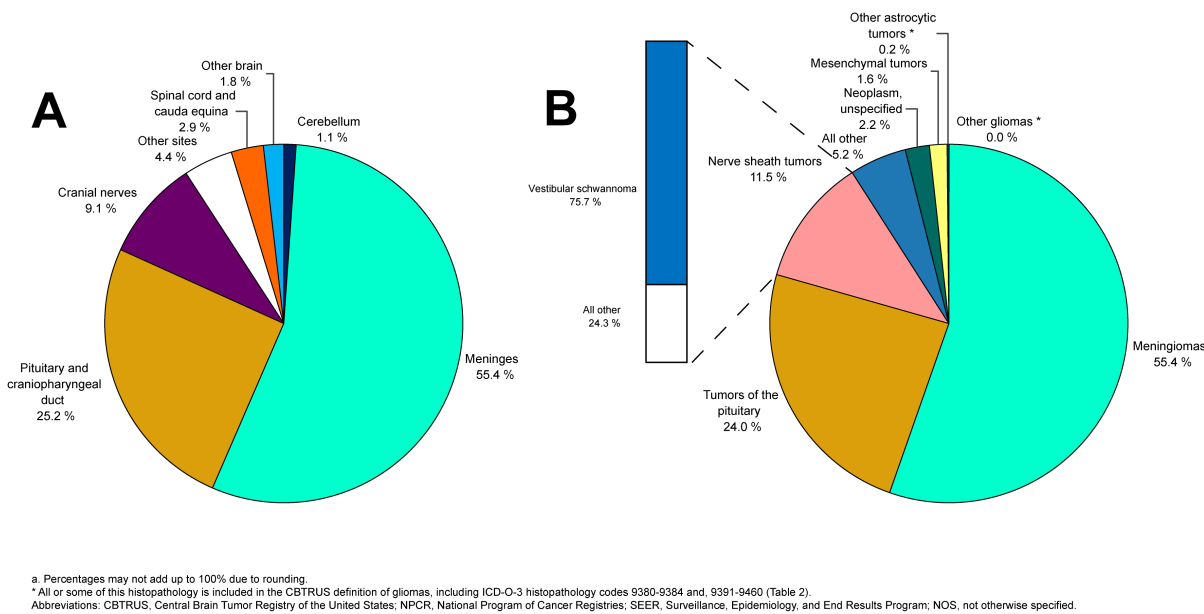
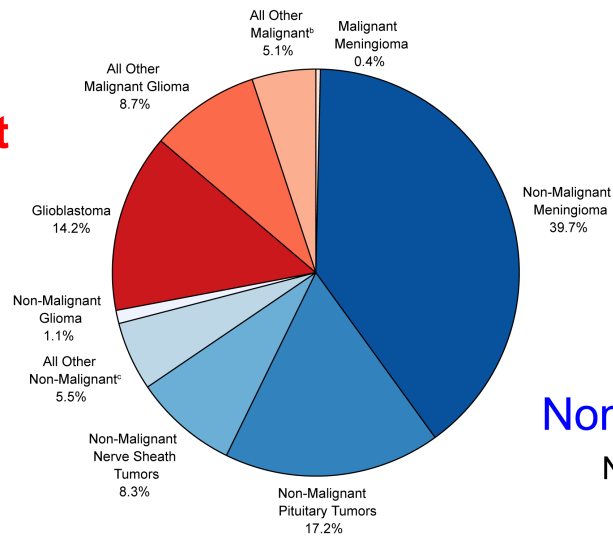


Fig. 10 Distribution^a of All Non-Malignant Primary Brain and Other Central Nervous System Tumors (Five-Year Total=319,447; Annual Average Cases=63,887) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

- Ten-year relative survival for **non-malignant** meningiomas was 83.4%. Age had a large effect on survival after diagnosis with **non-malignant** meningioma: 10-year relative survival was 93.2% in children 0–14, 95% in AYA 15–39, and 82.5% in adults 40+ years old (**Table 11**).
- Site of meningioma affected survival after diagnosis with meningioma. For **non-malignant** meningiomas, 10-year relative survival was 83.2% for tumors in the cerebral meninges, but 94.8% for tumors in the spinal meninges (**Supplementary Figure 6, Supplementary Table 12**).

Malignant

N = 126,345
28.3%



a. Percentages may not add up to 100% due to rounding.
 b. Includes histopathologies with ICD-O-3 behavior code of /3 from choroid plexus tumors, neuronal and mixed neuronal-glioma 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 histopathologies with ICD-O-3 behavior code of /0 or /1 from neuronal and mixed neuronal-glioma 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.
 Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Fig. 11 Distribution^a of All Primary Brain and Other Central Nervous System Tumors by Behavior (Five-Year Total=445,792; Annual Average Cases=87,427), CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

- Survival was also higher in **malignant** meningiomas for spinal tumors, where 10-year relative survival was 71.1%, as compared to 59.9% for tumors in the cerebral meninges (**Supplementary Figure 6, Supplementary Table 12**).

Descriptive Summary of Glioblastoma

- Glioblastoma was the third most frequently reported CNS histopathology and the most common **malignant** tumor histopathology overall (**Table 8**).
- Glioblastoma accounted for 14.2% of all primary brain and other CNS tumors and 50.1% of primary **malignant** brain tumors (**Figure 12B** and **Figure 5B**).
- Glioblastoma was more common in older adults and was less common in children (**Table 10, Figure 18**); these tumors comprised approximately 2.7% of all brain and other CNS tumors reported among ages 0–19 years (**Figure 19**).
- Incidence of glioblastoma increased with age, with rates highest in individuals ages 75 to 84 years (**Supplementary Table 8**).
- Glioblastoma was 1.6 times more common in males than females (**Figure 16**).
- Glioblastoma was 1.95 times higher among people who are White compared to people who are Black (**Figure 17**).
- Relative survival estimates for glioblastoma were quite low; 6.9% 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 11, Supplementary Table 13**).

Descriptive Summary of Embryonal Tumors

- Embryonal tumors were the most frequently reported brain and other CNS tumor histopathology in children ages 0-4 years, and the fourth most common tumor type overall in children and adolescents ages 0-19 years (**Table 12, Figure 19**).
- Embryonal tumors accounted for 12.2% of all primary brain and other CNS tumors in children ages 0-14 years, 9.2% of tumors in children and adolescents ages 0-19 years, and 0.8% of tumors diagnosed overall (**Figure 19B, Figure 20B, Table 8**).
- Embryonal tumors within the CBTRUS histopathologic grouping scheme included multiple different histopathologies: medulloblastoma, atypical teratoid/rhabdoid tumor (ATRT), and several other histopathologies (**Table 2**).
- Incidence of medulloblastoma decreased with age. Incidence was 0.51 per 100,000 population, 0.62 per 100,000 population, and 0.15 per 100,000 population in children age groups 0–4, 5–9, 10–14 years, and adolescents ages 15–19 years, respectively (**Table 12**).
- Incidence of ATRT was 0.33 per 100,000 population and 0.03 per 100,000 population in children ages 0–4 and 5–9 years, respectively. There were too few of these cases in older age groups to report (**Table 12**).

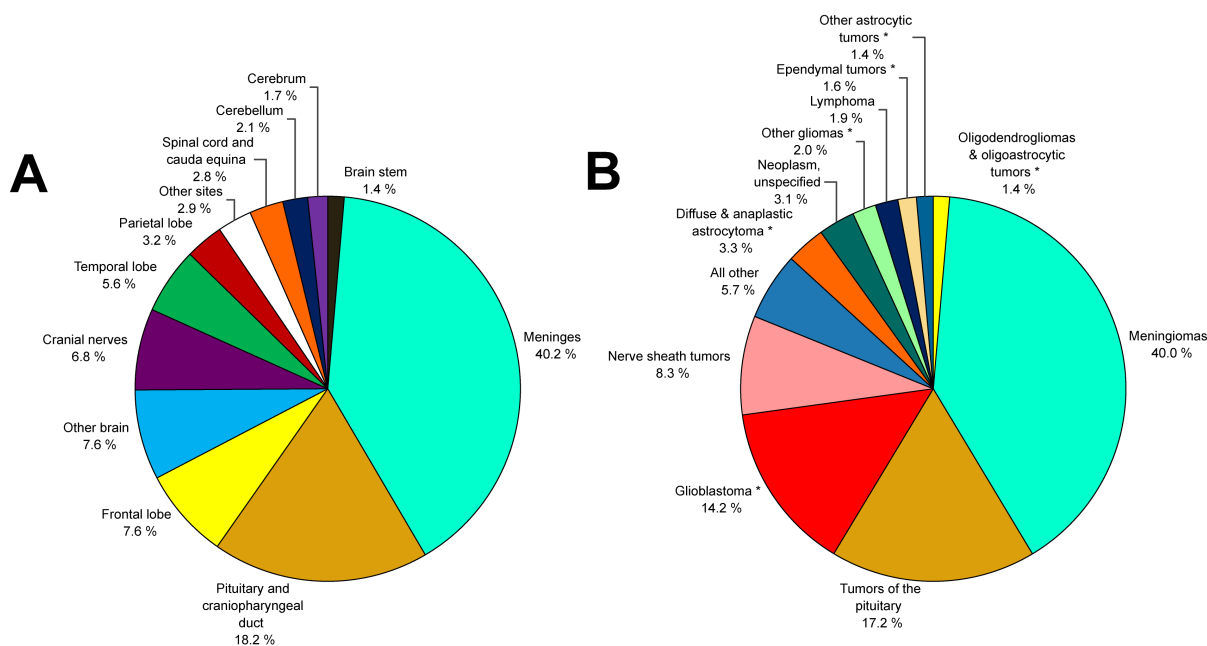


Fig. 12 Distribution^a of All Primary Brain and Other Central Nervous System Tumors (Malignant and Non-Malignant Combined; Five-Year Total=445,792; Annual Average Cases=89,158) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

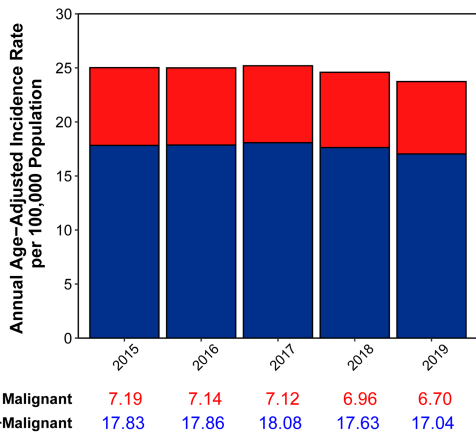


Fig. 13 Annual Age-Adjusted Incidence Rates^a of All Primary Brain and Other Central Nervous System Tumors by Year and Behavior, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

- Embryonal tumors were 1.46 times more common in males than females (Figure 16), and this sex difference was largest in medulloblastoma (Supplementary Figure 7).

Distributions and Incidence by Age at Diagnosis

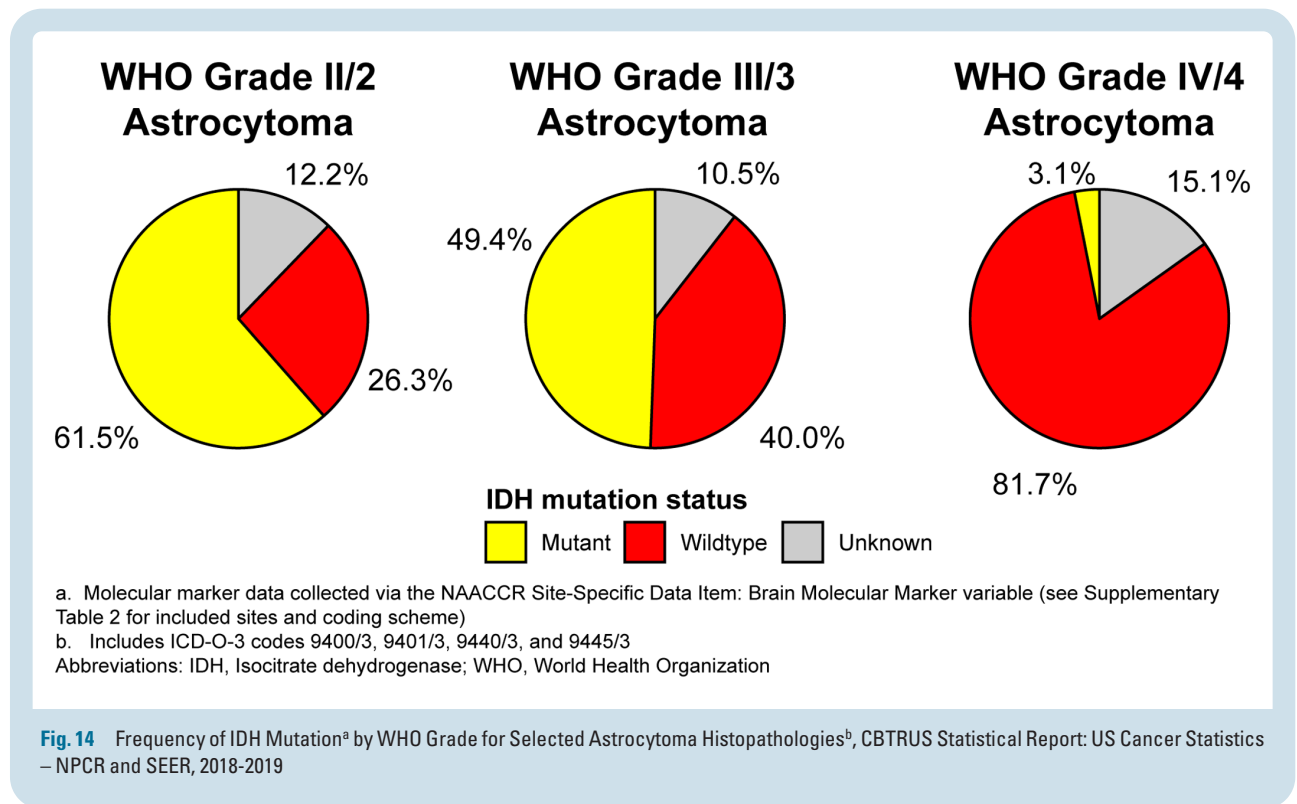
Incidence Rates by Age at Diagnosis

The overall AAAIR for 2015-2019 for all primary brain and other CNS tumors was 24.71 per 100,000 population (Table 5). The overall incidence rate was 5.79 per 100,000 population for children ages 0-14 years, 11.96 per 100,000 population for adolescents and young adults ages 15-39 years, and 44.65 per 100,000 population for adults ages 40+ years (Table 10). The overall incidence rates of tumors by behavior and age group (0-14 years, 0-19 years and 20+ years) are shown in Figure 21.

Incidence Rates by Age at Diagnosis and Histopathology

The AAAIRs by age and histopathology at diagnosis are presented in Table 10, Table 12, and Supplementary Table 8, as well as in Figure 18A (Ages 0-19 Years) and Figure 18B (Ages 20+ Years).

- The incidence rate for all brain and other CNS tumors was highest among ages 85+ years (90.05 per 100,000) and lowest among children and adolescents ages 0-19 years (6.2 per 100,000).
- Incidence rates of pilocytic astrocytoma, germ cell tumors, and embryonal tumors were higher in the younger age groups and decreased with advancing age.



- Incidence rates of meningiomas increased with age.
- Incidence rates declined with increasing age for those ages 0-19 years for gliomas, choroid plexus tumors, and medulloblastomas.
- Incidence rates of other astrocytic tumors and germ cell tumors were higher in the younger age groups and decreased with advancing age.

Median Age at Diagnosis

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

- The histopathology-specific median ages ranged from eight years for embryonal tumors to 70 years for neoplasm, unspecified.
- Pilocytic astrocytomas, unique astrocytoma variants, neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, and germ cell tumors were histopathologies with younger median ages at diagnosis compared to other histopathologies.
- The most commonly diagnosed histopathologies in older ages were glioblastoma, meningioma, and lymphoma (median age of 65, 67, and 67 years, respectively).

Distribution and Incidence Rates of Tumors by Site, Histopathology, and Age at Diagnosis

Distribution and Incidence Rates of Tumors by Site, Histopathology, and Age at Diagnosis in Children and Adolescents (Ages 0-19 Years)

Brain and other CNS tumors are the most common form of solid tumors in children, and they account for the majority

of cancer mortality in this age-group. About 5.7% of the reported brain and other CNS tumors during 2015-2019 occurred in children and adolescents ages 0-19 years (Table 12). The distribution of brain and other CNS tumors for children and adolescents ages 0-19 years by site is shown in Figure 19A.

- The largest percentages of tumors in childhood and adolescence were located in the pituitary and craniopharyngeal duct (18%).
- Frontal, temporal, parietal, and occipital lobes of the brain accounted for 5.8%, 6.6%, 2.6%, and 1.2% 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%, 10.1%, and 13.9% of all brain and other CNS tumors in childhood and adolescence, respectively.
- The cranial nerves and the spinal cord and cauda equina accounted for 7.5% and 5.1% of all brain and other CNS tumors in childhood and adolescence, respectively.

Figure 19B presents the most common brain and other CNS histopathologies in children and adolescents ages 0-19 years.

- For children and adolescents ages 0-19 years, pilocytic astrocytomas, other gliomas, and embryonal tumors accounted for 15.3%, 12.6%, and 9.2%, respectively.
- Tumors of the pituitary were the most common nonglial and predominantly **non-malignant** histopathology and accounted for 14.7% of all tumors in this age group.

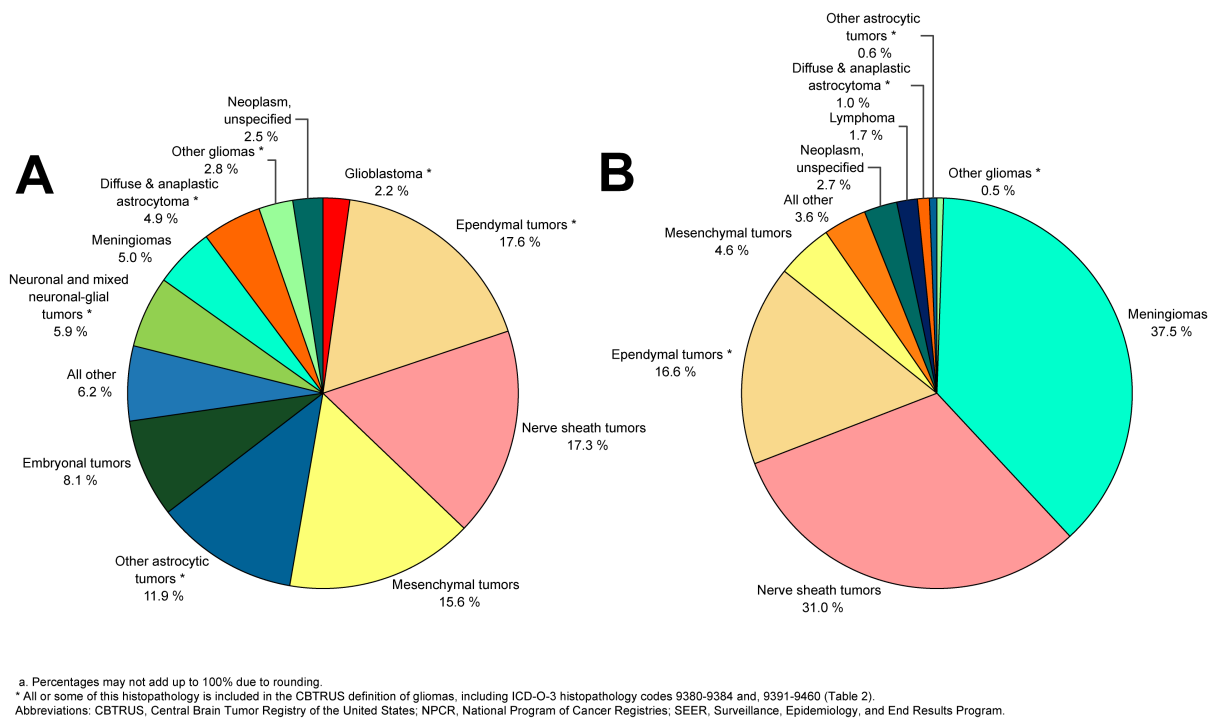


Fig. 15 Distribution^a of Primary Spinal Cord, Spinal Meninges, and Cauda Equina Tumors by Histopathology in A) Children and Adolescents (Ages 0-19 Years, Five-Year Total=1,451; Annual Average Cases=290) and B) Adults (Ages 20+ Years, Five-Year Total=19,103; Annual Average Cases=3,821), CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

- Gliomas accounted for approximately 44.6% of tumors in children and adolescents ages 0-19 years.
- Medulloblastomas accounted for 69.5% of all embryonal tumors in this age group.

Distribution of Tumors by Site and Histopathology in Children (Ages 0-14 Years)

Approximately 3.9% of all reported tumors occurred in children ages 0-14 years. The distribution of brain and other CNS tumors for children ages 0-14 years by site is shown in **Figure 20A**.

- Tumors of cerebellum (16.9%) comprised the largest proportion of tumors followed by tumors located in other brain (13.1%) and brain stem (12.6%).

Figure 20B presents the most common brain and other CNS histopathologies in children ages 0-14 years.

- For children ages 0-14 years, pilocytic astrocytomas, other gliomas, and embryonal tumors accounted for 18.7%, 15.3%, and 12.2%, respectively.
- Gliomas accounted for approximately 49.4% of tumors in children ages 0-14 years.
- Of embryonal tumors, medulloblastomas, atypical teratoid rhabdoid tumors (ATRT), and all other embryonal tumors accounted for 68.3%, 17.2%, and 14.8%, respectively.

Distribution of Tumors by Site and Histopathology in Adolescents (Ages 15-19 Years)

About 1.7% of the reported brain and other CNS tumors during 2015-2019 occurred in adolescents ages 15-19 years for a total of 7,779 tumors diagnosed between 2015 and 2019 (**Table 12**). The distribution of these tumors by site is shown in **Figure 22A**.

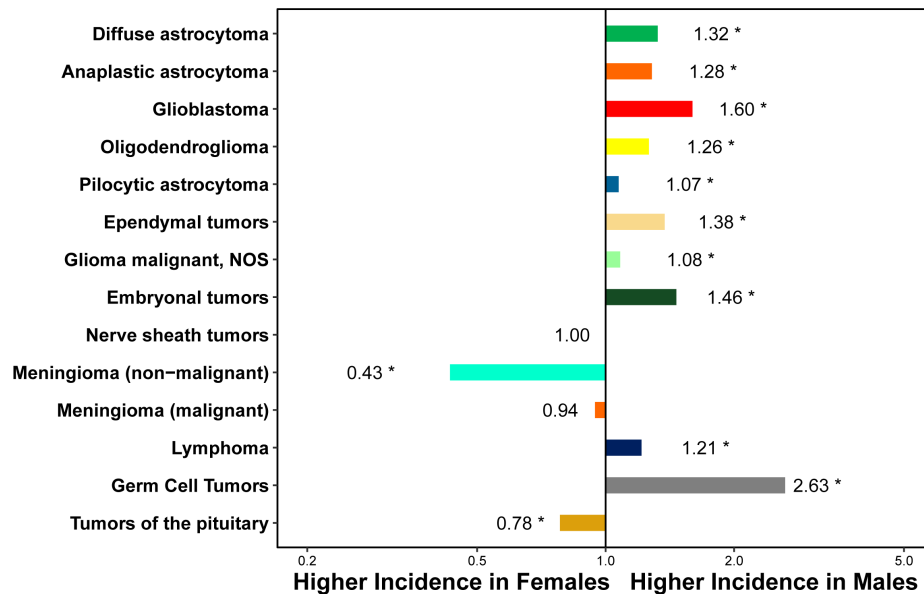
- 35.8% of these tumors were diagnosed in the pituitary and craniopharyngeal duct.
- The frontal lobe, temporal lobe, occipital lobe, and parietal lobe accounted for 18.4% of tumors in this age group.

The distribution of brain and other CNS tumors in adolescents ages 15-19 years by histopathology is shown in **Figure 22B**.

- The most common histopathology in adolescents was tumors of the pituitary (33.5%).
- Gliomas accounted for approximately 27.9% of tumors in adolescents. Of these gliomas, the histopathology pilocytic astrocytoma accounted for 7.7% of all tumors in this age group.

Incidence Rates by Histopathology Defined by ICCC in Children and Adolescents (Ages 0-19 Years)

Supplementary Table 10 presents the CBTRUS brain and other CNS tumor data for children and adolescents used



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
 * Incidence Rate is significantly different between groups at the $p < 0.05$ level.
 Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; NOS, Not otherwise specified.

Fig. 16 Incidence Rate Ratios^a by Sex (Males:Females) for Selected Primary Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

for this report according to the ICCC grouping system for pediatric cancers (See [Supplementary Table 1](#) for more additional information on the ICCC classification scheme).

Distribution and Incidence Rates of Adolescent and Young Adult Primary Brain and Other CNS Tumors (Ages 15-39 Years)

- There were 63,812 primary brain and other CNS tumors diagnosed in AYA between 2015 and 2019, representing 14.3% of all brain and other CNS tumors ([Figure 23](#)).
- The overall incidence rate in this age group was 11.96 per 100,000 population ([Table 10](#)). Incidence of **malignant** tumors was 3.25 per 100,000, and incidence of **non-malignant** tumors was 8.71 per 100,000 ([Table 10](#)).
- Tumors of the sellar region had the highest incidence (4.39 per 100,000 population), followed by tumors of the meninges (2.27 per 100,000 population) ([Table 10](#)).
- The most common histopathology in AYA was tumors of the pituitary (4.26 per 100,000 population), followed by meningiomas (1.97 per 100,000 population) and nerve sheath tumors (1.04 per 100,000 population) ([Table 10](#)).
- The majority of AYA brain and other CNS tumors occurred in the pituitary and craniopharyngeal duct (37.5%), followed by the meninges (16.2%) ([Figure 23A](#)).
- Approximately 17.6% of tumors diagnosed in AYA were located within the frontal, temporal, parietal, and occipital lobes of the brain combined ([Figure 23A](#)).
- Cerebrum, ventricle, cerebellum, and brain stem tumors combined accounted for about 9.9% of all AYA tumors ([Figure 23A](#)).

- The predominately **non-malignant** tumors of the pituitary (36%), meningioma (15.9%), and nerve sheath (8.6%) represented over half of CNS tumors diagnosed in AYA ([Figure 23B](#)).
- Gliomas accounted for approximately 24.8% of all brain and other CNS tumors in AYA, and about 82.4% of all **malignant** tumors ([Figure 23B](#)).
- AYA had higher rates of relative survival than adults greater than 40 years old for all histopathologic types. Though one-year relative survival for most tumor types was higher for AYA than children, five- and ten-year survival were usually higher for children as compared to AYA ([Table 11](#)).

Distribution and Incidence Rates by CCR and Diagnostic Confirmation

The overall number of reported tumors is listed by CCR in [Table 13](#). While most **malignant** tumors are diagnosed by histopathologic confirmation (where the patient receives surgery and diagnosis is confirmed on tissue 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). Please note, while five years of data are available for most included CCR, data were not available from Nevada for diagnosis years 2018 and 2019 due to data quality issues.

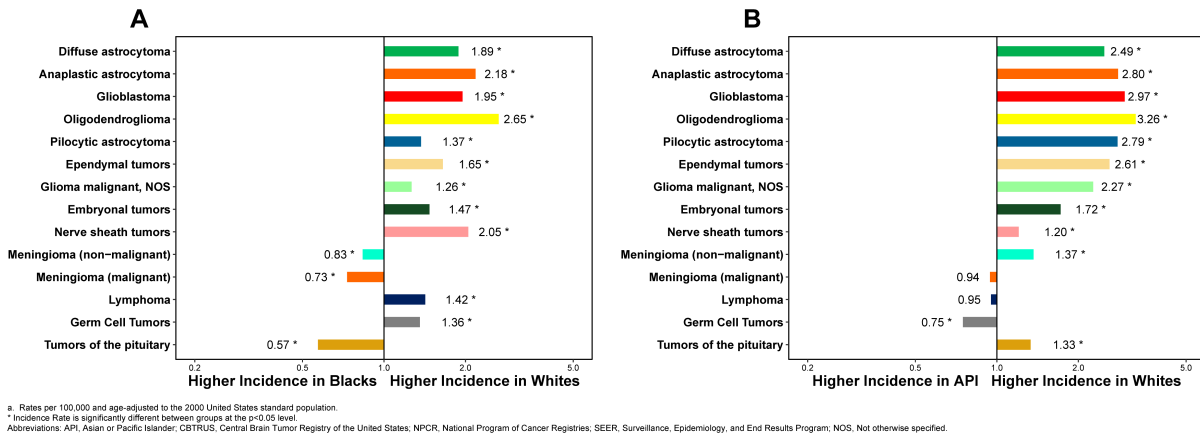


Fig. 17 Incidence Rate Ratios^a by Race (A- Whites:Blacks and B- Whites:Asian Or Pacific Islanders [API]) for Selected Primary Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

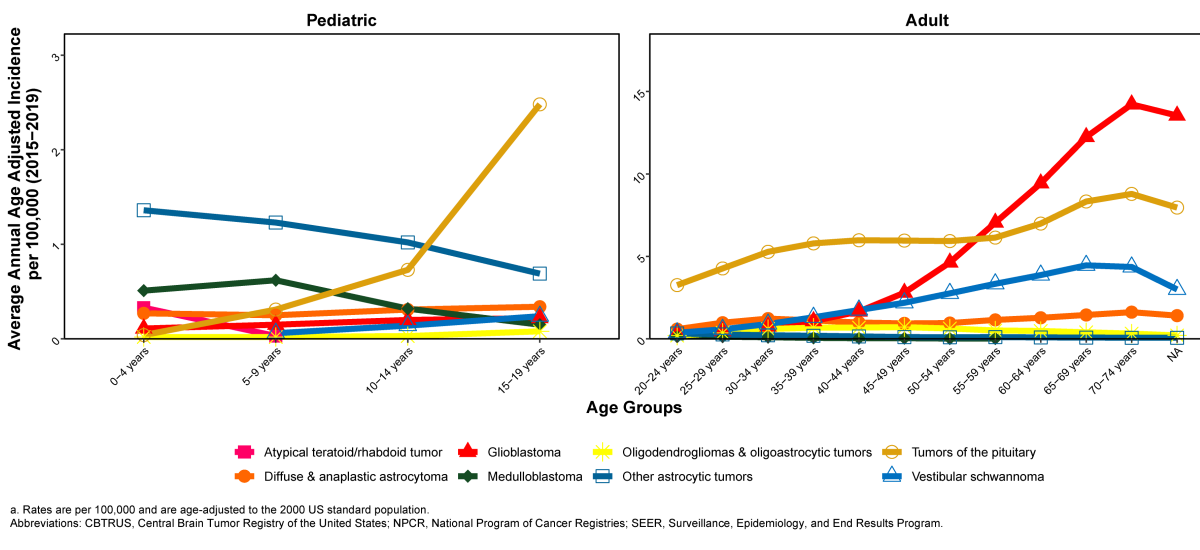


Fig. 18 Age-Adjusted Incidence Rates^a of Brain and Other Central Nervous System Tumors by Selected Histopathologies and Age Group at Diagnosis A) Ages 0-19 Years and B) Ages 20+ Years CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

- Approximately 71.7% of tumors were **non-malignant**, but there was variation by CCR (range: 56.2%-82.1%) (**Table 13**).
- Overall, 52.9% of tumors were histopathologically-confirmed. A larger proportion of **malignant** tumors were histopathologically-confirmed (84.3%) compared to **non-malignant** tumors (40.5%) (**Table 9**).
- A slight majority of **non-malignant** brain and other CNS tumors were radiographically-confirmed (56%).

The overall AAAIRs by age, behavior, and CCR are shown in **Table 14**, **Supplementary Table 9**, and **Figure 20**.

- There was less variation by region for **malignant** tumor incidence rates (**Figure 23A**) compared to incidence rates for **non-malignant** tumors (**Figure 23B**). CCR and

regional variations 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 17.45 to 44.14 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 4.73 to 8.28 per 100,000 population.
- Among adults 20 years of age and older, CCR-specific incidence rates ranged from 5.74 to 10.09 per 100,000 population for **malignant** tumors.
- In persons less than 20 years of age, incidence rates ranged from 2.09 to 4.83 per 100,000 population for **malignant** tumors.

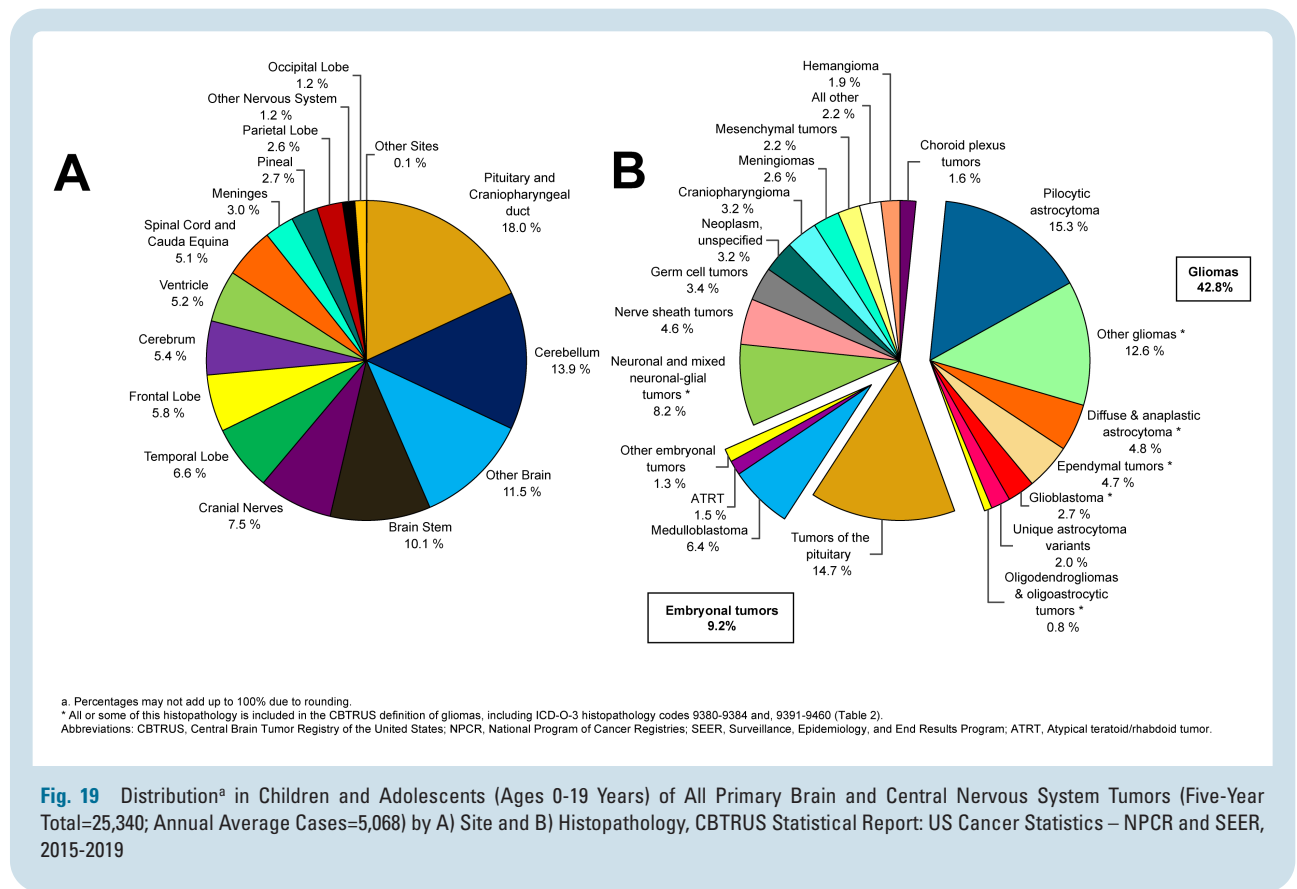


Fig. 19 Distribution^a in Children and Adolescents (Ages 0-19 Years) of All Primary Brain and Central Nervous System Tumors (Five-Year Total=25,340; Annual Average Cases=5,068) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

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

The distribution of reported tumors with histopathologically-confirmed diagnosis from 2015 to 2019 is listed by histopathology and reported WHO grade in [Table 9](#).

- Overall, 65.7% of tumors had complete WHO grade information, but there was substantial variation by histopathology.
- The histopathologic types with the highest WHO grade completeness were anaplastic astrocytoma (94.1%), anaplastic oligodendroglioma (93.6%), and oligodendroglioma (92.4%).

Distribution of Tumors in Puerto Rico

The distribution of brain and other CNS tumors diagnosed among residents of Puerto Rico by histopathology is shown in [Supplementary Figure 3](#).

- Approximately 40.2% of tumors were **malignant** and 59.8% were **non-malignant**. The most common histopathologies were **non-malignant** meningioma (27%), followed by glioblastoma (18.3%).

Distributions and Incidence by Sex

Distribution by Sex and Behavior

- Overall, 41.3% of all tumors diagnosed between 2015 and 2019 occurred in males (184,168 tumors) and 58.7% in females (261,624 tumors) ([Table 8](#)).
- Approximately 55.8% of the **malignant** tumors occurred in males (70,459 tumors between 2015 and 2019) and 44.2% in females (55,886 tumors between 2015 and 2019).
- Approximately 35.6% of the **non-malignant** tumors occurred in males (113,709 tumors between 2015 and 2019) and 64.4% in females (205,738 tumors between 2015 and 2019).

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 7](#).

- Incidence rates were highest for tumors located in the meninges (9.55 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 cranial nerves, other nervous

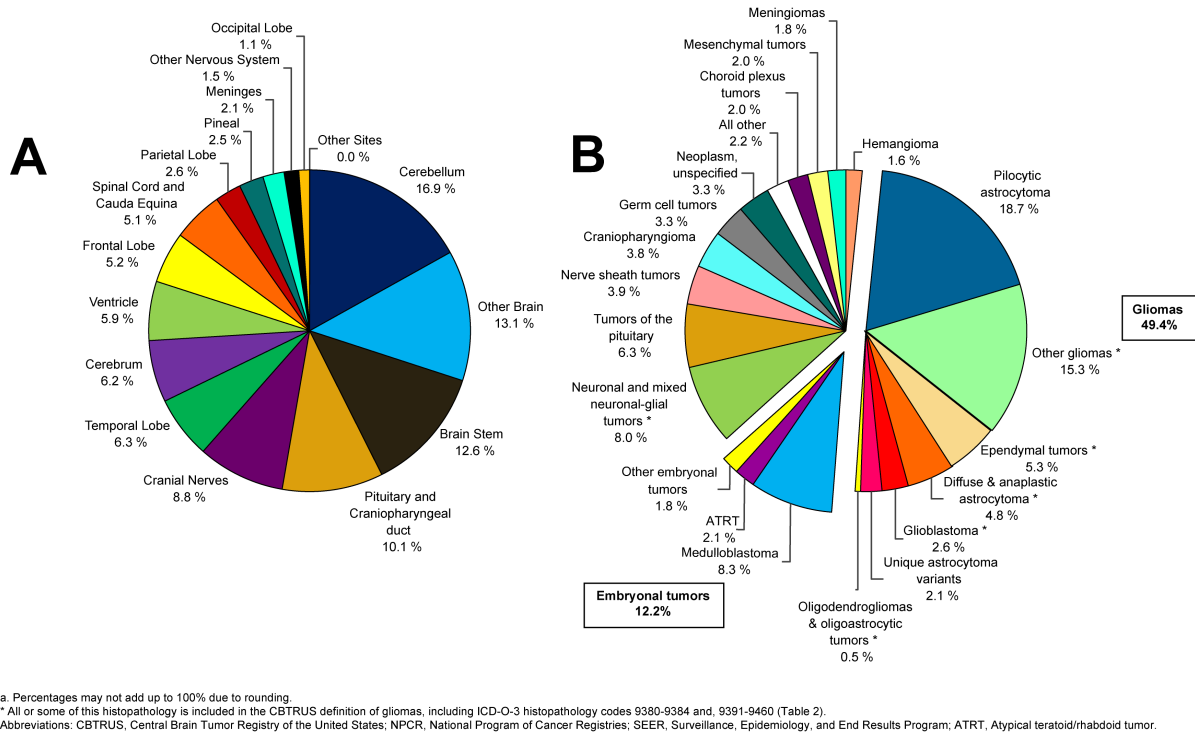


Fig. 20 Distribution^a in Children (Ages 0-14 Years) of All Primary Brain and Central Nervous System Tumors (Five-Year Total=17,561; Annual Average Cases=3,512) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

system, meninges, pituitary and craniopharyngeal duct, while males had higher incidence rates for tumors located in most other locations.

Incidence Rates by Sex and Histopathology

AAAIRs by sex and histopathology are shown in **Table 8**. Incidence rates for all primary brain and other CNS tumors combined were higher among females (27.62 per 100,000 population) than males (21.6 per 100,000 population).

- The incidence rate of tumors of meninges was higher in females (13.28 per 100,000 population) than in males (6.0 per 100,000 population).

Incidence rate ratios (male:female) for selected histopathologies and histopathology groupings are shown in (**Figure 15**).

- Incidence was higher in males for many histopathologies, such as germ cell tumors ($p<0.0001$), most glial tumors, lymphomas ($p<0.0001$), and embryonal tumors ($p<0.0001$).
- In addition to **non-malignant** ($p<0.0001$) and malignant ($p=0.2731$) meningiomas, tumors of the pituitary ($p<0.0001$) were also more common in females than in males.

Incidence Rates by Sex and Histopathology in Children and Adolescents (Age 0-19 Years)

The incidence rates for brain and other CNS tumors in children and adolescents by histopathology and sex are shown in **Table 15**.

- AAAIRs were highest for other astrocytic tumors (1.08 per 100,000) and tumors of the sellar region (1.10 per 100,000). Among these tumors, the most common histopathologies were pilocytic astrocytoma (0.95 per 100,000) and tumors of the pituitary (0.90 per 100,000).
- There were notable differences in incidence rates between males and females for neuronal and mixed neuronal-glioma tumors, embryonal tumors, germ cell tumors, and tumors of the sellar region.

Incidence Rates by Race, Ethnicity, and Histopathology

Incidence rates by race and histopathology are shown in **Table 16**, and for children and adolescents ages 0-19 years in **Table 17**.

- Incidence rates for all primary brain and other CNS tumors combined were lower for people who are AIAN (15.15 per 100,000) compared to people who are White

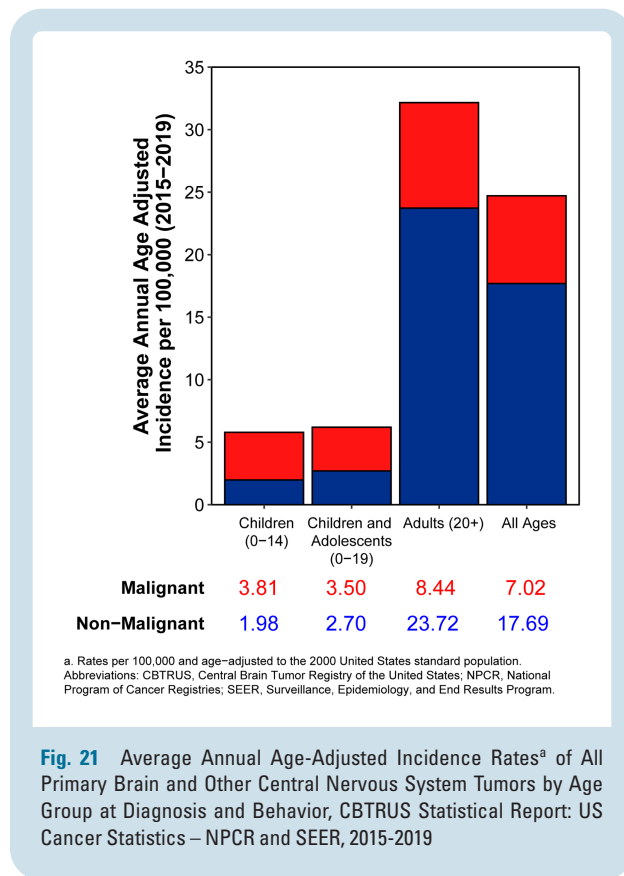


Fig. 21 Average Annual Age-Adjusted Incidence Rates^a of All Primary Brain and Other Central Nervous System Tumors by Age Group at Diagnosis and Behavior, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

(24.65 per 100,000), Black (25.18 per 100,000), and API (15.86 per 100,000).

- Incidence rates for **non-malignant** primary brain and other CNS tumors were highest in people who are Black (20.75 per 100,000) compared to people who are White (17.13 per 100,000), AIAN (11.52 per 100,000), and API (12.51 per 100,000).
- Incidence rates for **malignant** primary brain and other CNS tumors were highest in people who are White (7.51 per 100,000) compared to people who are Black (4.43 per 100,000), AIAN (3.63 per 100,000), and API (3.34 per 100,000).

Incidence rate ratios (White:Black) for selected histopathologies are shown in **Figure 17A**.

- Incidence rates for glioblastoma ($p < 0.0001$), all other astrocytoma ($p < 0.0001$), and nerve sheath tumors ($p < 0.0001$) were approximately two times greater in people who are White than in people who are Black.
- Incidence of oligodendroglioma was 2.65 times greater in people who are White than in people who are Black ($p < 0.0001$).
- Incidence rates for pilocytic astrocytoma ($p < 0.0001$), ependymal tumors ($p < 0.0001$), embryonal tumors ($p < 0.0001$), lymphoma ($p < 0.0001$), and germ cell tumors ($p = 0.0004$) were also higher among the people who are White than people who are Black.
- 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 people who are Black than people who are White.

Incidence rate ratios (White:API) for selected histopathologies are shown in **Figure 17B**.

- Incidence rates for glioblastoma ($p < 0.0001$) were 2.97 times greater in people who are White than in people who are API.
- Incidence of nerve sheath tumors ($p < 0.0001$) was approximately 1.2 times higher in people who are White than in people who are API.
- Germ cell tumors ($p < 0.0001$) were 0.75 times greater among people who are API than people who are White.

Incidence rates by Hispanic ethnicity and histopathology are shown in **Table 18**, for children and adolescents ages 0-19 years in **Table 19** and **Supplementary Figure 4**.

- The overall incidence rate for primary brain and other CNS tumors was 22.95 per 100,000 population among people who are Hispanic and 25.09 per 100,000 population among people who are non-Hispanic.
- Lymphomas and other hematopoietic neoplasms and tumors of the sellar region were the only histopathologies that were higher in people who are Hispanic than in people who are non-Hispanic.

While there are several histopathologies 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 Rates by Histopathology and Race/Ethnicity in Children and Adolescents (Age 0-19 Years)

Table 17 shows incidence rates for brain and other CNS tumors by histopathology and race for children and adolescents ages 0-19 years. Incidence rates by histopathology and ethnicity for children and adolescents ages 0-19 years are shown in **Table 19**.

- Incidence rates were highest among children and adolescents who are White (6.39 per 100,000) compared to children and adolescents who are Black (4.89 per 100,000 population), AIAN (3.38 per 100,000), or API (3.47 per 100,000).
- Incidence rates were highest among children and adolescents who are non-Hispanic (6.44 per 100,000) compared to children and adolescents who are Hispanic (5.47 per 100,000).

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

Expected Cases by State

The estimated number of cases of all primary brain and other CNS tumors for 2022 and 2023 by State and Behavior are shown in **Table 20**. Overall total rates by states presented are based on total **malignant** and **non-malignant** incidence. Stratified rates may not add up to these totals.

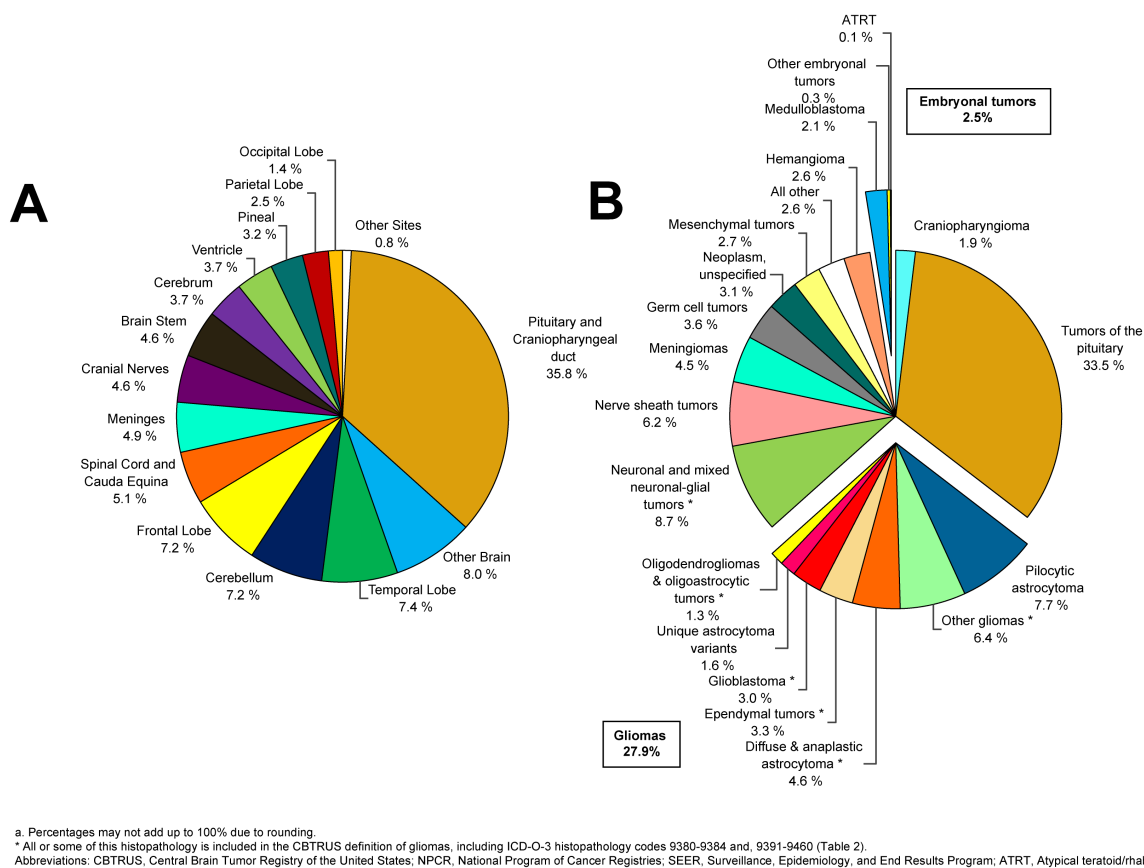


Fig. 22 Distribution^a in Adolescents (Ages 15-19 Years) of All Primary Brain and Central Nervous System Tumors (Five-Year Total=7,779; Annual Average Cases=1,556) by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Estimated numbers of cases are highly dependent on input data. Different patterns of incidence within strata can substantially 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 2022 is estimated to be 93,470, with 26,670 **malignant** and 66,800 **non-malignant** cases.
- For 2023, the estimate is 94,390 new cases of primary brain and other CNS tumors of which 26,940 and 67,440 are expected to be **malignant** and **non-malignant**, respectively.

Expected Cases by Histopathology and Age at Diagnosis

The estimated number of cases of all primary brain and other CNS tumors for 2022 and 2023 overall and by histopathology are shown in **Table 21** and including by age groups in **Supplementary Table 11**.

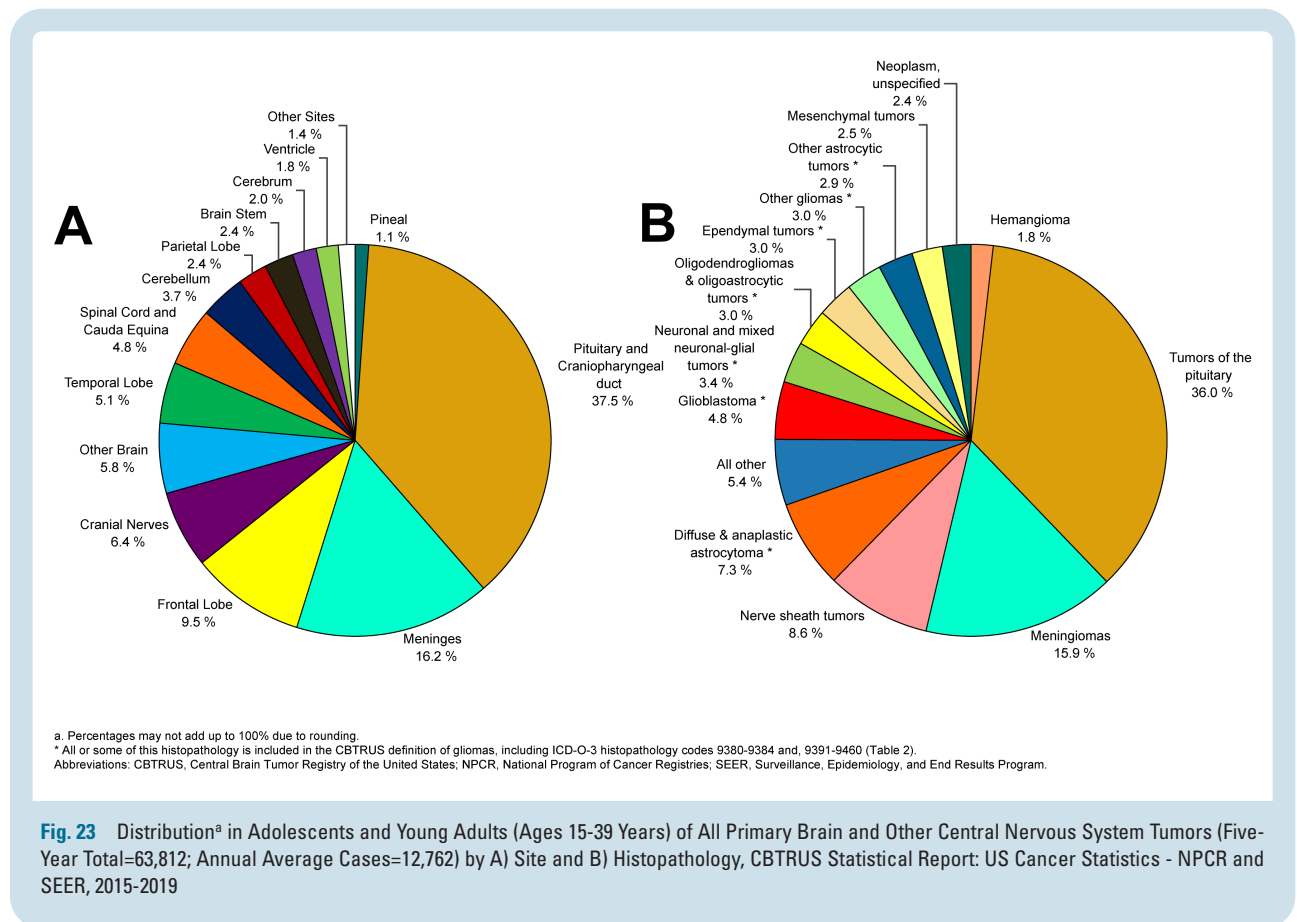
- Meningioma was the histopathology with the highest number of all estimated new cases, with 41,110 cases projected in 2022 and 42,260 cases projected in 2023.

- Glioblastoma was the **malignant** histopathology with the highest number of cases, with 14,190 cases projected in 2022 and 14,490 cases projected in 2023.
- For 2022 and 2023, the highest number of new cases is predicted in those age 65+ years, with 44,130 cases and 45,390 cases, respectively.
- For 2022 and 2023, children ages 0-14 years are estimated to have 3,860 and 3,920 new cases of primary brain and other CNS tumors each year, respectively.
- For 2022 and 2023, children and adolescents ages 0-19 years are estimated to have 5,220 and 5,230 new cases of primary brain and other CNS tumors each year, respectively.

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

AAAMR for primary **malignant** brain and other CNS tumors in the United States during 2015-2019 by state and sex are shown in **Table 22** and **Figure 25**.

- The aggregate total number of observed deaths was 84,264, for an average annual age-adjusted mortality rate of 4.41 per 100,000 population.
- There was considerable variation by individual state, which ranged from a low of 2.9 deaths per 100,000



population to a high of 5.68 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 5.38 per 100,000 population as compared to 3.58 per 100,000 population.

Overall Survival and Relative Survival

Estimates of median survival in months by histopathology and age group for all individuals diagnosed with primary **malignant** brain and other CNS tumors irrespective of whether individuals received any treatment for their tumor are shown in **Table 23**. Survival curves for the most common histopathologies are shown by age group in **Figure 26A**.

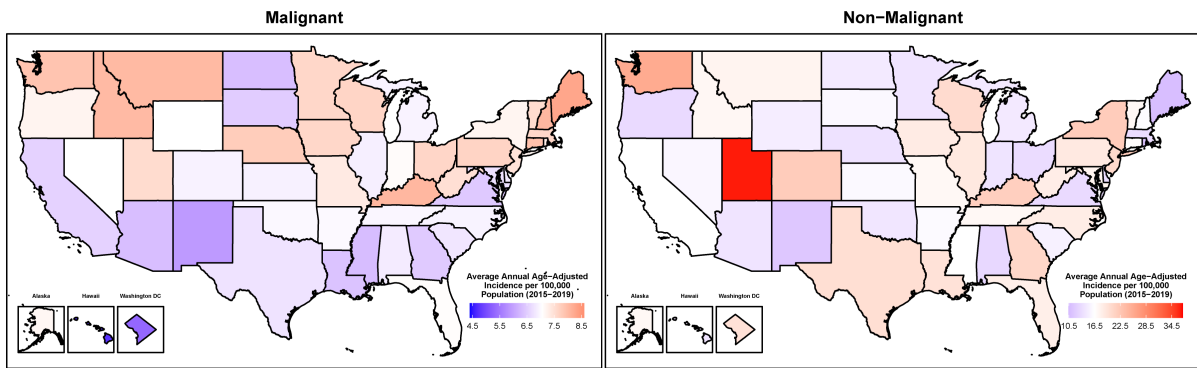
- Median survival was lowest for glioblastoma (8 months) and highest for oligodendroglioma (199 months, or approximately 16.6 years).
- Median survival was not able to be estimated for pilocytic astrocytoma, unique astrocytoma variants, ependymal tumors, other neuroepithelial tumors, neuronal and mixed neuronal-glioma tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, nerve sheath tumors, other tumors of cranial and spinal nerves, germ cell tumors, tumors of the pituitary,

craniopharyngioma, and hemangioma 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.

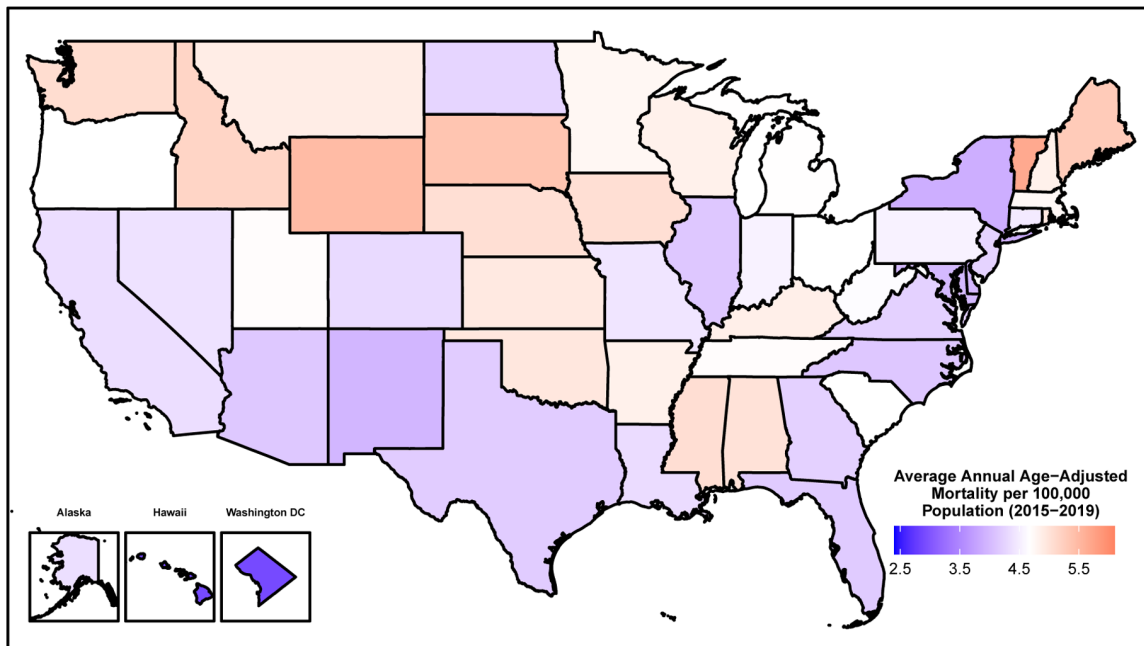
Demographic factors such as age at diagnosis, sex, race, and ethnicity are known to have a significant effect on survival time after diagnosis in primary brain and other CNS tumors. Hazard ratios for the effect of age groups, sex, race, and ethnicity are shown in **Table 24** for all individuals regardless of whether they received any treatment for their tumor. Hazard ratio estimates for demographic factors in the five most common histopathologies are shown by histopathology in **Figure 26B**.

- AYA (15-39 years) had better overall survival as compared to children ages 0-14 years old in almost half of the histopathologies evaluated. Children and AYA age groups had similar survival in germ cell tumors.
- Older adults (40+ years old) had poorer survival than children (0-14 years) in nearly every histopathology with the exception of primary melanocytic lesions.
- Females generally had better survival outcomes as compared to males with the exception of glioblastoma, glioma malignant, NOS, embryonal tumors, other hemopoietic neoplasms, and germ cell tumors.



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
 b. Data from Nevada included for 2015-2017 only
 Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Fig. 24 Average Annual Age-Adjusted Incidence Rates^a of Malignant and Non-Malignant Primary Brain and Other Central Nervous System Tumors by Central Cancer Registry, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019



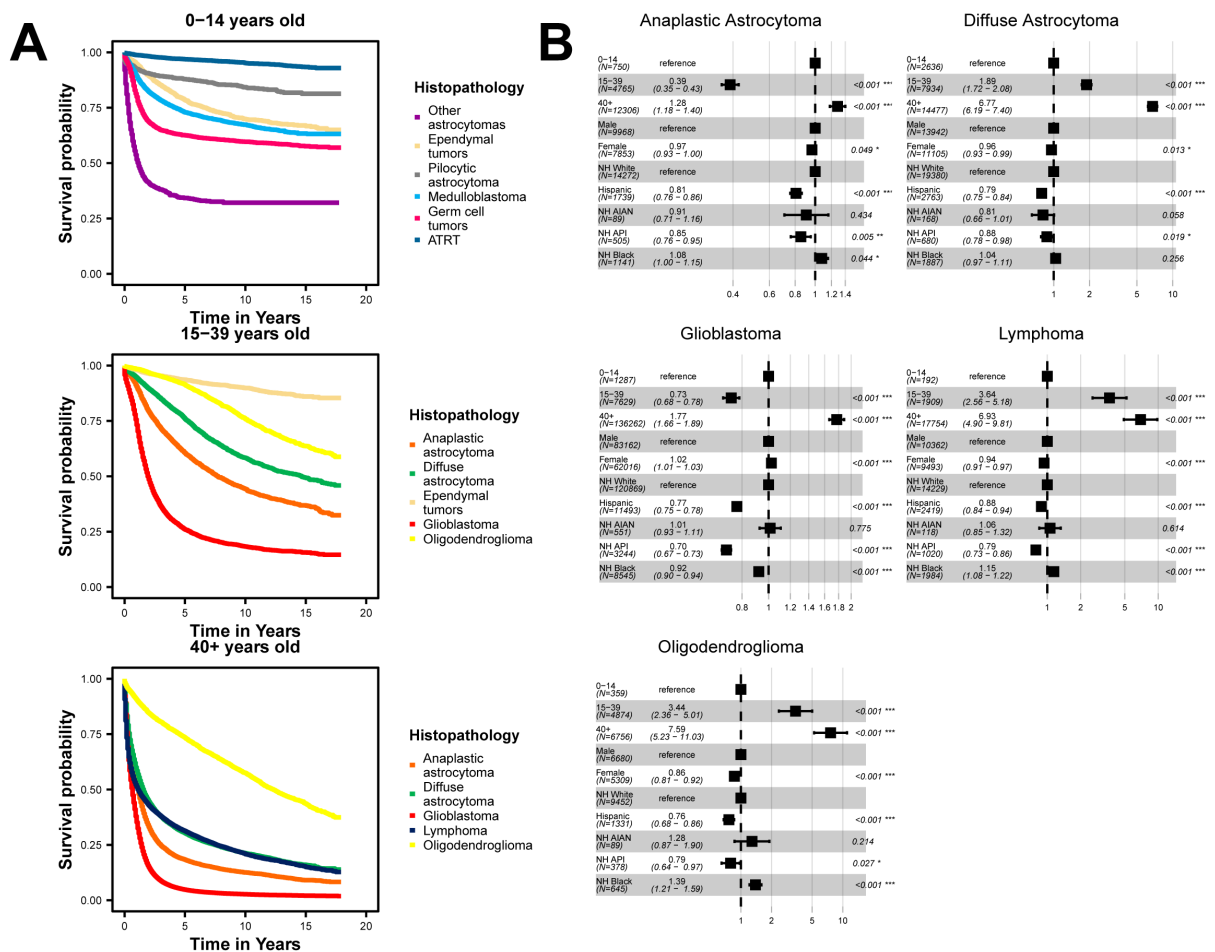
a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
 Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NVSS, National Vital Statistics System.

Fig. 25 Average Annual Age-Adjusted Mortality Rates^a for Malignant Primary Brain and Other Central Nervous System Tumors by Central Cancer Registry, CBTRUS Statistical Report: NVSS, 2015-2019

- Individuals who are Black, non-Hispanic had poorer survival outcomes as compared to individuals who are White, non-Hispanic with the exception of glioblastoma, unique astrocytoma variants, other neuroepithelial tumors, other hemopoietic neoplasms, germ cell tumors, and neoplasm unspecified.
- Individuals who are AIAN, non-Hispanic had poorer survival as compared to individuals who are White,

non-Hispanic in many histopathologies, though the small size of this population meant that many of these associations were non-significant.

- Being an API, non-Hispanic individual was associated with improved survival in many histopathologies as compared to individuals who were White, Non-Hispanic, though many of these associations were non-significant.



Abbreviations: CDC, Centers for Disease Control and Prevention; ATRT, Atypical teratoid/rhabdoid tumor; NH, non-Hispanic; AIAN, American Indian/Alaskan Native; API, Asian or Pacific Islander.

Fig. 26 A) Kaplan-Meier Survival Curves for the Five Most Common Histopathologies within Age Group at Diagnosis (Ages 0-14, 15-39, and 40+ Years) and B) Hazard Ratios And 95% Confidence Intervals for Sex, Age at Diagnosis, Race, and Ethnicity for the Five Most Common Histopathologies Overall, CBTRUS Statistical Report: NPCR 2001-2018

- Hispanic ethnicity was associated with improved survival in most histopathologies.
- Many other published survival estimates (including many of those previously published by CBTRUS⁸³⁻⁸⁵) incorporate treatment patterns which may explain differences between these population-level estimates and other published estimates.
- The highest overall five-year survival was for tumors occurring in the acoustic nerves (99.5%).
- The lowest overall five-year survival was for tumors occurring in the overlapping lesion of the brain (21.4%).
- The five-year survival for **malignant** tumors by site ranged from 18.6% (tumors in the overlapping lesion of the brain) to 95.6% (tumors in the optic nerves).
- The five-year survival for **non-malignant** tumors ranged from 72.3% (tumors in the overlapping lesion of the brain) to 99.5% (tumors in the cranial nerves and acoustic nerve).

When interpreting these results, it is important to remember that these models do not incorporate important 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 [Table 25](#) and [Supplementary Table 12](#).

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

Relative survival estimates for brain and other CNS tumors by histopathology, behavior, and age at diagnosis are shown in [Table 11](#) and [Supplementary Table 13](#).

- There was large variation in survival estimates for all ages depending upon tumor histopathology; five-year

- survival rates were 99.2% for tumors of the pituitary and 6.9% for glioblastoma.
- Survival generally decreased with older age at diagnosis; children and young adults generally had better survival outcomes for most histopathologies.
 - Among predominantly **non-malignant** histopathologies, five-year survival was lowest in primary melanocytic lesions which had five-year relative survival of 66.5%.
 - Among predominantly **non-malignant** histopathologies, five-year survival was highest in nerve sheath tumors which had five-year relative survival of 99.3%.
 - In general, relative survival in most histopathologies was higher in adolescents and young adults ages 15-39 years as compared to children and adults of all other ages.

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 United States 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 2015-2019* 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 United States.

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, 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 reported cases for the time period examined, 2015-2019, 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 United States via the cancer registry system. Survival data used for this report are collected by NPCR for 42 of the 51 CCRs in the United States—primarily through linkage with death certificate and other administrative records—and by SEER for the remaining CCRs—through active and passive methods—and the feasibility of these data for use in survival studies has been evaluated^{86,87} 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 whose members 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 histopathology code assignment at case registration is based on histopathology information contained in the patient's medical record. The *WHO Classification of Tumours of the Central Nervous System* was revised in 1993, 2000, 2007, 2016, and 2021.^{2,19,20,88,89} 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 2016 due to the variation in adoption of new standards by individual physicians and medical practices. As a result, histopathologies are reflective of the prevailing criteria for the histopathology at the time of case registration. This means that despite changes to the histopathology 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 histopathologic criteria over time, there is significant inter-rater variability in histopathological diagnosis of glioma.^{90,91} 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 histopathologic confirmation (where surgery was performed and the diagnosis confirmed on a tissue specimen 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 histopathologic confirmation allows certainty on the assignment of a specific histopathology 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 histopathology in these tumors.

CONCLUDING COMMENT

The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2015-2019* comprehensively describes the most up to date (October 2022) 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 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 United States.⁹²

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 the CDC or of the NCI.

Jill S. Barnholtz-Sloan, Ph.D. is a full-time paid employee of the NIH/NCI. Gino Cioffi, M.P.H. and Kristin A. Waite, Ph.D. are full-time contractors of the NIH/NCI.

Abbreviations

AAAIR	–	Average Annual Age-Adjusted Incidence Rate
AAAMR	–	Average Annual Age-Adjusted Mortality Rate
ABTA	–	American Brain Tumor Association
<i>ACVR1</i>	–	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
CI	–	Confidence Interval
CNS	–	Central Nervous System
CS	–	Collaborative Staging
DIPG	–	Diffuse Intrinsic Pontine Glioma

IACR	–	International Agency for Cancer Research
ICD-O-3	–	International Classification of Diseases for Oncology, Third Edition
ICCC	–	International Classification of Childhood Cancer
<i>IDH1/2</i>	–	Isocitrate Dehydrogenase 1/2
IRR	–	Incidence Rate Ratio
<i>MGMT</i>	–	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
<i>PDGFRA</i>	–	Platelet-derived Growth Factor Receptor A
<i>PI3KCA</i>	–	Phosphatidylinositol 3-Kinase Catalytic subunit Alpha
SEER	–	Surveillance, Epidemiology, and End Results
<i>SHH</i>	–	Sonic Hedgehog
SSDI	–	Site-Specific Data Items
SSF	–	Site-Specific Factors
SSF 4	–	Promoter methylation status of O-6-Methylguanine-DNA Methyltransferase
SSF 5	–	Deletion of the 1p
SSF 6	–	Deletion of 19q
<i>TP53</i>	–	Tumor Protein p53
UDS	–	Uniform Data Standards
US	–	United States
USCS	–	United States Cancer Statistics
VACCR	–	Veterans Affairs Central Cancer Registry
VHA	–	Veterans Health Administration
WHO	–	World Health Organization
<i>WNT</i>	–	Wingless

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The CBTRUS Scientific Team

Quinn T. Ostrom, Ph.D., M.P.H., CBTRUS Co-Scientific -Principal Investigator, Assistant Professor, The Preston Robert Tisch Brain Tumor Center at Duke University Medical Center and Department of Neurosurgery, Duke University School of Medicine, Durham, NC

Jill S. Barnholtz-Sloan, Ph.D., CBTRUS Co-Scientific Principal Investigator, Associate Director and Senior Investigator, Center for Biomedical Informatics & Information Technology (CBII) and Trans Divisional Research Program (TDRP), Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute, Bethesda, MD

Gino Cioffi, M.P.H., Trans Divisional Research Program (TDRP), Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute, Bethesda, MD

Corey Neff, M.P.H., Department of Neurosurgery, Duke University School of Medicine, Durham, NC

Mackenzie Price, M.P.H., Department of Neurosurgery, Duke University School of Medicine, Durham, NC

Kristin A. Waite, Ph.D., Trans Divisional Research Program (TDRP), Division of Cancer Epidemiology and Genetics (DCEG), National Cancer Institute, Bethesda, MD

The CBTRUS Consulting Neuropathologists

Daniel J. Brat, M.D., Ph.D., Professor and Chair, Department of Pathology, Northwestern University Feinberg School of Medicine, Chicago, IL

Janet M. Bruner, M.D., MD Anderson Cancer Center, Houston, TX (Retired)

Roger E. McLendon, M.D., Professor, The Preston Robert Tisch Brain Tumor Center at Duke University Medical Center and Department of Pathology, Duke University Medical Center, Durham, NC

Tarik Tihan, M.D., Ph.D., Professor, Neuropathology Division, Department of Pathology, School of Medicine, University of California San Francisco (UCSF), San Francisco, CA

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Fred H. Hochberg, M.D., Visiting Scientist, Department of Neurosurgery, University of California at San Diego, San Diego, CA

Margaret Wrensch, Ph.D., Professor, Neuroepidemiology Division, Department of Neurological Surgery, School of Medicine, University of California-San Francisco, San Francisco, CA

Darell D. Bigner, M.D., Ph.D. (Emeritus Member), Edwin L. Jones, Jr. and Lucille Finch Jones Cancer Research Professor, Department of Pathology, Emeritus Director, The Preston Robert Tisch Brain Tumor Center, Chief, Preuss Laboratory for Brain Tumor Research, Duke University Medical Center, Durham, NC
L. Lloyd Morgan (Emeritus Member), Patient Advocate, Berkeley, CA.

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Melissa Bondy, Ph.D., Professor and Chair, Department of Epidemiology and Population Health, Stanford University School of Medicine, Stanford, CA

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Roberta McKean-Cowdin, Ph.D., Associate Professor, Department of Epidemiology, University of Southern California, Los Angeles, CA

Nancy Stroup, Ph.D., Epidemiologist (Retired).

John Villano, M.D., Ph.D., Professor, Division of Medical Oncology, University of Kentucky Markey Cancer Center, Lexington, KY

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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.

Iorgulescu JB, et al. "Molecular Biomarker-Defined Brain Tumors: Epidemiology, Validity, and Completeness in the United States." *Neuro Oncol*. 2022 Apr 23;noac113. doi: 10.1093/neuonc/noac113. Epub ahead of print. PMID: 35460555.

This analysis investigated the completeness and validity of the novel brain molecular markers (BMM) site-specific data item after its first year of collection.

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.

Low JT, et al. "Primary brain and other central nervous system tumors in the United States (2014-2018): A summary of the CBTRUS statistical report for clinicians." *Neurooncol Pract*. 2022 Feb 22;9(3):165-182. doi: 10.1093/nop/npac015. PMID: 35601966; PMCID: PMC9113389.

A special, condensed CBTRUS Statistical Report designed to be a streamlined and useful resource for practicing clinicians.

Ostrom QT, et al. "CBTRUS Statistical Report: Pediatric Brain Tumor Foundation Childhood and Adolescent Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2014-2018." *Neuro Oncol*. 2022 Sep 6;24(Suppl 3):iii1-iii38. doi: 10.1093/neuonc/noac161. PMID: 36066969; PMCID: PMC9447434.

This special report, funded by the Pediatric Brain Tumor Foundation, presents incidence and survival statistics for children 0-14 using histopathology 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 histopathologies 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*. 2022 Feb 1;24(2):302-310. doi: 10.1093/neuonc/noab199. PMID: 34387331; PMCID: PMC8804884.

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

Waite KA, et al. "Aligning the Central Brain Tumor Registry of the United States (CBTRUS) histology groupings with current definitions." *Neurooncol Pract*. 2022 Mar 24;9(4):317-327. doi: 10.1093/nop/npac025. PMID: 35859542; PMCID: PMC9290890.

This manuscript traces the rationale for changes made to the CBTRUS histopathology grouping scheme in order to better align it with modern diagnostic criteria.

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/nov252. 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 histopathologies.

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

^aInternational Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.

^bICD-O-3 histopathology codes 9522-9523 only.

^cThese ICD-O-3 codes are combined for analysis in figures and tables presented in this report.

Abbreviations: NOS, not otherwise specified.

Table 2 Central Brain Tumor Registry of the United States (CBTRUS), 2021 Brain and Other Central Nervous System Tumor Histopathology Groupings (Based on 2016 WHO Classification)

Histopathology	ICD-O-3 ^a Histopathology Codes ^b	ICD-O-3 ^a Histopathology and Behavior Code ^b	
		Malignant	Non-Malignant
Diffuse Astrocytic and Oligodendroglial Tumors			
Diffuse astrocytoma*	9381, 9400, 9410, 9411, 9420, 9442/1	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 oligodendrogloma*	9451, 9460	9451/3, 9460/3	None
Oligoastrocytic tumors* ⁹³⁸²		9382/3	None
Other Astrocytic Tumors			
Pilocytic astrocytoma*	9421, 9425 ^c	9421/1 ^d , 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, 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
Medulloblastoma	9470-9472, 9474-9478	9470/3, 9471/3, 9472/3, 9474/3, 9475/3, 9476/3, 9477/3, 9478/3,	None
Atypical teratoid/rhabdoid tumor	9508	9508/3	None
Other embryonal tumors ^e	8963, 9364, 9473, 9480, 9500, 9501, 9502	8963/3, 9364/3, 9473/3, 9480/3, 9500/3, 9501/3, 9502/3	None
Tumors of Cranial and Paraspinous 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 paraspinous 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

Histopathology	ICD-O-3 ^a Histopathology Codes ^b	ICD-O-3 ^a Histopathology 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, 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 ^c (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

Histopathology	ICD-O-3 ^a Histopathology Codes ^b	ICD-O-3 ^a Histopathology 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

^aInternational Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.

^bSee the CBTRUS website for additional information about the specific histopathology codes included in each group: <http://www.cbtrus.org>.

^cAdded starting with diagnosis year 2018.

^dThis histopathologically is re-coded from behavior /1 to /3 and included in estimates for malignant brain and other central nervous system tumors by cancer surveillance organizations. Please see the following for more information: Ostrom QT, Kruchko C, Barnholtz-Sloan JS. Pilocytic astrocytomas: where do they belong in cancer reporting? *Neuro Oncol.* 2020;22(2):298-300. doi: 10.1093/neuonc/noz202.

^eIncludes tumors formerly classified as primitive neuroectodermal tumors of the central nervous system (PNET).

* All or some of this histopathology is included in the CBTRUS definition of gliomas, including ICD-O-3 histopathology codes 9380-9384, 9391-9460.

Abbreviations: WHO, World Health Organization; NOS, not otherwise specified.

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

Gene or Marker	Histopathology	Outcome	Collected by US Cancer Registry System
Large deletions (missing parts of the chromosome) in the short arm of chromosome 1 (1p) and the long arm of chromosome 19 (19q)	Glioma (especially oligodendroglial tumors) ¹⁻⁵	Improved response to chemotherapy and radiation, and increased survival.	Yes, collected as Site-specific factor 5 (2011-2017), Site-specific factor 6 (2011-2017), Site-specific data item: Chromosome 19q Status (2018+), Site-specific data item: Chromosome 1p Status (2018+).
Protein-truncating mutation in isocitrate dehydrogenase 1 (<i>IDH1</i>) or in isocitrate dehydrogenase 2 (<i>IDH2</i>)	Glioma (especially low grade astrocytomas and oligodendroglial tumors) ⁴⁻⁶	Increased survival time.	Yes, began in collection year 2018 (January 1), Site-specific data item: Brain Molecular Markers (2018+).
Loss of function mutation in alpha thalassemia/mental retardation syndrome X-linked (<i>ATRX</i>)	Glioma (especially IDH-mutated glioma) ^{4,7,8}	Increased survival time.	No
Methylation of the promoter of O-6-methylguanine-DNA methyltransferase (<i>MGMT</i>)	Glioblastoma ⁹⁻¹¹	Limits ability of the tumor cells to repair DNA damage caused by chemotherapy and radiation; results in increased survival time.	Yes, collected as Site-specific factor 4 (2011-2017) and Site-specific data item: MGMT (2018+).
Glioma-CpG island methylator phenotype (G-CIMP), Genome-wide DNA methylation	Glioblastoma ^{5,12}	Significantly increased survival time.	No
Amplification of epidermal growth factor receptor (<i>EGFR</i>)	Glioblastoma ^{5,13}	Activates the RTK/RAS/PI3K pathway, leading to increased proliferation. Associated with poorer survival.	No
Mutation of promoter of Telomerase reverse transcriptase (<i>TERT</i>)	Glioma (oligodendroglial tumors and IDH-wildtype glioblastoma) ^{5,14,15}	Facilitates increased telomere lengthening, and decreases survival in IDH-wildtype glioma.	No
Mutation or fusion of B-Raf (<i>BRAF</i>)	Glioma (particularly pediatric lower grade glioma) ¹⁶	Activates the RAS/MAPK pathway. Fusion leads to improved survival.	No
WNT-activated medulloblastoma	Medulloblastoma ¹⁷⁻²⁰	Low prevalence of metastatic disease. Highest five-year survival.	Yes, began in collection year 2018 (January 1), collected via new ICD-O-3 code.
SHH-activated and <i>TP53</i> -mutant medulloblastoma	Medulloblastoma ¹⁷⁻²¹	Occur primary in older children, very poor prognosis.	Yes, began in collection year 2018 (January 1), collected via new ICD-O-3 code.
SHH-activated and <i>TP53</i> -wildtype medulloblastoma	Medulloblastoma ¹⁷⁻²¹	Most common in adolescents and young children, good prognosis.	Yes, began in collection year 2018 (January 1), collected via Site-specific data item: Brain Molecular Markers (2018+).
non-WNT/non-SHH, Group 3 medulloblastoma subtype (also known as Group C)	Medulloblastoma ¹⁷⁻²⁰	Increased prevalence of metastatic disease. Poorest five-year survival.	Yes, began in collection year 2018 (January 1), combined with group 4 and collected via new ICD-O-3 code.
non-WNT/non-SHH, Group 4 medulloblastoma subtype (also known as Group D)	Medulloblastoma ¹⁷⁻²⁰	Increased prevalence of metastatic disease. Moderate five-year survival.	Yes, began in collection year 2018 (January 1), combined with group 3 and collected via new ICD-O-3 code.
C19MC amplification and presence of multilayered rosettes	Embryonal tumor ^{22,23}	Highly aggressive, with average survival of 12 months after diagnosis.	Yes, began in collection year 2018 (January 1), collected via Site-specific data item: Brain Molecular Markers (2018+).

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Table 3 Continued

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Table 4 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: US Cancer Statistics – NPCR and SEER, 2015–2019

Site (ICD-O Topography Code)	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)
Olfactory tumors of the nasal cavity (C30.0) ^d	735	147	0.2%	0.04 (0.04-0.04)	419	84	0.2%	0.05 (0.04-0.05)	316	63	0.1%	0.03 (0.03-0.04)
Meninges (cerebral and spinal) (C70.0-C70.9)	179,112	35,822	40.2%	9.55 (9.50-9.59)	48,792	9,758	26.5%	5.69 (5.64-5.75)	130,320	26,064	49.8%	12.97 (12.90-13.04)
<i>Cerebral meninges (C70.0)</i>	147,043	29,409	33.0%	7.84 (7.80-7.88)	40,373	8,075	21.9%	4.71 (4.66-4.76)	106,670	21,334	40.8%	10.62 (10.56-10.69)
<i>Spinal meninges (C70.1)</i>	7,591	1,518	1.7%	0.40 (0.39-0.41)	1,662	332	0.9%	0.19 (0.18-0.20)	5,929	1,186	2.3%	0.58 (0.57-0.60)
<i>Meninges, NOS (C70.9)</i>	24,478	4,896	5.5%	1.31 (1.29-1.33)	6,757	1,351	3.7%	0.79 (0.77-0.81)	17,721	3,544	6.8%	1.77 (1.74-1.80)
Cerebrum (C71.0)	7,460	1,492	1.7%	0.43 (0.42-0.44)	3,978	796	2.2%	0.47 (0.46-0.49)	3,482	696	1.3%	0.39 (0.37-0.40)
Frontal, temporal, parietal, and occipital lobes of the brain (C71.1-C71.4)	76,878	15,376	17.2%	4.20 (4.17-4.23)	43,063	8,613	23.4%	4.96 (4.92-5.01)	33,815	6,763	12.9%	3.52 (3.49-3.56)
<i>Frontal lobe (C71.1)</i>	33,973	6,795	7.6%	1.88 (1.86-1.90)	18,138	3,628	9.8%	2.12 (2.09-2.15)	15,835	3,167	6.1%	1.67 (1.65-1.70)
<i>Temporal lobe (C71.2)</i>	24,837	4,967	5.6%	1.35 (1.33-1.36)	14,876	2,975	8.1%	1.70 (1.68-1.73)	9,961	1,992	3.8%	1.03 (1.01-1.06)
<i>Parietal lobe (C71.3)</i>	14,252	2,850	3.2%	0.76 (0.75-0.77)	7,945	1,589	4.3%	0.90 (0.88-0.92)	6,307	1,261	2.4%	0.64 (0.62-0.66)
<i>Occipital lobe (C71.4)</i>	3,816	763	0.9%	0.21 (0.20-0.21)	2,104	421	1.1%	0.24 (0.23-0.25)	1,712	342	0.7%	0.18 (0.17-0.18)
Ventricle (C71.5)	4,109	822	0.9%	0.25 (0.24-0.26)	2,279	456	1.2%	0.28 (0.27-0.29)	1,830	366	0.7%	0.22 (0.21-0.23)
Cerebellum (C71.6)	9,291	1,858	2.1%	0.58 (0.57-0.59)	5,028	1,006	2.7%	0.64 (0.62-0.65)	4,263	853	1.6%	0.52 (0.51-0.54)
Brain stem (C71.7)	6,113	1,223	1.4%	0.39 (0.38-0.40)	3,284	657	1.8%	0.42 (0.40-0.43)	2,829	566	1.1%	0.36 (0.35-0.38)
Other brain (C71.8-C71.9)	33,701	6,740	7.6%	1.84 (1.82-1.86)	18,023	3,605	9.8%	2.11 (2.08-2.15)	15,678	3,136	6.0%	1.61 (1.59-1.64)
<i>Overlapping lesion of brain (C71.8)</i>	12,794	2,559	2.9%	0.69 (0.68-0.70)	7,210	1,442	3.9%	0.83 (0.81-0.85)	5,584	1,117	2.1%	0.57 (0.55-0.58)
<i>Brain, NOS (C71.9)</i>	20,907	4,181	4.7%	1.16 (1.14-1.17)	10,813	2,163	5.9%	1.29 (1.26-1.31)	10,094	2,019	3.9%	1.04 (1.02-1.07)
Spinal cord and cauda equina (C72.0-C72.1)	12,700	2,540	2.8%	0.74 (0.73-0.76)	6,761	1,352	3.7%	0.81 (0.79-0.83)	5,939	1,188	2.3%	0.68 (0.66-0.70)
<i>Spinal cord (C72.0)</i>	12,303	2,461	2.8%	0.72 (0.71-0.73)	6,560	1,312	3.6%	0.79 (0.77-0.81)	5,743	1,149	2.2%	0.66 (0.64-0.68)
<i>Cauda equina (C72.1)</i>	397	79	0.1%	0.02 (0.02-0.03)	201	40	0.1%	0.02 (0.02-0.03)	196	39	0.1%	0.02 (0.02-0.03)
Cranial nerves (C72.2-C72.5)	30,488	6,098	6.8%	1.69 (1.67-1.71)	14,307	2,861	7.8%	1.65 (1.62-1.68)	16,181	3,236	6.2%	1.74 (1.71-1.76)
<i>Olfactory nerve (C72.2)</i>	42	8	0.0%	0.00 (0.00-0.00)	17	3	0.0%	0.00 (0.00-0.00)	25	5	0.0%	0.00 (0.00-0.00)
<i>Optic nerve (C72.3)</i>	1,782	356	0.4%	0.12 (0.12-0.13)	859	172	0.5%	0.12 (0.11-0.12)	923	185	0.4%	0.13 (0.12-0.13)
<i>Acoustic nerve (C72.4)</i>	22,509	4,502	5.0%	1.22 (1.21-1.24)	10,581	2,116	5.7%	1.20 (1.18-1.23)	11,928	2,386	4.6%	1.25 (1.23-1.27)
<i>Cranial nerve, NOS (C72.5)</i>	6,155	1,231	1.4%	0.34 (0.34-0.35)	2,850	570	1.5%	0.33 (0.32-0.34)	3,305	661	1.3%	0.36 (0.35-0.37)
Other nervous system (C72.8-C72.9)	2,506	501	0.6%	0.14 (0.13-0.15)	1,266	253	0.7%	0.15 (0.14-0.16)	1,240	248	0.5%	0.13 (0.13-0.14)
<i>Overlapping lesion of brain & CNS (C72.8)</i>	348	70	0.1%	0.02 (0.02-0.02)	188	38	0.1%	0.02 (0.02-0.03)	160	32	0.1%	0.02 (0.01-0.02)
<i>Nervous system, NOS (C72.9)</i>	2,158	432	0.5%	0.12 (0.12-0.13)	1,078	216	0.6%	0.13 (0.12-0.14)	1,080	216	0.4%	0.12 (0.11-0.12)

Table 4 Continued

Site (ICD-O Topography Code)	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 and craniopharyngeal duct (C75.1- C75.2)	81,005	16,201	18.2%	4.74 (4.71-4.78)	35,971	7,194	19.5%	4.23 (4.18-4.27)	45,034	9,007	17.2%	5.35 (5.30-5.40)
<i>Pituitary gland (C75.1)</i>	78,859	15,772	17.7%	4.62 (4.58-4.65)	34,845	6,969	18.9%	4.09 (4.05-4.13)	44,014	8,803	16.8%	5.23 (5.18-5.28)
<i>Craniopharyngeal duct (C75.2)</i>	2,146	429	0.5%	0.13 (0.12-0.14)	1,126	225	0.6%	0.14 (0.13-0.15)	1,020	204	0.4%	0.12 (0.11-0.13)
Pineal (C75.3)	1,694	339	0.4%	0.11 (0.10-0.11)	997	199	0.5%	0.13 (0.12-0.14)	697	139	0.3%	0.09 (0.08-0.09)
TOTAL	445,792	89,158	100.0%	24.71 (24.63-24.78)	184,168	36,834	100.0%	21.60 (21.50-21.70)	261,624	52,325	100.0%	27.62 (27.51-27.73)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cThe sites referred to in this table are loosely based on the categories and site codes defined in the SEER site/histopathology validation list.

^dICD-O-3 histopathology 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; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, Not otherwise specified.

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 Histopathology Groupings, Histopathology, Behavior, and Sex, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	Total			Male			Female				
	5-Year Total	Annual Average	% of all Median Age tumors	5-Year Total	Annual Average	% Malignant ^c	5-Year Total	Annual Average	% Malignant ^c	Rate (95% CI)	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	84,012	16,802	18.8	48,292	9,658	100.0	35,720	7,144	100.0	5.48 (5.43-5.53)	3.64 (3.60-3.68)
Diffuse astrocytoma	7,634	1,527	1.7	4,270	854	99.9	3,364	673	99.9	0.52 (0.51-0.54)	0.39 (0.38-0.41)
Anaplastic astrocytoma	7,046	1,409	1.6	3,847	769	100.0	3,199	640	100.0	0.46 (0.45-0.48)	0.36 (0.35-0.37)
Glioblastoma	63,258	12,652	14.2	36,826	7,365	100.0	26,432	5,286	100.0	4.08 (4.04-4.12)	2.55 (2.52-2.59)
Oligodendrogloma	3,687	737	0.8	2,037	407	100.0	1,650	330	100.0	0.26 (0.25-0.27)	0.20 (0.19-0.22)
Anaplastic oligodendrogloma	1,871	374	0.4	1,038	208	99.8	833	167	100.0	0.13 (0.12-0.14)	0.10 (0.09-0.10)
Oligoastrocytic tumors	516	103	0.1	274	55	100.0	242	48	100.0	0.03 (0.03-0.04)	0.03 (0.03-0.03)
Other Astrocytic Tumors	6,252	1,250	1.4	3,293	659	93.3	2,959	592	94.5	0.44 (0.43-0.46)	0.41 (0.39-0.42)
Pilocytic astrocytoma	5,339	1,068	1.2	2,805	561	100.0	2,534	507	100.0	0.38 (0.36-0.39)	0.35 (0.34-0.36)
Unique astrocytoma variants	913	183	0.2	488	98	55.1	425	85	61.9	0.06 (0.06-0.07)	0.06 (0.05-0.06)
Non-Malignant	381	76	0.1	219	44	--	162	32	--	0.03 (0.03-0.03)	0.02 (0.02-0.03)
Malignant	532	106	0.1	269	54	--	263	53	--	0.03 (0.03-0.04)	0.03 (0.03-0.04)
Ependymal Tumors	6,911	1,382	1.6	3,964	793	53.6	2,947	589	60.6	0.49 (0.47-0.50)	0.35 (0.34-0.37)
Non-Malignant	3,002	600	0.7	1,840	368	--	1,162	232	--	0.22 (0.21-0.23)	0.14 (0.13-0.14)
Malignant	3,909	782	0.9	2,124	425	--	1,785	357	--	0.26 (0.25-0.28)	0.22 (0.21-0.23)
Other Gliomas	8,854	1,771	2.0	4,476	895	99.6	4,378	876	99.5	0.57 (0.55-0.59)	0.53 (0.51-0.55)
Glioma malignant, NOS	8,753	1,751	2.0	4,437	887	100.0	4,316	863	100.0	0.56 (0.55-0.58)	0.52 (0.51-0.54)
Other neuroepithelial tumors	101	20	0.0	39	8	48.7	62	12	66.1	0.00 (0.00-0.01)	0.01 (0.01-0.01)
Non-Malignant	41	8	0.0	20	4	--	21	4	--	0.00 (0.00-0.00)	0.00 (0.00-0.00)
Malignant	60	12	0.0	19	4	--	41	8	--	0.00 (0.00-0.00)	0.01 (0.00-0.01)
Neuronal and Mixed Neuronal-Glial Tumors	5,339	1,068	1.2	2,911	582	18.2	2,428	486	17.8	0.37 (0.36-0.39)	0.31 (0.30-0.32)
Non-Malignant	4,379	876	--	2,382	476	--	1,997	399	--	0.31 (0.30-0.32)	0.26 (0.25-0.27)
Malignant	960	192	--	529	106	--	431	86	--	0.06 (0.06-0.07)	0.05 (0.04-0.05)
Choroid Plexus Tumors	827	165	0.2	415	83	17.6	412	82	11.7	0.05 (0.05-0.06)	0.05 (0.05-0.06)
Non-Malignant	706	141	--	342	68	--	364	73	--	0.04 (0.04-0.05)	0.05 (0.04-0.05)
Malignant	121	24	--	73	15	--	48	10	--	0.01 (0.01-0.01)	0.01 (0.00-0.01)
Tumors of the Pineal Region	769	154	0.2	322	64	69.6	447	89	53.2	0.04 (0.04-0.05)	0.06 (0.05-0.06)
Non-Malignant	307	61	0.1	98	20	--	209	42	--	0.01 (0.01-0.01)	0.03 (0.02-0.03)
Malignant	462	92	0.1	224	45	--	238	48	--	0.03 (0.02-0.03)	0.03 (0.03-0.03)

Table 5 Continued

Histopathology	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)
Embryonal Tumors	3,170	634	0.7	8	0.22 (0.21-0.22)	1,909	382	100.0	0.26 (0.25-0.27)	1,261	252	99.8	0.18 (0.17-0.19)
Tumors of Cranial and Paraspinal Nerves	37,048	7,410	8.3	58	2.05 (2.03-2.07)	17,785	3,557	0.6	2.05 (2.02-2.08)	19,263	3,853	0.5	2.06 (2.03-2.09)
Nerve sheath tumors	37,015	7,403	8.3	58	2.05 (2.03-2.07)	17,764	3,553	0.6	2.05 (2.02-2.08)	19,251	3,850	0.5	2.06 (2.03-2.09)
Non-Malignant	36,804	7,361	8.3	--	2.04 (2.02-2.06)	17,658	3,532	--	2.04 (2.01-2.07)	19,146	3,829	--	2.05 (2.02-2.08)
Malignant	211	42	0.0	--	0.01 (0.01-0.01)	106	21	--	0.01 (0.01-0.02)	105	21	--	0.01 (0.01-0.01)
Other tumors of cranial and paraspinal nerves	33	7	0.0	55	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--
Tumors of Meninges	184,405	36,881	41.4	66	9.85 (9.81-9.90)	51,371	10,274	2.3	6.00 (5.95-6.05)	133,034	26,607	1.0	13.28 (13.21-13.36)
Meningiomas	178,447	35,689	40.0	67	9.51 (9.46-9.55)	48,335	9,667	1.5	5.64 (5.59-5.69)	130,112	26,022	0.7	12.95 (12.87-13.02)
Non-Malignant	176,832	35,366	39.7	--	9.42 (9.38-9.47)	47,602	9,520	--	5.55 (5.50-5.60)	129,230	25,846	--	12.86 (12.79-12.93)
Malignant	1,615	323	0.4	--	0.09 (0.08-0.09)	733	147	--	0.08 (0.08-0.09)	882	176	--	0.09 (0.08-0.09)
Mesenchymal tumors	5,815	1,163	1.3	51	0.34 (0.33-0.35)	2,953	591	13.6	0.35 (0.34-0.37)	2,862	572	12.7	0.33 (0.32-0.34)
Non-Malignant	5,049	1,010	1.1	--	0.30 (0.29-0.30)	2,551	510	--	0.30 (0.29-0.32)	2,498	500	--	0.29 (0.28-0.30)
Malignant	766	153	0.2	--	0.04 (0.04-0.05)	402	80	--	0.05 (0.04-0.05)	364	73	--	0.04 (0.04-0.05)
Primary melanocytic lesions	143	29	0.0	61	0.01 (0.01-0.01)	83	17	69.9	0.01 (0.01-0.01)	60	12	51.7	0.01 (0.00-0.01)
Non-Malignant	54	11	0.0	--	0.00 (0.00-0.00)	25	5	--	0.00 (0.00-0.00)	29	6	--	0.00 (0.00-0.00)
Malignant	89	18	0.0	--	0.00 (0.00-0.01)	58	12	--	0.01 (0.01-0.01)	31	6	--	0.00 (0.00-0.00)
Lymphomas and Hematopoietic Neoplasms	8,525	1,705	1.9	67	0.45 (0.44-0.46)	4,352	870	99.9	0.49 (0.48-0.51)	4,173	835	99.8	0.41 (0.39-0.42)
Lymphoma	8,482	1,696	1.9	67	0.45 (0.44-0.46)	4,328	866	99.9	0.49 (0.48-0.51)	4,154	831	99.8	0.41 (0.39-0.42)
Other hematopoietic neoplasms	43	9	0.0	59	0.00 (0.00-0.00)	24	5	95.8	0.00 (0.00-0.00)	19	4	94.7	0.00 (0.00-0.00)
Germ Cell Tumors	1,280	256	0.3	15	0.09 (0.08-0.09)	942	188	89.4	0.12 (0.12-0.13)	338	68	79.3	0.05 (0.04-0.05)
Non-Malignant	170	34	0.0	--	0.01 (0.01-0.01)	100	20	--	0.01 (0.01-0.02)	70	14	--	0.01 (0.01-0.01)
Malignant	1,110	222	0.2	--	0.07 (0.07-0.08)	842	168	--	0.11 (0.10-0.12)	268	54	--	0.04 (0.03-0.04)
Tumors of Sellar Region	79,996	15,999	17.9	51	4.69 (4.65-4.72)	35,594	7,119	0.2	4.18 (4.14-4.23)	44,402	8,880	0.1	5.28 (5.23-5.33)
Tumors of the pituitary	76,863	15,373	17.2	51	4.50 (4.47-4.53)	33,981	6,796	0.2	3.98 (3.94-4.03)	42,882	8,576	0.1	5.10 (5.05-5.15)
Non-Malignant	76,755	15,351	17.2	--	4.49 (4.46-4.52)	33,913	6,783	--	3.98 (3.93-4.02)	42,842	8,568	--	5.09 (5.04-5.14)
Malignant	108	22	0.0	--	0.01 (0.00-0.01)	68	14	--	0.01 (0.01-0.01)	40	8	--	0.00 (0.00-0.01)
Craniopharyngioma	3,133	627	0.7	45	0.19 (0.18-0.20)	1,613	323	0.4	0.20 (0.19-0.21)	1,520	304	0.1	0.18 (0.17-0.19)
Unclassified Tumors	18,404	3,681	4.1	65	1.03 (1.02-1.05)	8,542	1,708	38.5	1.05 (1.02-1.07)	9,862	1,972	35.1	1.02 (1.00-1.04)

Table 5 Continued

Histopathology	Total			Male			Female							
	Annual Average	% of all tumors	Median Age	Annual Average	% Malignant ^c	Rate (95% CI)	5-Year Total	Annual Average	% Malignant ^c	Rate (95% CI)				
	Total			Total			Total	Total						
Hemangioma	4,215	843	0.9	50	0.25 (0.24-0.26)	1,956	391	0.0	0.0	0.24 (0.23-0.25)	2,259	452	0.0	0.26 (0.25-0.27)
Neoplasm, unspecified	13,647	2,729	3.1	70	0.75 (0.73-0.76)	6,292	1,258	51.8	0.77 (0.75-0.79)	7,355	1,471	46.7	0.73 (0.71-0.75)	
Non-Malignant	6,954	1,391	1.6	--	0.39 (0.38-0.40)	3,032	606	--	0.37 (0.36-0.39)	3,922	784	--	0.41 (0.40-0.42)	
Malignant	6,693	1,339	1.5	--	0.36 (0.35-0.36)	3,260	652	--	0.40 (0.38-0.41)	3,433	687	--	0.32 (0.31-0.33)	
All other	542	108	0.1	37.5	0.03 (0.03-0.04)	294	59	9.2	0.04 (0.03-0.04)	248	50	12.9	0.03 (0.03-0.03)	
Non-Malignant	483	97	0.1	--	0.03 (0.03-0.04)	267	53	--	0.03 (0.03-0.04)	216	43	--	0.03 (0.02-0.03)	
Malignant	59	12	0.0	--	0.00 (0.00-0.01)	27	5	--	0.00 (0.00-0.01)	32	6	--	0.00 (0.00-0.01)	
TOTAL^d	445,792	89,158	100.0	61	24.71 (24.63-24.78)	184,168	36,834	38.3	21.60 (21.50-21.70)	261,624	52,325	21.4	27.62 (27.51-27.73)	
Non-Malignant	319,447	63,889	71.7	--	17.69 (17.62-17.75)	113,709	22,742	--	13.36 (13.28-13.44)	205,738	41,148	--	21.68 (21.58-21.78)	
Malignant	126,345	25,269	28.3	--	7.02 (6.98-7.06)	70,459	14,092	--	8.24 (8.18-8.30)	55,886	11,177	--	5.94 (5.89-5.99)	

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cAssigned behavior code of /3 (see Table 2).

^dRefers to all brain tumors including histopathologies 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 Histopathologies by Sex, Age Group at Diagnosis, Race, Hispanic Ethnicity, and Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Group	Vestibular Schwannoma ^c			Pituitary Adenoma ^d			WHO Grade I Meningioma ^e			WHO Grade II Meningioma ^f		
	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)
Sex												
Male	13,078	2,616	1.49 (1.47-1.52)	29,868	5,974	3.49 (3.45-3.53)	16,042	3,208	1.84 (1.81-1.87)	4,050	810	0.46 (0.45-0.48)
Female	14,795	2,959	1.56 (1.53-1.58)	37,282	7,456	4.41 (4.36-4.45)	43,389	8,678	4.47 (4.43-4.51)	5,653	1,131	0.60 (0.58-0.61)
Age Groups												
0-14 years	213	43	0.07 (0.06-0.08)	937	187	0.31 (0.29-0.33)	108	22	0.04 (0.03-0.04)	78	16	0.03 (0.02-0.03)
15-39 years	3,687	737	0.70 (0.68-0.72)	19,150	3,830	3.56 (3.51-3.61)	4,552	910	0.89 (0.87-0.92)	1,063	213	0.20 (0.19-0.22)
40-64 years	14,399	2,880	2.59 (2.54-2.63)	28,324	5,665	5.40 (5.34-5.47)	27,964	5,593	5.03 (4.97-5.09)	4,578	916	0.83 (0.80-0.85)
65+ years	9,574	1,915	3.74 (3.66-3.82)	18,739	3,748	7.45 (7.34-7.56)	26,807	5,361	10.73 (10.60-10.86)	3,984	797	1.59 (1.54-1.64)
Race												
White	23,866	4,773	1.62 (1.59-1.64)	47,724	9,545	3.51 (3.48-3.55)	47,661	9,532	3.15 (3.12-3.18)	7,354	1,471	0.49 (0.48-0.51)
Black	1,546	309	0.70 (0.67-0.74)	13,520	2,704	6.24 (6.13-6.35)	7,662	1,532	3.61 (3.53-3.69)	1,547	309	0.71 (0.68-0.75)
American Indian/Alaska Native	161	32	0.76 (0.64-0.89)	614	123	2.90 (2.66-3.15)	409	82	2.13 (1.92-2.35)	57	11	0.30 (0.22-0.39)
Asian or Pacific Islander	1,347	269	1.25 (1.18-1.32)	2,883	577	2.71 (2.61-2.81)	2,325	465	2.23 (2.13-2.32)	507	101	0.49 (0.44-0.53)
Hispanic Ethnicity												
Non-Hispanic	25,447	5,089	1.61 (1.59-1.63)	55,782	11,156	3.82 (3.78-3.85)	53,374	10,675	3.28 (3.25-3.31)	8,731	1,746	0.55 (0.54-0.56)
Hispanic	2,426	485	1.03 (0.99-1.07)	11,368	2,274	4.51 (4.42-4.59)	6,057	1,211	2.77 (2.69-2.84)	972	194	0.43 (0.41-0.46)
TOTAL	27,873	5,575	1.52 (1.50-1.54)	67,150	13,430	3.91 (3.88-3.94)	59,431	11,886	3.21 (3.18-3.24)	9,703	1,941	0.53 (0.52-0.54)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cICD-O-3 histopathology code 9560/0 and ICD-O-3 topography code C72.4 and C72.5.

^dICD-O-3 histopathology code 8272/0 and ICD-O-3 topography code C75.1.

^eICD-O-3 histopathology codes 9530/0, 9531/0, 9532/0, 9533/0, 9534/0, and 9537/0. WHO grade may be reported according to 2007 or 2016 WHO classification depending on year of diagnosis, in which roman numerals are used to denote tumor grade.

^fICD-O-3 histopathology codes 9530/1, 9531/1, 9532/1, 9533/1, 9534/1, 9537/1, 9538/1, and 9539/1. WHO grade may be reported according to 2007 or 2016 WHO classification depending on year of diagnosis, in which roman numerals are used to denote tumor grade.

- 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; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; WHO, World Health Organization; CI, confidence interval.

Table 7 Distribution of Brain Molecular Markers for Select Histopathologically-Confirmed Glioma and Embryonal Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2018-2019

Histopathology	Frequency (%)
Diffuse Astrocytoma	
9400/3: Diffuse astrocytoma, IDH-mutant ^a	1,103 (42.7%)
9400/3: Diffuse astrocytoma, IDH-wildtype ^a	883 (34.2%)
9400/3: Diffuse astrocytoma, IDH Status Unknown	599 (23.2%)
Anaplastic Astrocytoma	
9401/3: Anaplastic astrocytoma, IDH-mutant ^a	1,159 (43.6%)
9401/3: Anaplastic astrocytoma, IDH-wildtype ^a	1,167 (43.9%)
9401/3: Anaplastic astrocytoma, IDH Status Unknown	331 (12.5%)
Glioblastoma	
9440/3: Glioblastoma, IDH-wildtype ^a	18,579 (76.8%)
9440/3: Glioblastoma, IDH Status Unknown	4,398 (18.2%)
9441/3: Giant cell glioblastoma	155 (0.6%)
9442/3: Gliosarcoma	475 (2%)
9445/3: Glioblastoma, IDH-mutant ^b	580 (2.4%)
Oligodendroglioma	
9450/3: Oligodendroglioma, IDH-mutant and 1 p/19q co-deleted ^a	1,227 (90.8%)
9450/3: Oligodendroglioma, NOS	124 (9.2%)
Anaplastic Oligodendroglioma	
9451/3: Anaplastic oligodendroglioma, IDH-mutant and 1 p/19q co-deleted ^a	653 (93.3%)
9451/3: Oligodendroglioma, anaplastic	47 (6.7%)
Medulloblastoma	
9470/3: Medulloblastoma, NOS	404 (48.5%)
9471/3: Desmoplastic nodular medulloblastoma	30 (3.6%)
9471/3: Medulloblastoma, SHH-activated and TP53-wildtype ^a	161 (19.3%)
9472/3: Medulloblastoma	--
9474/3: Large cell medulloblastoma	59 (7.1%)
9475/3: Medulloblastoma, WNT-activated, NOS ^b	29 (3.5%)
9476/3: Medulloblastoma, SHH-activated and TP53-mutant ^b	--
9477/3: Medulloblastoma, non-WNT/non-SHH ^b	134 (16.1%)

^aCollected in NAACCR Item #3816, Brain Molecular Markers.

^bNew ICD-O-3 codes implemented in 2018.

-- Cases and rates are not presented when fewer than 16 cases were reported for the specific category.

Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; NOS, not otherwise specified.

Table 8 Annual Age-Adjusted Incidence Rates^a, Median Age at Diagnosis, Sex, and Race/Ethnicity of Histopathologically-Confirmed Molecularely-Defined Brain and Other Central Nervous System Tumors by WHO Grade^b for Diagnosis Years 2018-2019, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2018-2019

Tumor type	ICD-O-3 Histopathology Codes	WHO Grade	Total cases (2018-2019) ^c	Rate (95% CI)	Age (median, interquartile range)	Female (%)	Non-Hispanic White (%)	Non-Hispanic Black (%)	Hispanic (%)
Adult-type diffuse glioma									
IDH-mutant Astrocytoma (BMM 1, 3)	9400/3, 9401/3, 9445/3	All grades	2,842	0.44 (0.43-0.46)	36 (29-49)	42.8	80.0	6.5	11.0
		II ^d	845	0.14 (0.13-0.15)	34 (28-44)	41.4	79.3	6.3	10.8
		III	947	0.15 (0.14-0.16)	37 (29-48)	42.9	80.9	5.9	11.2
		IV	565	0.09 (0.08-0.09)	39.5 (31-59)	42.3	80.1	7.7	9.7
IDH-wildtype Astrocytoma and Glioblastoma ^{e,f} (BMM 2, 4, 5)	9400/3, 9401/3, 9440/3	All grades	20,625	2.61 (2.57-2.64)	65 (56-72)	41.1	82.6	6.3	8.6
		II	394	0.06 (0.05-0.06)	54 (34.5-65)	46.4	77.6	9.0	9.8
		III	762	0.10 (0.10-0.11)	59 (46-70)	46.1	81.8	7.4	8.2
		IV	14,773	1.85 (1.82-1.88)	65 (56-72)	40.2	82.8	6.2	8.6
IDH-mutant & 1p/19q-deleted Oligodendroglioma (BMM 6, 7)	9450/3, 9451/3	All grades	1,880	0.29 (0.28-0.31)	45 (35-56)	44.9	76.9	4.9	13.9
		II	940	0.15 (0.14-0.16)	42 (33-53)	45.3	75.9	5.1	14.8
		III	640	0.10 (0.09-0.10)	48 (37-58)	43.8	77.9	4.8	13.2
Medulloblastoma^f									
SHH-activated & TP53-wildtype (BMM 8)	9471/3	All grades	161	0.03 (0.02-0.03)	20 (5-30)	36.0	57.5	12.4	24.2
SHH-activated & TP53-mutant	9476/3	All grades	< 16 cases	--	--	--	--	--	--
		All grades	29	0.01 (0.00-0.01)	10 (7-12)	--	72.4	--	--
WNT-activated	9475/3	All grades	134	0.02 (0.02-0.03)	8 (4-12)	33.6	63.8	4.6	28.5
Non-WNT/non-SHH	9477/3	All grades	331	0.06 (0.05-0.06)	14 (7-31.5)	54.7	56.9	12.5	24.4
Other tumor types									
Diffuse midline glioma, H3 K27M-mutant	9385/3	All grades	27	0.00 (0.00-0.01)	2 (1.5-3.5)	--	--	--	--
ETMR C19MC-altered (BMM 9)	9478/3	All grades	18	0.00 (0.00-0.00)	13 (4.25-17.25)	--	--	--	--
RELA-fusion ependymoma	9396/3	All grades	18	0.00 (0.00-0.00)	13 (4.25-17.25)	--	--	--	--

^aRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^bWHO grade is reported according to 2016 WHO classification, in which Roman numerals are used to denote tumor grade.

^cExcludes cases with missing molecular classification data or that are not histopathologically-confirmed.

^dAdult-type diffuse glioma cases reported as WHO grade I or "low-grade, NOS" were grouped with WHO grade II.

^eIn WHO-CNS5, grading is denoted using Arabic numerals rather than roman numerals. In this 2021 revision, all IDH-wildtype adult-type diffuse astrocytic gliomas are classified as glioblastoma, IDH-wildtype, WHO CNS grade 4, without separate grades 2 or 3.

^fBoth histopathologically-defined and new molecularly-defined ICD-0-3 codes for medulloblastomas were reported in the registry data; however, only a single ICD-0-3 diagnosis can be reported per case. As a result, the national incidence rates could not be estimated for the SHH-activated and TP53 mutant subtype.

-- 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 Distribution of Histopathologically-Confirmed Brain and Other Central Nervous System Tumors by WHO Grade Completeness, Treatment Information Completeness, and Histopathology, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	Number of Newly Diagnosed Tumors	Histopathologically-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	84,012	94.3%	9.1%	0.1%	0.5%	10.8%	12.9%	75.8%	59.0%	99.6%	
Diffuse astrocytoma	7,634	92.5%	15.6%	0.1%	2.8%	71.9%	15.6%	9.8%	44.7%	99.4%	
Anaplastic astrocytoma	7,046	99.3%	5.9%	0.1%	0.2%	2.2%	89.6%	8.0%	69.1%	99.6%	
Glioblastoma	63,258	93.6%	8.8%	0.1%	0.2%	0.2%	0.7%	98.9%	60.6%	99.7%	
Oligodendrogloma	3,687	96.9%	7.6%	0.0%	1.4%	89.2%	7.7%	1.7%	38.2%	99.5%	
Anaplastic oligodendrogloma	1,871	99.1%	6.4%	0.1%	0.0%	4.3%	89.9%	5.8%	64.6%	99.6%	
Oligoastrocytic tumors	516	97.3%	8.8%	0.0%	1.5%	43.0%	46.3%	9.2%	61.8%	99.8%	
Other Astrocytic Tumors	6,252	86.4%	12.8%	0.4%	86.4%	9.7%	3.3%	0.7%	6.5%	99.7%	
Piloicytic astrocytoma	5,339	87.9%	12.4%	0.4%	95.3%	3.7%	0.6%	0.4%	4.9%	99.8%	
Unique astrocytoma variants	913	77.5%	15.4%	0.1%	25.8%	50.5%	21.2%	2.5%	15.8%	99.4%	
Malignant	532	97.9%	12.1%	0.2%	3.1%	66.0%	27.7%	3.3%	24.4%	99.4%	
Non-Malignant	381	49.1%	24.6%	0.0%	100.0%	0.0%	0.0%	0.0%	0.8%	99.5%	
Ependymal Tumors	6,911	86.2%	12.0%	0.1%	36.8%	48.0%	14.3%	0.9%	23.0%	99.7%	
Malignant	3,909	93.4%	10.4%	0.1%	2.6%	73.4%	22.7%	1.3%	34.2%	99.9%	
Non-Malignant	3,002	76.9%	14.4%	0.0%	93.6%	5.9%	0.2%	0.3%	7.8%	99.5%	
Other Gliomas	8,854	41.7%	47.1%	1.0%	10.3%	22.8%	19.5%	47.3%	26.4%	99.3%	
Glioma malignant, NOS	8,753	41.1%	47.3%	1.0%	10.3%	21.7%	19.6%	48.4%	26.3%	99.3%	
Other neuroepithelial tumors	101	92.1%	41.9%	0.0%	10.9%	61.8%	18.2%	9.1%	33.8%	98.9%	
Malignant	60	98.3%	55.9%	0.0%	14.8%	29.6%	37.0%	18.5%	43.5%	98.3%	
Non-Malignant	41	82.9%	17.6%	0.0%	7.1%	92.9%	0.0%	0.0%	17.9%	100.0%	
Neuronal and Mixed Neuronal-Glial Tumors	5,339	91.7%	19.5%	14.8%	82.8%	13.5%	2.8%	0.9%	12.9%	99.6%	
Malignant	960	98.3%	26.9%	5.6%	28.7%	7.0%	51.0%	13.4%	53.5%	99.3%	

Table 9 Continued

Histopathology	Number of Newly Diagnosed Tumors	Histopathologically-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	Complete	Not Applicable	WHO Grade I	WHO Grade II			WHO Grade III
Non-Malignant	4,379	90.3%	23.3%	0.4%	76.3%	85.7%	13.9%	0.3%	0.2%	3.9%	99.7%
Choroid Plexus Tumors	827	87.4%	23.1%	0.1%	76.8%	64.8%	20.9%	13.6%	0.7%	3.9%	99.4%
Malignant	121	96.7%	22.2%	0.9%	76.9%	77%	4.4%	83.5%	4.4%	11.2%	100.0%
Non-Malignant	706	85.8%	23.3%	0.0%	76.7%	75.9%	24.1%	0.0%	0.0%	2.7%	99.3%
Tumors of the Pineal Region	769	79.2%	0.0%	57.9%	42.1%	0.0%	100.0%	0.0%	0.0%	39.1%	99.5%
Malignant	462	97.8%	0.0%	57.1%	42.9%	0.0%	100.0%	0.0%	0.0%	59.4%	99.3%
Non-Malignant	307	51.1%	0.0%	60.4%	39.6%	--	--	--	--	7.6%	100.0%
Embryonal Tumors	3,170	98.4%	16.8%	0.6%	82.5%	0.5%	0.3%	1.1%	98.1%	58.4%	99.9%
Tumors of Cranial and Spinal Nerves	37,048	48.1%	56.2%	0.0%	43.8%	99.4%	0.3%	0.1%	0.2%	14.2%	99.4%
Nerve sheath tumors	37,015	48.1%	56.2%	0.0%	43.8%	99.4%	0.3%	0.1%	0.2%	14.2%	99.4%
Malignant	211	83.9%	77.4%	0.0%	22.6%	57.5%	12.5%	20.0%	10.0%	32.2%	98.3%
Non-Malignant	36,804	47.9%	56.0%	0.0%	44.0%	99.6%	0.3%	0.0%	0.1%	14.1%	99.4%
Other tumors of cranial and spinal nerves	33	42.4%	71.4%	0.0%	28.6%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Tumors of Meninges	184,405	37.4%	19.5%	0.1%	80.5%	79.9%	18.0%	2.0%	0.1%	6.1%	99.6%
Meningiomas	178,447	36.2%	17.8%	0.0%	82.2%	80.1%	18.3%	1.5%	0.1%	5.9%	99.5%
Malignant	1,615	78.1%	11.9%	0.0%	88.1%	20.4%	15.0%	63.6%	1.0%	34.4%	98.5%
Non-Malignant	176,832	35.8%	17.9%	0.0%	82.1%	81.4%	18.4%	0.2%	0.1%	5.6%	99.6%
Mesenchymal tumors	5,815	75.4%	42.0%	0.8%	57.1%	77.1%	10.4%	11.8%	0.7%	11.9%	99.6%
Malignant	766	96.3%	53.2%	4.1%	42.8%	11.3%	14.4%	70.2%	4.1%	47.5%	99.5%
Non-Malignant	5,049	72.3%	39.7%	0.2%	60.1%	86.6%	9.8%	3.3%	0.2%	6.3%	99.6%
Primary melanocytic lesions	143	88.1%	83.3%	4.8%	11.9%	60.0%	13.3%	6.7%	20.0%	35.0%	99.2%
Malignant	89	94.4%	84.5%	7.1%	8.3%	42.9%	0.0%	14.3%	42.9%	44.8%	98.8%
Non-Malignant	54	77.8%	81.0%	0.0%	19.0%	75.0%	25.0%	0.0%	0.0%	21.4%	100.0%
Lymphomas and Hematopoietic Neoplasms	8,525	94.9%	97.3%	0.8%	1.9%	84.3%	1.3%	4.6%	9.8%	16.5%	99.0%
Lymphoma	8,482	94.9%	97.5%	0.6%	1.9%	84.2%	1.3%	4.6%	9.9%	16.3%	99.1%
Other hematopoietic neoplasms	43	97.7%	64.3%	33.3%	2.4%	100.0%	0.0%	0.0%	0.0%	64.7%	95.2%

Table 9 Continued

Histopathology	Number of Newly Diagnosed Tumors	Histopathologically-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		
Germ Cell Tumors	1,280	86.6%	43.4%	47.8%	18.8%	7.8%	7.8%	65.6%	53.5%	99.0%
<i>Malignant</i>	1,110	88.6%	40.6%	50.6%	1.9%	9.4%	9.4%	79.2%	60.4%	99.2%
<i>Non-Malignant</i>	170	74.1%	65.4%	25.2%	100.0%	0.0%	0.0%	0.0%	7.7%	97.6%
Tumors of Sellar Region	79,996	43.9%	0.4%	85.5%	100.0%	0.0%	0.0%	0.0%	2.5%	99.5%
Tumors of the pituitary	76,863	42.3%	0.0%	88.2%	100.0%	0.0%	0.0%	0.0%	1.8%	99.5%
<i>Malignant</i>	108	63.9%	0.0%	92.0%	--	--	--	--	17.7%	97.1%
<i>Non-Malignant</i>	76,755	42.3%	0.0%	88.2%	100.0%	0.0%	0.0%	0.0%	1.8%	99.5%
Craniopharyngioma	3,133	83.1%	4.0%	59.0%	100.0%	0.0%	0.0%	0.0%	20.1%	99.6%
Unclassified Tumors	18,404	16.8%	83.4%	8.1%	80.1%	5.7%	3.7%	10.6%	3.3%	95.6%
Hemangioma	4,215	28.3%	91.0%	0.3%	97.1%	2.9%	0.0%	0.0%	1.4%	98.7%
Neoplasm, unspecified	13,647	11.9%	77.1%	14.8%	68.1%	7.8%	7.8%	16.4%	4.1%	92.7%
<i>Malignant</i>	6,693	8.5%	87.3%	5.6%	27.0%	10.8%	18.9%	43.2%	6.6%	89.4%
<i>Non-Malignant</i>	6,954	15.1%	71.6%	19.7%	87.3%	6.3%	2.5%	3.8%	2.7%	94.5%
All other	542	50.2%	87.5%	2.6%	65.4%	7.7%	0.0%	26.9%	3.3%	99.3%
<i>Malignant</i>	59	94.9%	63.2%	5.3%	47.1%	11.8%	0.0%	41.2%	25.0%	100.0%
<i>Non-Malignant</i>	483	44.7%	94.0%	1.9%	100.0%	0.0%	0.0%	0.0%	0.0%	99.1%
TOTAL	445,792	53.4%	19.1%	15.2%	40.4%	14.1%	7.7%	37.7%	17.9%	99.5%
Malignant	126,345	85.8%	18.5%	1.9%	5.8%	13.1%	13.6%	67.5%	48.5%	99.5%
Non-Malignant	319,447	40.5%	19.6%	26.0%	84.2%	15.4%	0.3%	0.1%	5.7%	99.5%

^aHistopathologic confirmation includes tumors classified as diagnosis confirmed by positive histopathology, positive cytology, positive immunophenotyping and/or positive genetic studies, or positive microscopic confirmation, method not specified.

^bCompleteness 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).

^cGrade as recorded in the American Joint Commission on Cancer's Collaborative Staging schema, SSDI Clinical Grade (2018+ only) or SSDI Pathological Grade (2018+ only). WHO grade may be reported according to 2007 or 2016 WHO classification depending on year of diagnosis, in which roman numerals are used to denote tumor grade.

^dRadiation is defined using a recoded variable based on NAACCR Item #1360 (<http://datadictionary.naacr.org/default.aspx?c=10#136>). Completeness is defined as having a value other than 'none' or 'unknown.'

^eSurgery is defined using a recoded variable based on NAACCR Item #1290 (<http://datadictionary.naacr.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; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; WHO, World Health Organization.

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 Histopathology, and NCI Age at Diagnosis Groups, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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 Oligo-dendroglial Tumors	1,410	282	0.47 (0.44-0.49)	9,819	1,964	1.84 (1.80-1.87)	72,783	14,557	8.72 (8.65-8.78)
Diffuse astrocytoma	627	125	0.21 (0.19-0.22)	2,614	523	0.48 (0.46-0.50)	4,393	879	0.56 (0.54-0.58)
Anaplastic astrocytoma	222	44	0.07 (0.06-0.08)	2,046	409	0.38 (0.36-0.39)	4,778	956	0.60 (0.58-0.62)
Glioblastoma	465	93	0.15 (0.14-0.17)	3,038	608	0.58 (0.56-0.60)	59,755	11,951	7.03 (6.97-7.09)
Oligodendroglioma	64	13	0.02 (0.02-0.03)	1,426	285	0.27 (0.25-0.28)	2,197	439	0.31 (0.29-0.32)
Anaplastic oligodendroglioma	--	--	--	517	103	0.10 (0.09-0.11)	1,345	269	0.18 (0.17-0.19)
Oligoastrocytic tumors	--	--	--	178	36	0.03 (0.03-0.04)	315	63	0.04 (0.04-0.05)
Other Astrocytic Tumors	3,658	732	1.21 (1.17-1.24)	1,836	367	0.34 (0.32-0.35)	758	152	0.10 (0.10-0.11)
Pilocytic astrocytoma	3,283	657	1.08 (1.04-1.12)	1,463	293	0.27 (0.26-0.28)	593	119	0.08 (0.07-0.09)
Unique astrocytoma variants	375	75	0.12 (0.11-0.14)	373	75	0.07 (0.06-0.08)	165	33	0.02 (0.02-0.03)
<i>Non-Malignant</i>	232	46	0.08 (0.07-0.09)	112	22	0.02 (0.02-0.02)	37	7	0.01 (0.00-0.01)
<i>Malignant</i>	143	29	0.05 (0.04-0.06)	261	52	0.05 (0.04-0.05)	128	26	0.02 (0.01-0.02)
Ependymal Tumors	925	185	0.30 (0.28-0.32)	1,924	385	0.36 (0.34-0.38)	4,062	812	0.53 (0.51-0.54)
<i>Non-Malignant</i>	112	22	0.04 (0.03-0.04)	910	182	0.17 (0.16-0.18)	1,980	396	0.26 (0.25-0.27)
<i>Malignant</i>	813	163	0.27 (0.25-0.29)	1,014	203	0.19 (0.18-0.20)	2,082	416	0.27 (0.26-0.28)
Other Gliomas	2,690	538	0.89 (0.85-0.92)	1,925	385	0.35 (0.34-0.37)	4,239	848	0.53 (0.52-0.55)
Glioma malignant, NOS	2,668	534	0.88 (0.85-0.91)	1,889	378	0.35 (0.33-0.36)	4,196	839	0.53 (0.51-0.54)
Other neuroepithelial tumors	22	4	0.01 (0.00-0.01)	36	7	0.01 (0.00-0.01)	43	9	0.01 (0.00-0.01)
<i>Non-Malignant</i>	--	--	--	--	--	--	26	5	0.00 (0.00-0.01)
<i>Malignant</i>	--	--	--	--	--	--	17	3	0.00 (0.00-0.00)
Neuronal and Mixed Neuronal-Glial Tumors	1,411	282	0.47 (0.44-0.49)	2,164	433	0.40 (0.38-0.42)	1,764	353	0.23 (0.22-0.24)
<i>Non-Malignant</i>	1,324	265	0.44 (0.41-0.46)	1,973	395	0.36 (0.35-0.38)	1,082	216	0.15 (0.14-0.16)
<i>Malignant</i>	87	17	0.03 (0.02-0.04)	191	38	0.04 (0.03-0.04)	682	136	0.09 (0.08-0.09)
Choroid Plexus Tumors	359	72	0.12 (0.11-0.13)	210	42	0.04 (0.03-0.04)	258	52	0.03 (0.03-0.04)
<i>Non-Malignant</i>	261	52	0.09 (0.08-0.10)	--	--	--	--	--	--
<i>Malignant</i>	98	20	0.03 (0.03-0.04)	--	--	--	--	--	--
Tumors of the Pineal Region	143	29	0.05 (0.04-0.06)	294	59	0.05 (0.05-0.06)	332	66	0.04 (0.04-0.05)
<i>Non-Malignant</i>	18	4	0.01 (0.00-0.01)	117	23	0.02 (0.02-0.03)	172	34	0.02 (0.02-0.03)
<i>Malignant</i>	125	25	0.04 (0.03-0.05)	177	35	0.03 (0.03-0.04)	160	32	0.02 (0.02-0.02)
Embryonal Tumors	2,144	429	0.71 (0.68-0.74)	755	151	0.14 (0.13-0.15)	271	54	0.04 (0.03-0.04)

Table 10 Continued

Histopathology	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)
Medulloblastoma	1,464	293	0.48 (0.46-0.51)	633	127	0.11 (0.11-0.12)	155	31	0.02 (0.02-0.03)
Atypical teratoid/rhabdoid tumor	365	73	0.12 (0.11-0.13)	31	6	0.01 (0.00-0.01)	16	3	0.00 (0.00-0.00)
All other embryonal	315	63	0.10 (0.09-0.12)	91	18	0.02 (0.01-0.02)	100	20	0.01 (0.01-0.02)
Tumors of Cranial and Paraspinal Nerves	686	137	0.23 (0.21-0.24)	5,518	1,104	1.05 (1.02-1.07)	30,844	6,169	3.79 (3.75-3.83)
Nerve sheath tumors	--	--	--	--	--	--	30,818	6,164	3.79 (3.74-3.83)
Non-Malignant	--	--	--	--	--	--	30,671	6,134	3.77 (3.73-3.81)
Malignant	--	--	--	--	--	--	147	29	0.02 (0.02-0.02)
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--	26	5	0.00 (0.00-0.00)
Tumors of Meninges	680	136	0.22 (0.21-0.24)	11,756	2,351	2.27 (2.23-2.32)	171,969	34,394	20.91 (20.81-21.01)
Meningiomas	--	--	--	10,127	2,025	1.97 (1.93-2.01)	168,002	33,600	20.41 (20.31-20.51)
Non-Malignant	--	--	--	10,015	2,003	1.95 (1.91-1.99)	166,514	33,303	20.23 (20.13-20.33)
Malignant	--	--	--	112	22	0.02 (0.02-0.03)	1,488	298	0.18 (0.17-0.19)
Mesenchymal tumors	354	71	0.12 (0.10-0.13)	--	--	--	3,855	771	0.49 (0.47-0.50)
Non-Malignant	285	57	0.09 (0.08-0.11)	--	--	--	3,324	665	0.42 (0.41-0.43)
Malignant	69	14	0.02 (0.02-0.03)	--	--	--	531	106	0.07 (0.06-0.07)
Primary melanocytic lesions	--	--	--	--	--	--	112	22	0.01 (0.01-0.02)
Non-Malignant	--	--	--	--	--	--	44	9	0.01 (0.00-0.01)
Malignant	--	--	--	--	--	--	68	14	0.01 (0.01-0.01)
Lymphomas and Hematopoietic Neoplasms	89	18	0.03 (0.02-0.04)	535	107	0.10 (0.09-0.11)	7,901	1,580	0.94 (0.92-0.96)
Lymphoma	--	--	--	--	--	--	7,862	1,572	0.94 (0.92-0.96)
Other hematopoietic neoplasms	--	--	--	--	--	--	39	8	0.00 (0.00-0.01)
Germ Cell Tumors	581	116	0.19 (0.18-0.21)	625	125	0.11 (0.10-0.12)	74	15	0.01 (0.01-0.01)
Non-Malignant	82	16	0.03 (0.02-0.03)	45	9	0.01 (0.01-0.01)	43	9	0.01 (0.00-0.01)
Malignant	499	100	0.16 (0.15-0.18)	580	116	0.11 (0.10-0.11)	31	6	0.00 (0.00-0.01)
Tumors of Sellar Region	1,774	355	0.59 (0.56-0.61)	23,663	4,733	4.39 (4.34-4.45)	54,559	10,912	6.98 (6.91-7.04)
Tumors of the pituitary	1,115	223	0.37 (0.35-0.39)	22,980	4,596	4.26 (4.21-4.32)	52,768	10,554	6.75 (6.69-6.81)
Non-Malignant	--	--	--	--	--	--	52,678	10,536	6.74 (6.68-6.80)
Malignant	--	--	--	--	--	--	90	18	0.01 (0.01-0.01)

Table 10 Continued

Histopathology	Children ^e (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)
Craniopharyngioma	659	132	0.22 (0.20-0.24)	688	137	0.13 (0.12-0.14)	1,791	358	0.23 (0.21-0.24)
Unclassified Tumors	1,010	202	0.33 (0.31-0.35)	2,788	558	0.52 (0.50-0.54)	14,606	2,921	1.80 (1.77-1.83)
Hemangioma	287	57	0.09 (0.08-0.11)	1,158	232	0.22 (0.20-0.23)	2,770	554	0.36 (0.34-0.37)
Neoplasm, unspecified	571	114	0.19 (0.17-0.20)	1,503	301	0.28 (0.27-0.30)	11,573	2,315	1.41 (1.38-1.44)
Non-Malignant	409	82	0.14 (0.12-0.15)	1,151	230	0.21 (0.20-0.23)	5,394	1,079	0.66 (0.65-0.68)
Malignant	162	32	0.05 (0.05-0.06)	352	70	0.07 (0.06-0.07)	6,179	1,236	0.75 (0.73-0.76)
All other	152	30	0.05 (0.04-0.06)	127	25	0.02 (0.02-0.03)	263	53	0.03 (0.03-0.04)
Non-Malignant	120	24	0.04 (0.03-0.05)	--	--	--	--	--	--
Malignant	32	6	0.01 (0.01-0.01)	--	--	--	--	--	--
TOTAL^e	17,560	3,512	5.79 (5.70-5.88)	63,812	12,762	11.96 (11.87-12.06)	364,420	72,884	44.65 (44.51-44.80)
Non-Malignant	5,888	1,178	1.94 (1.89-1.99)	46,363	9,273	8.71 (8.63-8.79)	267,063	53,413	32.92 (32.79-33.05)
Malignant	11,672	2,334	3.85 (3.78-3.92)	17,449	3,490	3.25 (3.20-3.30)	97,357	19,471	11.74 (11.66-11.81)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cChildren as defined by the National Cancer Institute, see: <http://www.cancer.gov/researchandfunding/snapshots/pediatric>.

^dAdolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: <http://www.cancer.gov/cancertopics/aya>.

^eRefers to all brain tumors including histopathologies 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 11 One-, Five-, and Ten-Year Relative Survival Rates^{a,b} (RS) with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Histopathology and Behavior, Overall, and by NCI Age Group at Diagnosis, CBTRUS Statistical Report: NPCR and SEER, 2001-2018 (Varying)

Histopathology	Age Groups (years)	All (2004-2018)					Malignant (2001-2018) ^c					Non-Malignant (2004-2018) ^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)	5-Year RS (95% CI)	10-Year RS (95% CI)	N ^g	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	
Diffuse astrocytoma	0-14 ^h	2,097	92.2 (91.0-93.3)	82.3 (80.5-83.9)	79.8 (77.8-81.7)	2,627	91.9 (90.7-92.9)	81.3 (79.7-82.8)	79.2 (77.4-80.8)	81.3 (79.7-82.8)	79.2 (77.4-80.8)	--	--	--	--	
	15-39 ^h	6,597	95.5 (95.0-96.0)	78.1 (76.9-79.2)	60.9 (59.3-62.4)	7,918	95.0 (94.5-95.5)	76.9 (75.8-77.9)	59.2 (57.8-60.5)	76.9 (75.8-77.9)	59.2 (57.8-60.5)	--	--	--	--	
	40+	11,838	62.7 (61.7-63.6)	33.4 (32.4-34.4)	25.1 (24.1-26.1)	14,446	61.0 (60.2-61.9)	32.3 (31.5-33.2)	23.8 (23.0-24.7)	32.3 (31.5-33.2)	23.8 (23.0-24.7)	--	--	--	--	
	All ages	20,532	76.3 (75.7-76.9)	52.9 (52.1-53.6)	42.4 (41.6-43.3)	24,991	75.1 (74.5-75.6)	51.8 (51.1-52.4)	41.2 (40.5-41.9)	51.8 (51.1-52.4)	41.2 (40.5-41.9)	--	--	--	--	
Anaplastic astrocytoma	0-14	656	66.9 (63.1-70.4)	25.4 (21.9-29.1)	19.8 (16.2-23.5)	750	66.2 (62.7-69.5)	25.1 (21.9-28.5)	20.1 (17.0-23.5)	25.1 (21.9-28.5)	20.1 (17.0-23.5)	--	--	--	--	
	15-39	4,058	92.5 (91.6-93.2)	62.8 (61.1-64.5)	46.2 (44.0-48.3)	4,765	91.4 (90.6-92.2)	61.3 (59.7-62.8)	45.1 (43.2-46.9)	61.3 (59.7-62.8)	45.1 (43.2-46.9)	--	--	--	--	
	40+	10,321	57.2 (56.2-58.2)	19.9 (19.1-20.8)	14.0 (13.1-14.9)	12,306	55.4 (54.5-56.3)	19.4 (18.6-20.2)	13.8 (13.1-14.6)	19.4 (18.6-20.2)	13.8 (13.1-14.6)	--	--	--	--	
	All ages	15,035	67.1 (66.3-67.9)	31.7 (30.9-32.6)	22.9 (22.1-23.8)	17,821	65.5 (64.8-66.2)	30.9 (30.1-31.6)	22.5 (21.7-23.3)	30.9 (30.1-31.6)	22.5 (21.7-23.3)	--	--	--	--	
Glioblastoma	0-14	1,102	57.1 (54.1-60.0)	19.9 (17.4-22.5)	16.6 (14.1-19.2)	1,287	56.5 (53.7-59.2)	20.9 (18.5-23.3)	17.7 (15.4-20.0)	20.9 (18.5-23.3)	17.7 (15.4-20.0)	--	--	--	--	
	15-39	6,467	76.8 (75.7-77.8)	26.6 (25.4-27.8)	18.6 (17.4-19.8)	7,629	75.8 (74.8-76.7)	26.4 (25.3-27.5)	18.6 (17.5-19.7)	26.4 (25.3-27.5)	18.6 (17.5-19.7)	--	--	--	--	
	40+	117,076	40.6 (40.4-40.9)	5.6 (5.5-5.8)	3.4 (3.2-3.5)	136,262	39.1 (38.8-39.3)	5.3 (5.2-5.4)	3.3 (3.1-3.4)	5.3 (5.2-5.4)	3.3 (3.1-3.4)	--	--	--	--	
	All ages	124,645	42.7 (42.4-43.0)	6.9 (6.7-7.1)	4.3 (4.2-4.5)	145,178	41.2 (40.9-41.5)	6.6 (6.5-6.8)	4.3 (4.1-4.4)	6.6 (6.5-6.8)	4.3 (4.1-4.4)	--	--	--	--	
Oligodendroglioma	0-14	272	97.4 (94.6-98.8)	94.3 (90.6-96.5)	92.2 (87.8-95.1)	359	97.2 (94.8-98.5)	94.3 (91.3-96.3)	91.9 (88.1-94.5)	94.3 (91.3-96.3)	91.9 (88.1-94.5)	--	--	--	--	
	15-39	3,934	98.6 (98.2-99.0)	92.5 (91.5-93.4)	78.5 (76.7-80.2)	4,874	98.7 (98.3-99.0)	92.2 (91.3-93.0)	77.4 (75.9-78.9)	92.2 (91.3-93.0)	77.4 (75.9-78.9)	--	--	--	--	
	40+	5,445	92.5 (91.7-93.2)	77.6 (76.3-78.9)	64.0 (62.1-65.7)	6,756	91.8 (91.1-92.5)	76.6 (75.4-77.7)	62.6 (61.0-64.1)	76.6 (75.4-77.7)	62.6 (61.0-64.1)	--	--	--	--	
	All ages	9,651	95.2 (94.7-95.6)	84.2 (83.4-85.1)	70.9 (69.6-72.1)	11,989	94.8 (94.3-95.2)	83.6 (82.8-84.3)	69.7 (68.6-70.7)	83.6 (82.8-84.3)	69.7 (68.6-70.7)	--	--	--	--	
Anaplastic oligodendroglioma	0-14	--	--	--	--	55	83.7 (71.0-91.2)	59.8 (45.1-71.8)	52.0 (36.7-65.2)	59.8 (45.1-71.8)	52.0 (36.7-65.2)	--	--	--	--	
	15-39	1,269	95.9 (94.6-96.9)	79.7 (77.0-82.0)	63.4 (59.7-66.8)	1,577	95.5 (94.3-96.4)	77.7 (75.3-79.8)	63.3 (60.2-66.1)	77.7 (75.3-79.8)	63.3 (60.2-66.1)	--	--	--	--	
	40+	2,998	85.9 (84.5-87.1)	59.8 (57.7-61.8)	46.4 (43.8-48.9)	3,719	84.0 (82.7-85.2)	55.9 (54.1-57.7)	43.1 (40.9-45.1)	55.9 (54.1-57.7)	43.1 (40.9-45.1)	--	--	--	--	
	All ages	4,303	88.8 (87.8-89.7)	65.7 (64.0-67.3)	51.5 (49.4-53.6)	5,351	87.4 (86.4-88.3)	62.5 (61.0-63.9)	49.3 (47.5-51.0)	62.5 (61.0-63.9)	49.3 (47.5-51.0)	--	--	--	--	
Oligoastrocytic tumors	0-14	153	91.5 (85.7-95.0)	80.6 (73.2-86.1)	78.0 (70.2-84.0)	194	90.7 (85.6-94.1)	77.4 (70.8-82.8)	75.5 (68.6-81.1)	77.4 (70.8-82.8)	75.5 (68.6-81.1)	--	--	--	--	
	15-39	2,528	97.6 (96.9-98.1)	81.0 (79.3-82.5)	60.6 (58.3-62.9)	3,088	97.3 (96.7-97.9)	79.6 (78.1-81.0)	59.4 (57.3-61.3)	79.6 (78.1-81.0)	59.4 (57.3-61.3)	--	--	--	--	
	40+	3,025	82.7 (81.3-84.1)	54.9 (53.0-56.8)	43.6 (41.4-45.7)	3,659	81.9 (80.6-83.1)	53.5 (51.8-55.2)	42.0 (40.1-43.8)	53.5 (51.8-55.2)	42.0 (40.1-43.8)	--	--	--	--	
	All ages	5,706	89.6 (88.7-90.4)	67.3 (66.0-68.5)	52.1 (50.6-53.7)	6,941	89.0 (88.2-89.8)	65.9 (64.7-67.0)	50.7 (49.4-52.1)	65.9 (64.7-67.0)	50.7 (49.4-52.1)	--	--	--	--	
Piloocytic astrocytoma	0-14	8,156	99.0 (98.7-99.2)	97.3 (96.8-97.6)	95.9 (95.3-96.4)	9,439	98.8 (98.6-99.0)	97.0 (96.6-97.4)	95.5 (95.0-96.0)	97.0 (96.6-97.4)	95.5 (95.0-96.0)	--	--	--	--	
	15-39	3,973	98.5 (98.1-98.9)	94.9 (94.0-95.6)	93.0 (91.9-94.0)	4,672	98.4 (98.0-98.7)	94.7 (93.9-95.4)	92.8 (91.8-93.6)	94.7 (93.9-95.4)	92.8 (91.8-93.6)	--	--	--	--	
	40+	1,348	92.1 (90.4-93.5)	79.8 (77.1-82.3)	76.9 (73.5-79.9)	1,569	91.8 (90.2-93.1)	78.9 (76.4-81.2)	76.6 (73.6-79.3)	78.9 (76.4-81.2)	76.6 (73.6-79.3)	--	--	--	--	
	All ages	13,477	98.2 (97.9-98.4)	94.8 (94.4-95.2)	93.1 (92.5-93.7)	15,680	98.0 (97.8-98.2)	94.5 (94.1-94.9)	92.9 (92.3-93.4)	94.5 (94.1-94.9)	92.9 (92.3-93.4)	--	--	--	--	
Unique astrocytoma variants	0-14	995	97.5 (96.2-98.3)	94.7 (92.9-96.0)	91.9 (89.4-93.9)	382	95.7 (93.1-97.4)	88.1 (84.0-91.1)	82.5 (77.1-86.7)	88.1 (84.0-91.1)	82.5 (77.1-86.7)	661	98.2 (96.8-99.0)	97.5 (95.9-98.5)	96.0 (93.4-97.6)	
	15-39	937	96.9 (95.5-97.9)	86.5 (83.8-88.7)	81.6 (78.2-84.6)	718	97.1 (95.5-98.1)	82.2 (78.9-85.1)	77.3 (73.3-80.7)	82.2 (78.9-85.1)	77.3 (73.3-80.7)	317	96.5 (93.7-98.1)	93.9 (90.3-96.3)	91.4 (86.4-94.5)	
	40+	349	83.3 (78.8-87.0)	59.4 (53.3-64.9)	52.6 (45.2-59.4)	310	81.2 (76.2-85.2)	53.4 (46.9-59.4)	49.4 (42.1-56.3)	53.4 (46.9-59.4)	49.4 (42.1-56.3)	75	91.1 (81.3-95.8)	80.5 (68.1-88.5)	65.5 (46.2-79.3)	
	All ages	2,281	95.1 (94.0-95.9)	86.0 (84.3-87.5)	81.8 (79.7-83.7)	1,410	93.2 (91.7-94.5)	77.6 (75.0-79.9)	72.7 (69.7-75.4)	77.6 (75.0-79.9)	72.7 (69.7-75.4)	1,053	97.2 (95.9-98.0)	95.3 (93.6-96.5)	92.6 (90.1-94.4)	

Table 11 Continued

Histopathology	All (2004-2018)					Malignant (2001-2018) ^c					Non-Malignant (2004-2018) ^d				
	Age Groups (Years)	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 ^g	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)		
Ependymal tumors	0-14	2,456	95.6 (94.7-96.3)	80.4 (78.6-82.1)	72.0 (69.7-74.2)	2,597	94.6 (93.6-95.4)	76.8 (75.0-78.5)	67.3 (65.1-69.4)	275	99.7 (97.0-100.0)	97.5 (94.2-98.9)	97.5 (94.2-98.9)		
	15-39	5,002	98.3 (97.8-98.6)	94.7 (93.9-95.4)	91.7 (90.6-92.7)	3,259	97.1 (96.5-97.7)	91.1 (90.0-92.1)	87.2 (85.8-88.5)	2,230	99.5 (99.0-99.8)	99.0 (98.3-99.5)	97.7 (96.3-98.6)		
	40+	9,470	95.0 (94.5-95.5)	91.0 (90.1-91.8)	87.9 (86.6-89.1)	5,834	93.2 (92.5-93.9)	86.8 (85.6-87.9)	83.0 (81.4-84.4)	4,510	96.7 (96.0-97.3)	95.2 (94.0-96.1)	93.2 (91.2-94.8)		
	All ages	16,928	96.0 (95.7-96.4)	90.5 (89.9-91.1)	86.7 (85.8-87.5)	11,690	94.6 (94.2-95.0)	85.8 (85.0-86.5)	80.7 (79.7-81.6)	7,015	97.7 (97.3-98.1)	96.5 (95.7-97.2)	94.9 (93.6-96.0)		
Glioma malignant, NOS	0-14	6,180	81.9 (80.9-82.8)	69.5 (68.3-70.7)	68.4 (67.1-69.6)	7,201	81.1 (80.2-82.0)	68.2 (67.1-69.3)	67.1 (65.9-68.2)	--	--	--	--		
	15-39	3,727	91.7 (90.8-92.6)	79.1 (77.6-80.6)	72.3 (70.4-74.1)	4,269	91.2 (90.2-92.0)	78.0 (76.6-79.3)	70.7 (69.0-72.4)	--	--	--	--		
	40+	7,932	53.1 (51.9-54.2)	35.9 (34.7-37.2)	29.6 (28.2-31.0)	9,355	51.4 (50.3-52.4)	34.2 (33.1-35.3)	28.1 (26.9-29.3)	--	--	--	--		
	All ages	17,839	71.3 (70.6-72.0)	56.9 (56.1-57.7)	52.5 (51.6-53.4)	20,825	70.0 (69.3-70.6)	55.3 (54.5-56.0)	50.9 (50.1-51.7)	--	--	--	--		
Other neuroepithelial tumors	0-14	65	96.9 (87.8-99.2)	91.3 (80.1-96.4)	91.3 (80.1-96.4)	56	96.3 (85.9-99.1)	89.9 (77.1-95.7)	89.9 (77.1-95.7)	--	--	--	--		
	15-39	88	96.6 (89.5-98.9)	88.2 (78.1-93.9)	84.7 (73.3-91.5)	70	95.6 (86.8-98.6)	87.0 (75.2-93.4)	80.0 (65.8-88.8)	--	--	--	--		
	40+	105	72.7 (62.7-80.4)	52.3 (40.7-62.6)	41.8 (28.8-54.3)	61	70.9 (57.2-81.0)	42.3 (28.1-55.8)	33.5 (19.5-48.1)	55	76.8 (62.7-86.1)	60.2 (43.8-73.2)	53.4 (34.1-69.4)		
	All ages	258	87.0 (82.0-90.6)	74.7 (68.2-80.1)	69.6 (61.9-76.0)	187	87.8 (81.9-91.9)	73.4 (65.6-79.8)	67.6 (58.8-75.0)	96	86.9 (78.0-92.4)	76.9 (65.8-84.8)	73.9 (61.2-83.1)		
Neuronal and mixed neuronal-glioma tumors	0-14	3,264	98.8 (98.3-99.1)	96.1 (95.3-96.8)	95.3 (94.3-96.1)	2,988	92.8 (89.1-95.2)	81.4 (76.1-85.6)	79.8 (74.3-84.3)	3,024	99.3 (98.9-99.6)	97.3 (96.5-97.8)	96.5 (95.5-97.2)		
	15-39	4,983	98.5 (98.1-98.8)	95.5 (94.8-96.1)	92.4 (91.3-93.4)	590	94.7 (92.5-96.3)	78.8 (75.0-82.1)	70.4 (65.7-74.5)	4,474	99.0 (98.6-99.3)	97.6 (97.0-98.1)	95.4 (94.3-96.2)		
	40+	3,987	93.4 (92.5-94.2)	84.9 (83.3-86.2)	80.1 (78.0-82.1)	1,623	90.7 (89.0-92.1)	76.9 (74.3-79.4)	68.9 (65.3-72.2)	2,575	94.6 (93.6-95.5)	89.5 (87.8-91.0)	86.0 (83.4-88.1)		
	All ages	12,234	96.9 (96.6-97.2)	92.2 (91.6-92.8)	89.2 (88.4-90.0)	2,511	91.9 (90.7-93.0)	77.9 (75.9-79.8)	70.7 (68.1-73.1)	10,073	98.0 (97.6-98.3)	95.5 (94.9-95.9)	93.3 (92.5-94.0)		
Choroid plexus tumors	0-14	961	95.4 (93.8-96.6)	89.9 (87.6-91.8)	88.0 (85.4-90.2)	283	86.1 (81.4-89.7)	65.5 (59.2-71.1)	60.2 (53.4-66.4)	718	98.5 (97.1-99.2)	97.5 (95.9-98.5)	96.8 (94.8-98.1)		
	15-39	586	98.2 (96.6-99.0)	96.0 (93.7-97.5)	92.5 (88.9-94.9)	--	--	--	--	547	98.2 (96.6-99.1)	97.2 (95.1-98.3)	95.5 (92.2-97.4)		
	40+	676	89.7 (86.9-91.9)	84.9 (81.0-88.0)	81.6 (75.9-86.1)	--	--	--	--	629	90.7 (87.8-92.9)	86.5 (82.5-89.6)	84.4 (78.4-88.9)		
	All ages	2,223	94.4 (93.3-95.3)	90.0 (88.4-91.4)	87.3 (85.2-89.1)	379	85.8 (81.7-89.0)	66.9 (61.5-71.7)	58.2 (52.1-63.8)	1,894	95.8 (94.7-96.7)	93.9 (92.4-95.1)	92.5 (90.3-94.1)		
Tumors of the pineal region	0-14	378	88.9 (85.2-91.7)	68.5 (63.1-73.3)	63.1 (57.1-68.5)	376	85.9 (81.9-89.1)	62.4 (56.9-67.4)	55.6 (49.7-61.1)	62	98.4 (88.5-99.8)	98.4 (88.5-99.8)	98.4 (88.5-99.8)		
	15-39	695	95.6 (93.7-96.9)	86.4 (83.2-89.0)	80.9 (76.8-84.4)	417	93.4 (90.4-95.4)	73.7 (68.5-78.2)	63.4 (57.1-68.9)	334	97.6 (95.2-98.8)	97.3 (94.3-98.7)	95.9 (91.6-98.0)		
	40+	754	90.6 (88.1-92.6)	80.8 (76.9-84.0)	72.8 (67.3-77.6)	336	86.6 (82.2-89.9)	70.0 (63.8-75.3)	57.3 (49.4-64.4)	453	92.6 (89.5-94.9)	87.6 (82.8-91.1)	83.0 (75.6-88.4)		
	All ages	1,827	92.2 (90.8-93.4)	80.3 (78.0-82.3)	73.9 (71.0-76.6)	1,129	88.8 (86.8-90.6)	68.7 (65.6-71.7)	59.1 (55.3-62.6)	849	95.1 (93.2-96.4)	92.3 (89.6-94.3)	89.5 (85.4-92.5)		
Embryonal tumors	0-14	6,037	81.9 (80.9-82.9)	64.0 (62.7-65.2)	59.1 (57.7-60.5)	7,197	81.5 (80.6-82.4)	63.2 (62.0-64.4)	58.4 (57.2-59.7)	--	--	--	--		
	15-39	2,139	91.2 (89.9-92.4)	71.4 (69.3-73.5)	61.3 (58.8-63.8)	2,599	90.6 (89.4-91.6)	70.7 (68.8-72.6)	61.0 (58.8-63.1)	--	--	--	--		
	40+	783	69.7 (66.2-72.8)	45.4 (41.5-49.2)	36.9 (32.6-41.2)	919	69.7 (66.6-72.7)	46.3 (42.7-49.8)	37.2 (33.3-41.0)	--	--	--	--		
	All ages	8,959	83.1 (82.3-83.9)	64.1 (63.0-65.2)	57.7 (56.5-58.9)	10,715	82.7 (82.0-83.4)	63.6 (62.6-64.6)	57.2 (56.2-58.3)	--	--	--	--		
Nerve sheath tumors	0-14	2,253	99.8 (99.4-99.9)	98.7 (98.1-99.2)	97.9 (96.9-98.5)	--	--	--	--	2,219	100.0 (100.0-100.0)	99.1 (98.5-99.5)	98.3 (97.4-98.9)		
	15-39	13,341	99.3 (99.1-99.4)	98.5 (98.2-98.7)	97.7 (97.2-98.1)	--	--	--	--	13,202	99.5 (99.4-99.6)	98.8 (98.5-99.0)	98.1 (97.6-98.5)		
	40+	71,631	99.2 (99.1-99.3)	99.2 (99.1-99.3)	99.2 (99.1-99.3)	493	85.4 (81.8-88.4)	76.2 (71.4-80.2)	73.2 (67.0-78.5)	71,267	99.3 (99.2-99.4)	99.3 (99.2-99.4)	99.3 (99.2-99.4)		
	All ages	87,225	99.2 (99.1-99.3)	99.2 (99.1-99.3)	99.2 (99.1-99.3)	713	84.4 (81.4-87.0)	74.2 (70.4-77.5)	70.5 (65.8-74.7)	86,688	99.3 (99.2-99.4)	99.3 (99.2-99.4)	99.3 (99.2-99.4)		

Table 11 Continued

Histopathology	Age Groups (years)	All (2004-2018)					Malignant (2001-2018) ^c					Non-Malignant (2004-2018) ^d				
		N ^e	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	I ^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+	53	97.5 (80.5-99.7)	95.2 (75.2-99.1)	89.0 (60.6-97.3)	--	--	--	--	53	97.5 (80.5-99.7)	95.2 (75.2-99.1)	89.0 (60.6-97.3)			
	All ages	65	96.4 (85.0-99.2)	92.8 (79.0-97.7)	87.7 (66.2-95.9)	--	--	--	--	65	96.4 (85.0-99.2)	92.8 (79.0-97.7)	87.7 (66.2-95.9)			
Meningiomas	0-14	683	97.8 (96.3-98.7)	95.6 (93.6-97.0)	91.7 (88.6-94.0)	59	89.8 (78.6-95.3)	79.0 (65.9-87.5)	73.7 (59.1-83.8)	635	98.6 (97.2-99.3)	96.8 (94.9-98.1)	93.2 (90.1-95.3)			
	15-39	23,524	98.8 (98.6-98.9)	97.0 (96.7-97.2)	94.7 (94.3-95.1)	422	93.9 (91.0-95.8)	84.2 (80.0-87.5)	79.0 (74.0-83.1)	23,200	98.8 (98.7-99.0)	97.2 (96.9-97.4)	95.0 (94.6-95.4)			
	40+	367,071	92.8 (92.7-92.9)	87.3 (87.1-87.4)	82.2 (81.9-82.5)	4,644	83.2 (82.0-84.3)	65.2 (63.4-66.8)	57.9 (55.7-60.0)	363,421	92.9 (92.8-93.0)	87.5 (87.3-87.7)	82.5 (82.2-82.8)			
	All ages	381,278	93.2 (93.1-93.3)	87.9 (87.7-88.1)	83.1 (82.8-83.4)	5,125	84.2 (83.0-85.2)	67.0 (65.4-68.6)	60.0 (57.9-61.9)	377,256	93.3 (93.2-93.4)	88.2 (88.0-88.4)	83.4 (83.1-83.7)			
Mesenchymal tumors	0-14	1,270	97.9 (96.8-98.6)	94.5 (92.8-95.7)	92.3 (90.1-94.1)	194	85.8 (79.9-90.0)	69.0 (61.5-75.3)	62.3 (54.0-69.5)	1,110	99.4 (98.6-99.8)	97.9 (96.6-98.7)	96.3 (94.2-97.7)			
	15-39	4,450	98.2 (97.7-98.5)	95.9 (95.2-96.5)	93.5 (92.4-94.4)	541	92.3 (89.7-94.3)	80.4 (76.4-83.7)	71.9 (67.1-76.2)	4,019	98.8 (98.4-99.1)	97.5 (96.9-98.0)	95.7 (94.6-96.5)			
	40+	10,687	94.3 (93.8-94.8)	89.7 (88.8-90.5)	84.5 (83.1-85.8)	1,292	87.1 (85.0-88.9)	69.1 (65.9-72.1)	52.1 (48.0-56.0)	9,596	95.2 (94.6-95.6)	92.1 (91.2-92.9)	88.2 (86.8-89.5)			
	All ages	16,407	95.7 (95.3-96.0)	91.8 (91.2-92.3)	87.6 (86.7-88.5)	2,027	88.4 (86.8-89.8)	72.3 (69.9-74.5)	58.9 (55.9-61.8)	14,725	96.5 (96.1-96.8)	94.0 (93.4-94.6)	90.9 (89.9-91.8)			
Primary melanocytic lesions	0-14	--	--	--	--	--	--	--	--	--	--	--	--			
	15-39	--	--	--	--	--	--	--	--	--	--	--	--			
	40+	185	68.5 (60.7-75.0)	43.2 (34.5-51.6)	26.2 (16.3-37.2)	130	60.5 (51.1-68.7)	30.5 (21.7-39.8)	16.3 (7.8-27.5)	74	84.3 (72.6-91.3)	59.1 (43.7-71.6)	37.6 (19.2-56.0)			
	All ages	254	68.8 (62.3-74.3)	46.0 (38.7-53.0)	31.3 (23.0-39.9)	182	58.4 (50.6-65.4)	32.2 (24.6-40.0)	20.6 (13.0-29.4)	99	87.4 (78.2-92.9)	66.5 (53.8-76.4)	49.2 (33.9-62.9)			
Lymphoma	0-14	171	91.0 (85.4-94.5)	84.8 (78.1-89.6)	79.2 (70.3-85.7)	192	90.9 (85.8-94.3)	84.8 (78.5-89.4)	80.6 (73.0-86.3)	--	--	--	--			
	15-39	1,528	67.3 (64.8-69.6)	59.2 (56.6-61.8)	54.9 (51.9-57.7)	1,909	63.0 (60.7-65.1)	54.1 (51.8-56.4)	50.2 (47.6-52.7)	--	--	--	--			
	40+	15,196	53.9 (53.0-54.7)	35.7 (34.8-36.6)	27.4 (26.4-28.5)	17,754	53.2 (52.5-54.0)	34.4 (33.6-35.2)	25.7 (24.8-26.6)	--	--	--	--			
	All ages	16,895	55.5 (54.7-56.3)	38.5 (37.7-39.4)	30.8 (29.8-31.8)	19,855	54.6 (53.8-55.3)	37.0 (36.2-37.7)	28.9 (28.1-29.8)	--	--	--	--			
Other hematopoietic neoplasms	0-14	--	--	--	--	--	--	--	--	--	--	--	--			
	15-39	--	--	--	--	--	--	--	--	--	--	--	--			
	40+	148	82.3 (74.6-87.8)	67.5 (57.6-75.5)	63.0 (51.4-72.6)	186	82.4 (75.7-87.4)	65.0 (56.4-72.3)	59.8 (49.9-68.4)	--	--	--	--			
	All ages	164	84.1 (77.0-89.1)	67.9 (58.7-75.5)	63.9 (53.1-72.8)	209	84.4 (78.4-88.9)	66.9 (58.9-73.6)	62.4 (53.3-70.3)	--	--	--	--			
Germ cell tumors	0-14	1,398	93.2 (91.7-94.5)	89.2 (87.4-90.8)	86.2 (83.9-88.2)	1,420	92.7 (91.2-94.0)	87.6 (85.6-89.3)	83.8 (81.4-85.9)	190	92.5 (87.5-95.6)	91.2 (85.8-94.6)	91.2 (85.8-94.6)			
	15-39	1,500	95.3 (94.0-96.3)	89.4 (87.6-91.0)	87.3 (85.1-89.2)	1,620	94.4 (93.1-95.4)	88.4 (86.5-90.0)	85.9 (83.8-87.8)	127	99.3 (93.5-99.9)	93.3 (86.2-96.8)	91.0 (82.9-95.4)			
	40+	194	92.1 (86.8-95.3)	83.5 (75.9-88.9)	79.7 (70.9-86.1)	88	81.4 (71.3-88.3)	64.8 (52.7-74.6)	61.4 (47.6-72.6)	123	98.5 (90.1-99.8)	92.9 (82.3-97.3)	87.5 (75.2-94.0)			
	All ages	3,092	94.1 (93.2-94.9)	89.0 (87.7-90.1)	86.3 (84.8-87.8)	3,128	93.2 (92.3-94.1)	87.3 (86.0-88.5)	84.3 (82.7-85.7)	440	96.2 (93.7-97.7)	92.2 (88.5-94.7)	89.9 (85.5-93.0)			
Tumors of the pituitary	0-14	2,430	99.8 (99.5-99.9)	99.4 (98.9-99.7)	99.2 (98.5-99.5)	--	--	--	--	2,428	99.8 (99.5-99.9)	99.4 (98.9-99.7)	99.2 (98.5-99.5)			
	15-39	53,372	99.7 (99.7-99.8)	99.4 (99.3-99.5)	98.8 (98.6-99.0)	--	--	--	--	53,301	99.7 (99.7-99.8)	99.4 (99.3-99.5)	98.8 (98.6-99.0)			
	40+	116,677	97.5 (97.4-97.6)	95.8 (95.6-96.0)	93.4 (92.9-93.8)	377	88.2 (84.2-91.3)	78.3 (73.5-83.9)	70.6 (62.6-77.2)	116,373	97.5 (97.4-97.7)	95.9 (95.6-96.1)	93.4 (93.0-93.8)			
	All ages	172,479	98.2 (98.2-98.3)	97.0 (96.8-97.1)	95.2 (94.9-95.5)	480	90.4 (87.1-92.9)	81.6 (76.8-85.5)	75.3 (68.9-80.6)	172,102	98.3 (98.2-98.3)	97.0 (96.9-97.2)	95.3 (95.0-95.5)			

Table 11 Continued

Histopathology	All (2004-2018)					Malignant (2001-2018) ^c					Non-Malignant (2004-2018) ^d				
	Age Groups (Years)	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 ^g	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)		
Craniopharyngioma	0-14	1,843	98.7 (98.0-99.1)	96.0 (94.9-96.9)	92.6 (90.9-94.0)	--	--	--	--	1,835	98.7 (98.1-99.2)	96.1 (94.9-96.9)	92.6 (90.9-94.0)		
	15-39	1,891	96.2 (95.2-97.0)	91.2 (89.7-92.5)	87.3 (85.3-89.1)	--	--	--	--	1,889	96.2 (95.2-97.0)	91.3 (89.8-92.6)	87.4 (85.4-89.2)		
	40+	4,265	88.9 (87.8-89.9)	78.3 (76.7-79.8)	69.2 (66.9-71.3)	--	--	--	--	4,255	88.9 (87.9-89.9)	78.4 (76.8-79.9)	69.2 (66.9-71.4)		
	All ages	7,999	92.9 (92.3-93.5)	85.6 (84.6-86.5)	79.3 (78.0-80.6)	--	--	--	--	7,979	92.9 (92.3-93.5)	85.7 (84.7-86.6)	79.3 (78.0-80.6)		
Hemangioma	0-14	589	99.5 (98.3-99.9)	98.5 (97.0-99.3)	96.5 (97.0-99.3)	--	--	--	--	589	99.5 (98.3-99.9)	98.5 (97.0-99.3)	98.5 (97.0-99.3)		
	15-39	2,684	99.7 (99.3-99.9)	98.9 (98.1-99.3)	97.1 (95.7-98.1)	--	--	--	--	2,678	99.7 (99.3-99.9)	98.9 (98.2-99.3)	97.2 (95.8-98.1)		
	40+	5,444	96.0 (95.4-96.6)	92.1 (90.9-93.2)	89.1 (87.0-91.0)	--	--	--	--	5,438	96.1 (95.4-96.7)	92.2 (90.9-93.3)	89.2 (87.0-91.0)		
	All ages	8,717	97.4 (97.0-97.8)	94.7 (93.9-95.4)	92.5 (91.1-93.6)	--	--	--	--	8,705	97.5 (97.0-97.8)	94.8 (94.0-95.5)	92.5 (91.2-93.7)		
Neoplasm, unspecified	0-14	1,429	88.0 (86.2-89.6)	85.0 (82.9-86.8)	83.2 (80.9-85.2)	391	64.5 (59.5-69.1)	56.5 (51.3-61.4)	53.2 (47.8-58.4)	1,084	95.3 (93.8-96.4)	94.0 (92.3-95.3)	92.8 (90.8-94.5)		
	15-39	4,246	93.5 (92.7-94.3)	90.2 (89.2-91.2)	88.1 (86.8-89.2)	852	79.6 (76.7-82.2)	68.4 (65.0-71.6)	63.0 (59.2-66.6)	3,560	96.1 (95.4-96.7)	94.1 (93.2-94.9)	92.3 (91.1-93.4)		
	40+	21,216	54.3 (53.6-55.0)	45.3 (44.5-46.1)	40.2 (39.2-41.2)	9,675	27.4 (26.5-28.4)	17.6 (16.7-18.5)	15.1 (14.2-16.1)	13,232	70.9 (70.1-71.7)	62.0 (61.0-63.1)	55.5 (54.1-56.8)		
	All ages	26,891	62.5 (61.9-63.2)	54.8 (54.1-55.5)	50.6 (49.7-51.4)	10,918	33.0 (32.1-34.0)	23.2 (22.3-24.1)	20.5 (19.5-21.5)	17,876	77.5 (76.9-78.2)	70.6 (69.8-71.4)	65.7 (64.6-66.7)		
All other	0-14	402	89.0 (85.4-91.8)	84.4 (80.3-87.8)	84.4 (80.3-87.8)	125	59.1 (49.9-67.3)	39.4 (30.2-48.5)	37.8 (28.4-47.1)	295	99.4 (96.9-99.9)	99.4 (96.9-99.9)	99.4 (96.9-99.9)		
	15-39	361	97.8 (95.6-98.9)	94.1 (90.7-96.3)	91.9 (87.4-94.9)	--	--	--	--	332	98.9 (96.7-99.6)	97.5 (94.5-98.9)	95.2 (90.4-97.6)		
	40+	561	87.9 (84.4-90.6)	84.8 (80.0-88.5)	75.7 (68.5-81.5)	--	--	--	--	537	89.2 (85.7-91.9)	86.6 (81.3-90.5)	77.5 (69.9-83.4)		
	All ages	1,324	91.0 (89.2-92.5)	87.3 (84.8-89.4)	83.3 (79.9-86.2)	191	64.5 (57.1-70.9)	42.8 (35.1-50.3)	39.9 (31.9-47.8)	1,164	94.6 (92.9-95.9)	93.2 (90.7-95.0)	88.8 (85.2-91.6)		
TOTAL^h	0-14	45,563	91.6 (91.3-91.8)	83.1 (82.8-83.5)	80.6 (80.2-81.0)	35,490	87.4 (87.1-87.8)	75.1 (74.6-75.6)	71.9 (71.4-72.5)	15,594	98.9 (98.8-99.1)	97.6 (97.3-97.8)	96.4 (96.0-96.8)		
	15-39	154,227	97.0 (96.9-97.1)	90.9 (90.7-91.1)	86.8 (86.6-87.0)	52,219	90.7 (90.5-91.0)	71.7 (71.3-72.1)	61.2 (60.6-61.7)	110,555	99.2 (99.2-99.3)	98.3 (98.2-98.4)	97.1 (96.9-97.2)		
	40+	779,936	82.9 (82.9-83.0)	72.5 (72.3-72.6)	68.5 (68.4-68.7)	231,959	49.2 (49.0-49.4)	21.0 (20.8-21.2)	16.7 (16.5-16.9)	583,147	94.2 (94.1-94.3)	90.3 (90.2-90.5)	86.8 (86.5-87.0)		
	All ages	979,726	85.6 (85.5-85.7)	76.0 (75.9-76.1)	72.1 (72.0-72.3)	319,668	60.3 (60.2-60.5)	35.7 (35.5-35.9)	30.5 (30.3-30.7)	709,296	95.1 (95.0-95.2)	91.8 (91.7-91.9)	88.7 (88.6-88.9)		

^aThe 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.

^bRates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively.

^cAssigned behavior code of /0 or /1 (see Table 2).

^dAssigned behavior code of /0 or /1 (see Table 2).

^eTotal number of cases that occurred within the included NPCR and SEER registries between 2004 and 2018.

^fTotal number of cases that occurred within the included NPCR and SEER registries between 2001 and 2018.

^gChildren as defined by the National Cancer Institute, see: <http://www.cancer.gov/researchandfunding/snapshots/pediatric>.

^hAdolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: <http://www.cancer.gov/cancerstatistics/aya>.

ⁱTotal includes histopathologies not listed in this table.

-- 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.

** Confidence interval could not be calculated.

Abbreviations: NCI, National Cancer Institute; 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 12 Five-Year Total, Annual Average Total^a, and Average Annual Age-Adjusted Incidence Rates^b with 95% Confidence Intervals for Children and Adolescents (Ages 0-19 Years), Brain and Other Central Nervous System Tumors by Histopathology and Age Group at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	0-4 Years			5-9 Years			10-14 Years			15-19 Years				
	5-Year Annual Total	Annual Rate (95% CI)	Average	5-Year Annual Total	Annual Rate (95% CI)	Average	5-Year Annual Total	Annual Rate (95% CI)	Average	5-Year Annual Total	Annual Rate (95% CI)	Average		
Diffuse Astrocytic and Oligodendroglial Tumors	2,102	0.51 (0.49-0.54)	409	82	0.41 (0.38-0.46)	430	86	0.42 (0.39-0.47)	571	114	0.55 (0.51-0.60)	692	138	0.66 (0.61-0.71)
Diffuse astrocytoma	878	0.21 (0.20-0.23)	222	44	0.22 (0.20-0.26)	173	35	0.17 (0.15-0.20)	232	46	0.22 (0.20-0.26)	251	50	0.24 (0.21-0.27)
Anaplastic astrocytoma	332	0.08 (0.07-0.09)	51	10	0.05 (0.04-0.07)	79	16	0.08 (0.06-0.10)	92	18	0.09 (0.07-0.11)	110	22	0.10 (0.09-0.13)
Glioblastoma	695	0.17 (0.16-0.18)	106	21	0.11 (0.09-0.13)	150	30	0.15 (0.13-0.17)	209	42	0.20 (0.18-0.23)	230	46	0.22 (0.19-0.25)
Oligodendroglioma	145	0.04 (0.03-0.04)	17	3	0.02 (0.01-0.03)	17	3	0.02 (0.01-0.03)	30	6	0.03 (0.02-0.04)	81	16	0.08 (0.06-0.10)
Anaplastic oligodendroglioma	16	0.00 (0.00-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	36	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	4,382	1.08 (1.04-1.11)	1,352	270	1.37 (1.29-1.44)	1,247	249	1.23 (1.16-1.30)	1,059	212	1.03 (0.96-1.09)	724	145	0.69 (0.64-0.74)
Piloicytic astrocytoma	3,885	0.95 (0.92-0.98)	1,261	252	1.27 (1.20-1.35)	1,121	224	1.11 (1.04-1.17)	901	180	0.87 (0.82-0.93)	602	120	0.57 (0.53-0.62)
Unique astrocytoma variants	497	0.12 (0.11-0.13)	91	18	0.09 (0.07-0.11)	126	25	0.12 (0.10-0.15)	158	32	0.15 (0.13-0.18)	122	24	0.12 (0.10-0.14)
Malignant	230	0.06 (0.05-0.06)	--	--	--	44	9	0.04 (0.03-0.06)	87	17	0.08 (0.07-0.10)	--	--	--
Non-Malignant	2,67	0.07 (0.06-0.07)	--	--	--	82	16	0.08 (0.06-0.10)	71	14	0.07 (0.05-0.09)	--	--	--
Ependymal Tumors	1,185	0.29 (0.27-0.31)	451	90	0.46 (0.42-0.50)	224	45	0.22 (0.19-0.25)	250	50	0.24 (0.21-0.27)	260	52	0.25 (0.22-0.28)
Malignant	966	0.24 (0.22-0.25)	432	86	0.44 (0.40-0.48)	198	40	0.20 (0.17-0.22)	183	37	0.18 (0.15-0.20)	153	31	0.15 (0.12-0.17)
Non-Malignant	219	0.05 (0.05-0.06)	19	4	0.02 (0.01-0.03)	26	5	0.03 (0.02-0.04)	67	13	0.06 (0.05-0.08)	107	21	0.10 (0.08-0.12)
Other Gliomas	3,188	0.78 (0.76-0.81)	902	180	0.91 (0.85-0.97)	1,022	204	1.01 (0.95-1.07)	766	153	0.74 (0.69-0.80)	498	100	0.47 (0.43-0.52)
Glioma malignant, NOS	3,160	0.78 (0.75-0.80)	--	--	--	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	28	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	2,090	0.51 (0.49-0.53)	375	75	0.38 (0.34-0.42)	374	75	0.37 (0.33-0.41)	662	132	0.64 (0.59-0.69)	679	136	0.65 (0.60-0.70)
Malignant	120	0.24 (0.20-0.04)	36	7	0.04 (0.03-0.05)	19	4	0.02 (0.01-0.03)	32	6	0.03 (0.02-0.04)	33	7	0.03 (0.02-0.04)
Non-Malignant	1,970	0.48 (0.46-0.50)	339	68	0.34 (0.31-0.38)	355	71	0.35 (0.32-0.39)	630	126	0.61 (0.56-0.66)	646	129	0.61 (0.57-0.66)
Choroid Plexus Tumors	407	0.10 (0.09-0.11)	254	51	0.26 (0.23-0.29)	47	9	0.05 (0.03-0.06)	58	12	0.06 (0.04-0.07)	48	10	0.05 (0.03-0.06)
Malignant	98	0.20 (0.02-0.03)	83	17	0.08 (0.07-0.10)	--	--	--	--	--	--	--	--	--
Non-Malignant	309	0.08 (0.07-0.08)	171	34	0.17 (0.15-0.20)	--	--	--	--	--	--	--	--	--
Tumors of the Pineal Region	215	0.43 (0.05-0.06)	55	11	0.06 (0.04-0.07)	50	10	0.05 (0.04-0.07)	38	8	0.04 (0.03-0.05)	72	14	0.07 (0.05-0.09)
Malignant	179	0.36 (0.04-0.05)	--	--	--	--	--	--	--	--	--	54	11	0.05 (0.04-0.07)

Table 12 Continued

Histopathology	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)
<i>Non-Malignant</i>	36	7	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--	18	4	0.02 (0.01-0.03)
Embryonal Tumors	2,338	468	0.58 (0.55-0.60)	1,053	211	1.07 (1.00-1.13)	715	143	0.71 (0.66-0.76)	376	75	0.36 (0.33-0.40)	194	39	0.18 (0.16-0.21)
<i>Medulloblastoma</i>	1,626	325	0.40 (0.38-0.42)	509	102	0.51 (0.47-0.56)	623	125	0.62 (0.57-0.67)	332	66	0.32 (0.29-0.36)	162	32	0.15 (0.13-0.18)
<i>Atypical teratoid/rhabdoid tumor</i>	372	74	0.09 (0.08-0.10)	320	64	0.33 (0.29-0.36)	32	6	0.03 (0.02-0.04)	--	--	--	--	--	--
<i>All other embryonal</i>	340	68	0.08 (0.07-0.09)	224	45	0.23 (0.20-0.26)	60	12	0.06 (0.05-0.08)	--	--	--	--	--	--
Tumors of Cranial and Parasagittal Nerves	1,173	235	0.29 (0.27-0.30)	216	43	0.22 (0.19-0.25)	182	36	0.18 (0.15-0.21)	288	58	0.28 (0.25-0.31)	487	97	0.46 (0.42-0.51)
<i>Nerve sheath tumors</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Other tumors of cranial and parasagittal nerves</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	1,252	250	0.30 (0.29-0.32)	231	46	0.24 (0.21-0.27)	157	31	0.16 (0.13-0.18)	292	58	0.28 (0.25-0.32)	572	114	0.54 (0.50-0.59)
<i>Meningiomas</i>	671	134	0.16 (0.15-0.18)	59	12	0.06 (0.05-0.08)	84	17	0.08 (0.07-0.10)	175	35	0.17 (0.15-0.20)	353	71	0.34 (0.30-0.37)
<i>Malignant</i>	21	4	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	650	130	0.16 (0.15-0.17)	--	--	--	--	--	--	--	--	--	--	--	--
<i>Mesenchymal tumors</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Primary melanocytic lesions</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	133	27	0.03 (0.03-0.04)	23	5	0.02 (0.01-0.03)	36	7	0.04 (0.02-0.05)	30	6	0.03 (0.02-0.04)	44	9	0.04 (0.03-0.06)
<i>Lymphoma</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Other hematopoietic neoplasms</i>	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	863	173	0.21 (0.20-0.23)	106	21	0.11 (0.09-0.13)	156	31	0.15 (0.13-0.18)	319	64	0.31 (0.28-0.34)	282	56	0.27 (0.24-0.30)
<i>Malignant</i>	770	154	0.19 (0.18-0.20)	--	--	--	128	26	0.13 (0.11-0.15)	302	60	0.29 (0.26-0.33)	--	--	--
<i>Non-Malignant</i>	93	19	0.02 (0.02-0.03)	--	--	--	28	6	0.03 (0.02-0.04)	17	3	0.02 (0.01-0.03)	--	--	--
Tumors of Sellar Region	4,530	906	1.10 (1.07-1.13)	186	37	0.19 (0.16-0.22)	606	121	0.60 (0.55-0.65)	982	196	0.95 (0.89-1.01)	2,756	551	2.62 (2.53-2.72)
<i>Tumors of the pituitary</i>	3,723	745	0.90 (0.87-0.93)	44	9	0.04 (0.03-0.06)	314	63	0.31 (0.28-0.35)	757	151	0.73 (0.68-0.79)	2,608	522	2.48 (2.39-2.58)
<i>Craniopharyngioma</i>	807	161	0.20 (0.18-0.21)	142	28	0.14 (0.12-0.17)	292	58	0.29 (0.26-0.32)	225	45	0.22 (0.19-0.25)	148	30	0.14 (0.12-0.17)
Unclassified Tumors	1,481	296	0.36 (0.34-0.38)	336	67	0.34 (0.31-0.38)	290	58	0.29 (0.25-0.32)	384	77	0.37 (0.34-0.41)	471	94	0.45 (0.41-0.49)
<i>Hemangioma</i>	486	97	0.12 (0.11-0.13)	73	15	0.07 (0.06-0.09)	83	17	0.08 (0.07-0.10)	131	26	0.13 (0.11-0.15)	199	40	0.19 (0.16-0.22)
<i>Neoplasm, unspecified</i>	811	162	0.20 (0.19-0.21)	176	35	0.18 (0.15-0.21)	169	34	0.17 (0.14-0.19)	226	45	0.22 (0.19-0.25)	240	48	0.23 (0.20-0.26)
<i>Malignant</i>	213	43	0.05 (0.05-0.06)	69	14	0.07 (0.05-0.09)	49	10	0.05 (0.04-0.06)	44	9	0.04 (0.03-0.06)	51	10	0.05 (0.04-0.06)

Table 12 Continued

Histopathology	0-4 Years			5-9 Years			10-14 Years			15-19 Years					
	5-Year Annual Total	Annual Average	Rate (95% CI)	5-Year Annual Total	Annual Average	Rate (95% CI)	5-Year Annual Total	Annual Average	Rate (95% CI)	5-Year Annual Total	Annual Average	Rate (95% CI)			
<i>Non-Malignant</i>	598	120	0.15 (0.13-0.16)	107	21	0.11 (0.09-0.13)	120	24	0.12 (0.10-0.14)	182	36	0.18 (0.15-0.20)	189	38	0.18 (0.16-0.21)
All other	184	37	0.05 (0.04-0.05)	87	17	0.09 (0.07-0.11)	38	8	0.04 (0.03-0.05)	27	5	0.03 (0.02-0.04)	32	6	0.03 (0.02-0.04)
<i>Malignant</i>	40	8	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	144	29	0.04 (0.03-0.04)	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL^c	25,339	5,068	6.20 (6.12-6.27)	5,949	1,190	6.03 (5.87-6.18)	5,536	1,107	5.47 (5.33-5.62)	6,075	1,215	5.88 (5.74-6.03)	7,779	1,556	7.40 (7.24-7.57)
Malignant	14,385	2,877	3.53 (3.47-3.59)	4,439	888	4.49 (4.36-4.63)	3,857	771	3.81 (3.69-3.93)	3,376	675	3.27 (3.16-3.38)	2,713	543	2.58 (2.49-2.68)
Non-Malignant	10,954	2,191	2.67 (2.62-2.72)	1,510	302	1.53 (1.46-1.61)	1,679	336	1.66 (1.58-1.74)	2,699	540	2.61 (2.52-2.71)	5,066	1,013	4.82 (4.69-4.96)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cRefers to all brain tumors including histopathologies 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; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, Not otherwise specified.

Table 13 Five-Year Total^a, Annual Average Total^b, Average Annual Age-Adjusted Incidence Rates^c with 95% Confidence Intervals, and Characteristics of All Brain and Other Central Nervous System Tumors by Central Cancer Registry, Behavior, and Diagnostic Confirmation, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2015-2019

Central Cancer Registry	Total		Malignant			Non-Malignant			Average Annual 5-Year Population ^d				
	5-Year Total	Annual Average Total	Histopathologically-Confirmed (%) ^e	Radiographically-Confirmed (%) ^f	5-Year Total	% Malignant	Histopathologically-Confirmed (%)	Radiographically-Confirmed (%)					
Alabama	5,546	1,109	56.6	36.7	1,912	34.5	77.1	6.7	3,634	65.5	45.7	52.5	4,879,842
Alaska	880	176	47.8	48.8	267	30.3	81.7	13.1	613	69.7	33.1	64.3	738,443
Arizona	8,187	1,637	62.4	33.8	2,541	31	85	7.8	5,646	69	52.2	45.5	7,056,347
Arkansas	3,918	784	51.9	43.4	1,203	30.7	81.5	10.6	2,715	69.3	38.8	57.9	3,001,710
California	48,214	9,643	56	39.3	13,686	28.4	84.7	8.3	34,528	71.6	44.6	51.6	39,253,268
Colorado	8,558	1,712	47.3	49.9	2,060	24.1	83.4	11.8	6,498	75.9	35.9	62	5,614,247
Connecticut	5,143	1,029	63.9	33.2	1,656	32.2	89.6	7.1	3,487	67.8	51.7	45.6	3,576,860
Delaware	1,142	228	60.8	36.8	386	33.8	85.2	10.9	756	66.2	48.3	50	958,730
District of Columbia	851	170	50.4	46.3	180	21.1	85.6	7.2	671	78.8	41	56.8	694,814
Florida	32,991	6,598	51.1	45.2	9,048	27.4	83.8	10.5	23,943	72.6	38.8	58.3	20,914,084
Georgia	14,863	2,973	46.2	47.2	3,519	23.7	83.1	11	11,344	76.3	34.7	58.4	10,411,247
Hawaii	1,571	314	53	41.4	382	24.3	82.7	10.2	1,189	75.7	43.5	51.4	1,423,273
Idaho	2,374	475	57.6	39.8	750	31.6	83.3	13.1	1,624	68.4	45.8	52.1	1,719,482
Illinois	18,227	3,645	52.9	44.2	4,846	26.6	88	7.3	13,381	73.4	40.2	57.6	12,770,578
Indiana	7,782	1,556	54.1	41.9	2,603	33.5	84.2	9.6	5,179	66.6	39	58.1	6,668,180
Iowa	4,713	943	54.3	42.8	1,377	29.2	83.2	11.5	3,336	70.8	42.4	55.8	3,141,796
Kansas	3,641	728	53.7	43.4	1,100	30.2	88.4	8.4	2,541	69.8	38.7	58.6	2,911,994
Kentucky	7,374	1,475	46.6	46.4	2,002	27.1	80.1	11	5,372	72.8	34.1	59.6	4,452,328
Louisiana	6,620	1,324	53.2	41.4	1,625	24.6	86.1	9.8	4,995	75.4	42.5	51.7	4,668,950
Maine	1,574	315	69.4	27.3	689	43.8	84.2	10.3	885	56.2	58	40.5	1,336,616
Maryland	8,206	1,641	54.9	40.4	2,232	27.2	84.4	6.7	5,974	72.8	43.9	53	6,024,167
Massachusetts	8,250	1,650	67.4	28.2	2,972	36	87.8	6.6	5,278	64	55.9	40.4	6,853,785
Michigan	12,392	2,478	56.9	37.7	3,976	32.1	85	6.5	8,416	67.9	43.6	52.5	9,967,487
Minnesota	6,723	1,345	65.4	31.9	2,334	34.7	87	9.2	4,389	65.3	54	43.9	5,565,492
Mississippi	3,766	753	54.1	42.2	1,034	27.5	86.1	10.1	2,732	72.5	42	54.4	2,986,521
Missouri	8,544	1,709	51.1	44.2	2,539	29.7	83.8	8.6	6,005	70.3	37.2	59.3	6,108,928
Montana	1,593	319	53	42.6	501	31.4	80.4	14	1,092	68.6	40.4	55.8	1,051,887
Nebraska	2,243	449	57.8	39.1	805	35.9	84	10.8	1,438	64.1	43.1	54.9	1,914,725
Nevada ^g	2,190	730	54.5	40.8	687	31.4	82.7	8.3	1,503	68.6	41.6	55.7	2,358,182
New Hampshire	1,977	395	57.6	39.4	652	33	90.8	5.1	1,325	67	41.2	56.3	1,349,483

Table 13 Continued

Central Cancer Registry	Total		Malignant			Non-Malignant			Average Annual 5-Year Population ^d				
	5-Year Total	Annual Average	Histopathologically-Confirmed (%) ^e	Radiographically-Confirmed (%) ^f	5-Year Total	% Malignant	Histopathologically-Confirmed (%)	Radiographically-Confirmed (%)					
New Jersey	14,083	2,817	50.3	44.6	3,745	26.6	85.2	9.2	10,338	73.4	37.6	57.4	8,883,006
New Mexico	2,067	413	68.9	24.5	713	34.5	88.2	5.8	1,354	65.5	58.8	34.4	2,093,772
New York	32,321	6,464	50.3	46.2	7,906	24.5	85	10.2	24,415	75.5	39	57.8	19,578,958
North Carolina	14,618	2,924	52.4	44	3,947	27	85.9	9.2	10,671	73	40	56.9	10,273,504
North Dakota	841	168	46.4	50.8	258	30.7	83.3	11.6	583	69.3	30	68.1	758,438
Ohio	13,994	2,799	63.7	31.8	5,056	36.1	87.6	6.2	8,938	63.9	50.2	46.2	11,661,096
Oklahoma	4,567	913	58.1	37.8	1,511	33.1	82.1	9.3	3,056	66.9	46.2	51.8	3,935,285
Oregon	4,861	972	64.8	30.5	1,703	35	84.2	6.9	3,158	65	54.4	43.3	4,131,752
Pennsylvania	20,292	4,058	48.5	46.9	5,795	28.6	81.4	9.2	14,497	71.4	35.3	62	12,796,195
Rhode Island	1,144	229	67	28.6	452	39.5	87.4	6.6	692	60.5	53.6	42.9	1,057,750
South Carolina	6,463	1,293	54	41.8	1,990	30.8	85.6	8.5	4,473	69.2	40	56.6	5,027,109
South Dakota	1,082	216	41.2	55.5	312	28.8	75.3	17.6	770	71.2	27.4	70.8	871,720
Tennessee	9,174	1,835	50.8	45.9	2,632	28.7	85.6	8.8	6,542	71.3	36.8	60.8	6,713,977
Texas	37,517	7,503	47.4	47.1	9,593	25.6	80.6	12.8	27,924	74.4	36	58.9	28,256,995
Utah	6,114	1,223	39.1	59.5	1,092	17.9	84.2	12.7	5,022	82.1	29.3	69.7	3,097,989
Vermont	945	189	54.3	43.1	280	29.6	86.1	6.8	665	70.4	40.9	58.4	624,831
Virginia	9,257	1,851	60.2	35.9	3,010	32.5	85.8	6.1	6,247	67.5	47.9	50.2	8,464,705
Washington	13,542	2,708	43	52.2	3,191	23.6	80.7	11	10,351	76.4	31.4	64.9	7,407,203
West Virginia	2,834	567	49.2	46.1	821	29	86.4	8.7	2,013	71	34	61.4	1,819,133
Wisconsin	9,315	1,863	48.2	48.7	2,547	27.3	83.1	12.3	6,768	72.7	35	62.5	5,793,029
Wyoming	708	142	61.7	35.7	227	32.1	86.8	9.2	481	67.9	49.9	48.2	582,159
TOTAL	445,792	89,158	52.9	42.8	126,345	28.3	84.3	9.3	319,447	71.7	40.5	56	324,202,052

^aWith the exception of Nevada, where total cases represent three years of diagnoses (2015, 2016, 2017).

^bAnnual average cases are calculated by dividing the five-year total by five, with the exception of Nevada where annual average cases are obtained by dividing total by three.

^cRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^dPopulation estimates were obtained from the United States Bureau of the Census available on the SEER program website.

^eHistopathologic confirmation includes tumors classified as having diagnosis confirmed by: positive histopathology, positive cytology, positive immunophenotyping and/or positive genetic studies, or positive microscopic confirmation, method not specified.

^fRadiographic confirmation includes tumors classified as having diagnosis confirmed by Radiography and/or other imaging techniques without microscopic confirmation.

^gData not available for diagnosis years 2018-2019.

-- 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 14 Five-Year Total^a, Annual Average Total^b, Average Annual Age-Adjusted Incidence Rates^c with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Age at Diagnosis, Behavior, and Central Cancer Registry, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015–2019

Central Cancer Registry	All Ages						0-19 Years						20+ Years					
	All			Malignant			All			Malignant			All			Malignant		
	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	5,546	1,109	19.92 (19.38-20.47)	1,912	382	6.84 (6.53-7.16)	323	65	5.27 (4.72-5.88)	220	44	3.61 (3.15-4.12)	5,223	1,045	25.81 (25.09-26.54)	1,692	338	8.14 (7.74-8.55)
Alaska	880	176	24.45 (22.79-26.21)	267	53	7.17 (6.30-8.13)	65	13	6.52 (5.03-8.31)	38	8	3.75 (2.65-5.15)	815	163	31.67 (29.42-34.04)	229	46	8.55 (7.42-9.80)
Arizona	8,187	1,637	20.46 (20.01-20.92)	2,541	508	6.32 (6.07-6.58)	514	103	5.62 (5.14-6.13)	268	54	2.95 (2.60-3.32)	7,673	1,535	26.43 (25.82-27.04)	2,273	455	7.68 (7.36-8.02)
Arkansas	3,918	784	23.04 (22.31-23.80)	1,203	241	6.99 (6.59-7.41)	216	43	5.51 (4.80-6.30)	121	24	3.09 (2.56-3.69)	3,702	740	30.10 (29.11-31.11)	1,082	216	8.56 (8.05-9.11)
California	48,214	9,643	23.00 (22.79-23.21)	13,686	2,737	6.55 (6.44-6.67)	2,648	530	5.26 (5.06-5.46)	1,505	301	2.99 (2.84-3.15)	45,566	9,113	30.14 (29.86-30.42)	12,181	2,436	7.98 (7.84-8.13)
Colorado	8,558	1,712	28.86 (28.24-29.49)	2,060	412	6.91 (6.61-7.22)	443	89	6.30 (5.72-6.91)	219	44	3.12 (2.72-3.56)	8,115	1,623	37.94 (37.10-38.79)	1,841	368	8.43 (8.04-8.84)
Connecticut	5,143	1,029	24.61 (23.92-25.32)	1,656	331	7.93 (7.54-8.34)	263	53	6.15 (5.43-6.94)	155	31	3.71 (3.15-4.35)	4,880	976	32.04 (31.11-32.99)	1,501	300	9.63 (9.13-10.15)
District of Columbia	851	170	25.00 (23.30-26.79)	180	36	5.31 (4.54-6.18)	42	8	5.79 (4.14-7.86)	31	6	4.24 (2.86-6.05)	809	162	32.72 (30.45-35.12)	149	30	5.74 (4.83-6.77)
Delaware	1,142	228	20.42 (19.20-21.70)	386	77	6.83 (6.14-7.58)	88	18	7.68 (6.16-9.47)	51	10	4.46 (3.32-5.87)	1,054	211	25.55 (23.96-27.22)	335	67	7.79 (6.94-8.71)
Florida	32,991	6,598	25.30 (25.02-25.59)	9,048	1,810	7.09 (6.93-7.24)	1,631	326	6.99 (6.66-7.34)	900	180	3.87 (3.62-4.13)	31,360	6,272	32.67 (32.29-33.05)	8,148	1,630	8.38 (8.19-8.57)
Georgia	14,863	2,973	27.29 (26.85-27.75)	3,519	704	6.46 (6.24-6.68)	975	195	6.97 (6.54-7.42)	466	93	3.35 (3.06-3.67)	13,888	2,778	35.47 (34.87-36.08)	3,053	611	7.70 (7.43-7.99)
Hawaii	1,571	314	18.82 (17.87-19.82)	382	76	4.73 (4.25-5.24)	60	12	3.62 (2.76-4.66)	38	8	2.25 (1.59-3.09)	1,511	302	24.94 (23.65-26.28)	344	69	5.72 (5.11-6.38)
Iowa	4,713	943	26.27 (25.50-27.06)	1,377	275	7.62 (7.21-8.05)	272	54	6.61 (5.85-7.45)	149	30	3.64 (3.08-4.28)	4,441	888	34.18 (33.14-35.24)	1,228	246	9.22 (8.69-9.77)
Idaho	2,374	475	25.37 (24.33-26.44)	750	150	8.01 (7.43-8.62)	126	25	5.16 (4.30-6.15)	69	14	2.84 (2.21-3.59)	2,248	450	33.50 (32.09-34.96)	681	136	10.09 (9.32-10.90)
Illinois	18,227	3,645	25.80 (25.42-26.19)	4,846	969	6.88 (6.68-7.08)	979	196	6.06 (5.69-6.45)	543	109	3.38 (3.10-3.68)	17,248	3,450	33.74 (33.23-34.26)	4,303	861	8.28 (8.03-8.54)
Indiana	7,782	1,556	21.22 (20.73-21.71)	2,603	521	7.11 (6.83-7.40)	503	101	5.71 (5.22-6.23)	310	62	3.53 (3.15-3.95)	7,279	1,456	27.45 (26.81-28.11)	2,293	459	8.55 (8.19-8.92)
Kansas	3,641	728	22.83 (22.07-23.60)	1,100	220	6.90 (6.49-7.33)	214	43	5.40 (4.70-6.18)	123	25	3.10 (2.58-3.70)	3,427	685	29.84 (28.81-30.88)	977	195	8.43 (7.89-8.99)
Kentucky	7,374	1,475	29.67 (28.98-30.38)	2,002	400	8.05 (7.69-8.42)	384	77	6.32 (5.70-6.98)	215	43	4.45 (3.91-5.04)	6,916	1,383	38.33 (37.41-39.27)	1,752	350	9.49 (9.04-9.96)
Louisiana	6,620	1,324	25.94 (25.31-26.59)	1,625	325	6.38 (6.06-6.70)	458	92	8.14 (7.41-8.92)	250	50	4.45 (3.96-4.01)	6,236	1,247	33.84 (32.98-34.71)	1,410	282	7.53 (7.13-7.95)
Massachusetts	8,250	1,650	21.01 (20.54-21.48)	2,972	594	7.62 (7.34-7.91)	450	90	5.65 (5.14-6.20)	263	53	3.36 (2.97-3.80)	7,800	1,560	27.19 (26.57-27.82)	2,709	542	9.33 (8.97-9.70)
Maryland	8,206	1,641	24.45 (23.91-25.00)	2,232	446	6.73 (6.44-7.02)	429	86	5.72 (5.19-6.29)	237	47	3.17 (2.78-3.60)	7,777	1,555	31.98 (31.26-32.72)	1,995	399	8.16 (7.79-8.53)
Maine	1,574	315	19.05 (18.05-20.08)	689	138	8.28 (7.63-8.97)	98	20	6.84 (5.55-8.35)	68	14	4.83 (3.75-6.13)	1,476	295	23.96 (22.67-25.29)	621	124	9.66 (8.88-10.50)
Michigan	12,392	2,478	21.51 (21.12-21.91)	3,976	795	6.93 (6.71-7.16)	591	118	4.82 (4.44-5.22)	373	75	3.07 (2.76-3.40)	11,801	2,360	28.22 (27.69-28.76)	3,603	721	8.49 (8.20-8.78)
Minnesota	6,723	1,345	21.73 (21.20-22.28)	2,334	467	7.62 (7.30-7.94)	459	92	6.38 (5.81-6.99)	259	52	3.59 (3.17-4.05)	6,264	1,253	27.91 (27.20-28.63)	2,075	415	9.24 (8.83-9.66)
Missouri	8,544	1,709	24.59 (24.06-25.14)	2,539	508	7.35 (7.06-7.65)	484	97	6.29 (5.75-6.88)	308	62	4.01 (3.57-4.48)	8,060	1,612	31.95 (31.24-32.68)	2,231	446	8.69 (8.33-9.08)
Mississippi	3,766	753	22.81 (22.06-23.57)	1,034	207	6.31 (5.93-6.72)	217	43	5.45 (4.75-6.22)	133	27	3.35 (2.80-3.97)	3,549	710	29.79 (28.79-30.81)	901	180	7.51 (7.01-8.03)
Montana	1,593	319	25.65 (24.34-27.02)	501	100	8.02 (7.29-8.79)	70	14	5.52 (4.30-6.97)	41	8	3.23 (2.32-4.38)	1,523	305	33.75 (31.99-35.59)	460	92	9.94 (9.01-10.95)
North Carolina	14,618	2,924	25.37 (24.95-25.79)	3,947	789	6.92 (6.70-7.14)	759	152	5.88 (5.47-6.31)	456	91	3.56 (3.24-3.90)	13,859	2,772	33.21 (32.65-33.78)	3,491	698	8.27 (7.99-8.55)
North Dakota	841	168	21.01 (19.57-22.54)	258	52	6.32 (5.55-7.17)	62	12	6.16 (4.79-7.90)	36	7	3.51 (2.46-4.87)	779	156	26.99 (25.05-29.03)	222	44	7.46 (6.47-8.54)
Nebraska	2,243	449	21.71 (20.80-22.66)	805	161	7.76 (7.22-8.32)	184	37	6.99 (6.01-8.07)	105	21	3.96 (3.24-4.80)	2,059	412	27.64 (26.42-28.90)	700	140	9.28 (8.59-10.02)
New Hampshire	1,977	395	24.28 (23.16-25.43)	652	130	8.05 (7.41-8.74)	107	21	7.08 (5.80-8.57)	66	13	4.46 (3.44-5.68)	1,870	374	31.19 (29.73-32.71)	586	117	9.50 (8.71-10.34)
New Jersey	14,083	2,817	27.89 (27.42-28.37)	3,745	749	7.45 (7.21-7.70)	756	151	6.93 (6.45-7.44)	405	81	3.73 (3.38-4.12)	13,327	2,665	36.32 (35.69-36.96)	3,340	668	8.95 (8.64-9.27)
New Mexico	2,067	413	17.45 (16.67-18.24)	713	143	5.90 (5.46-6.37)	121	24	4.47 (3.70-5.34)	67	13	2.49 (1.93-3.16)	1,946	389	22.67 (21.63-23.74)	646	129	7.27 (6.70-7.88)

Table 14 Continued

Central Cancer Registry	All Ages														
	0-19 Years						20+ Years								
	Malignant			All			Malignant			All					
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)	
Nevada ^d	2,190	730	22.75 (21.79-23.75)	687	229	7.06 (6.59-7.63)	133	44	6.02 (5.04-7.13)	86	29	3.87 (3.09-4.78)	2,057	656	29.48 (28.19-30.82)
New York	32,321	6,484	29.16 (28.83-29.49)	7,906	1,581	7.20 (7.03-7.36)	1,859	372	8.05 (7.69-8.42)	907	181	3.94 (3.69-4.21)	30,462	6,092	37.85 (37.22-38.09)
Ohio	13,994	2,799	21.06 (20.70-21.43)	5,056	1,011	7.63 (7.41-7.85)	1,016	203	6.95 (6.59-7.40)	603	121	4.14 (3.82-4.49)	12,978	2,596	26.74 (26.26-27.22)
Oklahoma	4,567	913	21.26 (20.64-21.90)	1,511	302	6.98 (6.63-7.35)	291	58	5.48 (4.87-6.15)	178	36	3.34 (2.87-3.87)	4,276	855	27.61 (26.77-28.48)
Oregon	4,861	972	20.49 (19.90-21.10)	1,703	341	7.21 (6.86-7.57)	284	57	5.87 (5.21-6.60)	177	35	3.66 (3.14-4.24)	4,577	915	26.37 (25.69-27.17)
Pennsylvania	20,292	4,058	26.53 (26.15-26.92)	5,795	1,159	7.66 (7.45-7.87)	992	198	6.56 (6.16-6.98)	602	120	4.03 (3.72-4.37)	19,300	3,860	34.57 (34.06-35.08)
Rhode Island	1,144	229	18.59 (17.48-19.75)	452	90	7.30 (6.61-8.03)	64	13	5.31 (4.08-6.79)	40	8	3.41 (2.44-4.65)	1,080	216	23.93 (22.47-25.47)
South Carolina	6,463	1,283	22.08 (21.53-22.65)	1,990	398	6.78 (6.48-7.10)	353	71	5.70 (5.12-6.32)	205	41	3.32 (2.88-3.81)	6,110	1,222	28.67 (27.93-29.43)
South Dakota	1,082	216	22.36 (20.99-23.79)	312	62	6.48 (5.76-7.28)	39	8	3.31 (2.35-4.52)	25	5	2.10 (1.36-3.10)	1,043	209	30.02 (28.15-31.98)
Tennessee	9,174	1,835	24.21 (23.70-24.72)	2,632	526	6.96 (6.69-7.24)	464	93	5.55 (5.06-6.08)	276	55	3.30 (2.93-3.72)	8,710	1,742	31.71 (31.03-32.40)
Texas	37,517	7,503	26.73 (26.46-27.01)	9,593	1,919	6.74 (6.60-6.88)	2,613	523	6.44 (6.19-6.69)	1,380	276	3.39 (3.21-3.57)	34,904	6,981	34.89 (34.52-35.27)
Utah	6,114	1,223	44.14 (43.03-45.28)	1,082	218	7.55 (7.10-8.02)	340	68	6.74 (6.04-7.50)	171	34	3.35 (2.87-3.89)	5,774	1,155	59.19 (57.85-60.76)
Virginia	9,257	1,851	19.73 (19.32-20.15)	3,010	602	6.45 (6.22-6.69)	541	108	5.17 (4.74-5.62)	346	69	3.31 (2.97-3.68)	8,716	1,743	25.59 (25.04-26.14)
Vermont	945	189	24.84 (23.18-26.59)	280	56	7.55 (6.63-8.55)	45	9	6.64 (4.83-8.90)	24	5	3.74 (2.39-5.56)	900	180	32.16 (29.97-34.47)
Washington	13,542	2,708	33.38 (32.80-33.96)	3,191	638	7.88 (7.60-8.16)	689	138	7.61 (7.05-8.20)	387	77	4.24 (3.83-4.69)	12,853	2,571	43.75 (42.97-44.53)
Wisconsin	9,315	1,863	28.00 (27.41-28.60)	2,547	509	7.85 (7.35-7.97)	440	88	6.12 (5.56-6.72)	269	54	3.77 (3.33-4.25)	8,875	1,775	36.80 (36.01-37.61)
West Virginia	2,834	567	25.90 (24.90-26.92)	821	164	7.50 (6.97-8.06)	149	30	7.19 (6.08-8.44)	80	16	3.90 (3.09-4.85)	2,685	537	33.42 (32.11-34.78)
Wyoming	708	142	22.02 (20.37-23.77)	227	45	7.06 (6.14-8.08)	36	7	4.80 (3.36-6.64)	19	4	2.52 (1.52-3.93)	672	134	28.95 (26.72-31.31)
TOTAL	445,792	89,158	24.71 (24.63-24.78)	126,345	25,269	7.02 (6.98-7.06)	25,339	5,068	6.20 (6.12-6.27)	14,263	2,853	3.50 (3.44-3.56)	420,453	84,091	32.15 (32.05-32.25)

With the exception of Nevada, where total cases represent three years of diagnoses (2015, 2016, 2017). Annual average cases are calculated by dividing the five-year total by five, with the exception of Nevada where annual average cases are obtained by dividing total by three.

Rates are per 100,000 and are age-adjusted to the 2000 US standard population.

Data not available for diagnosis years 2018-2019.

-- 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; CI, confidence interval; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Table 15 Five-Year Total, Annual Average Total^a, and Average Annual Age-Adjusted Incidence Rates^b with 95% Confidence Intervals for Children and Adolescents (Ages 0-19 Years) by Histopathology and Sex, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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	2,102	420	0.51 (0.49-0.54)	1,153	231	0.55 (0.52-0.58)	949	190	0.47 (0.44-0.51)
Diffuse astrocytoma	878	176	0.21 (0.20-0.23)	475	95	0.23 (0.21-0.25)	403	81	0.20 (0.18-0.22)
Anaplastic astrocytoma	332	66	0.08 (0.07-0.09)	188	38	0.09 (0.08-0.10)	144	29	0.07 (0.06-0.08)
Glioblastoma	695	139	0.17 (0.16-0.18)	389	78	0.19 (0.17-0.21)	306	61	0.15 (0.14-0.17)
Oligodendrogloma	145	29	0.04 (0.03-0.04)	71	14	0.03 (0.03-0.04)	74	15	0.04 (0.03-0.05)
Anaplastic oligodendrogloma	16	3	0.00 (0.00-0.01)	--	--	--	--	--	--
Oligoastrocytic tumors	36	7	0.01 (0.01-0.01)	--	--	--	--	--	--
Other Astrocytic Tumors	4,382	876	1.08 (1.04-1.11)	2,308	462	1.11 (1.06-1.15)	2,074	415	1.04 (1.00-1.09)
Pilocytic astrocytoma	3,885	777	0.95 (0.92-0.98)	2,033	407	0.98 (0.93-1.02)	1,852	370	0.93 (0.89-0.97)
Unique astrocytoma variants	497	99	0.12 (0.11-0.13)	275	55	0.13 (0.12-0.15)	222	44	0.11 (0.10-0.13)
Malignant	230	46	0.06 (0.05-0.06)	114	23	0.05 (0.05-0.07)	116	23	0.06 (0.05-0.07)
Non-Malignant	267	53	0.07 (0.06-0.07)	161	32	0.08 (0.07-0.09)	106	21	0.05 (0.04-0.06)
Ependymal Tumors	1,185	237	0.29 (0.27-0.31)	683	137	0.33 (0.30-0.35)	502	100	0.25 (0.23-0.27)
Malignant	966	193	0.24 (0.22-0.25)	548	110	0.26 (0.24-0.29)	418	84	0.21 (0.19-0.23)
Non-Malignant	219	44	0.05 (0.05-0.06)	135	27	0.06 (0.05-0.08)	84	17	0.04 (0.03-0.05)
Other Gliomas	3,188	638	0.78 (0.76-0.81)	1,577	315	0.76 (0.72-0.80)	1,611	322	0.81 (0.77-0.85)
Glioma malignant, NOS	3,160	632	0.78 (0.75-0.80)	--	--	--	--	--	--
Other neuroepithelial tumors	28	6	0.01 (0.00-0.01)	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	2,090	418	0.51 (0.49-0.53)	1,187	237	0.57 (0.54-0.60)	903	181	0.45 (0.42-0.48)
Malignant	120	24	0.03 (0.02-0.04)	60	12	0.03 (0.02-0.04)	60	12	0.03 (0.02-0.04)
Non-Malignant	1,970	394	0.48 (0.46-0.50)	1,127	225	0.54 (0.51-0.57)	843	169	0.42 (0.39-0.45)
Choroid Plexus Tumors	407	81	0.10 (0.09-0.11)	235	47	0.11 (0.10-0.13)	172	34	0.09 (0.07-0.10)
Malignant	98	20	0.02 (0.02-0.03)	63	13	0.03 (0.02-0.04)	35	7	0.02 (0.01-0.02)
Non-Malignant	309	62	0.08 (0.07-0.08)	172	34	0.08 (0.07-0.10)	137	27	0.07 (0.06-0.08)
Tumors of the Pineal Region	215	43	0.05 (0.05-0.06)	100	20	0.05 (0.04-0.06)	115	23	0.06 (0.05-0.07)
Malignant	179	36	0.04 (0.04-0.05)	--	--	--	--	--	--
Non-Malignant	36	7	0.01 (0.01-0.01)	--	--	--	--	--	--
Embryonal Tumors	2,338	468	0.58 (0.55-0.60)	1,406	281	0.68 (0.64-0.71)	932	186	0.47 (0.44-0.50)
Medulloblastoma	1,626	325	0.40 (0.38-0.42)	1,047	209	0.50 (0.47-0.54)	579	116	0.29 (0.27-0.32)

Table 15 Continued

Histopathology	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	372	74	0.09 (0.08-0.10)	191	38	0.09 (0.08-0.11)	181	36	0.09 (0.08-0.11)
All other embryonal	340	68	0.08 (0.07-0.09)	168	34	0.08 (0.07-0.09)	172	34	0.09 (0.07-0.10)
Tumors of Cranial and Spinal Nerves	1,173	235	0.29 (0.27-0.30)	622	124	0.30 (0.27-0.32)	551	110	0.27 (0.25-0.30)
Nerve sheath tumors	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--
Tumors of Meninges	1,252	250	0.30 (0.29-0.32)	610	122	0.29 (0.27-0.31)	642	128	0.32 (0.30-0.35)
Meningiomas	671	134	0.16 (0.15-0.18)	313	63	0.15 (0.13-0.17)	358	72	0.18 (0.16-0.20)
Malignant	21	4	0.01 (0.00-0.01)	--	--	--	--	--	--
Non-Malignant	650	130	0.16 (0.15-0.17)	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	133	27	0.03 (0.03-0.04)	75	15	0.04 (0.03-0.04)	58	12	0.03 (0.02-0.04)
Lymphoma	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	863	173	0.21 (0.20-0.23)	595	119	0.28 (0.26-0.31)	268	54	0.13 (0.12-0.15)
Malignant	770	154	0.19 (0.18-0.20)	536	107	0.26 (0.23-0.28)	234	47	0.12 (0.10-0.13)
Non-Malignant	93	19	0.02 (0.02-0.03)	59	12	0.03 (0.02-0.04)	34	7	0.02 (0.01-0.02)
Tumors of Sellar Region	4,530	906	1.10 (1.07-1.13)	1,406	281	0.67 (0.64-0.71)	3,124	625	1.55 (1.49-1.60)
Tumors of the pituitary	3,723	745	0.90 (0.87-0.93)	954	191	0.45 (0.43-0.48)	2,769	554	1.37 (1.32-1.42)
Craniopharyngioma	807	161	0.20 (0.18-0.21)	452	90	0.22 (0.20-0.24)	355	71	0.18 (0.16-0.20)
Unclassified Tumors	1,481	296	0.36 (0.34-0.38)	779	156	0.37 (0.35-0.40)	702	140	0.35 (0.33-0.38)
Hemangioma	486	97	0.12 (0.11-0.13)	260	52	0.12 (0.11-0.14)	226	45	0.11 (0.10-0.13)
Neoplasm, unspecified	811	162	0.20 (0.19-0.21)	422	84	0.20 (0.18-0.22)	389	78	0.19 (0.18-0.21)
Malignant	213	43	0.05 (0.05-0.06)	114	23	0.05 (0.05-0.07)	99	20	0.05 (0.04-0.06)
Non-Malignant	598	120	0.15 (0.13-0.16)	308	62	0.15 (0.13-0.17)	290	58	0.14 (0.13-0.16)
All other	184	37	0.05 (0.04-0.05)	97	19	0.05 (0.04-0.06)	87	17	0.04 (0.03-0.05)
Malignant	40	8	0.01 (0.01-0.01)	19	4	0.01 (0.01-0.01)	21	4	0.01 (0.01-0.02)
Non-Malignant	144	29	0.04 (0.03-0.04)	78	16	0.04 (0.03-0.05)	66	13	0.03 (0.03-0.04)

Table 15 Continued

Histopathology	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)
TOTAL^c	25,339	5,068	6.20 (6.12-6.27)	12,736	2,547	6.10 (6.00-6.21)	12,603	2,521	6.29 (6.18-6.40)
Malignant	14,385	2,877	3.53 (3.47-3.59)	7,854	1,571	3.77 (3.69-3.85)	6,531	1,306	3.28 (3.20-3.36)
Non-Malignant	10,954	2,191	2.67 (2.62-2.72)	4,882	976	2.33 (2.27-2.40)	6,072	1,214	3.02 (2.94-3.09)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cRefers to all brain tumors including histopathologies 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 All Brain and Other Central Nervous System Tumors by Histopathology and Race^c. CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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	74,935	14,987	4.92 (4.89-4.96)	5,369	1,074	2.45 (2.38-2.52)	439	88	2.15 (1.95-2.37)	1,799	360	1.72 (1.64-1.80)
Diffuse astrocytoma	6,581	1,316	0.50 (0.49-0.51)	593	119	0.26 (0.24-0.29)	48	10	0.21 (0.16-0.29)	210	42	0.20 (0.17-0.23)
Anaplastic astrocytoma	6,245	1,249	0.46 (0.44-0.47)	462	92	0.21 (0.19-0.23)	35	7	0.16 (0.11-0.22)	174	35	0.16 (0.14-0.19)
Glioblastoma	56,771	11,354	3.55 (3.52-3.58)	3,979	796	1.82 (1.76-1.88)	294	59	1.50 (1.33-1.70)	1,240	248	1.20 (1.13-1.27)
Oligodendroglioma	3,239	648	0.26 (0.25-0.27)	210	42	0.10 (0.09-0.11)	40	8	0.18 (0.13-0.24)	88	18	0.08 (0.06-0.10)
Anaplastic oligodendrogloma	1,638	328	0.12 (0.12-0.13)	98	20	0.04 (0.04-0.05)	--	--	--	69	14	0.06 (0.05-0.08)
Oligoastrocytic tumors	461	92	0.04 (0.03-0.04)	27	5	0.01 (0.01-0.02)	--	--	--	18	4	0.02 (0.01-0.03)
Other Astrocytic Tumors	4,994	999	0.45 (0.43-0.46)	774	155	0.33 (0.31-0.35)	60	12	0.23 (0.17-0.29)	168	34	0.17 (0.15-0.20)
Pilocytic astrocytoma	4,272	854	0.38 (0.37-0.40)	659	132	0.28 (0.26-0.30)	--	--	--	131	26	0.14 (0.11-0.16)
Unique astrocytoma variants	722	144	0.06 (0.06-0.07)	115	23	0.05 (0.04-0.06)	--	--	--	37	7	0.04 (0.03-0.05)
<i>Non-Malignant</i>	282	56	0.03 (0.02-0.03)	69	14	0.03 (0.02-0.04)	--	--	--	--	--	--
<i>Malignant</i>	440	88	0.04 (0.03-0.04)	46	9	0.02 (0.01-0.03)	--	--	--	--	--	--
Ependymal Tumors	5,851	1,170	0.45 (0.44-0.46)	617	123	0.27 (0.25-0.30)	54	11	0.24 (0.18-0.31)	180	36	0.17 (0.15-0.20)
<i>Non-Malignant</i>	2,610	522	0.20 (0.19-0.21)	218	44	0.10 (0.09-0.11)	27	5	0.12 (0.08-0.18)	56	11	0.05 (0.04-0.07)
<i>Malignant</i>	3,241	648	0.25 (0.25-0.26)	399	80	0.17 (0.16-0.19)	27	5	0.11 (0.07-0.17)	124	25	0.12 (0.10-0.14)
Other Gliomas	7,230	1,446	0.56 (0.55-0.58)	1,009	202	0.45 (0.42-0.48)	64	13	0.28 (0.21-0.37)	243	49	0.25 (0.22-0.28)
Glioma malignant, NOS	7,151	1,430	0.56 (0.54-0.57)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	79	16	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	34	7	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	45	9	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	4,344	869	0.36 (0.35-0.37)	563	113	0.24 (0.22-0.27)	39	8	0.16 (0.11-0.22)	210	42	0.21 (0.18-0.24)
<i>Non-Malignant</i>	3,527	705	0.30 (0.29-0.31)	494	99	0.21 (0.19-0.23)	--	--	--	--	--	--
<i>Malignant</i>	817	163	0.06 (0.06-0.06)	69	14	0.03 (0.03-0.04)	--	--	--	--	--	--
Choroid Plexus Tumors	681	136	0.06 (0.05-0.06)	78	16	0.03 (0.03-0.04)	--	--	--	--	--	--
<i>Non-Malignant</i>	585	117	0.05 (0.04-0.05)	--	--	--	--	--	--	--	--	--

Table 16 Continued

Histopathology	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)
Malignant	96	19	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Tumors of the Pineal Region	593	119	0.05 (0.04-0.05)	114	23	0.05 (0.04-0.06)	--	--	--	30	6	0.03 (0.02-0.04)
Non-Malignant	247	49	0.02 (0.02-0.02)	35	7	0.02 (0.01-0.02)	--	--	--	--	--	--
Malignant	346	69	0.03 (0.03-0.03)	79	16	0.03 (0.03-0.04)	--	--	--	--	--	--
Embryonal Tumors	2,515	503	0.23 (0.22-0.24)	370	74	0.15 (0.14-0.17)	36	7	0.14 (0.10-0.20)	122	24	0.13 (0.11-0.16)
Tumors of Cranial and Spinal Nerves	31,292	6,258	2.15 (2.13-2.17)	2,316	463	1.05 (1.01-1.09)	242	48	1.14 (1.00-1.30)	1,918	384	1.78 (1.70-1.87)
Nerve sheath tumors	31,263	6,253	2.15 (2.12-2.17)	--	--	--	--	--	--	--	--	--
Non-Malignant	31,087	6,217	2.14 (2.11-2.16)	--	--	--	--	--	--	--	--	--
Malignant	176	35	0.01 (0.01-0.02)	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	29	6	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Tumors of Meninges	148,601	29,720	9.62 (9.57-9.67)	23,645	4,729	11.43 (11.28-11.58)	1,139	228	6.18 (5.81-6.57)	7,002	1,400	7.01 (6.84-7.18)
Meningiomas	143,767	28,753	9.27 (9.22-9.32)	22,960	4,592	11.12 (10.97-11.27)	1,096	219	5.98 (5.61-6.37)	6,796	1,359	6.81 (6.65-6.98)
Non-Malignant	142,513	28,503	9.19 (9.14-9.24)	22,727	4,545	11.01 (10.86-11.16)	--	--	--	6,710	1,342	6.72 (6.56-6.89)
Malignant	1,254	251	0.08 (0.08-0.09)	233	47	0.11 (0.10-0.13)	--	--	--	86	17	0.09 (0.07-0.11)
Mesenchymal tumors	4,712	942	0.35 (0.34-0.36)	--	--	--	--	--	--	--	--	--
Non-Malignant	4,083	817	0.30 (0.29-0.31)	--	--	--	--	--	--	--	--	--
Malignant	629	126	0.05 (0.04-0.05)	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	122	24	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Non-Malignant	47	9	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Malignant	75	15	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	7,117	1,423	0.45 (0.44-0.46)	681	136	0.32 (0.29-0.34)	56	11	0.30 (0.23-0.40)	479	96	0.47 (0.43-0.51)
Lymphoma	7,085	1,417	0.45 (0.43-0.46)	--	--	--	56	11	0.30 (0.23-0.40)	--	--	--
Other hematopoietic neoplasms	32	6	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	962	192	0.09 (0.08-0.09)	149	30	0.06 (0.05-0.07)	--	--	--	109	22	0.11 (0.09-0.14)
Non-Malignant	131	26	0.01 (0.01-0.01)	17	3	0.01 (0.00-0.01)	--	--	--	--	--	--
Malignant	831	166	0.07 (0.07-0.08)	132	26	0.06 (0.05-0.07)	--	--	--	--	--	--

Table 16 Continued

Histopathology	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)
Tumors of Sellar Region	56,950	11,390	4.22 (4.19-4.26)	16,010	3,202	7.37 (7.26-7.49)	748	150	3.51 (3.25-3.78)	3,377	675	3.18 (3.07-3.29)
Tumors of the pituitary	54,706	10,941	4.05 (4.01-4.09)	15,393	3,079	7.10 (6.98-7.21)	716	143	3.37 (3.11-3.63)	3,238	648	3.04 (2.93-3.15)
Non-Malignant	54,625	10,925	4.04 (4.01-4.08)	15,372	3,074	7.09 (6.97-7.20)	--	--	--	--	--	--
Malignant	81	16	0.01 (0.00-0.01)	21	4	0.01 (0.01-0.01)	--	--	--	--	--	--
Craniopharyngioma	2,244	449	0.17 (0.16-0.18)	617	123	0.27 (0.25-0.30)	32	6	0.14 (0.10-0.20)	139	28	0.14 (0.11-0.16)
Unclassified Tumors	15,176	3,035	1.04 (1.02-1.06)	2,008	402	0.97 (0.93-1.02)	126	25	0.69 (0.57-0.83)	589	118	0.60 (0.56-0.66)
Hemangioma	3,435	687	0.26 (0.25-0.27)	447	89	0.20 (0.19-0.22)	--	--	--	175	35	0.17 (0.14-0.19)
Neoplasm, unspecified	11,309	2,262	0.75 (0.73-0.76)	1,496	299	0.74 (0.70-0.78)	90	18	0.53 (0.42-0.66)	395	79	0.42 (0.38-0.46)
Non-Malignant	5,566	1,113	0.38 (0.37-0.40)	912	182	0.44 (0.41-0.47)	46	9	0.26 (0.19-0.35)	208	42	0.21 (0.18-0.24)
Malignant	5,743	1,149	0.36 (0.35-0.37)	584	117	0.30 (0.27-0.33)	44	9	0.27 (0.19-0.37)	187	37	0.20 (0.18-0.24)
All other	432	86	0.03 (0.03-0.04)	65	13	0.03 (0.02-0.04)	--	--	--	19	4	0.02 (0.01-0.03)
Non-Malignant	391	78	0.03 (0.03-0.03)	--	--	--	--	--	--	--	--	--
Malignant	41	8	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
TOTAL^d	361,241	72,248	24.65 (24.56-24.73)	53,703	10,741	25.18 (24.96-25.40)	3,033	607	15.15 (14.59-15.72)	16,246	3,249	15.86 (15.61-16.11)
Malignant	109,685	21,937	7.51 (7.47-7.56)	9,759	1,952	4.43 (4.34-4.52)	755	151	3.63 (3.36-3.91)	3,398	680	3.34 (3.23-3.46)
Non-Malignant	251,556	50,311	17.13 (17.06-17.20)	43,944	8,789	20.75 (20.55-20.95)	2,278	456	11.52 (11.03-12.03)	12,848	2,570	12.51 (12.29-12.74)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cIndividuals with unknown race were excluded (N = 11,569).

^dRefers to all brain tumors including histopathologies 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 (Ages 0-19 Years), Brain and Other Central Nervous System Tumors by Histopathology and Race^c; CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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	1,677	335	0.54 (0.52-0.57)	247	49	0.36 (0.32-0.41)	19	4	0.25 (0.15-0.39)	74	15	0.29 (0.23-0.36)
Diffuse astrocytoma	706	141	0.23 (0.21-0.25)	94	19	0.14 (0.11-0.17)	--	--	--	25	5	0.10 (0.06-0.14)
Anaplastic astrocytoma	270	54	0.09 (0.08-0.10)	38	8	0.06 (0.04-0.08)	--	--	--	--	--	--
Glioblastoma	539	108	0.18 (0.16-0.19)	93	19	0.14 (0.11-0.17)	--	--	--	29	6	0.11 (0.08-0.16)
Oligodendroglioma	120	24	0.04 (0.03-0.05)	--	--	--	--	--	--	--	--	--
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	3,467	693	1.13 (1.10-1.17)	558	112	0.82 (0.75-0.89)	48	10	0.63 (0.46-0.83)	111	22	0.43 (0.35-0.52)
Pilocytic astrocytoma	3,091	618	1.01 (0.98-1.05)	481	96	0.70 (0.64-0.77)	--	--	--	94	19	0.37 (0.30-0.45)
Unique astrocytoma variants	376	75	0.12 (0.11-0.14)	77	15	0.11 (0.09-0.14)	--	--	--	17	3	0.07 (0.04-0.11)
Malignant	193	39	0.06 (0.05-0.07)	51	10	0.07 (0.06-0.10)	--	--	--	--	--	--
Non-Malignant	183	37	0.06 (0.05-0.07)	26	5	0.04 (0.03-0.06)	--	--	--	--	--	--
Ependymal Tumors	938	188	0.31 (0.29-0.33)	153	31	0.22 (0.19-0.26)	--	--	--	41	8	0.16 (0.11-0.22)
Malignant	187	37	0.06 (0.05-0.07)	16	3	0.02 (0.01-0.04)	--	--	--	--	--	--
Non-Malignant	751	150	0.24 (0.23-0.26)	137	27	0.20 (0.17-0.24)	--	--	--	--	--	--
Other Gliomas	2,439	488	0.80 (0.77-0.83)	457	91	0.67 (0.61-0.74)	29	6	0.38 (0.25-0.54)	105	21	0.41 (0.33-0.49)
Glioma malignant, NOS	2,418	484	0.79 (0.76-0.82)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	21	4	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	1,640	328	0.53 (0.51-0.56)	277	55	0.41 (0.36-0.46)	21	4	0.28 (0.17-0.42)	82	16	0.32 (0.25-0.40)
Malignant	1,540	308	0.50 (0.48-0.53)	--	--	--	--	--	--	--	--	--
Non-Malignant	100	20	0.03 (0.03-0.04)	--	--	--	--	--	--	--	--	--
Choroid Plexus Tumors	324	65	0.11 (0.09-0.12)	48	10	0.07 (0.05-0.09)	--	--	--	--	--	--
Malignant	249	50	0.08 (0.07-0.09)	--	--	--	--	--	--	--	--	--
Non-Malignant	75	15	0.02 (0.02-0.03)	--	--	--	--	--	--	--	--	--
Tumors of the Pineal Region	145	29	0.05 (0.04-0.06)	51	10	0.07 (0.06-0.10)	--	--	--	--	--	--

Table 17 Continued

Histopathology	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)
Malignant	29	6	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Non-Malignant	116	23	0.04 (0.03-0.05)	--	--	--	--	--	--	--	--	--
Embryonal Tumors	1,825	365	0.60 (0.57-0.63)	284	57	0.41 (0.37-0.47)	26	5	0.34 (0.22-0.49)	106	21	0.41 (0.34-0.50)
Medulloblastoma	1,289	258	0.42 (0.40-0.45)	170	34	0.25 (0.21-0.29)	--	--	--	75	15	0.29 (0.23-0.36)
Atypical teratoid/rhabdoid tumor	280	56	0.09 (0.08-0.10)	55	11	0.08 (0.06-0.10)	--	--	--	--	--	--
All other embryonal	256	51	0.08 (0.07-0.09)	59	12	0.09 (0.07-0.11)	--	--	--	--	--	--
Tumors of Cranial and Spinal Nerves	915	183	0.30 (0.28-0.32)	130	26	0.19 (0.16-0.23)	--	--	--	43	9	0.17 (0.12-0.22)
Nerve sheath tumors	--	--	--	130	26	0.19 (0.16-0.23)	--	--	--	43	9	0.17 (0.12-0.22)
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	974	195	0.32 (0.30-0.34)	177	35	0.26 (0.22-0.30)	--	--	--	41	8	0.16 (0.11-0.22)
Meningiomas	520	104	0.17 (0.15-0.18)	103	21	0.15 (0.12-0.18)	--	--	--	17	3	0.07 (0.04-0.11)
Malignant	502	100	0.16 (0.15-0.18)	--	--	--	--	--	--	--	--	--
Non-Malignant	18	4	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	74	15	0.11 (0.09-0.14)	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	95	19	0.03 (0.03-0.04)	16	3	0.02 (0.01-0.04)	--	--	--	--	--	--
Lymphoma	95	19	0.03 (0.03-0.04)	16	3	0.02 (0.01-0.04)	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	640	128	0.21 (0.19-0.22)	101	20	0.15 (0.12-0.18)	--	--	--	81	16	0.31 (0.25-0.39)
Malignant	68	14	0.02 (0.02-0.03)	--	--	--	--	--	--	--	--	--
Non-Malignant	572	114	0.19 (0.17-0.20)	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	3,407	681	1.10 (1.06-1.13)	657	131	0.96 (0.89-1.04)	55	11	0.73 (0.55-0.95)	149	30	0.58 (0.49-0.68)
Tumors of the pituitary	2,820	564	0.90 (0.87-0.94)	518	104	0.76 (0.70-0.83)	--	--	--	114	23	0.44 (0.36-0.53)

Table 17 Continued

Histopathology	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)
<i>Malignant</i>	2,820	564	0.90 (0.87-0.94)	518	104	0.76 (0.70-0.83)	--	--	--	114	23	0.44 (0.36-0.53)
<i>Non-Malignant</i>	--	--	--	--	--	--	--	--	--	--	--	--
Craniopharyngioma	587	117	0.19 (0.18-0.21)	139	28	0.20 (0.17-0.24)	--	--	--	35	7	0.14 (0.09-0.19)
Unclassified Tumors	1,170	234	0.38 (0.36-0.40)	176	35	0.26 (0.22-0.30)	--	--	--	31	6	0.12 (0.08-0.17)
Hemangioma	404	81	0.13 (0.12-0.14)	42	8	0.06 (0.04-0.08)	--	--	--	--	--	--
Neoplasm, unspecified	624	125	0.20 (0.19-0.22)	104	21	0.15 (0.12-0.19)	--	--	--	16	3	0.06 (0.04-0.10)
<i>Malignant</i>	469	94	0.15 (0.14-0.17)	70	14	0.10 (0.08-0.13)	--	--	--	--	--	--
<i>Non-Malignant</i>	155	31	0.05 (0.04-0.06)	34	7	0.05 (0.03-0.07)	--	--	--	--	--	--
All other	142	28	0.05 (0.04-0.05)	30	6	0.04 (0.03-0.06)	--	--	--	--	--	--
<i>Malignant</i>	116	23	0.04 (0.03-0.05)	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	26	5	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
TOTAL^a	19,656	3,931	6.39 (6.30-6.48)	3,332	666	4.89 (4.72-5.06)	257	51	3.38 (2.98-3.82)	894	179	3.47 (3.25-3.71)
<i>Non-Malignant</i>	8,552	1,710	2.77 (2.71-2.82)	1,473	295	2.16 (2.05-2.28)	118	24	1.56 (1.29-1.87)	367	73	1.42 (1.28-1.58)
<i>Malignant</i>	11,104	2,221	3.63 (3.56-3.70)	1,859	372	2.73 (2.60-2.85)	139	28	1.82 (1.53-2.15)	527	105	2.05 (1.88-2.23)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cIndividuals with unknown race were excluded (N = 1200).

^dRefers to all brain tumors including histopathologies 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 All Brain and Other Central Nervous System Tumors by Histopathology, Hispanic Ethnicity^c, and Race, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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	76,233	15,247	4.67 (4.64-4.71)	7,779	1,556	3.49 (3.40-3.57)	7,125	1,425	3.52 (3.43-3.60)	208	42	2.00 (1.72-2.32)
Diffuse astrocytoma	6,753	1,351	0.49 (0.47-0.50)	881	176	0.34 (0.31-0.36)	795	159	0.34 (0.31-0.36)	23	5	0.16 (0.10-0.25)
Anaplastic astrocytoma	6,363	1,273	0.44 (0.43-0.45)	683	137	0.27 (0.25-0.29)	616	123	0.27 (0.25-0.29)	24	5	0.18 (0.11-0.28)
Glioblastoma	57,829	11,566	3.36 (3.33-3.39)	5,429	1,086	2.59 (2.52-2.66)	4,999	1,000	2.61 (2.54-2.69)	148	30	1.58 (1.31-1.87)
Oligodendrogloma	3,209	642	0.24 (0.24-0.25)	478	96	0.18 (0.16-0.19)	431	86	0.18 (0.16-0.20)	--	--	--
Anaplastic oligodendrogloma	1,617	323	0.12 (0.11-0.12)	254	51	0.10 (0.09-0.11)	233	47	0.10 (0.09-0.11)	--	--	--
Oligoastrocytic tumors	462	92	0.03 (0.03-0.04)	54	11	0.02 (0.02-0.03)	51	10	0.02 (0.02-0.03)	--	--	--
Other Astrocytic Tumors	5,231	1,046	0.46 (0.45-0.47)	1,021	204	0.30 (0.28-0.32)	907	181	0.30 (0.28-0.32)	26	5	0.15 (0.09-0.23)
Pilocytic astrocytoma	4,494	899	0.40 (0.39-0.41)	845	169	0.25 (0.23-0.26)	748	150	0.25 (0.23-0.26)	21	4	0.12 (0.07-0.20)
Unique astrocytoma variants	737	147	0.06 (0.06-0.07)	176	35	0.06 (0.05-0.07)	159	32	0.06 (0.05-0.07)	--	--	--
<i>Non-Malignant</i>	301	60	0.03 (0.02-0.03)	80	16	0.02 (0.02-0.03)	71	14	0.02 (0.02-0.03)	--	--	--
<i>Malignant</i>	436	87	0.04 (0.03-0.04)	96	19	0.03 (0.03-0.04)	88	18	0.03 (0.03-0.04)	--	--	--
Ependymal Tumors	5,893	1,179	0.43 (0.42-0.44)	1,018	204	0.36 (0.34-0.39)	912	182	0.36 (0.34-0.39)	27	5	0.18 (0.11-0.28)
<i>Non-Malignant</i>	2,615	523	0.19 (0.18-0.19)	387	77	0.15 (0.13-0.16)	339	68	0.14 (0.13-0.16)	--	--	--
<i>Malignant</i>	3,278	656	0.25 (0.24-0.25)	631	126	0.22 (0.20-0.24)	573	115	0.22 (0.20-0.24)	--	--	--
Other Gliomas	7,598	1,520	0.57 (0.56-0.59)	1,256	251	0.45 (0.43-0.48)	1,097	219	0.44 (0.41-0.47)	57	11	0.43 (0.31-0.58)
Glioma malignant, NOS	7,519	1,504	0.57 (0.55-0.58)	1,234	247	0.44 (0.42-0.47)	1,077	215	0.43 (0.41-0.46)	57	11	0.43 (0.31-0.58)
Other neuroepithelial tumors	79	16	0.01 (0.00-0.01)	22	4	0.01 (0.00-0.01)	20	4	0.01 (0.00-0.01)	--	--	--
<i>Non-Malignant</i>	34	7	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	45	9	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	4,558	912	0.37 (0.35-0.38)	781	156	0.25 (0.23-0.27)	688	138	0.25 (0.23-0.27)	31	6	0.19 (0.12-0.27)
<i>Non-Malignant</i>	3,729	746	0.31 (0.30-0.32)	650	130	0.20 (0.19-0.22)	569	114	0.20 (0.18-0.22)	--	--	--
<i>Malignant</i>	829	166	0.06 (0.05-0.06)	131	26	0.05 (0.04-0.06)	119	24	0.05 (0.04-0.06)	--	--	--
Choroid Plexus Tumors	665	133	0.05 (0.05-0.06)	162	32	0.05 (0.04-0.06)	143	29	0.05 (0.04-0.06)	--	--	--
<i>Non-Malignant</i>	578	116	0.05 (0.04-0.05)	128	26	0.04 (0.04-0.05)	114	23	0.04 (0.03-0.05)	--	--	--
<i>Malignant</i>	87	17	0.01 (0.01-0.01)	34	7	0.01 (0.01-0.01)	29	6	0.01 (0.01-0.01)	--	--	--
Tumors of the Pineal Region	659	132	0.05 (0.05-0.06)	110	22	0.04 (0.03-0.05)	100	20	0.04 (0.03-0.05)	--	--	--
<i>Non-Malignant</i>	272	54	0.02 (0.02-0.02)	35	7	0.01 (0.01-0.02)	31	6	0.01 (0.01-0.02)	--	--	--

Table 18 Continued

Histopathology	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)
<i>Malignant</i>	387	77	0.03 (0.03-0.03)	75	15	0.02 (0.02-0.03)	69	14	0.03 (0.02-0.03)	--	--	--
Embryonal Tumors	2,453	491	0.22 (0.21-0.23)	717	143	0.21 (0.19-0.23)	651	130	0.21 (0.20-0.23)	22	4	0.10 (0.06-0.16)
Tumors of Cranial and Spinal Nerves	33,525	6,705	2.15 (2.13-2.18)	3,523	705	1.45 (1.40-1.51)	3,120	624	1.42 (1.37-1.48)	96	19	0.83 (0.66-1.03)
Nerve sheath tumors	33,495	6,699	2.15 (2.13-2.18)	3,520	704	1.45 (1.40-1.50)	--	--	--	96	19	0.83 (0.66-1.03)
<i>Non-Malignant</i>	33,329	6,666	2.14 (2.12-2.16)	3,475	695	1.43 (1.39-1.49)	--	--	--	--	--	--
<i>Malignant</i>	166	33	0.01 (0.01-0.01)	45	9	0.02 (0.01-0.02)	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	30	6	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Tumors of Meninges	165,351	33,070	9.97 (9.92-10.02)	19,054	3,811	9.33 (9.20-9.47)	17,215	3,443	9.25 (9.10-9.39)	544	109	5.98 (5.45-6.54)
Meningiomas	160,230	32,046	9.62 (9.57-9.66)	18,217	3,643	9.02 (8.88-9.15)	16,462	3,292	8.93 (8.79-9.07)	532	106	5.88 (5.35-6.43)
<i>Non-Malignant</i>	158,843	31,769	9.53 (9.48-9.58)	17,989	3,598	8.90 (8.77-9.04)	16,250	3,250	8.81 (8.67-8.96)	--	--	--
<i>Malignant</i>	1,387	277	0.08 (0.08-0.09)	228	46	0.11 (0.10-0.13)	212	42	0.11 (0.10-0.13)	--	--	--
Mesenchymal tumors	4,989	998	0.35 (0.34-0.36)	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	4,351	870	0.30 (0.29-0.31)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	638	128	0.04 (0.04-0.05)	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	132	26	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
<i>Non-Malignant</i>	50	10	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	82	16	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	7,461	1,492	0.44 (0.43-0.45)	1,064	213	0.51 (0.48-0.55)	997	199	0.53 (0.49-0.56)	17	3	0.18 (0.10-0.29)
Lymphoma	7,427	1,485	0.44 (0.43-0.45)	1,055	211	0.51 (0.48-0.54)	989	198	0.52 (0.49-0.56)	17	3	0.18 (0.10-0.29)
Other hematopoietic neoplasms	34	7	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	997	199	0.09 (0.08-0.09)	283	57	0.08 (0.07-0.09)	251	50	0.08 (0.07-0.09)	--	--	--
<i>Non-Malignant</i>	137	27	0.01 (0.01-0.01)	33	7	0.01 (0.01-0.02)	30	6	0.01 (0.01-0.02)	--	--	--
<i>Malignant</i>	860	172	0.08 (0.07-0.08)	250	50	0.07 (0.06-0.08)	221	44	0.07 (0.06-0.08)	--	--	--
Tumors of Sellar Region	66,389	13,278	4.58 (4.55-4.62)	13,607	2,721	5.33 (5.24-5.43)	12,037	2,407	5.23 (5.14-5.33)	486	97	3.85 (3.49-4.24)
Tumors of the pituitary	63,773	12,755	4.39 (4.35-4.43)	13,090	2,618	5.15 (5.06-5.24)	11,579	2,316	5.05 (4.96-5.15)	462	92	3.71 (3.35-4.09)
<i>Non-Malignant</i>	63,682	12,736	4.38 (4.35-4.42)	13,073	2,615	5.14 (5.05-5.23)	--	--	--	462	92	3.71 (3.35-4.09)
<i>Malignant</i>	91	18	0.01 (0.00-0.01)	17	3	0.01 (0.00-0.01)	--	--	--	--	--	--

Table 18 Continued

Histopathology	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)
Craniopharyngioma	2,616	523	0.19 (0.18-0.20)	517	103	0.18 (0.17-0.20)	458	92	0.18 (0.16-0.20)	24	5	0.14 (0.09-0.22)
Unclassified Tumors	15,998	3,200	1.03 (1.01-1.04)	2,406	481	1.08 (1.03-1.13)	2,159	432	1.07 (1.03-1.12)	60	12	0.56 (0.41-0.74)
Hemangioma	3,525	705	0.25 (0.24-0.26)	690	138	0.26 (0.24-0.28)	620	124	0.26 (0.24-0.29)	22	4	0.16 (0.10-0.25)
Neoplasm, unspecified	12,045	2,409	0.75 (0.73-0.76)	1,602	320	0.77 (0.73-0.81)	1,434	287	0.77 (0.72-0.81)	37	7	0.39 (0.27-0.56)
<i>Non-Malignant</i>	5,999	1,200	0.39 (0.38-0.40)	955	191	0.42 (0.39-0.45)	834	167	0.40 (0.38-0.43)	26	5	0.29 (0.18-0.44)
<i>Malignant</i>	6,046	1,209	0.36 (0.35-0.37)	647	129	0.36 (0.33-0.39)	600	120	0.36 (0.33-0.39)	--	--	--
All other	428	86	0.03 (0.03-0.04)	114	23	0.04 (0.04-0.05)	105	21	0.04 (0.04-0.05)	--	--	--
<i>Non-Malignant</i>	379	76	0.03 (0.02-0.03)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	49	10	0.00 (0.00-0.01)	--	--	--	--	--	--	--	--	--
TOTAL^d	393,011	78,602	25.09 (25.01-25.17)	52,781	10,556	22.95 (22.74-23.16)	47,402	9,480	22.76 (22.55-22.98)	1,591	318	14.55 (13.77-15.35)
Malignant	112,404	22,481	7.25 (7.21-7.30)	13,941	2,788	5.85 (5.75-5.96)	12,699	2,540	5.91 (5.80-6.02)	380	76	3.23 (2.87-3.61)
Non-Malignant^d	280,607	56,121	17.84 (17.77-17.90)	38,840	7,768	17.09 (16.92-17.27)	34,703	6,941	16.86 (16.67-17.04)	1,211	242	11.32 (10.63-12.03)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cHispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).

^dRefers to all brain tumors including histopathologies 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 Five-Year Total, Annual Average Total^a, and Average Annual Age-Adjusted Incidence Rates^b with 95% Confidence Intervals for Children and Adolescents (Ages 0-19 Years), Brain and Other Central Nervous System Tumors by Histopathology, Hispanic Ethnicity^c, and Race, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2015-2019

Histopathology	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	1,730	346	0.56 (0.53-0.59)	372	74	0.37 (0.33-0.41)	333	67	0.37 (0.33-0.42)	--	--	--
Diffuse astrocytoma	736	147	0.24 (0.22-0.26)	142	28	0.14 (0.12-0.17)	125	25	0.14 (0.12-0.17)	--	--	--
Anaplastic astrocytoma	271	54	0.09 (0.08-0.10)	61	12	0.06 (0.05-0.08)	55	11	0.06 (0.05-0.08)	--	--	--
Glioblastoma	551	110	0.18 (0.16-0.19)	144	29	0.14 (0.12-0.17)	129	26	0.14 (0.12-0.17)	--	--	--
Oligodendroglioma	129	26	0.04 (0.03-0.05)	16	3	0.02 (0.01-0.03)	16	3	0.02 (0.01-0.03)	--	--	--
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	3,611	722	1.18 (1.14-1.22)	771	154	0.75 (0.70-0.81)	689	138	0.76 (0.71-0.82)	16	3	0.26 (0.15-0.42)
Piloicytic astrocytoma	3,219	644	1.05 (1.02-1.09)	666	133	0.65 (0.60-0.70)	596	119	0.66 (0.61-0.71)	--	--	--
Unique astrocytoma variants	392	78	0.13 (0.12-0.14)	105	21	0.10 (0.08-0.13)	93	19	0.10 (0.08-0.13)	--	--	--
<i>Non-Malignant</i>	207	41	0.07 (0.06-0.08)	60	12	0.06 (0.04-0.08)	52	10	0.06 (0.04-0.08)	--	--	--
<i>Malignant</i>	185	37	0.06 (0.05-0.07)	45	9	0.05 (0.03-0.06)	41	8	0.05 (0.03-0.06)	--	--	--
Ependymal Tumors	912	182	0.30 (0.28-0.32)	273	55	0.27 (0.24-0.30)	248	50	0.28 (0.24-0.31)	--	--	--
<i>Non-Malignant</i>	170	34	0.05 (0.05-0.06)	49	10	0.05 (0.04-0.07)	43	9	0.05 (0.04-0.07)	--	--	--
<i>Malignant</i>	742	148	0.24 (0.23-0.26)	224	45	0.22 (0.19-0.25)	205	41	0.23 (0.20-0.26)	--	--	--
Other Gliomas	2,576	515	0.84 (0.81-0.88)	612	122	0.60 (0.55-0.65)	530	106	0.59 (0.54-0.64)	31	6	0.48 (0.33-0.69)
Glioma malignant, NOS	2,556	511	0.84 (0.81-0.87)	--	--	--	--	--	--	31	6	0.48 (0.33-0.69)
Other neuroepithelial tumors	20	4	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	1,711	342	0.55 (0.53-0.58)	379	76	0.38 (0.34-0.42)	336	67	0.38 (0.34-0.42)	17	3	0.28 (0.16-0.45)
<i>Non-Malignant</i>	1,618	324	0.52 (0.50-0.55)	352	70	0.35 (0.31-0.39)	312	62	0.35 (0.31-0.39)	16	3	0.27 (0.15-0.43)
<i>Malignant</i>	93	19	0.03 (0.02-0.04)	27	5	0.03 (0.02-0.04)	24	5	0.03 (0.02-0.04)	--	--	--
Choroid Plexus Tumors	310	62	0.10 (0.09-0.11)	97	19	0.09 (0.08-0.11)	85	17	0.09 (0.07-0.12)	--	--	--
<i>Non-Malignant</i>	240	48	0.08 (0.07-0.09)	69	14	0.07 (0.05-0.09)	62	12	0.07 (0.05-0.09)	--	--	--
<i>Malignant</i>	70	14	0.02 (0.02-0.03)	28	6	0.03 (0.02-0.04)	23	5	0.03 (0.02-0.04)	--	--	--

Table 19 Continued

Histopathology	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)
Tumors of the Pineal Region	171	34	0.06 (0.05-0.06)	44	9	0.04 (0.03-0.06)	37	7	0.04 (0.03-0.06)	--	--	--
Non-Malignant	28	6	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Malignant	143	29	0.05 (0.04-0.05)	--	--	--	--	--	--	--	--	--
Embryonal Tumors	1,814	363	0.60 (0.57-0.63)	524	105	0.51 (0.46-0.55)	475	95	0.52 (0.48-0.57)	21	4	0.33 (0.20-0.50)
Medulloblastoma	1,268	254	0.42 (0.40-0.44)	358	72	0.35 (0.31-0.39)	325	65	0.36 (0.32-0.40)	--	--	--
Atypical teratoid/rhabdoid tumor	291	58	0.10 (0.09-0.11)	81	16	0.08 (0.06-0.10)	76	15	0.08 (0.07-0.10)	--	--	--
All other embryonal	255	51	0.08 (0.07-0.09)	85	17	0.08 (0.07-0.10)	74	15	0.08 (0.06-0.10)	--	--	--
Tumors of Cranial and Spinal Nerves	928	186	0.30 (0.28-0.32)	245	49	0.24 (0.21-0.28)	208	42	0.23 (0.20-0.27)	--	--	--
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	954	191	0.31 (0.29-0.33)	298	60	0.30 (0.27-0.33)	274	55	0.31 (0.27-0.35)	--	--	--
Meningiomas	525	105	0.17 (0.15-0.18)	--	--	--	--	--	--	--	--	--
Non-Malignant	508	102	0.16 (0.15-0.18)	--	--	--	--	--	--	--	--	--
Malignant	17	3	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	151	30	0.15 (0.13-0.18)	140	28	0.16 (0.13-0.19)	--	--	--
Non-Malignant	--	--	--	129	26	0.13 (0.11-0.15)	118	24	0.13 (0.11-0.16)	--	--	--
Malignant	--	--	--	22	4	0.02 (0.01-0.03)	22	4	0.02 (0.02-0.04)	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	108	22	0.04 (0.03-0.04)	25	5	0.02 (0.02-0.04)	22	4	0.02 (0.02-0.04)	--	--	--
Lymphoma	108	22	0.04 (0.03-0.04)	25	5	0.02 (0.02-0.04)	22	4	0.02 (0.02-0.04)	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	658	132	0.21 (0.20-0.23)	205	41	0.20 (0.18-0.23)	185	37	0.21 (0.18-0.24)	--	--	--
Non-Malignant	78	16	0.03 (0.02-0.03)	--	--	--	--	--	--	--	--	--
Malignant	580	116	0.19 (0.17-0.20)	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	3,226	645	1.03 (0.99-1.06)	1,304	261	1.32 (1.25-1.40)	1,145	229	1.31 (1.24-1.39)	43	9	0.72 (0.52-0.97)
Tumors of the pituitary	2,618	524	0.83 (0.80-0.86)	1,105	221	1.13 (1.06-1.20)	967	193	1.11 (1.04-1.19)	--	--	--

Table 19 Continued

Histopathology	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)
Craniotharyngioma	608	122	0.20 (0.18-0.22)	199	40	0.20 (0.17-0.23)	178	36	0.20 (0.17-0.23)	--	--	--
Unclassified Tumors	1,111	222	0.36 (0.34-0.38)	370	74	0.37 (0.33-0.41)	322	64	0.36 (0.32-0.40)	--	--	--
Hemangioma	368	74	0.12 (0.11-0.13)	118	24	0.12 (0.10-0.14)	106	21	0.12 (0.10-0.14)	--	--	--
Neoplasm, unspecified	610	122	0.20 (0.18-0.21)	201	40	0.20 (0.17-0.23)	169	34	0.19 (0.16-0.22)	--	--	--
<i>Non-Malignant</i>	443	89	0.14 (0.13-0.16)	155	31	0.15 (0.13-0.18)	129	26	0.15 (0.12-0.17)	--	--	--
<i>Malignant</i>	167	33	0.05 (0.05-0.06)	46	9	0.05 (0.03-0.06)	40	8	0.04 (0.03-0.06)	--	--	--
All other	133	27	0.04 (0.04-0.05)	51	10	0.05 (0.04-0.07)	47	9	0.05 (0.04-0.07)	--	--	--
<i>Non-Malignant</i>	98	20	0.03 (0.03-0.04)	--	--	--	--	--	--	--	--	--
<i>Malignant</i>	35	7	0.01 (0.01-0.02)	--	--	--	--	--	--	--	--	--
TOTAL^d	19,820	3,964	6.44 (6.35-6.53)	5,519	1,104	5.47 (5.33-5.62)	4,889	978	5.48 (5.33-5.64)	182	36	2.94 (2.53-3.40)
<i>Non-Malignant</i>	8,379	1,676	2.70 (2.64-2.76)	2,697	539	2.71 (2.61-2.81)	2,373	475	2.69 (2.58-2.80)	83	17	1.39 (1.10-1.72)
<i>Malignant</i>	11,441	2,288	3.74 (3.67-3.81)	2,822	564	2.76 (2.66-2.86)	2,516	503	2.79 (2.68-2.90)	99	20	1.55 (1.26-1.89)

^aAnnual average cases are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

^cHispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).

^dRefers to all brain tumors including histopathologies 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 20 Estimated Number of Cases^{a,b} of Brain and Other Central Nervous System Tumors Overall and by Behavior by Central Cancer Registry for Diagnosis Years 2022 and 2023

Central Cancer Registry	2022			2023		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total ^c
Alabama	410	780	1,190	410	810	1,220
Alaska	60	140	200	60	140	200
Arizona	580	1,140	1,720	590	1,160	1,750
Arkansas	270	600	870	280	620	900
California	2,930	7,580	10,510	2,960	7,800	10,770
Colorado	460	1,420	1,870	460	1,460	1,920
Connecticut	340	760	1,090	340	780	1,120
Delaware	80	160	250	90	170	250
District of Columbia	--	--	210	--	--	220
Florida	1,910	5,140	7,050	1,930	5,270	7,200
Georgia	780	2,740	3,520	790	2,880	3,670
Hawaii	80	240	320	80	250	330
Idaho	160	380	540	160	400	560
Illinois	1,020	2,960	3,980	1,030	3,050	4,080
Indiana	550	1,060	1,610	560	1,070	1,630
Iowa	290	720	1,000	290	740	1,030
Kansas	230	570	800	230	590	820
Kentucky	450	1,180	1,630	460	1,210	1,670
Louisiana	340	1,180	1,520	350	1,220	1,570
Maine	140	180	320	140	180	320
Maryland	480	1,480	1,960	480	1,560	2,040
Massachusetts	600	1,050	1,660	610	1,080	1,690
Michigan	800	1,640	2,440	800	1,660	2,460
Minnesota	520	1,030	1,550	530	1,090	1,610
Mississippi	220	620	840	220	640	870
Missouri	540	1,260	1,790	540	1,290	1,830
Montana	110	240	350	110	250	360
Nebraska	170	310	480	170	310	490
Nevada ^d	260	590	850	270	610	880
New Hampshire	140	280	420	150	290	430
New Jersey	780	2,420	3,200	780	2,530	3,310
New Mexico	150	300	460	160	310	470
New York	1,590	5,250	6,830	1,590	5,400	6,990
North Carolina	880	2,480	3,360	890	2,580	3,470
North Dakota	60	130	180	60	130	190
Ohio	1,060	1,920	2,990	1,070	1,980	3,050
Oklahoma	310	750	1,070	310	780	1,100
Oregon	380	640	1,020	380	650	1,040
Pennsylvania	1,230	3,130	4,350	1,240	3,200	4,440
Rhode Island	90	120	200	90	120	200
South Carolina	450	1,030	1,480	460	1,070	1,520
South Dakota	70	190	260	70	200	270
Tennessee	580	1,450	2,030	590	1,480	2,070
Texas	2,080	6,550	8,630	2,110	6,820	8,930
Utah	250	1,390	1,640	250	1,490	1,740

Table 20 Continued

Central Cancer Registry	2022			2023		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total ^{c+}
Vermont	60	130	190	60	130	190
Virginia	680	1,360	2,040	690	1,400	2,090
Washington	700	2,420	3,130	720	2,530	3,240
West Virginia	160	440	600	160	460	620
Wisconsin	550	1,600	2,150	550	1,660	2,210
Wyoming	50	100	160	50	110	160
United States	26,670	66,800	93,470	26,940	67,440	94,390

^aSource: Estimation based on CBTRUS, NPCR, and SEER 2000-2018 data for malignant tumors, and NPCR and SEER 2006-2018 data for non-malignant tumors.

^bRounded to the nearest 10. Numbers may not add up due to rounding.

^cTotal estimate is based on histopathology-specific estimate and may not add up to total by state.

^dIncidence data not available for 2018-2019, these years are not used for estimation.

- 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 21 Estimated Number of Cases^{a,b} in the United States of Brain and Other Central Nervous System Tumors Overall and by Behavior and Histopathology^c for Diagnosis Years 2022 and 2023

Histopathology	2022			2023		
	Malignant	Non-Malignant	Total	Malignant	Non-Malignant	Total
<i>Diffuse Astrocytic and Oligodendroglial Tumors</i>	--	--	17,760	--	--	17,950
Diffuse astrocytoma	--	--	1,440	--	--	1,420
Anaplastic astrocytoma	--	--	1,090	--	--	1,020
Glioblastoma	--	--	14,190	--	--	14,490
Oligodendroglioma	--	--	660	--	--	650
Anaplastic oligodendroglioma	--	--	390	--	--	390
Oligoastrocytic tumors	--	--	--	--	--	--
<i>Other Astrocytic Tumors</i>	1,260	310	1,560	1,270	350	1,620
Pilocytic astrocytoma	1,130	220	1,340	1,130	260	1,400
Unique astrocytoma variants	130	90	220	130	90	230
<i>Ependymal Tumors</i>	710	680	1,390	700	690	1,390
<i>Other Gliomas</i>	--	--	1,990	--	--	2,030
Glioma malignant, NOS	--	--	1,970	--	--	2,010
Other neuroepithelial tumors	--	--	--	--	--	--
<i>Neuronal and Mixed Neuronal-Glial Tumors</i>	220	980	1,200	220	1,000	1,220
<i>Choroid Plexus Tumors</i>	--	--	170	--	--	170
<i>Tumors of the Pineal Region</i>	110	70	180	110	70	180
<i>Embryonal Tumors</i>	--	--	560	--	--	550
<i>Tumors of Cranial and Paraspinal Nerves</i>	--	--	6,380	--	--	6,190
Nerve sheath tumors	--	--	6,380	--	--	6,190
Other tumors of cranial and paraspinal nerves	--	--	--	--	--	--
<i>Tumors of Meninges</i>	470	41,600	42,060	460	42,710	43,170
Meningiomas	280	40,820	41,110	270	41,980	42,260
Mesenchymal tumors	160	760	920	160	710	870
Primary melanocytic lesions	--	--	--	--	--	--
<i>Lymphomas and Hematopoietic Neoplasms</i>	--	--	1,870	--	--	1,900
Lymphoma	--	--	1,860	--	--	1,890
Other hematopoietic neoplasms	--	--	--	--	--	--
<i>Germ Cell Tumors</i>	--	--	260	--	--	270
<i>Tumors of Sellar Region</i>	--	--	14,830	--	--	14,560
Tumors of the pituitary	--	--	14,170	--	--	13,900
Craniopharyngioma	--	--	650	--	--	660
<i>Unclassified Tumors</i>	1,430	1,830	3,260	1,440	1,730	3,180
Hemangioma	--	--	800	--	--	790
Neoplasm, unspecified	1,410	920	2,340	1,420	840	2,260
All other	--	--	130	--	--	130
TOTAL	26,670	66,800	93,470	26,940	67,440	94,390

^aSource: Estimation based on CBTRUS, NPCR, and SEER 2000-2018 data for malignant tumors, and NPCR and SEER 2006-2018 data for non-malignant tumors.

^bRounded to the nearest 10. Numbers may not add up due to rounding.

^cTotal estimate is based on overall estimate. Histopathology-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 22 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, CBTRUS Statistical Report: US Cancer Statistics – NCHS and NVSS, 2015-2019

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	1,495	299	5.01 (4.76-5.28)	818	164	6.01 (5.59-6.45)	677	135	4.17 (3.86-4.51)
Alaska	157	31	4.36 (3.67-5.15)	86	17	4.48 (3.51-5.63)	71	14	4.19 (3.23-5.33)
Arizona	1,765	353	4.14 (3.94-4.34)	484	97	5.79 (5.28-6.35)	395	79	3.97 (3.58-4.40)
Arkansas	879	176	4.84 (4.52-5.18)	1,010	202	5.03 (4.72-5.36)	755	151	3.33 (3.09-3.59)
California	9,381	1,876	4.35 (4.26-4.44)	5,343	1,069	5.33 (5.18-5.47)	4,038	808	3.50 (3.39-3.61)
Colorado	1,334	267	4.31 (4.08-4.56)	744	149	5.07 (4.70-5.46)	590	118	3.65 (3.36-3.97)
Connecticut	997	199	4.47 (4.19-4.77)	566	113	5.54 (5.08-6.03)	431	86	3.62 (3.27-4.00)
Delaware	248	50	3.98 (3.48-4.53)	53	11	3.28 (2.45-4.32)	50	10	2.60 (1.91-3.45)
District of Columbia	103	21	2.90 (2.36-3.53)	151	30	5.40 (4.54-6.37)	97	19	2.80 (2.25-3.46)
Florida	5,954	1,191	4.17 (4.06-4.28)	3,370	674	5.09 (4.91-5.27)	2,584	517	3.35 (3.21-3.49)
Georgia	2,366	473	4.23 (4.06-4.41)	1,305	261	5.15 (4.86-5.45)	1,061	212	3.47 (3.26-3.69)
Hawaii	252	50	2.90 (2.54-3.29)	145	29	3.56 (2.99-4.21)	107	21	2.28 (1.85-2.78)
Idaho	509	102	5.17 (4.72-5.66)	323	65	6.83 (6.09-7.65)	186	37	3.64 (3.12-4.22)
Illinois	3,066	613	4.13 (3.98-4.28)	1,735	347	5.13 (4.88-5.38)	1,331	266	3.31 (3.13-3.50)
Indiana	1,763	353	4.55 (4.33-4.77)	1,024	205	5.70 (5.35-6.08)	739	148	3.56 (3.30-3.83)
Iowa	962	192	5.05 (4.72-5.39)	542	108	5.99 (5.48-6.54)	420	84	4.22 (3.81-4.67)
Kansas	828	166	4.93 (4.59-5.29)	471	94	5.98 (5.43-6.56)	357	71	4.01 (3.59-4.46)
Kentucky	1,293	259	4.86 (4.59-5.14)	715	143	5.79 (5.36-6.25)	578	116	4.06 (3.73-4.42)
Louisiana	1,159	232	4.33 (4.07-4.59)	645	129	5.27 (4.86-5.71)	514	103	3.53 (3.22-3.86)
Maine	488	98	5.29 (4.80-5.81)	291	58	6.71 (5.92-7.57)	197	39	4.06 (3.47-4.72)
Maryland	1,386	277	3.99 (3.78-4.21)	765	153	4.86 (4.51-5.22)	621	124	3.28 (3.02-3.56)
Massachusetts	1,988	394	4.75 (4.54-4.97)	1,109	222	5.90 (5.55-6.27)	859	172	3.80 (3.55-4.08)
Michigan	2,891	578	4.68 (4.51-4.87)	1,625	325	5.73 (5.44-6.02)	1,266	253	3.80 (3.59-4.03)
Minnesota	1,548	310	4.77 (4.53-5.02)	904	181	5.86 (5.48-6.27)	644	129	3.82 (3.52-4.14)
Mississippi	881	176	5.06 (4.73-5.42)	463	93	5.90 (5.36-6.48)	418	84	4.37 (3.95-4.83)
Missouri	1,653	331	4.42 (4.21-4.65)	928	186	5.40 (5.05-5.77)	725	145	3.60 (3.33-3.88)
Montana	332	66	4.89 (4.36-5.48)	193	39	5.87 (5.04-6.80)	139	28	3.99 (3.33-4.76)
Nebraska	554	111	5.05 (4.63-5.50)	317	63	6.06 (5.39-6.78)	237	47	4.16 (3.63-4.75)
Nevada	759	152	4.39 (4.08-4.73)	424	85	5.12 (4.63-5.65)	335	67	3.73 (3.33-4.16)
New Hampshire	421	84	4.84 (4.37-5.36)	240	48	5.88 (5.13-6.72)	181	36	4.01 (3.41-4.68)

Table 22 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 Jersey	2,279	456	4.24 (4.06-4.42)	1,254	251	5.12 (4.83-5.42)	1,025	205	3.50 (3.29-3.73)
New Mexico	510	102	3.96 (3.61-4.33)	281	56	4.62 (4.08-5.21)	229	46	3.39 (2.95-3.89)
New York	4,549	910	3.88 (3.77-4.00)	2,509	502	4.70 (4.52-4.90)	2,040	408	3.19 (3.05-3.34)
North Carolina	2,502	500	4.13 (3.97-4.30)	1,415	283	5.17 (4.90-5.46)	1,087	217	3.28 (3.08-3.49)
North Dakota	180	36	4.26 (3.64-4.95)	104	21	5.09 (4.13-6.20)	76	15	3.47 (2.71-4.38)
Ohio	3,348	670	4.67 (4.50-4.83)	1,878	376	5.70 (5.44-5.97)	1,470	294	3.77 (3.57-3.98)
Oklahoma	1,122	224	4.96 (4.67-5.27)	608	122	5.86 (5.39-6.36)	514	103	4.17 (3.81-4.56)
Oregon	1,202	240	4.67 (4.40-4.95)	707	141	5.74 (5.31-6.19)	495	99	3.69 (3.36-4.05)
Pennsylvania	3,740	748	4.55 (4.40-4.71)	2,170	434	5.79 (5.54-6.04)	1,570	314	3.51 (3.33-3.70)
Rhode Island	327	65	4.93 (4.39-5.51)	181	36	6.04 (5.17-7.03)	146	29	4.00 (3.36-4.74)
South Carolina	1,453	291	4.67 (4.43-4.93)	795	159	5.57 (5.17-5.98)	658	132	3.93 (3.62-4.25)
South Dakota	276	55	5.36 (4.73-6.07)	164	33	6.86 (5.82-8.03)	112	22	4.08 (3.32-4.95)
Tennessee	1,872	374	4.70 (4.49-4.93)	1,056	211	5.76 (5.41-6.13)	816	163	3.82 (3.55-4.10)
Texas	5,934	1,187	4.18 (4.07-4.29)	3,293	659	4.99 (4.82-5.17)	2,641	528	3.48 (3.35-3.62)
Utah	646	129	4.70 (4.34-5.08)	389	78	5.90 (5.32-6.53)	257	51	3.61 (3.18-4.09)
Vermont	230	46	5.68 (4.93-6.51)	126	25	6.66 (5.49-8.02)	104	21	4.80 (3.87-5.90)
Virginia	2,073	415	4.23 (4.04-4.42)	1,160	232	5.19 (4.89-5.51)	913	183	3.42 (3.20-3.66)
Washington	2,152	430	5.08 (4.86-5.30)	1,243	249	6.19 (5.84-6.55)	909	182	4.07 (3.80-4.35)
West Virginia	572	114	4.64 (4.25-5.06)	320	64	5.55 (4.93-6.22)	252	50	3.84 (3.36-4.38)
Wisconsin	1,718	344	4.84 (4.61-5.08)	1,001	200	5.97 (5.59-6.36)	717	143	3.79 (3.51-4.10)
Wyoming	187	37	5.47 (4.69-6.36)	108	22	6.63 (5.39-8.08)	79	16	4.42 (3.46-5.58)
TOTAL	84,264	16,853	4.41 (4.38-4.44)	47,551	9,510	5.38 (5.33-5.43)	36,713	7,343	3.58 (3.54-3.61)

^aAnnual average deaths are calculated by dividing the five-year total by five.

^bRates are per 100,000 and are age-adjusted to the 2000 US standard population.

-- 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: CI, confidence interval; NCHS, National Center for Health Statistics; NVSS, National Vital Statistics System.

Table 23 Sixteen-Year Total Deaths and Median Survival in Months with 95% Confidence Intervals for Selected Primary Malignant Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: NPCR, 2001-2018⁷⁷

Histopathology	N	Deaths	Median Survival (95% CI)
Diffuse astrocytoma	25,047	13,802	61 (58-63)
Anaplastic astrocytoma	17,821	12,453	20 (20-21)
Glioblastoma	145,178	129,570	8 (8-8)
Oligodendroglioma	11,989	3,722	199 (190-209)
Anaplastic oligodendroglioma	5,351	2,532	103 (96-110)
Oligoastrocytic tumors	6,941	3,503	113 (107-120)
Pilocytic astrocytoma	15,813	1,197	** (**-**)
Unique astrocytoma variants	2,463	420	** (**-**)
Ependymal tumors	18,710	3,277	** (**-**)
Glioma malignant, NOS	20,825	9,875	96 (87-106)
Other neuroepithelial tumors	2,274	338	** (**-**)
Neuronal and mixed neuronal-glial tumors	283	83	** (201-**)
Choroid plexus tumors	12,602	1,559	** (**-**)
Tumors of the pineal region	1,979	506	** (**-**)
Embryonal tumors	10,715	4,194	** (**-**)
Nerve sheath tumors	87,503	8,450	** (**-**)
Other tumors of cranial and spinal nerves	--	--	--
Meningiomas	382,599	107,072	185 (180-188)
Mesenchymal tumors	16,764	2,943	** (**-**)
Primary melanocytic lesions	281	174	28 (21-47)
Lymphoma	19,855	13,519	16 (15-17)
Other hematopoietic neoplasms	209	97	138 (98-**)
Germ cell tumors	3,569	518	** (**-**)
Tumors of the pituitary	172,615	20,558	** (**-**)
Craniopharyngioma	8,005	1,673	** (**-**)
Hemangioma	8,709	957	** (**-**)
Neoplasm, unspecified	28,825	15,949	44 (41-48)
All other	1,260	206	** (**-**)

** Cannot be calculated due to median survival not being observed.

-- Survival estimates are not presented when fewer than 100 cases were reported for the specific category.

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

Table 24 Hazard Ratios for Death and 95% Confidence Intervals for Age Group at Diagnosis, Sex, Race, and Ethnicity for Selected Primary Malignant Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: NPCR, 2001-2018 (varying)

Histopathology	N	Deaths			Age Groups ^a			Sex ^b			Race & Ethnicity ^c							
		15-39 Years ^d			40+ Years			Female			Black, Non-Hispanic		AIAN, Non-Hispanic		API, 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	HR (95% CI)	P-value	HR (95% CI)
Diffuse astrocytoma	25,047	13,802	1.89 (1.72-2.08)	<0.0001	6.77 (6.19-7.40)	<0.0001	0.96 (0.93-0.99)	0.0132	1.04 (0.97-1.11)	0.2563	0.81 (0.66-1.01)	0.0583	0.88 (0.78-0.98)	0.0194	0.79 (0.75-0.84)	<0.0001		
Anaplastic astrocytoma	17,821	12,453	0.39 (0.35-0.43)	<0.0001	1.28 (1.18-1.40)	<0.0001	0.97 (0.93-1.00)	0.0495	1.08 (1.00-1.15)	0.0444	0.91 (0.71-1.16)	0.4344	0.85 (0.76-0.95)	0.0050	0.81 (0.76-0.86)	<0.0001		
Glioblastoma	145,178	129,570	0.73 (0.68-0.78)	<0.0001	1.77 (1.66-1.89)	<0.0001	1.02 (1.01-1.03)	<0.0001	0.92 (0.90-0.94)	<0.0001	1.01 (0.93-1.11)	0.7750	0.70 (0.67-0.73)	<0.0001	0.77 (0.75-0.78)	<0.0001		
Oligodendroglioma	11,989	3,722	3.44 (2.36-5.01)	<0.0001	7.59 (5.23-11.03)	<0.0001	0.86 (0.81-0.92)	<0.0001	1.39 (1.21-1.59)	<0.0001	1.28 (0.87-1.90)	0.2144	0.79 (0.64-0.97)	0.0273	0.76 (0.68-0.86)	<0.0001		
Anaplastic oligo-dendroglioma	5,351	2,532	0.74 (0.49-1.11)	0.1410	1.57 (1.05-2.33)	0.0261	0.89 (0.82-0.96)	0.0031	1.24 (1.06-1.46)	0.0089	0.91 (0.53-1.57)	0.7405	0.78 (0.64-0.96)	0.0192	0.79 (0.69-0.90)	0.0007		
Oligoastrocytic tumors	6,941	3,503	1.74 (1.29-2.35)	0.0003	3.68 (2.74-4.94)	<0.0001	0.92 (0.86-0.98)	0.0123	1.34 (1.17-1.53)	<0.0001	1.29 (0.87-1.89)	0.2026	0.90 (0.74-1.09)	0.2899	0.85 (0.75-0.95)	0.0060		
Piloicytic astrocytoma	15,813	1,197	1.81 (1.57-2.09)	<0.0001	8.32 (7.25-9.54)	<0.0001	0.85 (0.76-0.96)	0.0064	1.35 (1.13-1.61)	0.0008	1.25 (0.67-2.34)	0.4786	0.85 (0.57-1.28)	0.4398	1.09 (0.91-1.29)	0.3409		
Unique astrocytoma variants	2,463	420	2.13 (1.63-2.79)	<0.0001	7.94 (6.06-10.39)	<0.0001	0.78 (0.64-0.94)	0.0106	0.84 (0.62-1.13)	0.2410	1.06 (0.44-2.57)	0.8927	1.10 (0.68-1.80)	0.6919	0.83 (0.62-1.11)	0.2007		
Ependymal tumors	18,710	3,277	0.33 (0.29-0.37)	<0.0001	0.86 (0.79-0.94)	0.0007	0.78 (0.73-0.84)	<0.0001	1.43 (1.27-1.60)	<0.0001	1.28 (0.86-1.90)	0.2219	0.78 (0.61-0.99)	0.0446	1.12 (1.01-1.24)	0.0256		
Glioma malignant, NOS	20,825	9,875	0.77 (0.71-0.83)	<0.0001	3.52 (3.35-3.69)	<0.0001	1.01 (0.97-1.05)	0.7423	1.07 (1.00-1.14)	0.0387	0.91 (0.69-1.20)	0.5096	0.91 (0.81-1.02)	0.1059	0.99 (0.93-1.06)	0.8101		
Choroid plexus tumors	2,274	338	0.55 (0.39-0.79)	0.0011	2.41 (1.90-3.07)	<0.0001	0.89 (0.71-1.10)	0.2744	1.74 (1.24-2.44)	0.0012	2.03 (0.84-4.95)	0.1171	1.38 (0.80-2.37)	0.2458	0.93 (0.68-1.27)	0.6420		
Other neuroepithelial tumors	283	83	2.48 (0.80-7.53)	0.1146	13.18 (4.75-36.56)	<0.0001	0.96 (0.60-1.52)	0.8489	0.76 (0.34-1.70)	0.5064	** (**-*)	**	0.83 (0.26-2.66)	0.7502	0.85 (0.43-1.68)	0.6362		
Neuronal and mixed neuronal-glia tumors	12,602	1,559	1.43 (1.18-1.73)	0.0002	6.04 (5.10-7.15)	<0.0001	0.78 (0.70-0.86)	<0.0001	1.49 (1.28-1.73)	<0.0001	1.80 (1.04-3.11)	0.0357	1.09 (0.82-1.44)	0.5538	1.15 (0.98-1.35)	0.0826		
Tumors of the pineal region	1,979	506	0.55 (0.43-0.70)	<0.0001	1.04 (0.83-1.30)	0.7328	0.57 (0.47-0.68)	<0.0001	1.28 (1.02-1.61)	0.0356	1.00 (0.41-2.43)	0.9990	0.54 (0.25-1.14)	0.1061	1.13 (0.88-1.45)	0.3441		
Embryonal tumors	10,715	4,194	0.83 (0.77-0.90)	<0.0001	1.96 (1.79-2.15)	<0.0001	1.00 (0.94-1.06)	0.9695	1.20 (1.09-1.32)	0.0002	0.71 (0.46-1.08)	0.1063	1.02 (0.87-1.20)	0.7888	0.96 (0.89-1.04)	0.2917		
Nerve sheath tumors	87,503	8,450	1.58 (1.19-2.10)	0.0018	6.11 (4.66-8.01)	<0.0001	0.84 (0.81-0.88)	<0.0001	1.18 (1.08-1.29)	0.0003	1.44 (1.12-1.86)	0.0045	0.60 (0.53-0.69)	<0.0001	0.84 (0.77-0.91)	<0.0001		
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
Meningiomas	382,599	107,072	0.80 (0.60-1.06)	0.1178	5.75 (4.34-7.60)	<0.0001	0.70 (0.69-0.71)	<0.0001	1.03 (1.01-1.04)	0.0080	0.80 (0.73-0.88)	<0.0001	0.63 (0.61-0.66)	<0.0001	0.71 (0.69-0.73)	<0.0001		
Mesenchymal tumors	16,764	2,943	0.86 (0.68-1.08)	0.1984	3.10 (2.52-3.82)	<0.0001	0.87 (0.81-0.94)	0.0002	1.19 (1.06-1.34)	0.0036	1.03 (0.71-1.50)	0.8602	0.76 (0.60-0.96)	0.0194	0.93 (0.82-1.05)	0.2303		
Primary melanocytic lesions	281	174	0.35 (0.18-0.67)	0.0015	0.75 (0.43-1.30)	0.3076	0.94 (0.69-1.28)	0.6898	1.09 (0.56-2.15)	0.7966	** (**-*)	**	0.98 (0.31-3.11)	0.9780	1.00 (0.62-1.59)	0.9860		
Lymphoma	19,855	13,519	3.64 (2.56-5.18)	<0.0001	6.93 (4.90-9.81)	<0.0001	0.94 (0.91-0.97)	0.0002	1.15 (1.08-1.22)	<0.0001	1.06 (0.85-1.32)	0.6138	0.79 (0.73-0.86)	<0.0001	0.88 (0.84-0.94)	<0.0001		
Other hematopoietic neoplasms	209	97	** (**-*)	**	** (**-*)	**	1.02 (0.68-1.54)	0.9174	0.81 (0.49-1.35)	0.4276	1.84 (0.44-7.65)	0.4009	1.11 (0.40-3.08)	0.8393	0.72 (0.37-1.38)	0.3193		
Germ cell tumors	3,569	518	1.00 (0.83-1.21)	0.9997	2.08 (1.55-2.78)	<0.0001	1.30 (1.08-1.58)	0.0069	0.87 (0.63-1.21)	0.4191	1.59 (0.59-4.27)	0.3558	1.03 (0.76-1.41)	0.8313	1.08 (0.87-1.33)	0.4991		
Tumors of the pituitary	172,615	20,588	2.04 (1.30-3.22)	0.0021	20.62 (13.15-32.33)	<0.0001	0.75 (0.73-0.77)	<0.0001	1.14 (1.10-1.18)	<0.0001	0.91 (0.76-1.08)	0.2737	0.63 (0.58-0.69)	<0.0001	0.71 (0.68-0.75)	<0.0001		

Table 24 Continued

Histopathology	N	Deaths	Age Groups ^a		Sex ^b		Race & Ethnicity ^c							
			15-39 Years ^d	40+ Years	Female	Black, Non-Hispanic	AIAN, Non-Hispanic	API, 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		
Craniophaninglioma	8,005	1,673	1.99 (1.58-2.50)	<0.0001	0.86 (0.78-0.95)	0.0028	1.73 (1.55-1.93)	<0.0001	1.54 (0.94-2.53)	0.0863	0.63 (0.46-0.85)	0.0030	1.03 (0.88-1.20)	0.7045
Hemangioma	8,709	957	1.49 (0.76-2.89)	0.2436	0.65 (0.57-0.73)	<0.0001	1.45 (1.20-1.76)	0.0001	** (**,*)	**	0.64 (0.44-0.95)	0.0252	0.80 (0.65-0.99)	0.0426
Neoplasm, unspecified	28,825	15,949	0.73 (0.63-0.85)	<0.0001	0.94 (0.91-0.97)	<0.0001	0.74 (0.70-0.78)	<0.0001	0.71 (0.57-0.88)	0.0019	0.80 (0.72-0.89)	<0.0001	0.64 (0.61-0.68)	<0.0001
All other	1,260	206	1.53 (0.78-3.03)	0.2182	0.67 (0.51-0.89)	0.0057	1.11 (0.71-1.72)	0.6452	3.36 (0.83-13.61)	0.0901	0.49 (0.16-1.54)	0.2223	0.95 (0.64-1.41)	0.8008

Reference group is Children (<14 years) as defined by the National Cancer Institute, see: <http://www.cancer.gov/researchandfunding/snapshots/pediatric>.

Reference group is males.

Reference group is White non-Hispanic.

Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: <http://www.cancer.gov/cancertopics/aya>.

** Cannot be calculated.

-- Survival estimates are not presented when fewer than 100 cases were reported for the specific category.

Abbreviations: AIAN, American Indian/Alaska Native; API, Asian or Pacific Islander; CBTRUS, Central Brain Tumor Registry of the United States; CI, confidence interval; HR, Hazard Ratio; NOS, not otherwise specified; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Table 25 One-, Five-, and Ten-Year Relative Survival Rates^{a,b} with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Site and Behavior, CBTRUS Statistical Report: NPCR, 2001-2018 (varying)

Site (ICD-O Topography Code)	All (2004-2018)			Malignant (2001-2018) ^c			Non-Malignant (2004-2018) ^d					
	N ^e	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)	N ^f	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Olfactory tumors of the nasal cavity (C30.0) ^g	1,767	91.2 (89.6-92.5)	79.8 (77.3-82.1)	72.0 (68.5-75.3)	1,793	92.5 (91.0-93.7)	81.7 (79.3-83.8)	73.2 (69.9-76.2)	--	--	--	--
Meninges (cerebral and spinal) (C70.0-C70.9)	383,894	93.2 (93.1-93.3)	87.9 (87.7-88.1)	83.1 (82.8-83.4)	6,024	83.7 (82.7-84.7)	67.2 (65.8-68.7)	60.1 (58.3-61.9)	378,284	93.4 (93.3-93.5)	88.3 (88.1-88.5)	83.6 (83.3-83.8)
Cerebral meninges (C70.0)	313,886	93.1 (93.0-93.2)	87.8 (87.6-88.0)	82.8 (82.5-83.1)	4,351	84.7 (83.5-85.8)	67.2 (65.5-68.9)	59.9 (57.7-62.0)	309,834	93.3 (93.2-93.4)	88.1 (87.9-88.3)	83.2 (82.9-83.5)
Spinal meninges (C70.1)	17,249	97.5 (97.1-97.8)	96.1 (95.4-96.7)	94.0 (92.7-95.1)	446	85.6 (81.8-88.7)	75.3 (70.1-79.8)	71.1 (64.5-76.8)	16,827	97.8 (97.5-98.1)	96.7 (96.0-97.3)	94.8 (93.4-95.9)
Meninges, NOS (C70.9)	52,759	92.0 (91.8-92.3)	85.9 (85.4-86.3)	81.1 (80.3-81.8)	1,227	79.5 (77.0-81.8)	64.2 (60.8-67.4)	56.8 (52.7-60.7)	51,623	92.3 (92.1-92.6)	86.5 (86.0-86.9)	81.8 (81.0-82.5)
Cerebrum (C71.0)	17,763	58.0 (57.2-58.7)	38.1 (37.3-38.9)	34.3 (33.5-35.2)	15,433	52.8 (52.0-53.6)	29.7 (29.0-30.5)	26.1 (25.2-26.9)	3,142	89.0 (87.7-90.1)	84.6 (83.0-86.2)	80.5 (78.1-82.6)
Frontal, temporal, parietal, and occipital lobes of the brain (C71.1-C71.4)	189,945	59.9 (59.7-60.2)	31.9 (31.6-32.1)	26.4 (26.2-26.7)	174,036	57.9 (57.6-58.1)	27.4 (27.2-27.6)	21.5 (21.3-21.8)	19,565	90.9 (90.4-91.3)	86.9 (86.3-87.5)	83.4 (82.5-84.2)
Frontal lobe (C71.1)	81,943	62.2 (61.9-62.5)	37.0 (36.7-37.4)	30.5 (30.1-30.9)	75,551	61.2 (60.9-61.6)	34.3 (33.9-34.6)	27.1 (26.7-27.5)	7,927	89.3 (88.5-90.0)	84.3 (83.3-85.3)	79.8 (78.3-81.2)
Temporal lobe (C71.2)	60,591	60.8 (60.4-61.2)	29.1 (28.7-29.5)	24.4 (24.0-24.9)	54,708	58.0 (57.6-58.4)	23.1 (22.7-23.5)	17.8 (17.4-18.2)	6,763	93.8 (93.1-94.4)	91.0 (90.1-91.8)	89.0 (87.8-90.1)
Parietal lobe (C71.3)	37,208	54.0 (53.5-54.5)	25.4 (24.9-25.9)	20.9 (20.4-21.5)	34,965	51.4 (50.9-52.0)	20.7 (20.2-21.2)	16.2 (15.8-16.7)	3,407	88.5 (87.2-89.6)	84.2 (82.6-85.7)	80.2 (78.0-82.3)
Occipital lobe (C71.4)	10,203	58.2 (57.2-59.1)	30.1 (29.1-31.1)	26.0 (24.9-27.1)	8,812	53.9 (52.8-55.0)	22.0 (21.1-23.0)	17.9 (17.0-18.9)	1,478	91.5 (89.8-92.9)	88.5 (86.1-90.4)	83.8 (80.4-86.6)
Ventricle (C71.5)	10,613	86.4 (85.7-87.0)	78.9 (78.0-79.8)	74.9 (73.8-76.0)	5,006	76.7 (75.5-77.9)	64.0 (62.6-65.4)	59.3 (57.7-60.9)	6,041	94.5 (93.8-95.1)	91.6 (90.6-92.4)	88.7 (87.3-90.0)
Cerebellum (C71.6)	23,174	88.4 (87.9-88.8)	79.1 (78.5-79.7)	75.5 (74.8-76.3)	15,597	85.8 (85.3-86.4)	72.8 (72.1-73.6)	68.2 (67.3-69.0)	9,167	94.9 (94.4-95.4)	92.4 (91.6-93.2)	90.4 (89.1-91.5)
Brain stem (C71.7)	16,015	77.5 (76.8-78.1)	62.2 (61.3-63.0)	57.3 (56.3-58.2)	13,608	72.5 (71.7-73.3)	53.3 (52.4-54.2)	48.3 (47.4-49.3)	3,891	92.6 (91.7-93.5)	88.4 (87.1-89.6)	84.5 (82.5-86.3)
Other brain (C71.8-C71.9)	77,468	53.2 (52.8-53.5)	34.8 (34.4-35.1)	30.7 (30.3-31.1)	66,419	46.8 (46.4-47.2)	25.5 (25.1-25.9)	21.5 (21.1-21.8)	14,869	85.7 (85.1-86.3)	80.4 (79.6-81.2)	76.1 (75.1-77.2)
Overlapping lesion of brain (C71.8)	33,220	45.7 (45.2-46.3)	21.4 (20.9-21.9)	17.2 (16.8-17.8)	32,458	44.1 (43.6-44.7)	18.6 (18.1-19.0)	14.3 (13.8-14.8)	2,255	82.8 (81.0-84.4)	77.3 (75.1-79.3)	72.3 (69.6-74.9)
Brain, NOS (C71.9)	44,248	58.8 (58.3-59.2)	44.7 (44.2-45.2)	40.9 (40.3-41.4)	33,961	49.3 (48.7-49.8)	32.1 (31.5-32.6)	28.3 (27.7-28.8)	12,614	86.3 (85.6-86.9)	81.0 (80.1-81.8)	76.8 (75.7-78.0)
Spinal cord and cauda equina (C72.0-C72.1)	31,097	96.1 (95.8-96.3)	93.0 (92.5-93.4)	91.2 (90.6-91.8)	10,029	89.9 (89.3-90.5)	81.8 (80.9-82.7)	78.0 (76.9-79.1)	21,781	99.1 (98.9-99.2)	98.5 (98.1-98.9)	98.0 (97.2-98.6)
Spinal cord (C72.0)	29,969	96.0 (95.8-96.3)	92.9 (92.5-93.3)	91.0 (90.3-91.6)	9,794	89.9 (89.3-90.5)	81.7 (80.8-82.6)	77.9 (76.7-79.0)	20,855	99.1 (98.9-99.2)	98.6 (98.1-98.9)	98.0 (97.1-98.6)
Cauda equina (C72.1)	1,128	97.0 (95.6-98.0)	94.8 (92.3-96.5)	94.4 (91.7-96.3)	235	89.8 (84.8-93.2)	85.3 (78.8-90.0)	83.5 (75.4-89.1)	926	98.6 (97.2-99.3)	97.6 (94.5-98.9)	97.1 (93.8-98.7)
Cranial nerves (C72.2-C72.5)	72,578	99.3 (99.2-99.4)	99.3 (99.2-99.4)	99.3 (99.2-99.4)	4,386	97.3 (96.7-97.8)	94.2 (93.3-94.9)	93.1 (92.0-94.0)	68,633	99.5 (99.4-99.6)	99.5 (99.4-99.6)	99.5 (99.4-99.6)
Olfactory nerve (C72.2)	95.3 (87.2-98.3)	93.2 (80.4-97.8)	93.2 (80.4-97.8)	89.0 (72.3-95.8)	34	91.7 (74.0-97.5)	74.1 (51.7-87.3)	66.7 (42.5-82.5)	64	97.5 (84.8-99.6)	97.5 (84.8-99.6)	97.5 (84.8-99.6)
Optic nerve (C72.3)	4,273	98.3 (97.8-98.7)	96.0 (95.2-96.7)	95.2 (94.2-96.1)	3,931	98.0 (97.5-98.5)	95.6 (94.8-96.3)	94.8 (93.9-95.6)	740	99.8 (88.8-100.0)	97.8 (93.9-99.2)	96.5 (91.0-98.6)
Acoustic nerve (C72.4)	56,027	99.5 (99.4-99.6)	99.5 (99.4-99.6)	99.5 (99.4-99.6)	148	94.3 (88.3-97.3)	93.2 (86.4-96.7)	93.0 (81.6-97.4)	55,918	99.5 (99.4-99.6)	99.5 (99.4-99.6)	99.5 (99.4-99.6)

Table 25 Continued

Site (ICD-O Topography Code)	All (2004-2018)			Malignant (2001-2018) ^c			Non-Malignant (2004-2018) ^d					
	N ^e	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	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)	
<i>Cranial nerve, NOS (C72.5)</i>	12,183	98.9 (98.6-99.2)	98.7 (98.3-99.0)	98.7 (98.3-99.0)	273	88.8 (84.0-92.2)	75.8 (69.5-81.0)	71.6 (63.4-78.2)	11,911	99.3 (99.0-99.5)	99.2 (98.8-99.5)	99.2 (98.8-99.5)
Other nervous system (C72.8-C72.9)	6,083	79.8 (78.7-80.8)	72.3 (70.9-73.6)	67.8 (66.0-69.4)	3,075	63.7 (62.0-65.5)	50.4 (48.3-52.4)	44.3 (41.9-46.6)	2,985	97.3 (96.6-98.0)	94.7 (93.4-95.8)	91.4 (89.3-93.1)
<i>Overlapping lesion of brain & CNS (C72.8)</i>	786	74.8 (71.4-77.8)	66.0 (62.0-69.7)	60.7 (55.5-65.5)	447	61.0 (56.1-65.5)	45.4 (40.0-50.5)	37.2 (31.0-43.3)	346	95.1 (91.7-97.2)	90.5 (85.5-93.9)	87.4 (78.8-92.7)
<i>Nervous system, NOS (C72.9)</i>	5,297	80.5 (79.4-81.6)	73.2 (71.8-74.5)	68.8 (67.0-70.5)	2,628	64.2 (62.3-66.1)	51.2 (49.0-53.4)	45.4 (42.8-48.0)	2,639	97.6 (96.8-98.2)	95.2 (93.8-96.2)	91.9 (89.8-93.7)
<i>Pituitary and craniopharyngeal duct (C75.1-C75.2)</i>	183,633	97.9 (97.8-98.0)	96.3 (96.2-96.5)	94.3 (94.0-94.5)	1,320	87.4 (85.3-89.2)	76.3 (73.5-78.9)	69.2 (65.6-72.4)	182,453	98.0 (97.9-98.1)	96.5 (96.3-96.7)	94.5 (94.2-94.7)
<i>Pituitary gland (C75.1)</i>	178,233	98.1 (98.0-98.2)	96.7 (96.5-96.9)	94.8 (94.5-95.1)	1,295	87.6 (85.6-89.4)	76.7 (73.9-79.3)	69.5 (65.9-72.9)	177,078	98.2 (98.1-98.2)	96.9 (96.7-97.0)	95.0 (94.7-95.3)
<i>Craniopharyngeal duct (C75.2)</i>	5,400	92.4 (91.6-93.1)	84.6 (83.4-85.8)	77.6 (75.9-79.2)	--	--	--	--	5,375	92.5 (91.7-93.2)	84.8 (83.6-85.9)	77.8 (76.1-79.4)
<i>Pineal (C75.3)</i>	4,312	91.9 (91.0-92.7)	82.7 (81.4-84.0)	78.4 (76.7-80.0)	2,942	90.0 (88.9-91.1)	77.2 (75.4-78.8)	71.6 (69.6-73.5)	1,678	94.6 (93.2-95.6)	91.3 (89.4-92.9)	88.7 (85.9-90.9)

^aThe 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.

^bRates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively.

^cAssigned behavior code of /3 (see Table 2).

^dAssigned behavior code of /0 or /1 (see Table 2).

^eTotal number of cases that occurred within the included NPCR and SEER registries between 2001 and 2018.

^fTotal number of cases that occurred within the included NPCR and SEER registries between 2004 and 2018.

^gICD-O-3 histopathology codes 9522-9523 only.

-- 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.

*** Confidence interval could not be calculated.

Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; CI, confidence interval; NCI, National Cancer Institute; NOS, not otherwise specified; NPCR, National Program of Cancer Registries; RS, Relative Survival; SEER, Surveillance, Epidemiology, and End Results Program.