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CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2016—2020

Quinn T. Ostrom*, Mackenzie Price*, Corey Neff, Gino Cioffi, Kristin A. Waite, Carol Kruchko, Jill S. Barnholtz-Sloan

All author affiliations are listed at the end of the article

*The authors contributed equally to this work and should be considered joint first authors

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 CBTRUS 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 24.83 per 100,000 population (**malignant** AAAIR=6.94 and **non-malignant** AAAIR=17.88). This overall rate was higher in females compared to males (27.85 versus 21.62 per 100,000) and non-Hispanic persons compared to Hispanic persons (25.24 versus 22.61 per 100,000). Gliomas accounted for 26.3% of all tumors. The most commonly occurring **malignant** brain and other CNS histopathology was glioblastoma (14.2% of all tumors and 50.9% of all **malignant tumors**), and the most common predominantly **non-malignant** histopathology was meningioma (40.8% of all tumors and 56.2% of all **non-malignant** tumors). Glioblastomas were 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 6.13 per 100,000 population. There were 86,030 deaths attributed to **malignant** brain and other CNS tumors between 2016 and 2020. This represents an average annual mortality rate of 4.42 per 100,000 population and an average of 17,206 deaths per year. The five-year relative survival rate following diagnosis of a **malignant** brain and other CNS tumor was 35.7%, for a **non-malignant** brain and other CNS tumor 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 2016-2020* 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 CBTRUS 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 (CNS) Diagnosed in the United States in 2016-2020: For the first time in an annual statistical report, we present up-to-date prevalence estimates for all **malignant** and **non-malignant** brain and other CNS tumors for the United States based on all 52 central cancer registries (50 states, District of Columbia, and limited statistics from Puerto Rico). Time trends in **malignant** and **non-malignant** brain and other CNS tumors are presented by select demographic groups. We also present selected statistics for 2020, the first year of the coronavirus disease 2019 (COVID-19) pandemic.

Incidence

- **The average annual age-adjusted incidence rate (AAAIR) of all malignant and non-malignant brain and other CNS tumors was 24.83 per 100,000 population between 2016 and 2020.** The AAAIR of **malignant** brain and other CNS tumors was 6.94 per 100,000 population, and the AAAIR of **non-malignant** brain and other CNS tumors was 17.88 per 100,000 population.
- Overall incidence rate was higher in females compared to males (27.85 versus 21.62 per 100,000) and individuals who are non-Hispanic (of any race) compared to individuals who are Hispanic (25.24 versus 22.61 per 100,000).
- Approximately 27.9% of all brain and other CNS tumors were **malignant** and 72.1% were **non-malignant**, which makes **non-malignant** tumors more than twice as common as **malignant** tumors.
- Gliomas accounted for 26.3% of all tumors. The most commonly occurring **malignant** brain and other CNS tumor histopathology was glioblastoma (14.2% of all tumors and 50.9% of all **malignant** tumors), and the most common predominantly **non-malignant** histopathology was meningioma (40.8% of all tumors and 56.2% of all **non-malignant** tumors). Glioblastomas were 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 6.13 per 100,000 population between 2016 and 2020.
- In children and adolescents (ages 0-19 years), incidence was higher in females compared to males (6.27 versus 6.00 per 100,000), individuals who are White compared to individuals who are Black (6.36 versus 4.79 per 100,000), and individuals who are non-Hispanic compared to individuals who are Hispanic (6.38 versus 5.33 per 100,000).

Prevalence

- There were an estimated 1,323,121 individuals living with a previously diagnosed primary brain and other CNS tumor (**malignant and non-malignant**) on December 31, 2019.

Mortality

- There were 86,030 deaths attributed to **malignant** brain and other CNS tumors between 2016 and 2020. This represents an average annual mortality rate of 4.42 per 100,000 population and an average of 17,206 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%.
- Five-year survival following diagnosis with a **malignant** brain and other CNS tumor was highest in persons ages 0-14 years (75.0%) and ages 15-39 years (71.9%) as compared to those ages 40+ years (21.1%).
- The five-year relative survival rate following diagnosis of a **non-malignant** brain and other CNS tumor was 91.9%.
- Survival following diagnosis with a **non-malignant** brain and other CNS tumor was highest in persons ages 15-39 years (98.4%) and ages 0-14 years (97.6%) as compared to those ages 40+ years (90.4%).

Introduction

The objective of the *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2016-2020* is to provide a comprehensive summary of the current descriptive epidemiology of primary brain and other central nervous system (CNS) tumors in the United States population. Primary brain and other CNS tumors include those tumors that originate from the tissues of the brain or CNS. The Central Brain Tumor Registry of the United States (CBTRUS) obtained the latest available population-based data on all newly diagnosed primary brain and other CNS tumors reported 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 2016-2020. 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 were calculated using the National Center for Health Statistics' (NCHS) National Vital Statistics System (NVSS) data from 2016-2020, and relative survival rates, median survival, and adjusted hazard ratios for selected **malignant** and **non-malignant** histopathologies calculated using NPCR data for the period 2001-2019 (2004-2019 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/ and Kruchko, et al.[1]). CBTRUS was incorporated as a non-profit 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 thirty-first (31st) anniversary of CBTRUS and the twenty-sixth (26th) statistical report published by CBTRUS. For this twelfth (12th) 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 brain molecular markers (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 mechanism[4] 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.naaccr.org). Along with the UDS, there are quality control checks and a system for rating each central cancer registry (CCR) to ensure that these data are as accurate and complete as possible. As a surveillance partner, CBTRUS reports high-quality data on brain and other CNS tumors with 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, prevalence, mortality, 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 39 CCRs and incidence data from all 52 CCRs in the United States and Puerto Rico (excluding Nevada and Indiana cases from diagnosis year 2020). Aggregate information on all cancers from all 52 CCRs (excluding Nevada and Indiana cases from diagnosis year 2020) in the United States, including primary brain and other CNS tumors, is available from the *United States Cancer Statistics (USCS)*.[8]

Risk Factors for Primary Brain and Other CNS Tumors

Many environmental and behavioral risk factors have been investigated for primary brain and other CNS tumors. The only well-validated risk factors for these tumors (particularly meningiomas) is an increased risk with exposure to ionizing radiation[9] (the type of radiation generated by atomic bombs, therapeutic radiation treatment, and some forms of medical imaging) and a decreased risk for these tumors (particularly glioma) in persons with a history of allergy or other atopic disease[10] (including eczema, psoriasis, and asthma). Having a first-degree family member (including parents, children, and full siblings) who have been diagnosed with a brain tumor has been shown to increase risk approximately two-fold.[11-16] Several recent review articles have elaborated on the current state of risk factor research in primary brain and other CNS tumors.[17-20]

Data Collection and classification

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 US law, all primary **malignant** and **non-malignant** CNS tumors are reportable diseases based on their final histopathology, 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, plus 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 2016 to 2020 at any of the following International Classification of Diseases for Oncology, Third Edition (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).**[21]

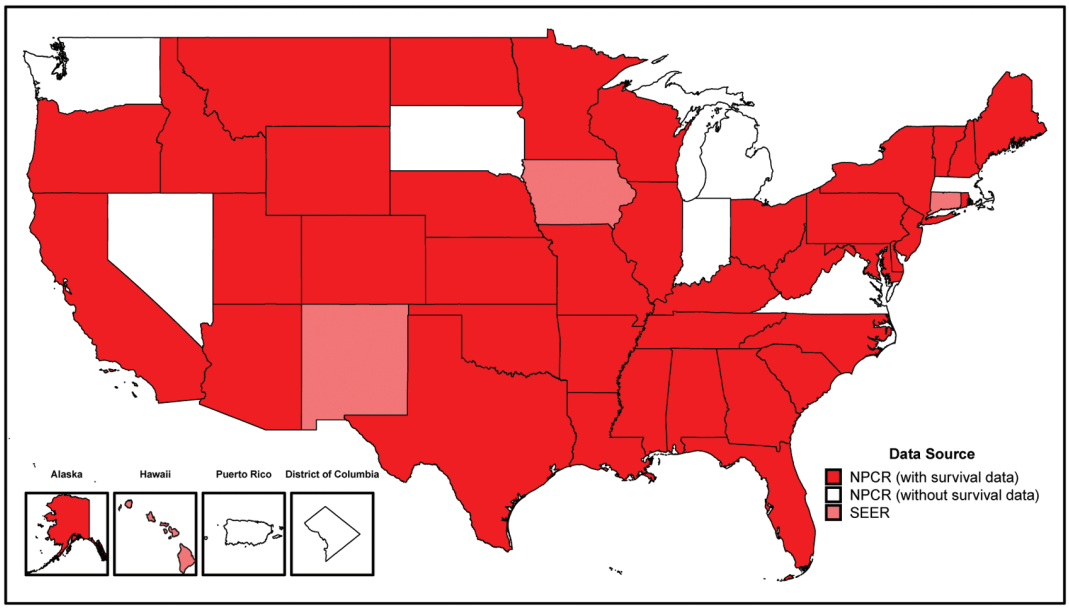


Fig. 1 Availability by Central Cancer Registry for SEER and NPCR Incidence Data (2016-2020) and Survival Data (2001-2019)

NPCR provided data on 452,485 primary brain and other CNS tumors diagnosed from 2016 to 2020 (**Figure 2**). An additional 13,806 case records for the period were obtained from SEER for primary brain and other CNS tumor case records from 2016 to 2020 for Connecticut, Hawaii, Iowa, and New Mexico only. These data were combined into a single dataset of 466,291 records for quality control. The final analytic dataset had 455,677 records, which included 453,623 records from the 50 state CCRs and the District of Columbia used in the analytic dataset, and an additional 2,054 records from Puerto Rico. A total of 10,614 records (2.3%) 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 meningioma that were merged to one paired-site record.

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 and Indiana for diagnosis year 2020 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 United States population.

De-identified survival data for **malignant** brain and other CNS tumors were obtained from NPCR for 39 CCRs for the years 2001 to 2019 and for **non-malignant** brain and other CNS tumors for the years 2004 to 2019. This dataset provides population-based information for 84% of the US population for the years 2001 to 2019 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 NVSS[22] (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.

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
Cerebral meninges	*C70.0*
Spinal meninges	*C70.1*
Meninges, NOS	*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
Overlapping lesion of brain	*C71.8*
Brain, NOS	*C71.9*
Spinal cord and cauda equina	C72.0-C72.1
Spinal cord	*C72.0*
Cauda equina	*C72.1*
Cranial nerves	C72.2-C72.5
Olfactory nerve	*C72.2*
Optic nerve	*C72.3*
Acoustic nerve	*C72.4*
Cranial nerve, NOS	*C72.5*
Other nervous system[c]	C72.8-C72.9
Overlapping lesion of brain and central nervous system	*C72.8*
Nervous system, NOS	*C72.9*
Pituitary and craniopharyngeal duct	C75.1-C75.2
Pituitary gland	*C75.1*
Craniopharyngeal duct	*C75.2*
Pineal gland	C75.3

[a]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[b]ICD-O-3 histopathology codes 9522-9523 only.
[c]These ICD-O-3 codes are combined for analysis in figures and tables presented in this report.
Abbreviations: NOS, not otherwise specified.

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 ICD-O-3 and are broadly based on the categories and site codes defined in the SEER Site/Histology Validation List.[23] 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. *A new variable for the identification of the pons site has been developed to discriminate between sites included under the broad category of Brain Stem (C71.7), which will be collected starting in diagnosis year 2024 and will be available for analysis beginning in 2027.*

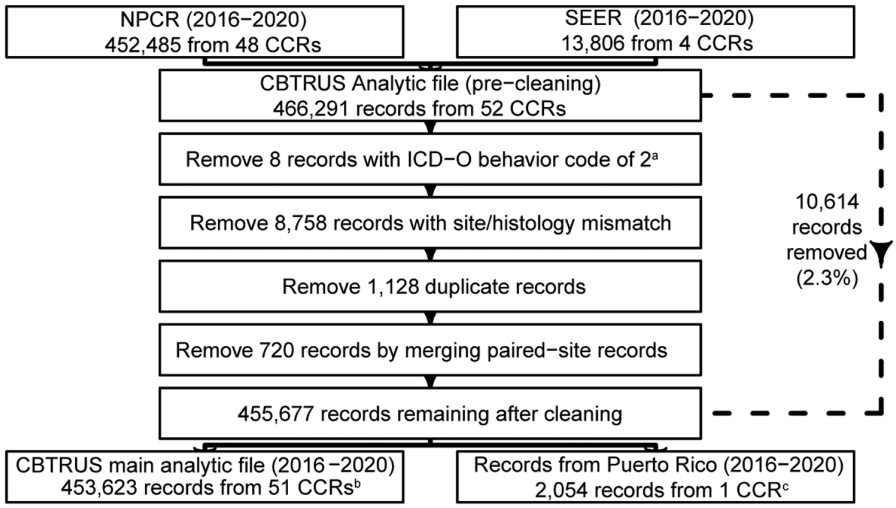
Classification by Histopathology

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 and updated periodically by expert neuropathologists and published by the World Health Organization (WHO). WHO publishes these classification updates periodically for all cancer sites and utilizes 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*.** *In anticipation of aligning its Histology Groupings to 2021 WHO, CBTRUS successfully petitioned the Uniform Data Standards (UDS) Committee of NAACCR to include 2021 WHO Tumor Types not identifiable through current ICD-O-3 codes into collection practices which will be collected starting in diagnosis year 2024 and available for analysis beginning in 2027 (see more information under Classification by BMM).*

The ICD-O-3 codes in this current CBTRUS grouping [21] (**Table 2**) may include morphology codes that were not previously reported to CBTRUS.[24] 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* [25] based on the *ICCC, Third edition*[26,27] and *2007 WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues*[28] (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.

The CBTRUS classification scheme is now available within NPCR's USCS Dataset (https://www.cdc.gov/cancer/uscs/public-use/index.htm), SEER*Explorer (https://seer.cancer.gov/statistics-network/explorer), and the NAACCR



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

Fig. 2 Overview of CBTRUS Data Edits Workflow, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

Cancer In North America Dataset (https://www.naaccr.org/cina-data-products-overview/).[29,30]

Classification by Behavior

Primary brain and other CNS tumors can be broadly classified in **non-malignant** (ICD-O-3 behavior codes of /0 for benign and /1 for uncertain) and **malignant** (ICD-O-3 behavior code of /3) (**Table 2**). Collection of central (state) cancer data was mandated in 1992 by Public Law 102-515 for all primary **malignant** tumors, also known as the Cancer Registries Amendment Act. This mandate was expanded to include **non-malignant** brain and other CNS tumors with the 2002 passage of Public Law 107–260, starting January 1, 2004.[6]

Classification by Brain Molecular Markers (BMM)

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. 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 multifaceted 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).[31] 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 (please 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 2018-2020 diagnosis years only. CBTRUS evaluated the completeness of these markers in their first year (2018) of collection (please see Iorgulescu, et al.[32]). *New molecularly defined histologies, introduced in the 2021 WHO classification, have been incorporated into a revised BMM variable. These will be collected for the first time starting in diagnosis year 2024 and will be available for analysis in reporting year 2027.* See **Supplementary Table 4** for a summary of biomarkers Identified for primary brain and other CNS tumors, outcomes, and collection status in US CCRs.

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 oligodendroglioma*	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 Paraspinal Nerves			
Nerve sheath tumors	9540, 9541, 9550, 9560, 9561, 9570, 9571	9540/3, 9560/3, 9561/3, 9571/3	9540/0,1, 9541/0, 9550/0, 9560/0,1, 9570/0, 9571/0
Other tumors of cranial and paraspinal nerves	9562, 9563	*None*	9562/0, 9563/0
Tumors of Meninges			
Meningioma	9530-9535, 9537-9539	9530/3, 9538/3, 9539/3	9530/0,1, 9531/0, 9532/0, 9533/0, 9534/0, 9535/0, 9537/0, 9538/1, 9539/1
Mesenchymal tumors	8324, 8710, 8711, 8800-8806, 8810, 8811, 8815, 8821, 8824, 8825, 8830, 8831, 8835, 8836, 8840, 8850-8854, 8857, 8861, 8870, 8880, 8890, 8897, 8900-8902, 8910, 8912, 8920, 8921, 8935, 8990, 9040, 9120, 9125, 9130, 9131, 9133, 9136, 9150, 9161, 9170, 9180, 9210, 9220, 9231, 9240, 9241, 9243, 9260, 9370-9373	8710/3, 8711/3, 8800/3, 8801/3, 8802/3, 8803/3, 8804/3, 8805/3, 8806/3, 8810/3, 8811/3, 8815/3[c], 8825/3, 8830/3, 8840/3, 8850/3, 8851/3, 8852/3, 8853/3, 8854/3, 8857/3, 8890/3, 8900/3, 8901/3, 8902/3, 8910/3, 8912/3, 8920/3, 8921/3, 8935/3, 8990/3, 9040/3, 9120/3, 9130/3, 9150/3, 9170/3, 9180/3, 9220/3, 9231/3, 9240/3, 9243/3, 9260/3, 9370/3, 9371/3, 9372/3	8324/0, 8711/0, 8800/0, 8810/0, 8811/0, 8815/0,1[c], 8821/1, 8824/0,1, 8825/0,1, 8830/0,1, 8831/0, 8835/1, 8836/1, 8840/0, 8850/0,1, 8851/0, 8852/0, 8854/0, 8857/0, 8861/0, 8870/0, 8880/0, 8890/0,1, 8897/1, 8900/0, 8920/1, 8935/0,1, 8990/0,1, 9040/0, 9120/0, 9125/0, 9130/0,1, 9131/0, 9136/1, 9150/0,1, 9161/0,1, 9170/0, 9180/0, 9210/0, 9220/0, 9241/0, 9373/0

Table 2. Continued

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

[a]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[b]See the CBTRUS website for additional information about the specific histopathology codes included in each group: http://www.cbtrus.org.
[c]Added starting with diagnosis year 2018.
[d]This histopathology 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.
[e]Includes 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.

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,[33] and though it was updated in 2007[34] and 2016,[2] these updated schema were not fully implemented by United States 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 uses both Arabic and Roman numerals.

The WHO grading assignments are recorded by cancer registrars as Collaborative Stage Site-Specific Factor 1 - WHO Grade Classification as directed in the AJCC, 8th Edition, Chapter 72 on Brain and Spinal Cord[35] (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). Site-specific factor variables were a required component of cancer registry data collection for brain and other CNS tumors beginning in 2004 for SEER registries, and beginning in 2011 for NPCR registries, and were collected through 2017 at which point they were replaced with SSDI. Completeness of these variables have improved significantly over time.[31,36]

Completeness of this variable is defined as having a value equal to WHO grade 1/I, 2/II, 3/III, or 4/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.[37] In contrast, the CBTRUS definition includes 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 (**Table 1**).[24] 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 1/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 (IARC) and International Association of Cancer Registries.[38,39] 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.[40,41]

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.**

Statistical Methods

The CBTRUS Statistical Report presents the following population-based measures: incidence rates, prevalence, 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/).

Estimation of Incidence Rates and Time Trends

AAAIR, incidence rate ratios (IRR) and 95% confidence intervals (95% CI) were estimated using the CBTRUS analytic dataset[42] 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 where this population is the standard used for age-adjustment.[43] Population data for each geographic region were obtained from the SEER program website.[44] IRRs used formulas described by Fay et al. to calculate p-values which were considered statistically significantly different when the p-value was less than 0.05. Joinpoint 5.0.2[45] was used to estimate incidence time trends and generate annual percentage changes (APC) and 95% CI.

Estimation of Prevalence

Point prevalence was estimated on December 31, 2019 using the *prevEst* package in R.[46] Counts of newly-diagnosed cases by single age and year at diagnosis for **malignant** and **non-malignant** brain and other CNS tumors were obtained from the 2022 CBTRUS dataset from 2000-2019 (2004-2019 for **non-malignant** tumors, and excluding cases from Nevada for diagnosis years 2018-2019 due to data quality issues) and survival data were obtained from SEER 8 from 1975-2019 (2004-2019 only for **non-malignant** tumors).[47,48] Cases diagnosed in 2019 were assumed to have a full year of follow-up with the same survival as 2018 to avoid overestimation.

Estimation of Mortality Rates, Relative Survival Rates, Overserved Survival, and Adjusted Hazard Ratios

Average annual age-adjusted mortality rates (AAAMR) 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.[22] 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.

Relative survival rates for primary **malignant** and **non-malignant** brain and other CNS tumor cases diagnosed between 2004-2019 in 39 NPCR CCRs were estimated using SEER*Stat. Median survival time for all reported primary **malignant** brain and other CNS tumors diagnosed between 2001-2019 in 39 NPCR CCRs was calculated by histopathology using the Kaplan-Meier method as well as by three age groups (0-14 years, 15-39 years, and 40+ years). 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.

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 group], 15-39 years, 40+ years), sex (male [reference group], female), and race and ethnicity (White non-Hispanic [reference group], Black non-Hispanic, American Indian/Alaskan Native (AIAN) non-Hispanic, Asian or Pacific Islander (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. Hazard ratios were considered statistically significantly different when the p-value was less than 0.05 or if the 95% CI did not include the null (1).

Variable Definitions

Age is reported using age groups by years including all ages, 0-19 and 20+ years and NIH age groups (0-14 years, 15-39 years, and 40+ years). Race categories are reported as all races: White, Black, AIAN, and 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.[49]

Statistical Software

Counts, means, medians, rates, ratios, proportions, and other relevant statistics were calculated using R 4.2.3 statistical software[50] and/or SEER*Stat 8.4.1.[51] Figures and tables were created in R using the following packages: flextable, officer, orca, plotly, SEER2R, sf, survminer, tigris, and tidyverse.[52-61] 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.**

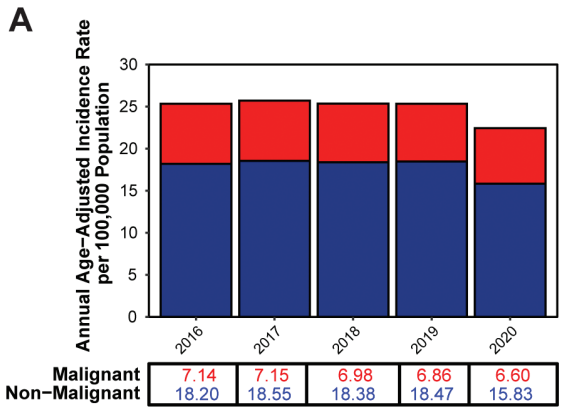
Impact of the Coronavirus Disease 2019 (COVID-19) Pandemic on 2020 Cancer Incidence Data

Health care disruptions caused by the COVID-19 pandemic have significantly affected cancer incidence data, through delays in diagnosis as well as new case abstraction.

The 2020 data are included in all calculated incidence rates.

Decline of 2020 Cancer Incidence Rates Relative to 2019 Rates

As discussed in the technical notes, incidence in more recent years of cancer registry data may be lower than the 'true' amount due to delays in data collection (**Figure 3A**). This leads to increases in annual incidence for these years in future data releases. The SEER program annually produces a special dataset that attempts to 'adjust' for these delays.[62] To assess the impact of COVID-19 as opposed to standard delays, we calculated delay-adjusted incidence rates for **malignant** brain tumors and other more common cancer types. As compared to other more common cancer



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

Fig. 3 A) Annual Age-Adjusted Incidence Rates[a] of All Primary Brain and Other Central Nervous System Tumors by Year and Behavior, B) Average Annual Age-Adjusted Incidence Rates 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, 2016-2020

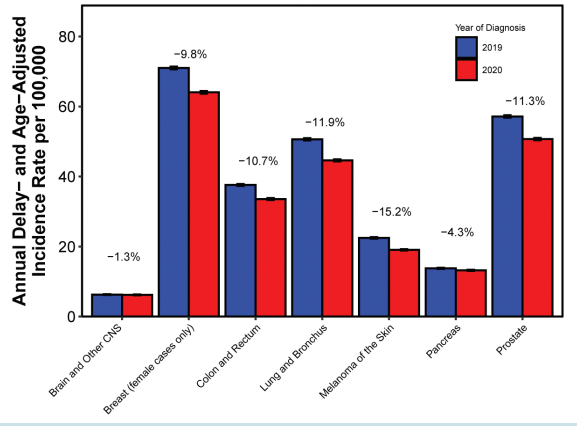
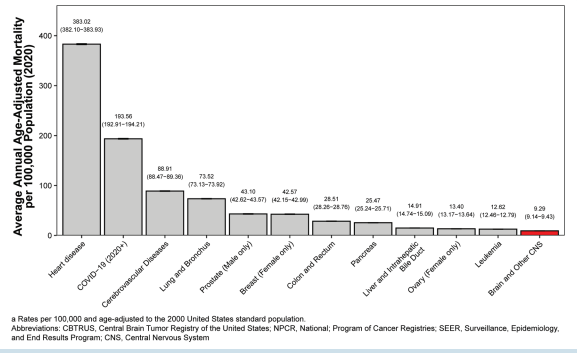


Fig. 4 Annual Delay- and Age-Adjusted Incidence Rates per 100,000 and Percent Change from 2019 to 2020 by Cancer Site, CBTRUS Statistical Report: SEER 2019-2020



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; NPCR, National; Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CNS, Central Nervous System

Fig. 5 Age-Adjusted Mortality Rates[a] with 95% Confidence Intervals of All Primary Brain and Other Central Nervous System Tumors in Comparison to the Top Eight Causes of Cancer Death and Top Three Non-Cancer Causes of Death (COD) for Older Adults Ages 40+ Years, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2020

sites, delay-adjusted incidence of **malignant** brain and other CNS tumors for 2020 was more similar to 2019 than for other cancer sites (**Figure 4**).

Mortality Due to Malignant Brain Tumors in Comparison to COVID-19 Deaths

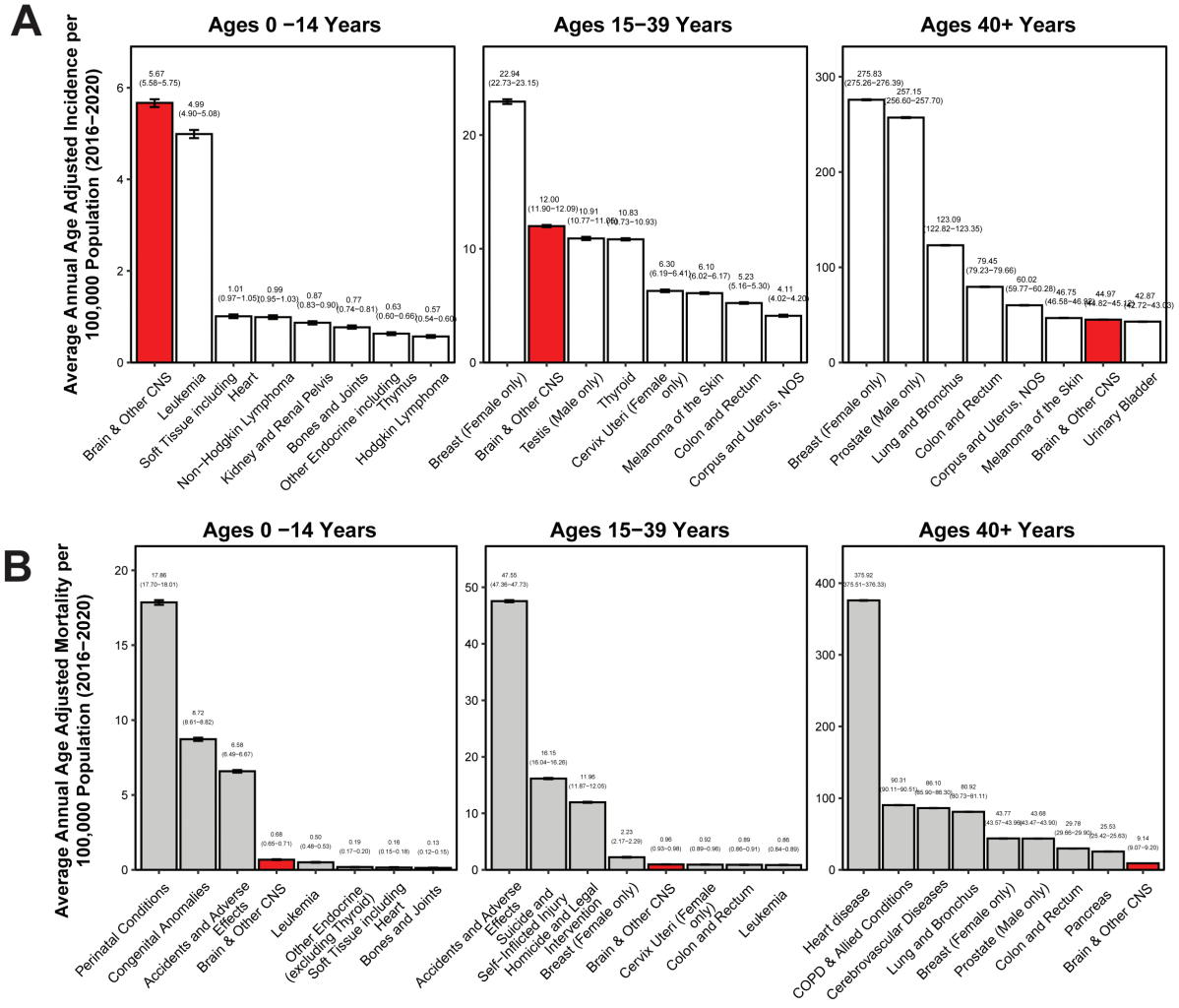
Annual age-adjusted mortality rates for older adults (ages 40+) from 2020 only are presented in **Figure 5**. COVID-19 is the second most frequent cause of death in this age group, as compared to average annual mortality rates from 2016-2020 (presented later in this report) where cerebrovascular diseases are the second most common cause of death in this age group. In 2020, brain and other CNS tumors were the 11th most common cause of cancer death and the 26th most common cause of death overall. COVID-19 was not in the top ten causes of death for children or AYA in 2020.

Exclusion of 2020 Incidence Data from Trends and Projections

All trends analyses are estimated using data collected through diagnosis year 2019 only. Please see the statement from the NCI's SEER program on the impact of the COVID-19 pandemic, including a recorded webinar, at https://seer.cancer.gov/data/covid-impact.html

Exclusion of Estimated Case Projections for 2023 and 2024

Due to high levels of variability due to data disruptions caused by the COVID-19 pandemic, estimated case projections were not calculated for the 2023 annual report.



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; NPCR, National; Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; NVSS, National Vital Statistics System; CNS, Central Nervous System; NOS, Not otherwise specified.

Fig. 6 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 the Top Eight Highest Incidence Cancers and B) Average Annual Age-Adjusted Mortality with 95% Confidence Intervals of All Primary Brain and Other Central Nervous System Tumors in Comparison to the 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, 2016-2020; and NVSS, 2016-2020

Please refer to the 2022 CBTRUS Statistical Report (https://doi.org/10.1093/neuonc/noac202)[63] for expected case estimates for 2023.

Results

Supplemental Data

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

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

AAAIRs for primary brain and other CNS tumors (2016-2020) and a selection of common cancers (USCS, 2016-2020) in the United States are presented by age in **Figure 6A** 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 children, with an AAAIR of 5.67 per 100,000 population.

- Leukemia was the second most common tumor in children, with an AAAIR of 4.99 per 100,000 population.
- Brain and other CNS tumors (both **malignant** and **non-malignant**) among AYA years had an AAAIR of 12.00 per 100,000 population. These tumors were the **second most common tumor type** in this age group.
- Testis cancer was the most common tumor type in male AYA, with an AAAIR of 10.91 per 100,000 (males only).
- Breast cancer was the most common tumor type among AYA and older adults, with AAAIRs of 22.94 and 275.83 per 100,000 (females only).
- The second most common tumor type among older adults was prostate cancer, which had an incidence rate of 257.15 per 100,000 (males only).
- Brain and other CNS tumors (both **malignant** and **non-malignant**) were the **seventh most common tumor** type among older adults with an AAAIR of 44.97 per 100,000 population.

AAAMR for primary **malignant** brain and other CNS tumors (2016-2020), a selection of common cancers, and the top three non-cancer causes of death in the United States are presented by age group in **Figure 6B**.

- The most common causes of death in children were perinatal conditions (17.86 per 100,000).
- Childhood brain and other CNS cancer, while rare, contributes substantially to cancer related mortality in **children** 0-14 years and is **the most common cause of cancer death**.
- **Malignant** brain and other CNS tumors among **children** had an AAAMR of 0.68 per 100,000 and were the **eighth most common cause of death** in this age group.
- Accidents and adverse effects were the leading causes of death in AYA (47.55 per 100,000).
- **Malignant** brain and other CNS tumors among **AYA** had an AAAMR of 0.96 per 100,000 and were the **12th 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 (0.86 per 100,000).
- Breast cancer (female only) was **the most common cause of cancer death** in this age group (2.23 per 100,000).
- Heart disease was the largest contributor to mortality in older adults in the United States, with an AAAMR of 375.92 per 100,000 for major cardiovascular diseases.
- **Malignant** brain and other CNS tumors among **older adults** had an AAAMR of 9.14 per 100,000 and were the 27th most common cause of death.
- Lung and bronchus cancer was **the most common cause of cancer death** in this age group (80.92 per 100,000).

Estimated Prevalence of Primary Brain and Other CNS Tumors by Histopathology, Behavior, and Age Groups

Prevalence is an estimate of the total number of individuals with a disease who currently are alive within a population, as compared to incidence, which is a calculation based on new diagnoses only. These calculations consider not only the number of new cases being diagnosed, but also the length of time that individuals survive after diagnosis. CBTRUS recently estimated the prevalence for both **malignant** and **non-malignant** brain and other CNS tumors as of December 31, 2019.[64] Prevalent estimates for primary brain and other CNS tumors and a selection of common cancers from the USCS in the United States are presented in **Figure 7A** and by histopathology in **Figure 7B**.

- **There were an estimated 1,323,121 individuals living with a previously diagnosed primary brain and other CNS tumor (malignant and non-malignant) on December 31, 2019.**
- In 2019, breast cancer (females only) was the most prevalent type of cancer with 4,456,708 individuals estimated to be living with a breast cancer diagnosis.
- Brain and other CNS tumors were the **fifth most prevalent cancer overall**.
- The most common histopathology, meningioma, accounted for over one-third (491,509) of all estimated individuals diagnosed with a brain and other CNS.
- The least prevalent histopathology was tumors of the pineal region at 777 estimated prevalent individuals.
- There were an estimated 141,446 individuals living with a glioma diagnosis in 2019, or about 11% of the total population diagnosed with brain or other CNS tumors. This included 24,688 individuals with glioblastoma and 55,343 individuals with lower-grade glioma (including diffuse and anaplastic astrocytoma and oligodendrogliomas).

Lifetime Risk of Primary Malignant Brain and Other CNS Tumors

From birth, a person in the United States has a 0.6% chance of ever being diagnosed with a primary **malignant** brain and other CNS tumor (as defined using the SEER definition of brain and CNS tumors, which excludes lymphomas, leukemias, tumors of the pituitary and pineal glands, and olfactory tumors of the nasal cavity) and a 0.5% chance of dying from a primary **malignant** brain/other CNS tumor. Lifetime risk of developing or dying of a primary **malignant** brain and other CNS tumor by five-year age group overall and by sex is presented in **Figure 8A** and by race/ethnicity in **Figure 8B**.

- For males (all races), the risk of developing and the risk of dying from a primary **malignant** brain and other CNS tumor is 0.7% and 0.5%, respectively.
- For females (all races), the risk of developing and the risk of dying from a primary **malignant** brain and other CNS tumor is 0.5% and 0.4%, respectively.
- For individuals who are White non-Hispanic (both sexes), the risk of developing and the risk of dying from a primary **malignant** brain and other CNS tumor is 0.7% and 0.6%, respectively.
- For individuals who are White Hispanic (both sexes), the risk of developing and the risk of dying from a primary **malignant** brain and other CNS tumor is 0.5% and 0.4%, respectively.
- For individuals who are Black (both sexes, both ethnicities), the risk of developing and the risk of dying from a

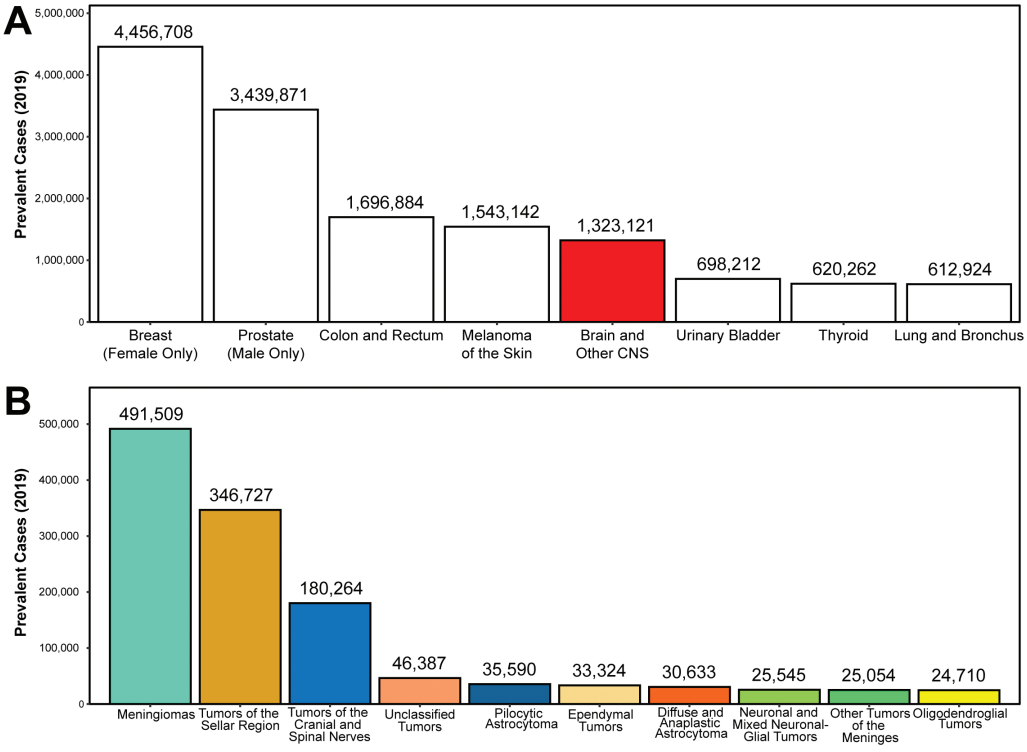
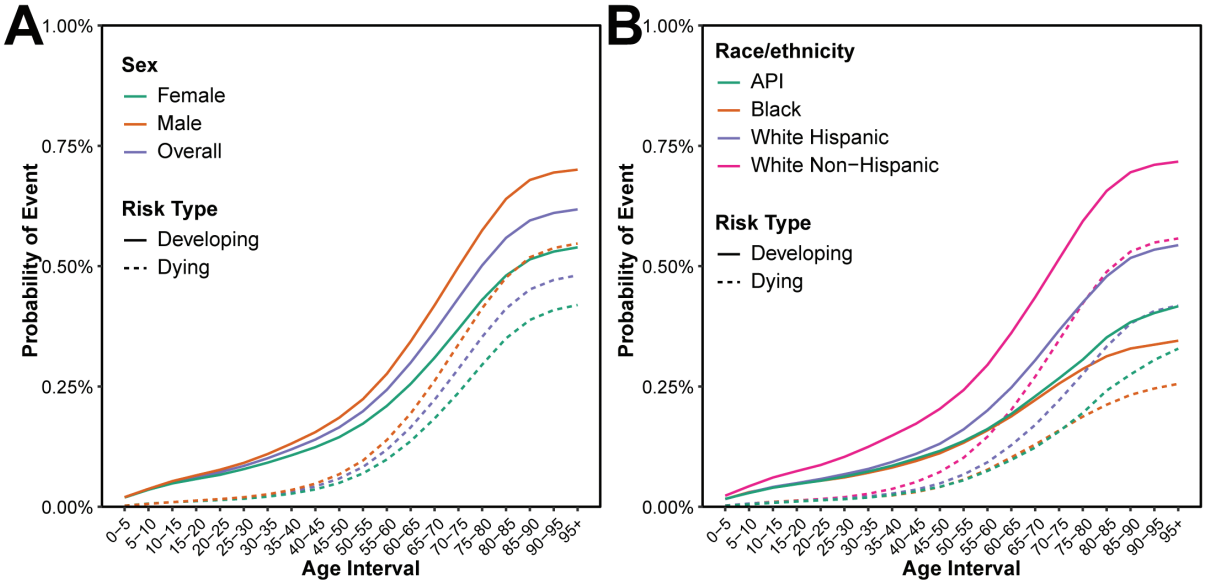


Fig. 7 Estimated Prevalent Cases in the United States in 2019 for A) the Seven Most Prevalent Cancers B) by the Ten Most Prevalent Brain and Other Central Nervous System Histopathologies, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 1975-2019 (varying)



Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National; Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; API, Asian or Pacific Islander.

Fig. 8 Lifetime Risk of Developing or Dying of a Primary Malignant Brain and Other Central Nervous System Tumor by Five-Year Age Group A) Overall and by Sex and by B) Race and Ethnicity, CBTRUS Statistical Report: US Cancer Statistics—SEER, 2016-2018

Table 3. Distribution of Brain Molecular Markers for Select Histopathologically-Confirmed Glioma and Embryonal Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2018-2020

Histopathology	Frequency (%)
Diffuse Astrocytoma	
9400/3: Diffuse astrocytoma, IDH-mutant[a]	1,701 (43.8%)
9400/3: Diffuse astrocytoma, IDH-wildtype[a]	1,337 (34.4%)
9400/3: Diffuse astrocytoma, IDH Status Unknown	845 (21.8%)
Anaplastic Astrocytoma	
9401/3: Anaplastic astrocytoma, IDH-mutant[a]	1,695 (44.3%)
9401/3: Anaplastic astrocytoma, IDH-wildtype[a]	1,696 (44.4%)
9401/3: Anaplastic astrocytoma, IDH Status Unknown	433 (11.3%)
Glioblastoma	
9440/3: Glioblastoma, IDH-wildtype[a]	29,066 (78.5%)
9440/3: Glioblastoma, IDH Status Unknown	6,068 (16.4%)
9441/3: Giant cell glioblastoma	229 (0.6%)
9442/3: Gliosarcoma	757 (2%)
9445/3: Glioblastoma, IDH-mutant[b]	919 (2.5%)
Oligodendroglioma	
9450/3: Oligodendroglioma, IDH-mutant and 1 p/19q co-deleted[a]	1,836 (91.5%)
9450/3: Oligodendroglioma, NOS	171 (8.5%)
Anaplastic Oligodendroglioma	
9451/3: Anaplastic oligodendroglioma, IDH-mutant and 1 p/19q co-deleted[a]	958 (93.1%)
9451/3: Oligodendroglioma, anaplastic	71 (6.9%)
Medulloblastoma	
9470/3: Medulloblastoma, NOS	602 (47.8%)
9471/3: Desmoplastic nodular medulloblastoma	--
9471/3: Medulloblastoma, SHH-activated and TP53-wildtype[a]	244 (19.4%)
9472/3: Medullomyoblastoma	--
9474/3: Large cell medulloblastoma	84 (6.7%)
9475/3: Medulloblastoma, WNT-activated, NOS[b]	47 (3.7%)
9476/3: Medulloblastoma, SHH-activated and TP53-mutant[b]	28 (2.2%%)
9477/3: Medulloblastoma, non-WNT/non-SHH[b]	214 (17%)

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

primary **malignant** brain and other CNS tumor is 0.3% and 0.3%, respectively.
- For individuals who are API (both sexes, both ethnicities), the risk of developing and the risk of dying from a primary **malignant** brain and other CNS tumor is 0.4% and 0.3%, respectively.

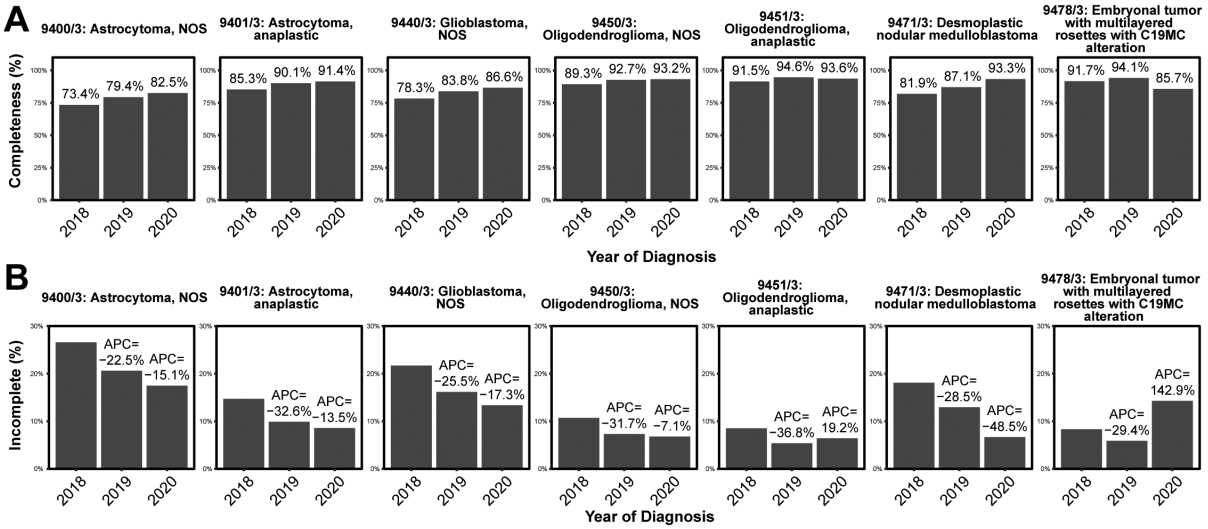
Incidence and Survival for Molecularly-Defined Brain and Other CNS Tumors Histopathologies

Please see the 2022 CBTRUS statistical report (https://doi.org/10.1093/neuonc/noac202)[63] for an overview of biomarkers collected in United States cancer registry data.

Completeness of Molecular Markers Variable Data Collection

The BMM variable and molecularly-defined ICD-O-3 codes are specific to certain histopathologies (please see **Supplementary Tables 2-4**). Frequency of reported molecular markers for relevant histopathologies (2018-2020) are shown in **Table 3**. Completeness of molecular marker reporting using BMM variable is shown in **Figure 9**.

- Among glioblastoma patients, 919 cases were coded as 9445/3, Glioblastoma *IDH*-mutant (2.5%), 29,066 cases were coded as 9440/3, Glioblastoma *IDH*-wildtype (78.5%), and 6,068 cases as 9440/3, Glioblastoma *IDH* Status Unknown (16.4%). Among those with unknown



a. Molecular marker data collected via the NAACCR Site-Specific Data Item #3816: Brain Molecular Marker variable (see Supplementary Table 2 for included sites and coding schemes).
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. 9 A) Completeness of the Brain Molecular Marker Variable[a] by Year of Diagnosis and B) Proportion of Individuals with Incomplete Data and Annual Percent Change in Incompleteness, for Selected Histopathologies by ICD-O-3 Code, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2018-2020

IDH status, 115 cases had a test ordered, but no results were reported in patient chart (1.9%), while the remaining patients did not have *IDH* status documented in their patient record, or the information was miscoded/unknown 5,945 (98%).

- Frequency of *IDH1/2* mutation reporting was high in diffuse astrocytoma (9400/3, 82.5%) and anaplastic astrocytoma (9401/3, 91.4%). Biomarker reporting was complete in 93.2% of oligodendroglioma coded as 9450/3 and 93.6% of anaplastic oligodendroglioma coded as 9451/3.
- For medulloblastoma coded as 9471/3, 93.3% had complete biomarker reporting.
- Completeness of biomarker reporting improved for all assigned ICD-O-3 codes except embryonal tumors with multilayered rosettes, C19MC-altered from years 2018-2020 (**Figure 9A**).
- Incompleteness decreased substantially annually for all histopathologies except embryonal tumors with multilayered rosettes, C19MC-altered (**Figure 9B**).

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

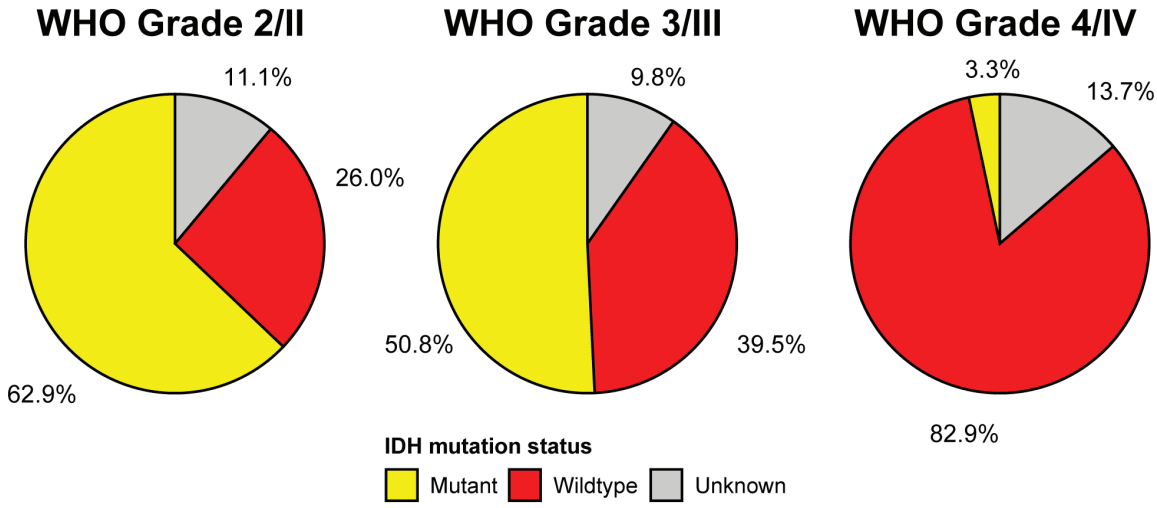
Total cases of molecularly-defined histopathologies diagnosed in 2018-2020, age-adjusted incidence rates, median age of diagnosis, and distribution by sex and race/ethnicity are shown in **Table 4**.

- The *IDH1/2*-mutant astrocytoma subtype had incidence rate of 0.45 per 100,000 population, while *IDH1/2*-wildtype astrocytoma subtype had an incidence rate of 2.66 per 100,000 population. Median age of diagnosis for these subtypes was 37 and 65 years, respectively.
- When stratified by WHO grade, 62.9% of WHO grade 2/II astrocytoma were *IDH1/2* mutant, while 50.8% and 3.3% of WHO grade 3/III and 4/IV astrocytoma were *IDH1/2*-mutant (**Figure 10**).
- The most common medulloblastoma subtype was Sonic Hedgehog (*SHH)*-activated & *TP53*-wildtype (included in the SHH group), which had an incidence rate of 0.03 per 100,000 population and a median age of diagnosis of 19 years.
- Non-WNT/non-SHH medulloblastoma (including both group 3/group C and group 4/group D) 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 (also known as the WNT group) was 0.01 per 100,000 population, with a median age of diagnosis of 10 years. The SHH-activated, and *TP53*-mutant medulloblastoma subtype (included in the SHH group) 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 as seen with 9471/3, desmoplastic nodular medulloblastoma (**Figure 9**).
- 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. Completeness of this molecular subtype decreased from 94.1% in 2019 to 85.7% in 2020.

Table 4. Average Annual Age-Adjusted Incidence Rates[a], Median Age at Diagnosis, Sex, and Race/Ethnicity of Histopathologically-Confirmed Molecularly-Defined Brain and Other Central Nervous System Tumors by WHO Grade[b] for Diagnosis Years 2018-2020, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2018-2020

Histopathology	ICD-O-3 Histopathology Codes	WHO Grade	Total cases (2018-2020)[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	4,293	0.45 (0.43-0.46)	37 (29-49)	42.5%	78.7%	6.5%	11.8%
		2/II[d]	1,238	0.13 (0.13-0.14)	35 (28-45)	40.8%	78.5%	6.4%	11.2%
		3/III	1,403	0.15 (0.14-0.16)	37 (29-49)	43.0%	79.6%	5.9%	11.8%
		4/IV	933	0.09 (0.09-0.10)	39 (31-54)	42.0%	78.2%	7.1%	12.0%
IDH-wildtype Astrocytoma and Glioblastoma[d e] (BMM 2, 4, 5)	9400/3, 9401/3, 9440/3	All grades	31,971	2.66 (2.63-2.69)	65 (56-72)	41.5%	82.3%	6.4%	8.7%
		2/II	578	0.05 (0.05-0.06)	52 (33-65)	44.8%	77.6%	9.2%	9.7%
		3/III	1,090	0.10 (0.09-0.10)	60 (46-70)	46.2%	80.9%	7.3%	8.7%
		4/IV	23,088	1.91 (1.89-1.94)	65 (56-72)	40.6%	82.4%	6.4%	8.7%
IDH-mutant & 1p/19q-codeleted Oligodendroglioma (BMM 6, 7)	9450/3, 9451/3	All grades	2,783	0.29 (0.28-0.30)	45 (35-56)	43.6%	77.4%	4.7%	13.9%
		2/II	1,411	0.15 (0.14-0.16)	42 (34-53)	43.4%	75.5%	5.0%	15.0%
		3/III	928	0.09 (0.09-0.10)	48 (37-58)	42.7%	79.2%	4.6%	12.6%
Medulloblastoma[f]									
SHH-activated & *TP53*-wildtype (BMM 8)	9471/3	All grades	244	0.03 (0.02-0.03)	19 (5-31)	37.7%	57.0%	10.6%	28.1%
SHH-activated & *TP53*-mutant	9476/3	All grades	28	0.00 (0.00-0.00)	11 (7.5-23.25)	--	--	--	--
WNT-activated	9475/3	All grades	47	0.01 (0.00-0.01)	10 (7-12.5)	--	61.7%	--	--
Non-WNT/non-SHH	9477/3	All grades	208	0.02 (0.02-0.03)	8 (4-12)	33.7%	61.5%	--	30.0%
Other tumor types									
Diffuse midline glioma, H3 K27M-mutant	9385/3	All grades	527	0.06 (0.05-0.06)	15 (7-33)	52.2%	57.6%	13.0%	23.4%
ETMR C19MC-altered (BMM 9)	9478/3	All grades	45	0.01 (0.00-0.01)	2 (2-3)	57.8%	64.4%	--	--
RELA-fusion ependymoma	9396/3	All grades	23	0.00 (0.00-0.00)	13 (4.5-23.5)	--	--	--	--

[a]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[b]WHO grade is reported according to 2016 WHO classification, in which Roman numerals are used to denote tumor grade.
[c]Excludes cases with missing molecular classification data or that are not histopathologically-confirmed.
[d]Adult-type diffuse glioma cases reported as WHO grade I or "low-grade, NOS" were grouped with WHO grade II.
[e]In 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.
[f]Both histopathologically-defined and new molecularly-defined ICD-O-3 codes for medulloblastomas were reported in the registry data; however, only a single ICD-O-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; ETMR, Embryonal tumor with multilayered rosettes.



a. Molecular marker data collected via the NAACCR Site-Specific Data Item #3816: Brain Molecular Marker variable (see Supplementary Table 2 for included sites and coding schemes).
b. Includes ICD-O-3 codes 9400/3, 9401/3 9440/3, and 9445/3.
Abbreviations: IDH, Isocitrate dehydrogenase; WHO, World Health Organization; CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Fig. 10 Frequency of IDH Mutations[a] by WHO Grade for Selected Astrocytoma Histopathologies[b], CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2018-2020

- Diffuse midline glioma, H3 K27M-mutant had an incidence rate of 0.06 per 100,000 population and a median age of diagnosis of 15 years.

Time Trends in Primary Brain and Other CNS Tumors

Due to instability in cancer incidence due to health care disruption caused by the COVID-19 pandemic, CBTRUS does not include incidence data from 2020 in time trends analysis for the 2023 Statistical Report. In lieu of updated histopathology-specific time trends, we present overall trends in malignant and non-malignant brain tumor incidence by sex and race/ethnicity.

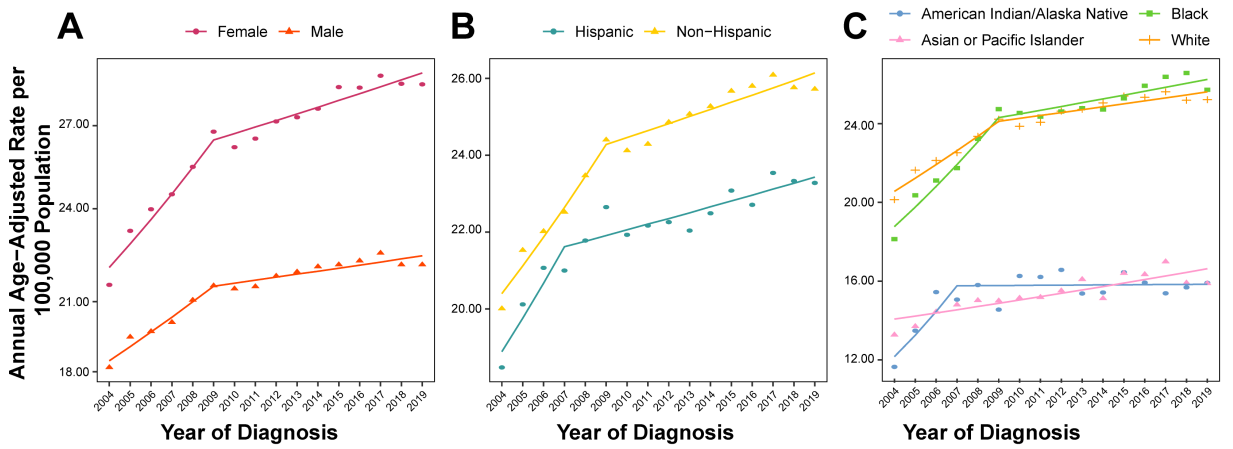
Incidence rates of cancer overall and many specific cancer histopathologies have decreased over time.[65] Overall, changes in incidence rates of all primary brain and other CNS tumors between 2000 and 2019 (limited to 2004 and 2019 for **non-malignant** tumors), have been small. As stated previously, 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.

For an overview of the overall incidence time trends by histopathology, behavior, and age group for diagnosis years 2000-2019 (2004-2019 for **non-malignant**) see the 2022 CBTRUS Statistical Report (https://doi.org/10.1093/neuonc/noac202).[63]

Trends in Incidence of Brain and Other CNS Tumors by Sex

Please see **Figure 12** and **Supplementary Table 5** for incidence trends of **malignant** brain and other CNS tumors overall and for selected histopathologies, from 2000-2019. Please see **Figure 13** and **Supplementary Table 6** for incidence trends of **non-malignant** brain and other CNS tumors, from 2004-2019.

- While incidence of brain and other CNS tumors increased overall, there was a greater increase in significant incidence changes among females compared to males from 2004-2009 (female APC=3.9% [95%CI: 2.7%, 5.1%]; male APC=2.8% [95%CI: 1.9%, 3.6%]) and from 2009-2019 (female APC=0.9% [95%CI: 0.5%, 1.2%]; male APC=0.5% [95%CI: 0.2%, 0.8%]; **Figure 11A**).
- There was a slight statistically significant decrease in overall incidence of **malignant** brain and other CNS tumors in both males and females in later years of the period examined (female 2007-2019 APC=-0.7% [95%CI: -1.0%, -0.6%]; male 2008-2019 APC=-0.8% [95%CI: -0.8%, -0.6%]).
- Incidence of CNS lymphoma has statistically significantly decreased slightly in males from 2000-2019 (APC=-0.6% [95%CI: -0.9%, -0.3%]) and increased slightly in females for the same trend period (APC=0.5% [95%CI: 0.1%, 0.9%]).
- There was a slight statistically significant increase in overall incidence of **non-malignant** brain and other CNS tumors in males from 2004-2009 (APC=5.1% [95%CI: 3.7%, 6.6%]) and 2009-2019 (APC=1.2% [95%CI: 0.8%, 1.6%]).



* Annual Percentage Change (APC) is statistically significant at the p<0.05 level.
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. 11 Annual Age-Adjusted Incidence Rates[a] of All Primary Malignant and Non-Malignant[b] Brain and Other Central Nervous System Tumors and Incidence Trends by A) Sex, B) Ethnicity, and C) Race, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2004-2019

- Incidence of **non-malignant** meningioma and tumors of the pituitary have continued to decrease in males and females at a similar rate.
- Both males and females had statistically significant increase in vestibular schwannoma from 2004-2014 and 2004-2015, respectively. This was followed by a statistically insignificant decrease in both sexes (**Supplementary Table 6**).

Trends in Incidence of Brain and Other CNS Tumors by Hispanic Ethnicity

- Overall, incidence of brain and other CNS tumors among individuals who are non-Hispanic or Hispanic increased from 2004-2019 (**Figure 11B**, **Supplementary Table 5**).
- Incidence of **malignant** brain and other CNS tumors among individuals who are non-Hispanic had a slight statistically significant increase from 2000-2008 (APC=0.4% [95%CI: 0.1%, 0.6%]) followed by a statistically significant decrease from 2008-2016 (APC=-0.5% [95%CI: -0.8%, -0.2] %) and 2016-2019 (APC=-1.4% [95%CI: -2.3%, -0.4%]; **Figure 12A**, **Supplementary Table 7**), while incidence among individuals who are Hispanic decreased statistically significantly from 2000-2012 (APC=-0.8% [95%CI: -1.1%, -0.6%]).
- Incidence of glioblastoma increased slightly statistically significantly among individuals who are non-Hispanic from 2000-2004 and 2004-2019 (APC=1.1% [95%CI: 0.2%, 2.0%]; APC=0.2% [95%CI: 0.1%, 0.4%], respectively) and among individuals who are Hispanic from 2014-2019 (APC=2.2% [95%CI: 0.4%, 4.1%]; **Figure 12B**).
- Incidence of CNS lymphoma had no significant change in incidence from 2000-2019 among individuals who are non-Hispanic or Hispanic (**Figure 12C**, **Supplementary Table 7**).
- There was a statistically significant increase in overall incidence of **non-malignant** brain and other CNS tumors among individuals who are non-Hispanic from 2004-2009 (APC=5.4% [95%CI: 4.0%, 6.8%]) and 2009-2019 (APC=1.3% [95%CI: 0.9%, 1.7%]) and individuals who are Hispanic from 2004-2008 (APC=5.7% [95%CI: 2.4%, 9.1%]) and 2008-2019 (APC=0.8% [95%CI: 0.3%, 1.3%], **Figure 13A**).
- Incidence trends of **non-malignant** meningioma, tumors of the pituitary, and vestibular schwannoma were similar between individuals who are non-Hispanic and Hispanic (**Supplementary Table 7**).

Trends in Incidence of Brain and Other CNS Tumors by Race

- Overall, the greatest statistically significant increases in incidence were among individuals who are AIAN from 2004-2007 (APC=9.0% [95%CI: 1.6%, 17.0%]) and individuals who are Black from 2004-2009 (APC=5.3% [95%CI: 3.7%, 6.9%]; **Figure 11C** and **Supplementary Table 5**).
- Incidence of **malignant** brain and other CNS tumors decreased in all racial groups from 2000-2019 with the greatest statistically significant decrease occurring in individuals who are White from 2016-2019 (APC=-1.5% [95%CI: -2.5%, -0.6%]; **Figure 13A**).
- Incidence of glioblastoma increased statistically significantly among individuals who are White (2000-2004: APC=1.2% [95%CI: 0.3%, 2.1%]; 2004-2019: APC=0.2% [95%CI: 0.1%, 0.3%]) or Black (2000-2019: APC=0.9% [95%CI: 0.6%, 1.2%]), but there was no significant change among persons who are AIAN or API (**Figure 13B**, **Supplementary Table 8**).
- Incidence of CNS lymphoma decreased statistically significantly among individuals who are Black (2000-2019: APC=-2.0% [95%CI: -2.8%, -1.3%]), but increased among

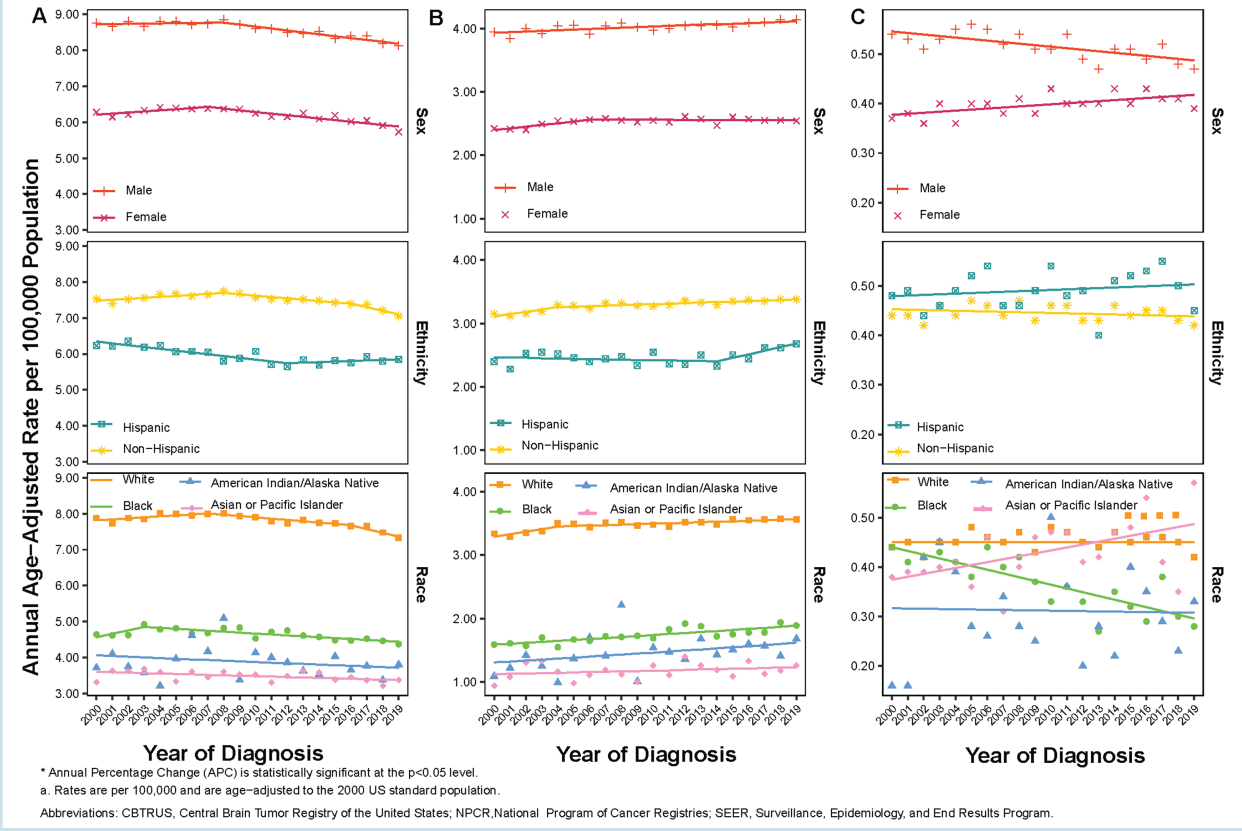


Fig. 12 Annual Age-Adjusted Incidence Rates[a] of Malignant Primary Brain and Other Central Nervous System Tumors and Incidence Trends by Sex, Ethnicity, and Race A) Overall and Among Selected Malignant Histopathologies; B) Glioblastoma and C) Primary CNS, Lymphoma, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2000-2019

individuals who are API for this trend period (APC=1.4% [95%CI: 0.2%, 2.6%]; **Figure 12C**).

- Incidence of **non-malignant** brain and other CNS tumors increased in all racial groups except API from 2004-2019 which showed a slight statistically insignificant decrease (APC=-1.7% [95%CI: -3.7%, 0.4%]; **Figure 13A**, **Supplementary Table 9**).
- Statistically significant increases of **non-malignant** meningioma incidence were highest among individuals who are AIAN from 2004-2007 (API=10.2% [95%CI: 1.7%, 19.4%]) and individuals who are Black from 2004-2009 (APC=8.0% [95%CI: 5.7%, 10.2%]; **Figure 13B**).
- Incidence of vestibular schwannoma had the greatest increase among individuals who are Black from 2004-2009 (APC=8.5% [95%CI: 2.3%, 15.0%]).

Distributions and Incidence by Site, Behavior, and Histopathology

Counts and rates from the 453,623 brain and other CNS tumors (27.9% **malignant**, 126,729 cases; 72.1% **non-malignant**; 326,894 cases shown in **Figure 14**) reported during 2016-2020 overall and by sex for all ages are shown by site in **Table 5** and by histopathology in **Table 6**. Counts and rates are shown by histopathology and behavior for selected histopathologies where there is a statistically sufficient number of individuals to calculate rates (>16 individuals).

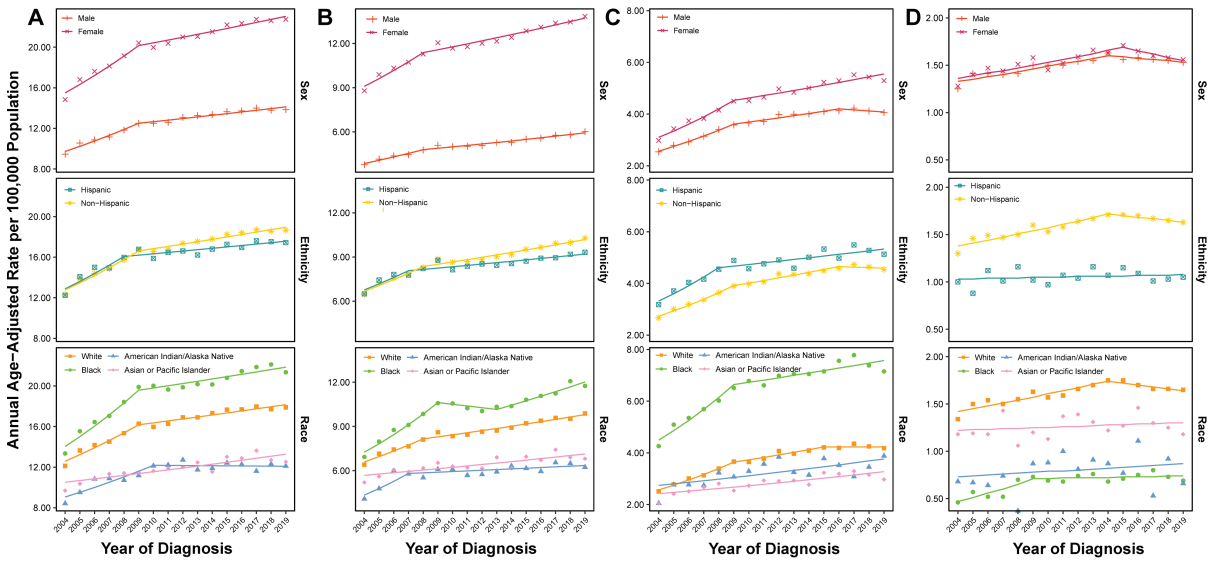
Distribution of Tumors by Site and Histopathology

The distribution of brain and other CNS tumors by site is shown in **Figure 15A** and **Table 5**.

- Overall, the **most common tumor site was the meninges**, representing 41.0% of all tumors.
- Frontal (7.6%), temporal (5.5%), parietal (3.2%), and occipital lobes (0.8%) accounted for 17.1% of all tumors.
- The cranial nerves (6.7%) and the spinal cord/cauda equina (2.7%) accounted for 9.4% of all tumors.
- The pituitary and craniopharyngeal duct accounted for 18.1% of all tumors.

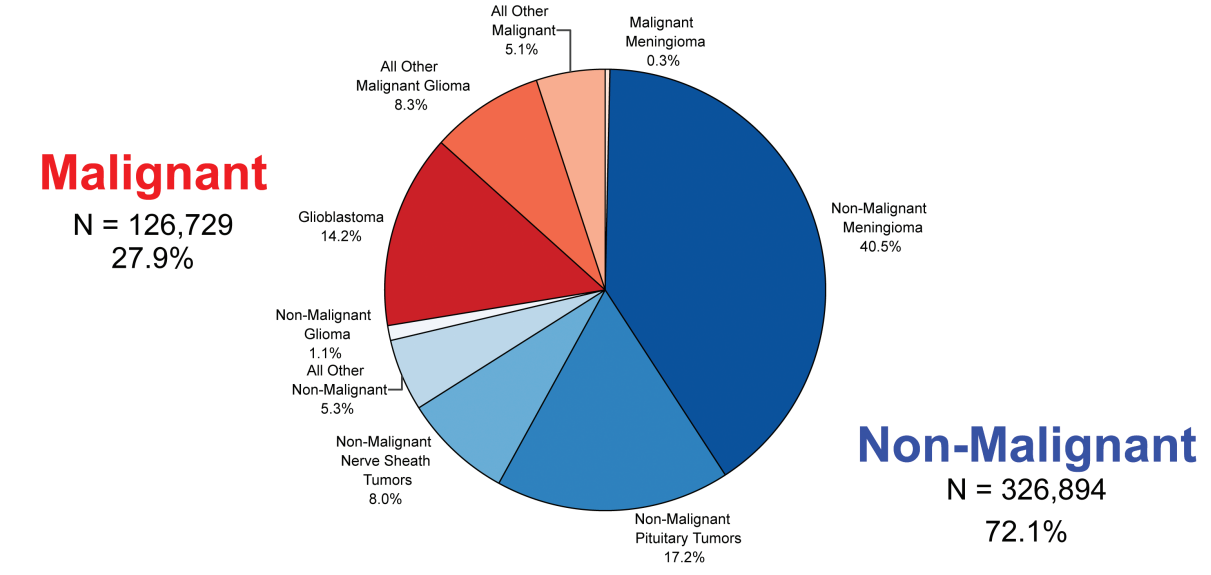
The distribution by brain and other CNS histopathologies is shown in **Figure 15B** and **Table 6**.

- The **most frequently reported histopathologies overall were meningiomas** (40.8%), followed by tumors of the pituitary (17.2%) and glioblastoma (14.2%).



* Annual Percentage Change (APC) is statistically significant at the p<0.05 level.
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. 13 Annual Age-Adjusted Incidence Rates[a] of Non-Malignant Primary Brain and Other Central Nervous System Tumors and Incidence Trends by Sex, Ethnicity, and Race A) Overall and Among Selected Non-Malignant Histopathologies; B) Meningioma, C) Tumors of the Pituitary, and D) Vestibular Schwannoma, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2004-2019



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-glial tumors, tumors of the pineal region, embryonal tumors, nerve sheath tumors, mesenchymal tumors, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, neoplasm unspecified, and all other.
c. Includes histopathologies with ICD-O-3 behavior code of /0 or /1 from neuronal and mixed neuronal-glial tumors, tumors of the pineal region, embryonal tumors, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other hematopoietic neoplasms, germ cell tumors, craniopharyngioma, hemangioma, neoplasm unspecified, and all other.
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.

Fig. 14 Distribution[a] of Primary Brain and Other Central Nervous System Tumors by Behavior (Five-Year Total=453,623; Annual Average Cases=90,725), CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

Table 5. Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals of Brain and Other Central Nervous System Tumors by Site[c] and Sex, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

Site (ICD-O-3Topography 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]	712	142	0.2%	0.04 (0.04-0.04)	418	84	0.2%	0.05 (0.04-0.05)	294	59	0.1%	0.03 (0.03-0.04)
Meninges (cerebral and spinal) (C70.0-C70.9)	186,065	37,213	41.0%	9.78 (9.73-9.82)	50,964	10,193	27.3%	5.85 (5.80-5.90)	135,101	27,020	50.6%	13.27 (13.20-13.35)
Cerebral meninges (C70.0)	153,072	30,614	33.7%	8.05 (8.01-8.09)	42,258	8,452	22.6%	4.85 (4.80-4.90)	110,814	22,163	41.5%	10.90 (10.83-10.96)
Spinal meninges (C70.1)	7,687	1,537	1.7%	0.40 (0.39-0.41)	1,684	337	0.9%	0.19 (0.18-0.20)	6,003	1,201	2.2%	0.58 (0.56-0.59)
Meninges, NOS (C70.9)	25,306	5,061	5.6%	1.33 (1.32-1.35)	7,022	1,404	3.8%	0.81 (0.79-0.83)	18,284	3,657	6.9%	1.80 (1.77-1.82)
Cerebrum (C71.0)	7,395	1,479	1.6%	0.42 (0.41-0.43)	3,930	786	2.1%	0.46 (0.45-0.48)	3,465	693	1.3%	0.38 (0.37-0.39)
Frontal, temporal, parietal, and occipital lobes of the brain (C71.1-C71.4)	77,432	15,486	17.1%	4.17 (4.14-4.20)	43,561	8,712	23.3%	4.95 (4.90-5.00)	33,871	6,774	12.7%	3.48 (3.44-3.51)
Frontal lobe (C71.1)	34,377	6,875	7.6%	1.88 (1.86-1.90)	18,398	3,680	9.8%	2.12 (2.09-2.15)	15,979	3,196	6.0%	1.66 (1.64-1.69)
Temporal lobe (C71.2)	24,982	4,996	5.5%	1.34 (1.32-1.35)	14,974	2,995	8.0%	1.69 (1.66-1.72)	10,008	2,002	3.8%	1.03 (1.01-1.05)
Parietal lobe (C71.3)	14,371	2,874	3.2%	0.76 (0.74-0.77)	8,127	1,625	4.4%	0.91 (0.89-0.93)	6,244	1,249	2.3%	0.62 (0.61-0.64)
Occipital lobe (C71.4)	3,702	740	0.8%	0.19 (0.19-0.20)	2,062	412	1.1%	0.23 (0.22-0.24)	1,640	328	0.6%	0.16 (0.16-0.17)
Ventricle (C71.5)	4,109	822	0.9%	0.25 (0.24-0.26)	2,284	457	1.2%	0.28 (0.27-0.29)	1,825	365	0.7%	0.22 (0.21-0.23)
Cerebellum (C71.6)	9,189	1,838	2.0%	0.57 (0.56-0.58)	4,987	997	2.7%	0.63 (0.61-0.64)	4,202	840	1.6%	0.51 (0.50-0.53)
Brain stem (C71.7)	6,092	1,218	1.3%	0.39 (0.38-0.40)	3,273	655	1.8%	0.41 (0.40-0.43)	2,819	564	1.1%	0.36 (0.35-0.37)
Other brain (C71.8-C71.9)	33,622	6,724	7.4%	1.81 (1.79-1.83)	18,065	3,613	9.7%	2.08 (2.05-2.12)	15,557	3,111	5.8%	1.58 (1.55-1.61)
Overlapping lesion of brain (C71.8)	12,747	2,549	2.8%	0.67 (0.66-0.69)	7,251	1,450	3.9%	0.82 (0.80-0.84)	5,496	1,099	2.1%	0.55 (0.54-0.57)
Brain, NOS (C71.9)	20,875	4,175	4.6%	1.14 (1.12-1.16)	10,814	2,163	5.8%	1.27 (1.24-1.29)	10,061	2,012	3.8%	1.03 (1.01-1.05)
Spinal cord and cauda equina (C72.0-C72.1)	12,423	2,485	2.7%	0.72 (0.71-0.74)	6,613	1,323	3.5%	0.79 (0.77-0.81)	5,810	1,162	2.2%	0.66 (0.64-0.68)
Spinal cord (C72.0)	12,028	2,406	2.7%	0.70 (0.69-0.71)	6,407	1,281	3.4%	0.77 (0.75-0.79)	5,621	1,124	2.1%	0.64 (0.62-0.66)
Cauda equina (C72.1)	395	79	0.1%	0.02 (0.02-0.02)	206	41	0.1%	0.02 (0.02-0.03)	189	38	0.1%	0.02 (0.02-0.02)
Cranial nerves (C72.2-C72.5)	30,362	6,072	6.7%	1.67 (1.65-1.69)	14,325	2,865	7.7%	1.63 (1.61-1.66)	16,037	3,207	6.0%	1.70 (1.68-1.73)
Olfactory nerve (C72.2)	46	9	0.0%	0.00 (0.00-0.00)	21	4	0.0%	0.00 (0.00-0.00)	25	5	0.0%	0.00 (0.00-0.00)
Optic nerve (C72.3)	1,796	359	0.4%	0.12 (0.12-0.13)	833	167	0.4%	0.11 (0.10-0.12)	963	193	0.4%	0.13 (0.12-0.14)
Acoustic nerve (C72.4)	22,280	4,456	4.9%	1.20 (1.18-1.21)	10,563	2,113	5.7%	1.18 (1.16-1.21)	11,717	2,343	4.4%	1.21 (1.19-1.23)
Cranial nerve, NOS (C72.5)	6,240	1,248	1.4%	0.35 (0.34-0.35)	2,908	582	1.6%	0.33 (0.32-0.35)	3,332	666	1.2%	0.36 (0.35-0.37)
Other nervous system (C72.8-C72.9)	2,439	488	0.5%	0.13 (0.13-0.14)	1,205	241	0.6%	0.14 (0.13-0.15)	1,234	247	0.5%	0.13 (0.12-0.14)

Table 5. Continued

Site (ICD-O-3Topography 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)
Overlapping lesion of brain & CNS (C72.8)	378	76	0.1%	0.02 (0.02-0.02)	194	39	0.1%	0.02 (0.02-0.03)	184	37	0.1%	0.02 (0.02-0.02)
Nervous system, NOS (C72.9)	2,061	412	0.5%	0.11 (0.11-0.12)	1,011	202	0.5%	0.12 (0.11-0.13)	1,050	210	0.4%	0.11 (0.10-0.12)
Pituitary (C75.1- C75.2)	82,172	16,434	18.1%	4.78 (4.74-4.81)	36,209	7,242	19.4%	4.21 (4.17-4.26)	45,963	9,193	17.2%	5.43 (5.38-5.49)
Pituitary gland (C75.1)	80,083	16,017	17.7%	4.65 (4.62-4.69)	35,107	7,021	18.8%	4.08 (4.03-4.12)	44,976	8,995	16.9%	5.32 (5.27-5.37)
Craniopharyngeal duct (C75.2)	2,089	418	0.5%	0.12 (0.12-0.13)	1,102	220	0.6%	0.13 (0.13-0.14)	987	197	0.4%	0.12 (0.11-0.12)
Pineal (C75.3)	1,611	322	0.4%	0.10 (0.10-0.11)	967	193	0.5%	0.12 (0.12-0.13)	644	129	0.2%	0.08 (0.07-0.09)
TOTAL	**453,623**	**90,725**	**100.0%**	**24.83 (24.75-24.90)**	**186,801**	**37,360**	**100.0%**	**21.62 (21.52-21.72)**	**266,822**	**53,364**	**100.0%**	**27.85 (27.74-27.96)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER site/histopathology validation list.
[d]ICD-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; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; US, United States; 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 All Brain and Other Central Nervous System Tumors by Major Histopathology Grouping, Histopathology, Behavior, and Sex, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

Histopathology	Total					Males				Females			
	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	Rate (95% CI)
Diffuse Astrocytic and Oligodendroglial Tumors	**84,389**	**16,878**	**18.6**	**63**	**4.45 (4.42-4.48)**	**48,666**	**9,733**	**100.0**	**5.44 (5.39-5.49)**	**35,723**	**7,145**	**100.0**	**3.58 (3.54-3.61)**
Diffuse astrocytoma	7,436	1,487	1.6	45	0.44 (0.43-0.45)	4,167	833	99.9	0.51 (0.49-0.52)	3,269	654	99.9	0.38 (0.37-0.40)
Anaplastic astrocytoma	6,729	1,346	1.5	52	0.39 (0.38-0.40)	3,718	744	100.0	0.44 (0.43-0.46)	3,011	602	100.0	0.34 (0.32-0.35)
Glioblastoma	64,548	12,910	14.2	66	3.27 (3.24-3.29)	37,609	7,522	100.0	4.09 (4.05-4.14)	26,939	5,388	100.0	2.55 (2.52-2.58)
Oligodendroglioma	3,599	720	0.8	44	0.23 (0.22-0.23)	2,000	400	100.0	0.25 (0.24-0.27)	1,599	320	100.0	0.20 (0.19-0.21)
Anaplastic oligodendroglioma	1,838	368	0.4	49	0.11 (0.10-0.11)	1,040	208	99.8	0.13 (0.12-0.13)	798	160	100.0	0.09 (0.09-0.10)
Oligoastrocytic tumors	239	48	0.1	47	0.01 (0.01-0.02)	132	26	100.0	0.02 (0.01-0.02)	107	21	100.0	0.01 (0.01-0.02)
Other Astrocytic Tumors	**6,351**	**1,270**	**1.4**	**12**	**0.43 (0.42-0.44)**	**3,393**	**679**	**89.3**	**0.45 (0.44-0.47)**	**2,958**	**592**	**89.3**	**0.41 (0.39-0.42)**
Pilocytic astrocytoma	5,417	1,083	1.2	11	0.37 (0.36-0.38)	2,894	579	95.4	0.39 (0.37-0.40)	2,523	505	94.4	0.35 (0.34-0.36)
Unique astrocytoma variants	934	187	0.2	18	0.06 (0.06-0.07)	499	100	54.1	0.07 (0.06-0.07)	435	87	59.5	0.06 (0.05-0.06)
Malignant	*529*	*106*	*0.1*	--	*0.03 (0.03-0.04)*	*270*	*54*	--	*0.03 (0.03-0.04)*	*259*	*52*	*100.0*	*0.03 (0.03-0.04)*
Non-Malignant	*405*	*81*	*0.1*	--	*0.03 (0.03-0.03)*	*229*	*46*	--	*0.03 (0.03-0.04)*	*176*	*35*	*0.0*	*0.02 (0.02-0.03)*
Ependymal Tumors	**6,858**	**1,372**	**1.5**	**46**	**0.41 (0.40-0.42)**	**3,953**	**791**	**52.2**	**0.48 (0.46-0.50)**	**2,905**	**581**	**60.2**	**0.35 (0.33-0.36)**
Malignant	*3,813*	*763*	*0.8*	--	*0.23 (0.23-0.24)*	*2,063*	*413*	--	*0.25 (0.24-0.27)*	*1,750*	*350*	--	*0.21 (0.20-0.22)*
Non-Malignant	*3,045*	*609*	*0.7*	--	*0.18 (0.17-0.19)*	*1,890*	*378*	--	*0.23 (0.22-0.24)*	*1,155*	*231*	--	*0.13 (0.13-0.14)*
Other Gliomas	**8,977**	**1,795**	**2.0**	**38**	**0.55 (0.54-0.56)**	**4,574**	**915**	**99.6**	**0.58 (0.56-0.59)**	**4,403**	**881**	**99.4**	**0.53 (0.52-0.55)**
Glioma malignant, NOS	8,877	1,775	2.0	38	0.54 (0.53-0.56)	4,535	907	100.0	0.57 (0.55-0.59)	4,342	868	100.0	0.52 (0.51-0.54)
Other neuroepithelial tumors	100	20	0.0	37.5	0.01 (0.01-0.01)	39	8	48.7	0.01 (0.00-0.01)	61	12	59.0	0.01 (0.01-0.01)
Malignant	*55*	*11*	*0.0*	--	*0.00 (0.00-0.00)*	*19*	*4*	--	*0.00 (0.00-0.00)*	*36*	*7*	--	*0.00 (0.00-0.01)*
Non-Malignant	*45*	*9*	*0.0*	--	*0.00 (0.00-0.00)*	*20*	*4*	--	*0.00 (0.00-0.00)*	*25*	*5*	--	*0.00 (0.00-0.00)*
Neuronal and Mixed Neuronal-Glial Tumors	5,304	1,061	1.2	26	0.34 (0.33-0.35)	2,860	572	18.2	0.37 (0.35-0.38)	2,444	489	16.7	0.31 (0.30-0.33)
Malignant	*928*	*186*	*0.2*	--	*0.05 (0.05-0.06)*	*520*	*104*	--	*0.06 (0.06-0.07)*	*408*	*82*	--	*0.05 (0.04-0.05)*
Non-Malignant	*4,376*	*875*	*1.0*	--	*0.29 (0.28-0.29)*	*2,340*	*468*	--	*0.30 (0.29-0.32)*	*2,036*	*407*	--	*0.27 (0.25-0.28)*
Choroid Plexus Tumors	**808**	**162**	**0.2**	**20.5**	**0.05 (0.05-0.06)**	**393**	**79**	**17.8**	**0.05 (0.05-0.06)**	**415**	**83**	**12.8**	**0.05 (0.05-0.06)**
Malignant	*123*	*25*	*0.0*	--	*0.01 (0.01-0.01)*	*70*	*14*	--	*0.01 (0.01-0.01)*	*53*	*11*	--	*0.01 (0.01-0.01)*
Non-Malignant	*685*	*137*	*0.2*	--	*0.04 (0.04-0.05)*	*323*	*65*	--	*0.04 (0.04-0.05)*	*362*	*72*	--	*0.05 (0.04-0.05)*

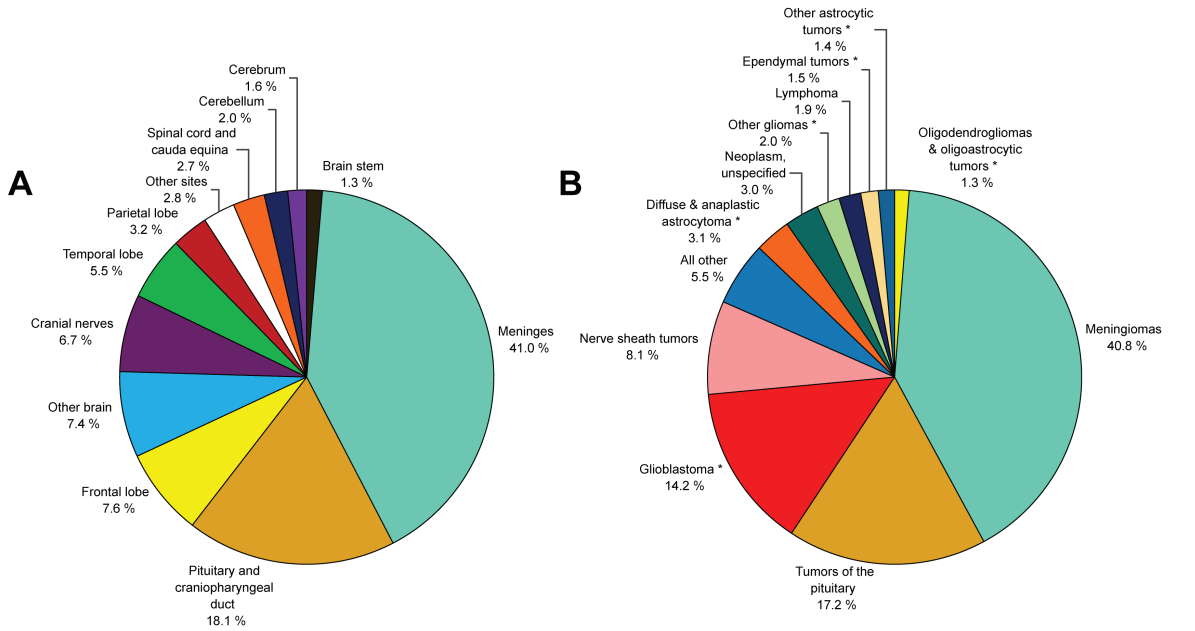
Table 6. Continued

Histopathology	Total					Males				Females			
	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	Rate (95% CI)
Tumors of The Pineal Region	**740**	**148**	**0.2**	**35**	**0.05 (0.04-0.05)**	**336**	**67**	**68.5**	**0.04 (0.04-0.05)**	**404**	**81**	**55.7**	**0.05 (0.05-0.06)**
Malignant	*455*	*91*	*0.1*	--	*0.03 (0.03-0.03)*	*230*	*46*	--	*0.03 (0.03-0.03)*	*225*	*45*	--	*0.03 (0.02-0.03)*
Non-Malignant	*285*	*57*	*0.1*	--	*0.02 (0.02-0.02)*	*106*	*21*	--	*0.01 (0.01-0.02)*	*179*	*36*	--	*0.02 (0.02-0.03)*
Embryonal Tumors	**3,057**	**611**	**0.7**	**8**	**0.21 (0.20-0.22)**	**1,826**	**365**	**100.0**	**0.25 (0.24-0.26)**	**1,231**	**246**	**100.0**	**0.17 (0.16-0.18)**
Tumors of Cranial and Spinal Nerves	**36,614**	**7,323**	**8.1**	**58**	**2.00 (1.98-2.03)**	**17,670**	**3,534**	**0.6**	**2.01 (1.98-2.04)**	**18,944**	**3,789**	**0.5**	**2.00 (1.97-2.03)**
Nerve sheath tumors	36,586	7,317	8.1	58	2.00 (1.98-2.02)	--	--	--	--	--	--	--	--
Malignant	*213*	*43*	*0.0*	--	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--
Non-Malignant	*36,373*	*7,275*	*8.0*	--	*1.99 (1.97-2.01)*	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	28	6	0.0	55.5	0.00 (0.00-0.00)	--	--	--	--	--	--	--	--
Tumors of Meninges	**191,055**	**38,211**	**42.1**	**67**	**10.06 (10.02-10.11)**	**53,423**	**10,685**	**2.2**	**6.14 (6.08-6.19)**	**137,632**	**27,526**	**0.9**	**13.56 (13.49-13.64)**
Meningiomas	185,195	37,039	40.8	67	9.73 (9.68-9.77)	50,439	10,088	1.4	5.79 (5.73-5.84)	134,756	26,951	0.6	13.24 (13.16-13.31)
Malignant	*1,571*	*314*	*0.3*	--	*0.08 (0.08-0.09)*	*728*	*146*	--	*0.08 (0.08-0.09)*	*843*	*169*	--	*0.08 (0.08-0.09)*
Non-Malignant	*183,624*	*36,725*	*40.5*	--	*9.64 (9.60-9.69)*	*49,711*	*9,942*	--	*5.70 (5.65-5.76)*	*133,913*	*26,783*	--	*13.15 (13.08-13.23)*
Mesenchymal tumors	5,718	1,144	1.3	51	0.33 (0.32-0.34)	2,897	579	14.1	0.34 (0.33-0.36)	2,821	564	13.3	0.32 (0.31-0.33)
Malignant	*783*	*157*	*0.2*	--	*0.05 (0.04-0.05)*	*408*	*82*	--	*0.05 (0.04-0.05)*	*375*	*75*	--	*0.04 (0.04-0.05)*
Non-Malignant	*4,935*	*987*	*1.1*	--	*0.29 (0.28-0.29)*	*2,489*	*498*	--	*0.29 (0.28-0.31)*	*2,446*	*489*	--	*0.28 (0.27-0.29)*
Primary melanocytic lesions	142	28	0.0	60	0.01 (0.01-0.01)	87	17	70.1	0.01 (0.01-0.01)	55	11	58.2	0.01 (0.00-0.01)
Malignant	*93*	*19*	*0.0*	--	*0.01 (0.00-0.01)*	*61*	*12*	--	*0.01 (0.01-0.01)*	*32*	*6*	--	*0.00 (0.00-0.01)*
Non-Malignant	*49*	*10*	*0.0*	--	*0.00 (0.00-0.00)*	*26*	*5*	--	*0.00 (0.00-0.00)*	*23*	*5*	--	*0.00 (0.00-0.00)*
Lymphomas and Hematopoietic Neoplasms	**8,628**	**1,726**	**1.9**	**67**	**0.44 (0.44-0.45)**	**4,360**	**872**	**99.8**	**0.49 (0.47-0.50)**	**4,268**	**854**	**99.7**	**0.41 (0.40-0.42)**
Lymphoma	8,583	1,717	1.9	67	0.44 (0.43-0.45)	4,336	867	99.8	0.48 (0.47-0.50)	4,247	849	99.7	0.41 (0.39-0.42)
Other hematopoietic neoplasms	45	9	0.0	64	0.00 (0.00-0.00)	24	5	91.7	0.00 (0.00-0.00)	21	4	95.2	0.00 (0.00-0.00)
Germ Cell Tumors	**1,255**	**251**	**0.3**	**15**	**0.08 (0.08-0.09)**	**908**	**182**	**89.9**	**0.12 (0.11-0.13)**	**347**	**69**	**79.5**	**0.05 (0.04-0.05)**
Malignant	*1,092*	*218*	*0.2*	--	*0.07 (0.07-0.08)*	*816*	*163*	--	*0.11 (0.10-0.11)*	*276*	*55*	--	*0.04 (0.03-0.04)*
Non-Malignant	*163*	*33*	*0.0*	--	*0.01 (0.01-0.01)*	*92*	*18*	--	*0.01 (0.01-0.02)*	*71*	*14*	--	*0.01 (0.01-0.01)*

Table 6. Continued

Histopathology	Total					Males				Females			
	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	Rate (95% CI)
Tumors of Sellar Region	**81,166**	**16,233**	**17.9**	**51**	**4.72 (4.69-4.75)**	**35,834**	**7,167**	**0.2**	**4.17 (4.12-4.21)**	**45,332**	**9,066**	**0.1**	**5.36 (5.31-5.41)**
Tumors of the pituitary	78,082	15,616	17.2	51	4.54 (4.50-4.57)	34,249	6,850	0.2	3.97 (3.93-4.02)	43,833	8,767	0.1	5.19 (5.14-5.24)
Malignant	*98*	*20*	*0.0*	--	*0.01 (0.00-0.01)*	*65*	*13*	--	*0.01 (0.01-0.01)*	*33*	*7*	--	*0.00 (0.00-0.01)*
Non-Malignant	*77,984*	*15,597*	*17.2*	--	*4.53 (4.50-4.56)*	*34,184*	*6,837*	--	*3.97 (3.92-4.01)*	*43,800*	*8,760*	--	*5.18 (5.13-5.23)*
Craniopharyngioma	3,084	617	0.7	46	0.18 (0.18-0.19)	1,585	317	0.4	0.19 (0.18-0.20)	1,499	300	0.1	0.18 (0.17-0.19)
Unclassified Tumors	**18,421**	**3,684**	**4.1**	**65**	**1.02 (1.01-1.04)**	**8,605**	**1,721**	**39.1**	**1.04 (1.02-1.06)**	**9,816**	**1,963**	**36.1**	**1.01 (0.99-1.03)**
Hemangioma	4,380	876	1.0	51	0.26 (0.25-0.26)	2,025	405	0.0	0.24 (0.23-0.26)	2,355	471	0.0	0.27 (0.26-0.28)
Neoplasm, unspecified	13,506	2,701	3.0	70	0.73 (0.72-0.74)	6,288	1,258	53.1	0.76 (0.74-0.78)	7,218	1,444	48.5	0.71 (0.70-0.73)
Malignant	*6,836*	*1,367*	*1.5*	--	*0.36 (0.35-0.37)*	*3,336*	*667*	--	*0.40 (0.39-0.41)*	*3,500*	*700*	--	*0.32 (0.31-0.34)*
Non-Malignant	*6,670*	*1,334*	*1.5*	--	*0.37 (0.36-0.38)*	*2,952*	*590*	--	*0.36 (0.34-0.37)*	*3,718*	*744*	--	*0.39 (0.37-0.40)*
All other	535	107	0.1	36	0.03 (0.03-0.04)	292	58	10.6	0.04 (0.03-0.04)	243	49	16.5	0.03 (0.03-0.03)
Malignant	*71*	*14*	*0.0*	--	*0.00 (0.00-0.01)*	*31*	*6*	--	*0.00 (0.00-0.01)*	*40*	*8*	--	*0.01 (0.00-0.01)*
Non-Malignant	*464*	*93*	*0.1*	--	*0.03 (0.03-0.03)*	*261*	*52*	--	*0.03 (0.03-0.04)*	*203*	*41*	--	*0.02 (0.02-0.03)*
TOTAL[d]	**453,623**	**90,725**	**100.0**	**62**	**24.83 (24.75-24.90)**	**186,801**	**37,360**	**37.9**	**21.62 (21.52-21.72)**	**266,822**	**53,364**	**20.9**	**27.85 (27.74-27.96)**
Malignant	***126,729***	***25,346***	***27.9***	--	***6.94 (6.91-6.98)***	***70,865***	***14,173***	--	***8.17 (8.11-8.23)***	***55,864***	***11,173***	--	***5.86 (5.81-5.91)***
Non-Malignant	***326,894***	***65,379***	***72.1***	--	***17.88 (17.82-17.95)***	***115,936***	***23,187***	--	***13.44 (13.37-13.52)***	***210,958***	***42,192***	--	***21.99 (21.89-22.09)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Assigned behavior code of /3 (see table 2).
[d]Refers 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.



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

Fig. 15 Distribution[a] of All Primary Brain and Other Central Nervous System Tumors (Malignant and Non-Malignant Combined; Five-Year Total=453,623; Annual Average Cases=90,725), by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

- Tumors of the pituitary (17.2%) and nerve sheath tumors (8.1%) combined accounted for slightly more than one-fourth of all tumors (25.3%), 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 16A** and **Figure 17A**, respectively.

- For **malignant** tumors, frontal (24.9%), temporal (17.7%), parietal (10.4%), and occipital (2.5%) accounted for 55.5% of tumors (**Figure 16A**).
- For **non-malignant** tumors, 56.3% of all tumors occurred in the meninges (**Figure 17A**).

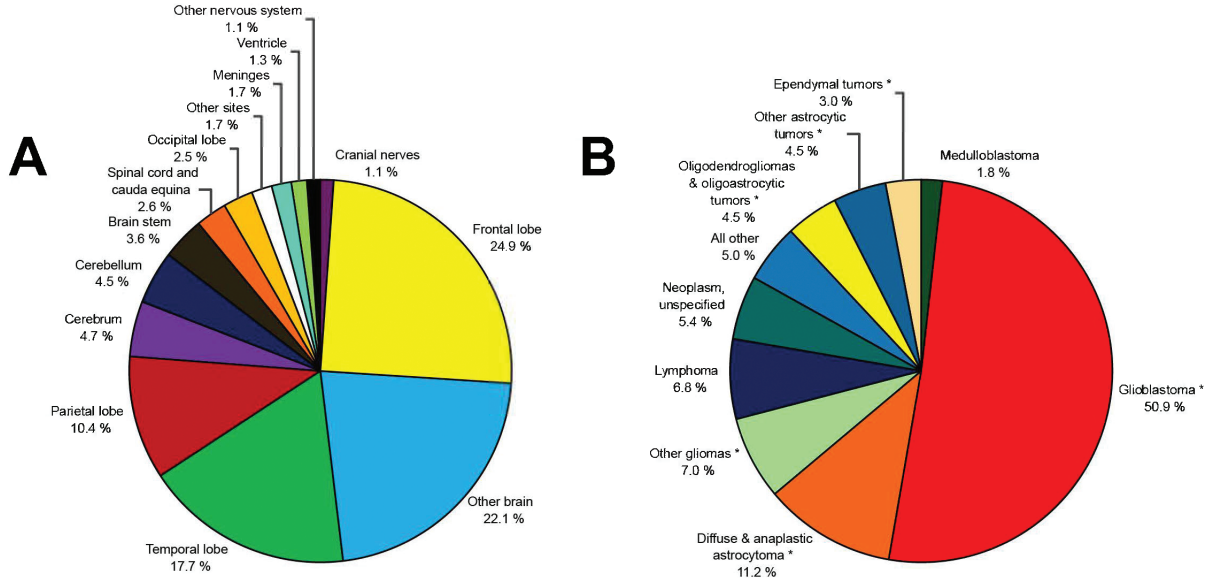
The distribution of **malignant** and **non-malignant** brain and other CNS tumors by histopathology are shown in **Figure 16B** and **Figure 17B**, respectively, as well as in **Table 6**.

- The most common of all **malignant** CNS tumor histopathology was glioblastoma (50.9%, **Figure 16B**).
- The most common of all **non-malignant** tumor histopathology was meningiomas (56.2%, **Figure 17B**).
- 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) (76.1%, **Figure 17B**).

Distribution of Gliomas by Site and Histopathology

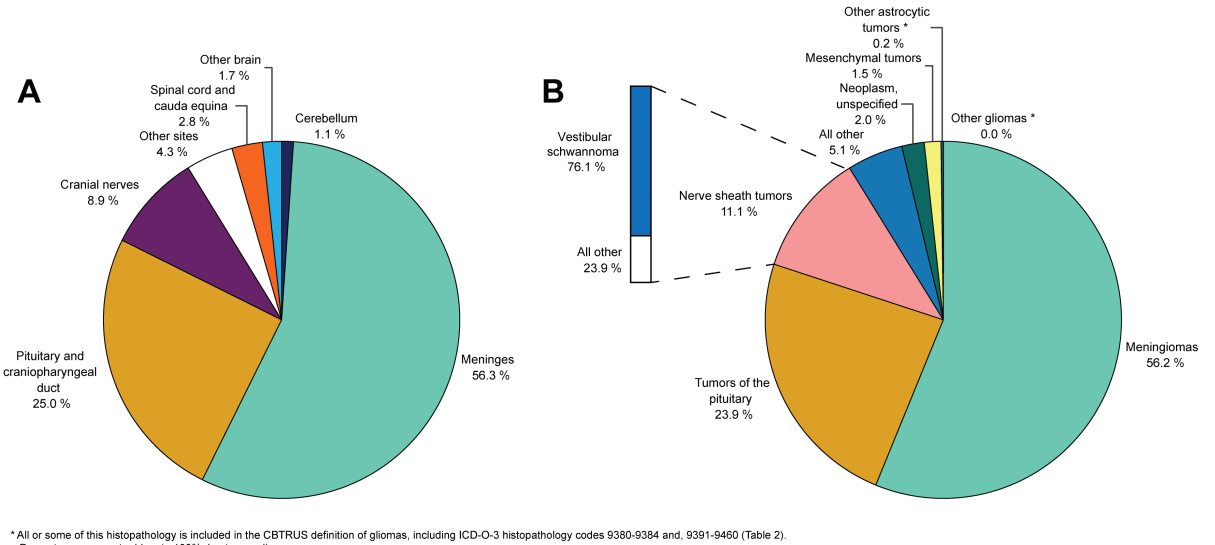
The broad category glioma (ICD-O-3 histopathology codes 9380–9384, 9391–9460; see **Table 2** for more information) represented **approximately 24% of all primary brain and other CNS tumors and 81% of malignant tumors.** The distribution of gliomas by site and histopathology are shown in **Figure 18A** and **Figure 18B**, respectively.

- The proportion of brain and CNS tumors classified as glioma varied substantially by age. Gliomas represented 51%, 24.5%, 23.1%, and 21.4% in individuals 0-14 years, 15-39 years (AYA), 40-64 years, and 65+ years respectively.
- The majority of gliomas occurred in the supra-tentorium (frontal, temporal, parietal, and occipital lobes combined) (62.2%). Only a very small proportion of gliomas occurred in areas of the CNS other than the brain.
- Glioblastoma accounted for the majority of gliomas (60.2%).



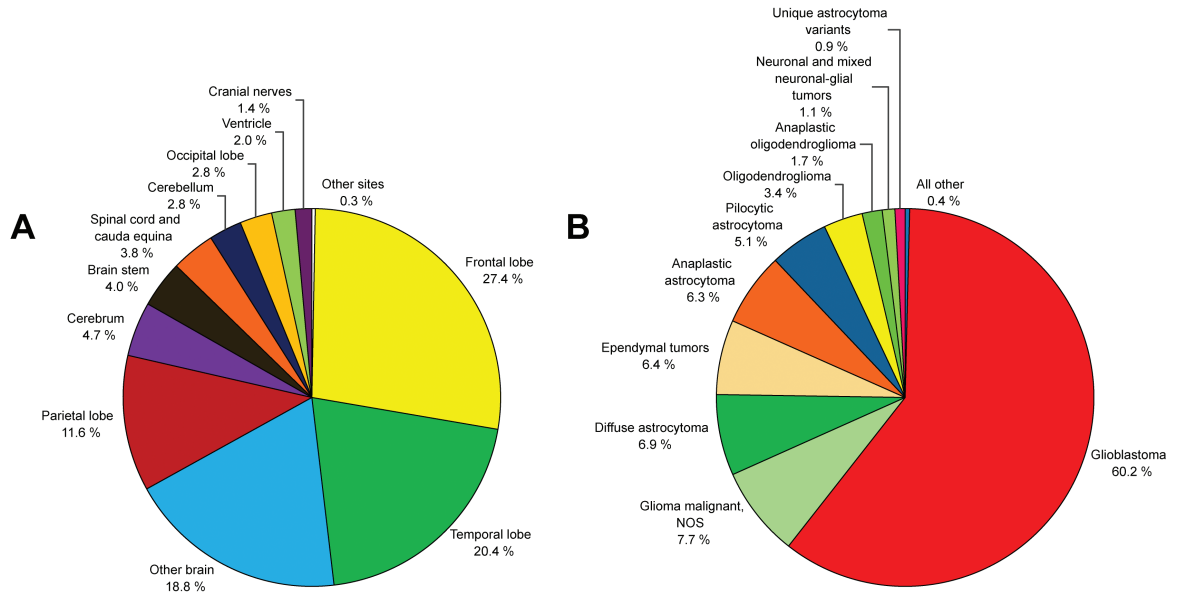
* All or some of this histopathology is included in the CBTRUS definition of gliomas, including ICD-O-3 histopathology codes 9380-9384 and 9391-9460 (Table 2).
a.Percentages may not add up to 100% due to rounding.
b.Includes neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the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

Fig. 16 Distribution[a] of Malignant Primary Brain and Other Central Nervous System Tumors (Five-Year Total=126,729; Annual Average Cases=25,346), by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020



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

Fig. 17 Distribution[a] of All Non-Malignant Primary Brain and Other Central Nervous System Tumors (Five-Year Total=326,894; Annual Average Cases=65,379), by A) Site and B) Histopathology, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020



a. Percentages may not add up to 100% due to rounding.
Abbreviations: ICD-O-3, International Classification of Diseases, Oncology, 3rd Edition; CBTRUS, Central Brain Tumor Registry of the United States; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results; NOS, Not otherwise specified

Fig. 18 Distribution[a] of Primary Brain and Other Central Nervous System Gliomas (ICD-O-3 histopathology codes 9380-9384 and 9391-9460) (Five-Year Total=107,201; Annual Average Cases=21,440) by A) Site and B) Histopathology Subtypes, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

- Astrocytic tumors, including glioblastoma, accounted for 78.5% of all gliomas.

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

AAAIRs overall by major histopathology grouping, specific histopathology, and behavior are shown in **Table 6**. Among CBTRUS major histopathology groupings, incidence rates were highest for tumors of the meninges (10.06 per 100,000 population), followed by tumors of the sellar region (4.72 per 100,000 population), diffuse astrocytic and oligodendroglial tumors (4.45 per 100,000 population), and tumors of the cranial and spinal nerves (2.00 per 100,000 population).

- Among CBTRUS specific histopathology groupings, incidence rates were highest for meningiomas (9.73 per 100,000 population), tumors of the pituitary (4.54 per 100,000 population), glioblastoma (3.27 per 100,000 population), and nerve sheath tumors (2.00 per 100,000 population).
- The majority of nerve sheath tumors were vestibular schwannoma (1.50 per 100,000 population, **Table 7**).
- Of all vestibular schwannoma tumors, 62.4% were located in the acoustic nerve (**Supplementary Figure 1**).
- For **malignant** tumors, the incidence rate was highest for glioblastoma (3.27 per 100,000 population), followed by glioma **malignant**, NOS (0.54 per 100,000 population), diffuse astrocytomas (0.44 per 100,000 population), and lymphomas (0.44 per 100,000 population).
- For **non-malignant** tumors, the incidence rate was highest for **non-malignant** meningiomas (9.64 per 100,000 population), followed by **non-malignant** tumors of the pituitary (4.53 per 100,000 population).

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 shown for both children (ages 0-19 years, **Figure 19A**) and adults (ages 20+ years, **Figure 19B**).

- The predominant histopathology group for those ages 0-19 years was ependymal tumors (18.5%) followed by nerve sheath tumors (17.6%).
- Meningiomas (39.9%) accounted for the largest proportion of spinal cord tumors among those ages 20 years and older.

Distributions and Incidence by Age at Diagnosis

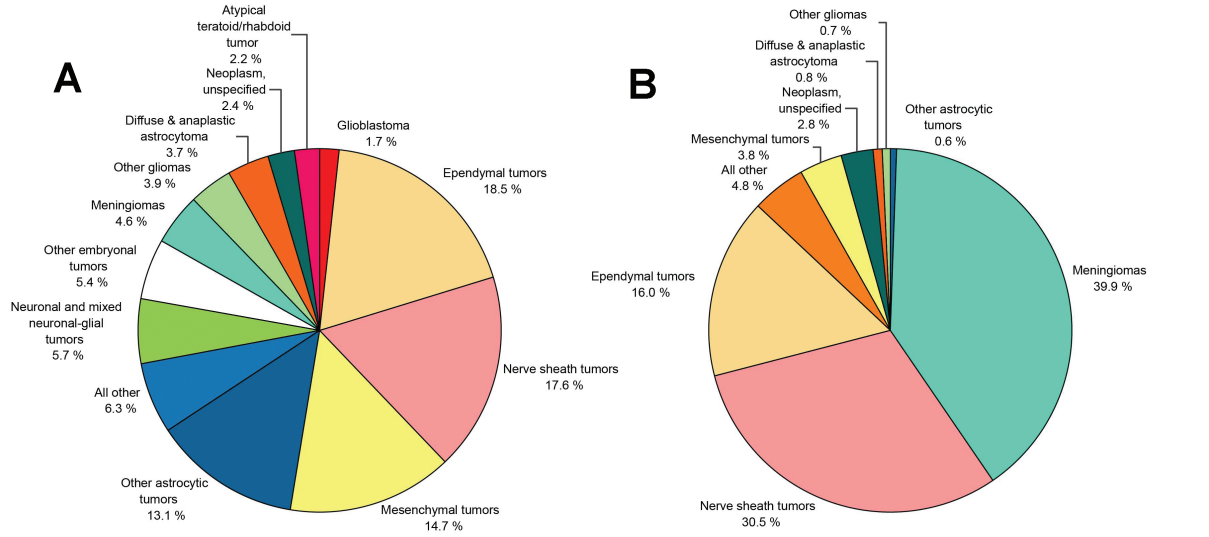
Incidence Rates by Age at Diagnosis

The overall AAAIR for 2016-2020 for all primary brain and other CNS tumors was 24.83 per 100,000 population (**Table 6**). The overall incidence rate was 5.67 per 100,000

Table 7. 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 Groups, Race, and Hispanic Ethnicity, Histopathology, and Age at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

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	13,107	2,621	1.48 (1.45-1.50)	30,296	6,059	3.51 (3.47-3.55)	20,158	4,032	2.29 (2.25-2.32)	4,144	829	0.47 (0.46-0.49)
Female	14,590	2,918	1.52 (1.49-1.55)	38,364	7,673	4.51 (4.47-4.56)	54,441	10,888	5.49 (5.45-5.54)	5,843	1,169	0.61 (0.60-0.63)
Age Groups												
0-14 years	198	40	0.07 (0.06-0.08)	989	198	0.33 (0.31-0.35)	110	22	0.04 (0.03-0.04)	83	17	0.03 (0.02-0.03)
15-39 years	3,632	726	0.69 (0.67-0.71)	19,705	3,941	3.64 (3.59-3.69)	5,158	1,032	1.01 (0.98-1.04)	1,124	225	0.22 (0.20-0.23)
40-64 years	14,070	2,814	2.53 (2.49-2.58)	28,540	5,708	5.47 (5.40-5.54)	32,676	6,535	5.86 (5.79-5.92)	4,657	931	0.85 (0.82-0.87)
65+ years	9,797	1,959	3.71 (3.63-3.78)	19,426	3,885	7.49 (7.39-7.60)	36,655	7,331	14.37 (14.22-14.52)	4,123	825	1.60 (1.55-1.65)
Race												
White	23,592	4,718	1.58 (1.56-1.60)	48,528	9,706	3.56 (3.52-3.59)	59,793	11,959	3.88 (3.85-3.91)	7,578	1,516	0.51 (0.50-0.52)
Black	1,602	320	0.72 (0.68-0.75)	14,032	2,806	6.38 (6.28-6.49)	9,715	1,943	4.51 (4.42-4.61)	1,591	318	0.71 (0.68-0.75)
American Indian/ Alaska Native	163	33	0.75 (0.63-0.87)	608	122	2.78 (2.55-3.02)	524	105	2.69 (2.46-2.94)	56	11	0.29 (0.22-0.38)
Asian or Pacific Islander	1,373	275	1.23 (1.16-1.29)	2,932	586	2.67 (2.58-2.77)	2,745	549	2.56 (2.46-2.66)	506	101	0.47 (0.43-0.51)
Ethnicity												
Non-Hispanic	25,235	5,047	1.58 (1.56-1.60)	57,030	11,406	3.89 (3.86-3.92)	67,178	13,436	4.06 (4.03-4.09)	8,946	1,789	0.56 (0.55-0.57)
Hispanic	2,412	482	0.99 (0.95-1.03)	11,515	2,303	4.45 (4.37-4.54)	7,248	1,450	3.27 (3.19-3.35)	1,026	205	0.44 (0.42-0.47)
TOTAL	**27,697**	**5,539**	**1.50 (1.48-1.51)**	**68,660**	**13,732**	**3.97 (3.94-4.00)**	**74,599**	**14,920**	**3.96 (3.93-3.99)**	**9,987**	**1,997**	**0.54 (0.53-0.55)**

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



a. Percentages may not add up to 100% due to rounding.
b. Includes oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, unique astrocytoma variants, other neuroepithelial tumors, choroid plexus tumors, tumors of the pineal region, medulloblastoma, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, all other (Table 2).
c. Includes anaplastic astrocytoma, glioblastoma, oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, unique astrocytoma variants, other neuroepithelial tumors, neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, medulloblastoma, atypical teratoid/rhabdoid tumor, other embryonal tumors, other tumors of cranial and spinal nerves, primary melanocytic lesions, lymphoma, other hematopoietic neoplasms, germ cell tumors, tumors of the pituitary, craniopharyngioma, hemangioma, all other (Table 2).
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.

Fig. 19 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=1,392; Annual Average Cases=278) and B) Adults (Ages 20+ Years, Five-Year Total=18,718; Annual Average Cases=3,744), CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2016-2020

population for children ages 0-14 years, 12.00 per 100,000 population for AYA 15-39 years, and 44.97 per 100,000 population for adults ages 40+ years (**Table 8**). The overall incidence rates of tumors by behavior and age group (0-14 years, 0-19 years, and 20+ years) are shown in **Figure 3**.

Incidence Rates by Age at Diagnosis and Histopathology

The AAAIRs by age group and histopathology at diagnosis are shown in **Table 8**, **Table 9**, **and Supplementary Table 10**, as well as in **Figure 20A** (ages 0-19 Years) and **Figure 20B** (ages 20+ Years).

- The incidence rate for all brain and other CNS tumors was highest among ages 85+ years (92.27 per 100,000 population) and lowest among children ages 10-14 years (5.79 per 100,000 population).
- Incidence rates of pilocytic astrocytoma, other glioma, embryonal tumors, and **malignant** tumors overall were higher in the younger age groups and decreased with advancing age.
- Incidence rates declined with increasing age for those ages 0-19 years, for gliomas, choroid plexus tumors, and medulloblastomas.
- Incidence rates of anaplastic astrocytoma, meningiomas, lymphoma, tumors of the pituitary, hemangioma, and **non-malignant** tumors overall were lower in the younger age groups and increased with advancing age.

Median Age at Diagnosis

The median age at diagnosis for all primary brain and other CNS tumors was 62 years (**Table 6**).

- The histopathology-specific median ages ranged from 8 years for embryonal tumors to 70 years for neoplasm, unspecified.
- Pilocytic astrocytoma, unique astrocytoma variants, neuronal and mixed neuronal-glial tumors, choroid plexus tumors, tumors of the pineal region, embryonal tumors, germ cell tumors, and all other were histopathologies with younger median ages at diagnosis compared to other histopathologies.
- The most commonly diagnosed histopathologies in older ages were glioblastoma, meningiomas, and tumors of the pituitary (median age of 66, 67, and 51 years, respectively).
- While less common, lymphomas were also most frequently diagnosed in older persons, with a median age of diagnosis of 67 years.

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 account for the majority of cancer mortality in this age group. About 5.3% of the reported brain and other CNS tumors during 2016-2020 occurred in children and adolescents ages 0-19 years (**Table 9**). The distribution of brain and other CNS tumors in children and adolescents ages 0-19 years by site is shown in **Figure 21A**.

Table 8. Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals of Brain and Other Central Nervous System Tumors by Histopathology and NCI Age Group, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

Histopathology	Children[c] (0-14 years)			AYA[d] (15-39 years)			Older Adults (40+ 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)
Diffuse Astrocytic and Oligodendroglial Tumors	**1,256**	**251**	**0.42 (0.39-0.44)**	**9,733**	**1,947**	**1.81 (1.78-1.85)**	**73,400**	**14,680**	**8.64 (8.57-8.70)**
Diffuse astrocytoma	563	113	0.19 (0.17-0.20)	2,637	527	0.48 (0.47-0.50)	4,236	847	0.54 (0.52-0.56)
Anaplastic astrocytoma	193	39	0.06 (0.06-0.07)	2,023	405	0.37 (0.35-0.39)	4,513	903	0.56 (0.54-0.58)
Glioblastoma	426	85	0.14 (0.13-0.16)	3,089	618	0.58 (0.56-0.61)	61,033	12,207	7.04 (6.99-7.10)
Oligodendroglioma	54	11	0.02 (0.01-0.02)	1,398	280	0.26 (0.25-0.28)	2,147	429	0.30 (0.29-0.31)
Anaplastic oligodendroglioma	--	--	--	--	--	--	1,318	264	0.17 (0.16-0.18)
Oligoastrocytic tumors	--	--	--	--	--	--	153	31	0.02 (0.02-0.02)
Other Astrocytic Tumors	**3,712**	**742**	**1.23 (1.19-1.27)**	**1,874**	**375**	**0.34 (0.33-0.36)**	**765**	**153**	**0.10 (0.10-0.11)**
Pilocytic astrocytoma	3,333	667	1.10 (1.06-1.14)	1,497	299	0.28 (0.26-0.29)	587	117	0.08 (0.07-0.09)
Unique astrocytoma variants	379	76	0.13 (0.11-0.14)	377	75	0.07 (0.06-0.08)	178	36	0.02 (0.02-0.03)
Malignant	*133*	*27*	*0.04 (0.04-0.05)*	*261*	*52*	*0.05 (0.04-0.05)*	*135*	*27*	*0.02 (0.01-0.02)*
Non-Malignant	*246*	*49*	*0.08 (0.07-0.09)*	*116*	*23*	*0.02 (0.02-0.03)*	*43*	*9*	*0.01 (0.00-0.01)*
Ependymal Tumors	**893**	**179**	**0.30 (0.28-0.32)**	**1,869**	**374**	**0.35 (0.33-0.36)**	**4,096**	**819**	**0.52 (0.51-0.54)**
Malignant	*781*	*156*	*0.26 (0.24-0.28)*	*976*	*195*	*0.18 (0.17-0.19)*	*2,056*	*411*	*0.26 (0.25-0.27)*
Non-Malignant	*112*	*22*	*0.04 (0.03-0.04)*	*893*	*179*	*0.17 (0.16-0.18)*	*2,040*	*408*	*0.26 (0.25-0.27)*
Other Gliomas	**2,692**	**538**	**0.89 (0.86-0.93)**	**1,936**	**387**	**0.36 (0.34-0.37)**	**4,349**	**870**	**0.54 (0.52-0.56)**
Glioma malignant, NOS	2,670	534	0.88 (0.85-0.92)	1,904	381	0.35 (0.34-0.37)	4,303	861	0.53 (0.52-0.55)
Other neuroepithelial tumors	22	4	0.01 (0.00-0.01)	32	6	0.01 (0.00-0.01)	46	9	0.01 (0.00-0.01)
Neuronal and Mixed Neuronal-Glial Tumors	1,395	279	0.46 (0.44-0.49)	2,166	433	0.40 (0.38-0.42)	1,743	349	0.23 (0.22-0.24)
Malignant	*84*	*17*	*0.03 (0.02-0.03)*	*177*	*35*	*0.03 (0.03-0.04)*	*667*	*133*	*0.08 (0.08-0.09)*
Non-Malignant	*1,311*	*262*	*0.43 (0.41-0.46)*	*1,989*	*398*	*0.36 (0.35-0.38)*	*1,076*	*215*	*0.15 (0.14-0.16)*
Choroid Plexus Tumors	**351**	**70**	**0.12 (0.10-0.13)**	**208**	**42**	**0.04 (0.03-0.04)**	**249**	**50**	**0.03 (0.03-0.04)**
Malignant	*93*	*19*	*0.03 (0.02-0.04)*	--	--	--	--	--	--
Non-Malignant	*258*	*52*	*0.09 (0.08-0.10)*	--	--	--	--	--	--
Tumors of The Pineal Region	**145**	**29**	**0.05 (0.04-0.06)**	**269**	**54**	**0.05 (0.04-0.06)**	**326**	**65**	**0.04 (0.04-0.05)**
Malignant	*128*	*26*	*0.04 (0.04-0.05)*	*164*	*33*	*0.03 (0.03-0.03)*	*163*	*33*	*0.02 (0.02-0.02)*

Table 8. Continued

Histopathology	Children[c] (0-14 years)			AYA[d] (15-39 years)			Older Adults (40+ 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)
Non-Malignant	*17*	*3*	*0.01 (0.00-0.01)*	*105*	*21*	*0.02 (0.02-0.02)*	*163*	*33*	*0.02 (0.02-0.03)*
Embryonal Tumors	**2,076**	**415**	**0.69 (0.66-0.72)**	**726**	**145**	**0.13 (0.12-0.14)**	**255**	**51**	**0.04 (0.03-0.04)**
Medulloblastoma	*1,429*	*286*	*0.47 (0.45-0.50)*	*622*	*124*	*0.11 (0.10-0.12)*	*159*	*32*	*0.02 (0.02-0.03)*
Atypical teratoid/ rhabdoid tumor	*349*	*70*	*0.12 (0.10-0.13)*	--	--	--	--	--	--
All other embryonal	*298*	*60*	*0.10 (0.09-0.11)*	--	--	--	--	--	--
Tumors of Cranial and Spinal Nerves	**565**	**113**	**0.19 (0.17-0.20)**	**5,445**	**1,089**	**1.03 (1.00-1.06)**	**30,604**	**6,121**	**3.72 (3.67-3.76)**
Nerve sheath tumors	565	113	0.19 (0.17-0.20)	--	--	--	30,579	6,116	3.71 (3.67-3.76)
Malignant	--	--	--	--	--	--	*147*	*29*	*0.02 (0.02-0.02)*
Non-Malignant	--	--	--	--	--	--	*30,432*	*6,086*	*3.69 (3.65-3.74)*
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	25	5	0.00 (0.00-0.00)
Tumors of Meninges	**663**	**133**	**0.22 (0.20-0.24)**	**11,845**	**2,369**	**2.29 (2.25-2.33)**	**178,547**	**35,709**	**21.39 (21.29-21.49)**
Meningiomas	--	--	--	--	--	--	174,626	34,925	20.90 (20.80-21.00)
Malignant	--	--	--	--	--	--	*1,468*	*294*	*0.17 (0.17-0.18)*
Non-Malignant	--	--	--	--	--	--	*173,158*	*34,632*	*20.73 (20.63-20.83)*
Mesenchymal tumors	349	70	0.12 (0.10-0.13)	1,557	311	0.29 (0.27-0.30)	3,812	762	0.48 (0.46-0.49)
Malignant	*66*	*13*	*0.02 (0.02-0.03)*	*169*	*34*	*0.03 (0.03-0.04)*	*548*	*110*	*0.07 (0.06-0.07)*
Non-Malignant	*283*	*57*	*0.09 (0.08-0.11)*	*1,388*	*278*	*0.26 (0.24-0.27)*	*3,264*	*653*	*0.41 (0.39-0.42)*
Primary melanocytic lesions	--	--	--	--	--	--	109	22	0.01 (0.01-0.02)
Lymphomas and Hematopoietic Neoplasms	**83**	**17**	**0.03 (0.02-0.03)**	**526**	**105**	**0.10 (0.09-0.11)**	**8,019**	**1,604**	**0.94 (0.92-0.96)**
Lymphoma	--	--	--	--	--	--	7,978	1,596	0.93 (0.91-0.95)
Other hematopoietic neoplasms	--	--	--	--	--	--	41	8	0.00 (0.00-0.01)
Germ Cell Tumors	**556**	**111**	**0.18 (0.17-0.20)**	**627**	**125**	**0.11 (0.11-0.12)**	**72**	**14**	**0.01 (0.01-0.01)**
Malignant	478	96	0.16 (0.14-0.17)	585	117	0.11 (0.10-0.12)	29	6	0.00 (0.00-0.01)
Non-Malignant	78	16	0.03 (0.02-0.03)	42	8	0.01 (0.01-0.01)	43	9	0.01 (0.00-0.01)
Tumors of Sellar Region	**1,772**	**354**	**0.58 (0.56-0.61)**	**24,202**	**4,840**	**4.47 (4.41-4.52)**	**55,192**	**11,038**	**6.99 (6.93-7.05)**
Tumors of the pituitary	1,155	231	0.38 (0.36-0.40)	23,522	4,704	4.34 (4.29-4.40)	53,405	10,681	6.77 (6.71-6.83)
Malignant	--	--	--	--	--	--	*80*	*16*	*0.01 (0.01-0.01)*
Non-Malignant	--	--	--	--	--	--	*53,325*	*10,665*	*6.76 (6.70-6.82)*

Table 8. Continued

Histopathology	Children[c] (0-14 years)			AYA[d] (15-39 years)			Older Adults (40+ 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)
Craniopharyngioma	617	123	0.20 (0.19-0.22)	680	136	0.13 (0.12-0.14)	1,787	357	0.22 (0.21-0.23)
Unclassified Tumors	**977**	**195**	**0.32 (0.30-0.34)**	**2,812**	**562**	**0.52 (0.50-0.54)**	**14,632**	**2,926**	**1.78 (1.75-1.81)**
Hemangioma	279	56	0.09 (0.08-0.10)	1,196	239	0.22 (0.21-0.23)	2,905	581	0.37 (0.35-0.38)
Neoplasm, unspecified	547	109	0.18 (0.17-0.20)	1,484	297	0.28 (0.26-0.29)	11,475	2,295	1.38 (1.35-1.41)
Malignant	*173*	*35*	*0.06 (0.05-0.07)*	*374*	*75*	*0.07 (0.06-0.08)*	*6,289*	*1,258*	*0.75 (0.73-0.77)*
Non-Malignant	*374*	*75*	*0.12 (0.11-0.14)*	*1,110*	*222*	*0.21 (0.19-0.22)*	*5,186*	*1,037*	*0.63 (0.62-0.65)*
All other	151	30	0.05 (0.04-0.06)	132	26	0.02 (0.02-0.03)	252	50	0.03 (0.03-0.04)
Malignant	*37*	*7*	*0.01 (0.01-0.02)*	--	--	--	--	--	--
Non-Malignant	*114*	*23*	*0.04 (0.03-0.05)*	--	--	--	--	--	--
TOTAL[e]	**17,136**	**3,427**	**5.67 (5.58-5.75)**	**64,238**	**12,848**	**12.00 (11.90-12.09)**	**372,249**	**74,450**	**44.97 (44.82-45.12)**
Malignant	***11,209***	***2,242***	***3.71 (3.64-3.78)***	***17,285***	***3,457***	***3.21 (3.16-3.26)***	***98,235***	***19,647***	***11.64 (11.57-11.72)***
Non-Malignant	***5,927***	***1,185***	***1.96 (1.91-2.01)***	***46,953***	***9,391***	***8.79 (8.71-8.87)***	***274,014***	***54,802***	***33.33 (33.20-33.46)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[d]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya.
[e]Refers to all brain tumors including 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 9. 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, 2016-2020

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)
Diffuse Astrocytic and Oligodendroglial Tumors	**1,907**	**381**	**0.47 (0.45-0.49)**	**362**	**72**	**0.37 (0.33-0.41)**	**382**	**76**	**0.38 (0.34-0.42)**	**512**	**102**	**0.50 (0.45-0.54)**	**651**	**130**	**0.62 (0.58-0.67)**
Diffuse astrocytoma	808	162	0.20 (0.18-0.21)	198	40	0.20 (0.18-0.23)	160	32	0.16 (0.13-0.18)	205	41	0.20 (0.17-0.23)	245	49	0.23 (0.21-0.27)
Anaplastic astrocytoma	298	60	0.07 (0.07-0.08)	43	9	0.04 (0.03-0.06)	66	13	0.07 (0.05-0.08)	84	17	0.08 (0.07-0.10)	105	21	0.10 (0.08-0.12)
Glioblastoma	642	128	0.16 (0.15-0.17)	99	20	0.10 (0.08-0.12)	136	27	0.14 (0.11-0.16)	191	38	0.18 (0.16-0.21)	216	43	0.21 (0.18-0.24)
Oligodendroglioma	125	25	0.03 (0.03-0.04)	--	--	--	--	--	--	28	6	0.03 (0.02-0.04)	71	14	0.07 (0.05-0.09)
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**4,456**	**891**	**1.10 (1.07-1.13)**	**1,364**	**273**	**1.39 (1.32-1.46)**	**1,250**	**250**	**1.24 (1.17-1.31)**	**1,098**	**220**	**1.06 (1.00-1.13)**	**744**	**149**	**0.71 (0.66-0.76)**
Pilocytic astrocytoma	3,963	793	0.98 (0.95-1.01)	1,268	254	1.29 (1.22-1.36)	1,126	225	1.11 (1.05-1.18)	939	188	0.91 (0.85-0.97)	630	126	0.60 (0.56-0.65)
Unique astrocytoma variants	493	99	0.12 (0.11-0.13)	96	19	0.10 (0.08-0.12)	124	25	0.12 (0.10-0.15)	159	32	0.15 (0.13-0.18)	114	23	0.11 (0.09-0.13)
Malignant	*215*	*43*	*0.05 (0.05-0.06)*	--	--	--	*42*	*8*	*0.04 (0.03-0.06)*	*82*	*16*	*0.08 (0.06-0.10)*	--	--	--
Non-Malignant	*278*	*56*	*0.07 (0.06-0.08)*	--	--	--	*82*	*16*	*0.08 (0.06-0.10)*	*77*	*15*	*0.08 (0.06-0.09)*	--	--	--
Ependymal Tumors	**1,151**	**230**	**0.28 (0.27-0.30)**	**448**	**90**	**0.46 (0.42-0.50)**	**214**	**43**	**0.21 (0.19-0.24)**	**231**	**46**	**0.22 (0.20-0.25)**	**258**	**52**	**0.25 (0.22-0.28)**
Malignant	*926*	*185*	*0.23 (0.21-0.24)*	*431*	*86*	*0.44 (0.40-0.48)*	*187*	*37*	*0.19 (0.16-0.21)*	*163*	*33*	*0.16 (0.13-0.18)*	*145*	*29*	*0.14 (0.12-0.16)*
Non-Malignant	*225*	*45*	*0.05 (0.05-0.06)*	*17*	*3*	*0.02 (0.01-0.03)*	*27*	*5*	*0.03 (0.02-0.04)*	*68*	*14*	*0.07 (0.05-0.08)*	*113*	*23*	*0.11 (0.09-0.13)*
Other Gliomas	**3,193**	**639**	**0.79 (0.76-0.82)**	**902**	**180**	**0.92 (0.86-0.98)**	**1,008**	**202**	**1.00 (0.94-1.06)**	**782**	**156**	**0.76 (0.71-0.81)**	**501**	**100**	**0.48 (0.44-0.52)**
Glioma malignant, NOS	3,167	633	0.78 (0.75-0.81)	893	179	0.91 (0.85-0.97)	1,002	200	0.99 (0.93-1.06)	775	155	0.75 (0.70-0.81)	497	99	0.47 (0.43-0.52)
Other neuroepithelial tumors	26	5	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--	--	--	--

Table 9. 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)
Neuronal and Mixed Neuronal-Glial Tumors	2,087	417	0.51 (0.49-0.53)	360	72	0.37 (0.33-0.41)	377	75	0.37 (0.34-0.41)	658	132	0.64 (0.59-0.69)	692	138	0.66 (0.61-0.71)
Malignant	*123*	*25*	*0.03 (0.03-0.04)*	*36*	*7*	*0.04 (0.03-0.05)*	*20*	*4*	*0.02 (0.01-0.03)*	*28*	*6*	*0.03 (0.02-0.04)*	*39*	*8*	*0.04 (0.03-0.05)*
Non-Malignant	*1,964*	*393*	*0.48 (0.46-0.50)*	*324*	*65*	*0.33 (0.30-0.37)*	*357*	*71*	*0.35 (0.32-0.39)*	*630*	*126*	*0.61 (0.56-0.66)*	*653*	*131*	*0.62 (0.58-0.67)*
Choroid Plexus Tumors	**395**	**79**	**0.10 (0.09-0.11)**	**253**	**51**	**0.26 (0.23-0.30)**	**44**	**9**	**0.04 (0.03-0.06)**	**54**	**11**	**0.05 (0.04-0.07)**	**44**	**9**	**0.04 (0.03-0.06)**
Malignant	*94*	*19*	*0.02 (0.02-0.03)*	*80*	*16*	*0.08 (0.07-0.10)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*301*	*60*	*0.07 (0.07-0.08)*	*173*	*35*	*0.18 (0.15-0.21)*	--	--	--	--	--	--	--	--	--
Tumors of The Pineal Region	**206**	**41**	**0.05 (0.04-0.06)**	**52**	**10**	**0.05 (0.04-0.07)**	**49**	**10**	**0.05 (0.04-0.06)**	**44**	**9**	**0.04 (0.03-0.06)**	**61**	**12**	**0.06 (0.04-0.07)**
Malignant	*172*	*34*	*0.04 (0.04-0.05)*	--	--	--	--	--	--	--	--	--	*44*	*9*	*0.04 (0.03-0.06)*
Non-Malignant	*34*	*7*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--	*17*	*3*	*0.02 (0.01-0.03)*
Embryonal Tumors	**2,266**	**453**	**0.56 (0.54-0.58)**	**1,008**	**202**	**1.03 (0.97-1.10)**	**689**	**138**	**0.68 (0.63-0.74)**	**379**	**76**	**0.37 (0.33-0.41)**	**190**	**38**	**0.18 (0.16-0.21)**
Medulloblastoma	*1,590*	*318*	*0.39 (0.37-0.41)*	*480*	*96*	*0.49 (0.45-0.53)*	*610*	*122*	*0.60 (0.56-0.65)*	*339*	*68*	*0.33 (0.29-0.37)*	*161*	*32*	*0.15 (0.13-0.18)*
Atypical teratoid/ rhabdoid tumor	*356*	*71*	*0.09 (0.08-0.10)*	*311*	*62*	*0.32 (0.29-0.36)*	*25*	*5*	*0.02 (0.02-0.04)*	--	--	--	--	--	--
All other embryonal	*320*	*64*	*0.08 (0.07-0.09)*	*217*	*43*	*0.22 (0.19-0.25)*	*54*	*11*	*0.05 (0.04-0.07)*	--	--	--	--	--	--
Tumors of Cranial and Spinal Nerves	**1,031**	**206**	**0.25 (0.24-0.27)**	**170**	**34**	**0.17 (0.15-0.20)**	**137**	**27**	**0.14 (0.11-0.16)**	**258**	**52**	**0.25 (0.22-0.28)**	**466**	**93**	**0.45 (0.41-0.49)**
Nerve sheath tumors	--	--	--	170	34	0.17 (0.15-0.20)	137	27	0.14 (0.11-0.16)	258	52	0.25 (0.22-0.28)	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,250**	**250**	**0.31 (0.29-0.32)**	**222**	**44**	**0.23 (0.20-0.26)**	**153**	**31**	**0.15 (0.13-0.18)**	**288**	**58**	**0.28 (0.25-0.31)**	**587**	**117**	**0.56 (0.52-0.61)**
Meningiomas	667	133	0.16 (0.15-0.18)	--	--	--	--	--	--	167	33	0.16 (0.14-0.19)	362	72	0.35 (0.31-0.38)

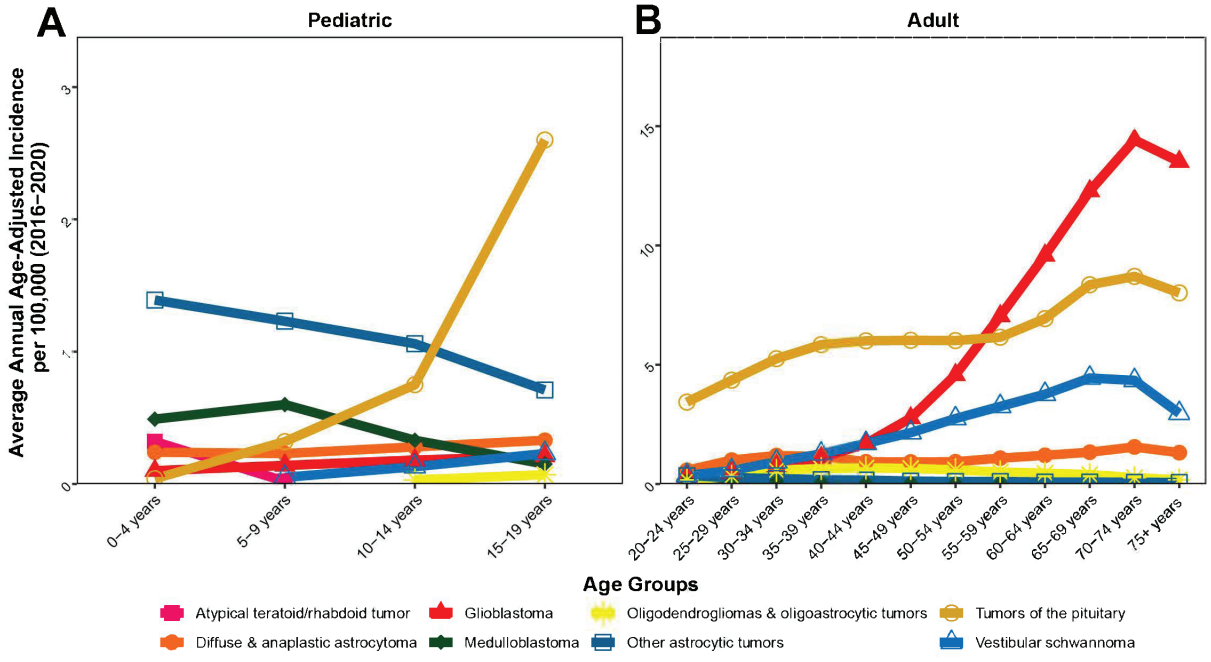
Table 9. Continued

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)
Malignant	*19*	*4*	*0.00 (0.00-0.01)*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*648*	*130*	*0.16 (0.15-0.17)*	--	--	--	--	--	--	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**122**	**24**	**0.03 (0.02-0.04)**	**22**	**4**	**0.02 (0.01-0.03)**	**34**	**7**	**0.03 (0.02-0.05)**	**27**	**5**	**0.03 (0.02-0.04)**	**39**	**8**	**0.04 (0.03-0.05)**
Lymphoma	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**848**	**170**	**0.21 (0.19-0.22)**	**104**	**21**	**0.11 (0.09-0.13)**	**142**	**28**	**0.14 (0.12-0.17)**	**310**	**62**	**0.30 (0.27-0.34)**	**292**	**58**	**0.28 (0.25-0.31)**
Malignant	760	152	0.19 (0.17-0.20)	--	--	--	117	23	0.12 (0.10-0.14)	294	59	0.29 (0.25-0.32)	--	--	--
Non-Malignant	88	18	0.02 (0.02-0.03)	--	--	--	25	5	0.02 (0.02-0.04)	16	3	0.02 (0.01-0.03)	--	--	--
Tumors of Sellar Region	**4,635**	**927**	**1.13 (1.09-1.16)**	**183**	**37**	**0.19 (0.16-0.22)**	**600**	**120**	**0.60 (0.55-0.65)**	**989**	**198**	**0.95 (0.89-1.01)**	**2,863**	**573**	**2.74 (2.64-2.84)**
Tumors of the pituitary	3,872	774	0.94 (0.91-0.97)	44	9	0.04 (0.03-0.06)	325	65	0.32 (0.29-0.36)	786	157	0.75 (0.70-0.81)	2,717	543	2.60 (2.50-2.70)
Craniopharyngioma	763	153	0.19 (0.18-0.20)	139	28	0.14 (0.12-0.17)	275	55	0.27 (0.24-0.31)	203	41	0.20 (0.17-0.23)	146	29	0.14 (0.12-0.16)
Unclassified Tumors	**1,452**	**290**	**0.36 (0.34-0.38)**	**345**	**69**	**0.35 (0.32-0.39)**	**271**	**54**	**0.27 (0.24-0.30)**	**361**	**72**	**0.35 (0.31-0.39)**	**475**	**95**	**0.45 (0.41-0.50)**
Hemangioma	485	97	0.12 (0.11-0.13)	79	16	0.08 (0.06-0.10)	79	16	0.08 (0.06-0.10)	121	24	0.12 (0.10-0.14)	206	41	0.20 (0.17-0.23)
Neoplasm, unspecified	784	157	0.19 (0.18-0.21)	181	36	0.19 (0.16-0.21)	155	31	0.15 (0.13-0.18)	211	42	0.20 (0.18-0.23)	237	47	0.23 (0.20-0.26)
Malignant	*225*	*45*	*0.06 (0.05-0.06)*	*79*	*16*	*0.08 (0.06-0.10)*	*48*	*10*	*0.05 (0.04-0.06)*	*46*	*9*	*0.04 (0.03-0.06)*	*52*	*10*	*0.05 (0.04-0.07)*

Table 9. 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)
Non-Malignant	*559*	*112*	*0.14 (0.13-0.15)*	*102*	*20*	*0.10 (0.09-0.13)*	*107*	*21*	*0.11 (0.09-0.13)*	*165*	*33*	*0.16 (0.14-0.19)*	*185*	*37*	*0.18 (0.15-0.20)*
All other	183	37	0.05 (0.04-0.05)	85	17	0.09 (0.07-0.11)	37	7	0.04 (0.03-0.05)	29	6	0.03 (0.02-0.04)	32	6	0.03 (0.02-0.04)
Malignant	*45*	*9*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*138*	*28*	*0.03 (0.03-0.04)*	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL[c]	**24,999**	**5,000**	**6.13 (6.06-6.21)**	**5,795**	**1,159**	**5.92 (5.77-6.07)**	**5,350**	**1,070**	**5.30 (5.16-5.45)**	**5,991**	**1,198**	**5.79 (5.65-5.94)**	**7,863**	**1,573**	**7.51 (7.34-7.68)**
Malignant	***13,888***	***2,778***	***3.42 (3.36-3.48)***	***4,219***	***844***	***4.31 (4.18-4.44)***	***3,680***	***736***	***3.65 (3.53-3.77)***	***3,310***	***662***	***3.21 (3.10-3.32)***	***2,679***	***536***	***2.56 (2.46-2.66)***
Non-Malignant	***11,111***	***2,222***	***2.71 (2.66-2.76)***	***1,576***	***315***	***1.61 (1.54-1.70)***	***1,670***	***334***	***1.66 (1.58-1.74)***	***2,681***	***536***	***2.59 (2.49-2.69)***	***5,184***	***1,034***	***4.95 (4.82-5.09)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Refers to all brain tumors including 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



[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; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results Program

Fig. 20 Average Annual 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, 2016-2020

- The largest percentage of tumors in childhood and adolescence was located in the pituitary and craniopharyngeal duct (18.8%), followed by the cerebellum (13.6%).
- Frontal, temporal, parietal, and occipital lobes of the brain accounted for 5.9%, 6.7%, 2.6%, and 1.0% of all brain and other CNS tumors in childhood and adolescence, respectively.
- Cerebrum, ventricle, and brain stem accounted for 5.3%, 5.2%, and 10.2% 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 5.2% of all brain and other CNS tumors in childhood and adolescence, respectively.

Figure 21B shows the most common brain and other CNS histopathologies in children and adolescents ages 0-19 years.

- For children and adolescents, pilocytic astrocytomas, other gliomas, and embryonal tumors accounted for 15.9%, 12.8%, and 9.1%, respectively.
- Tumors of the pituitary were the most common nonglial and predominantly **non-malignant** histopathology and accounted for 15.5% of all tumors in this age group.
- Gliomas accounted for 44.1% of tumors in children and adolescents.
- Medulloblastomas accounted for 70.2% of all embryonal tumors in this age group.

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

Supplementary Table 11 shows the CBTRUS brain and other CNS tumor data for children and adolescents used 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).

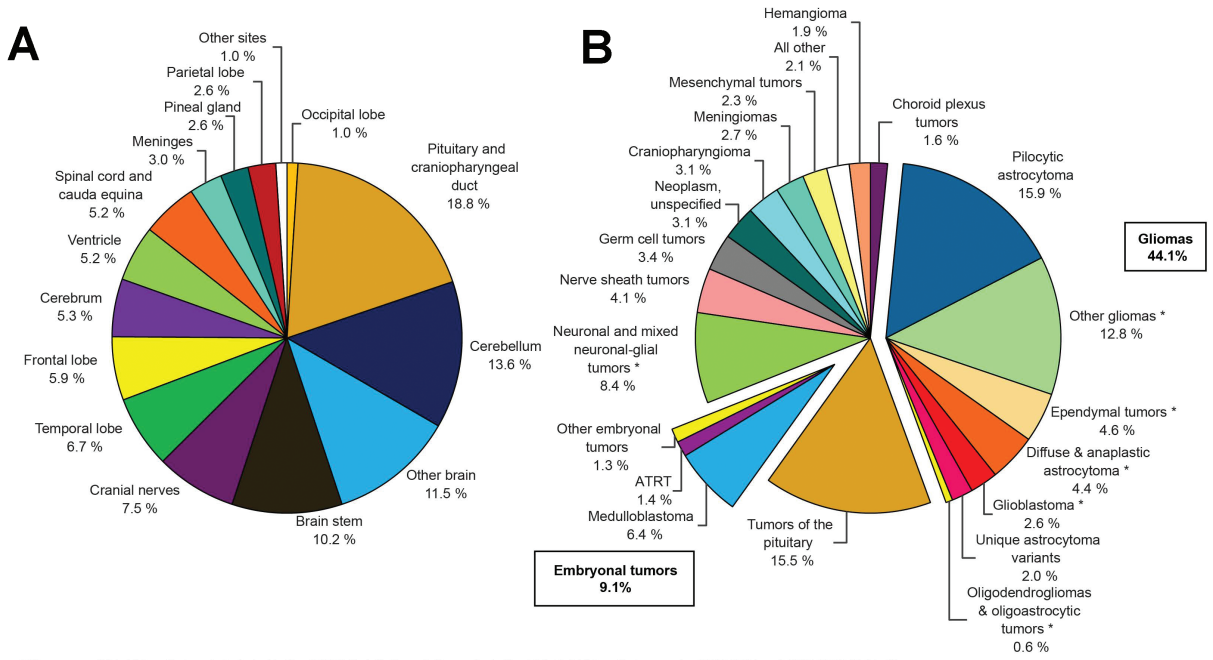
Distribution of Tumors by Site and Histopathology in Children (Ages 0-14 Years)

Approximately 3.6% of all reported tumors occurred in children ages 0-14 years (**Table 8**). The distribution of brain and other CNS tumors for children ages 0-14 years by site is shown in **Figure 22A**.

- Tumors of cerebellum (16.6%) comprised the largest proportion of tumors followed by tumors located in other brain (13.3%) and brain stem (12.6%) sites.

Figure 22B shows the most common brain and other CNS histopathologies in children ages 0-14 years.

- For children, pilocytic astrocytomas, other gliomas, and embryonal tumors accounted for 19.5%, 15.7%, and 12.1%, of brain and other CNS tumors respectively.
- Gliomas accounted for 51.1% of brain and other CNS tumors in children.



*All or some of this histopathology is included in the CBTRUS definition of gliomas including ICO-O-3 histopathology codes 9360-9384 and 9391-9480 (Table 2).
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; ATRT, Atypical Teratoid/Rhabdoid Tumor.

Fig. 21 Distribution[a] in Children and Adolescents (Ages 0-19 Years) of Primary Brain and Other Central Nervous System Tumors (Five-Year Total=24,999; Annual Average Cases=5,000) by A) Site and B) Histopathology Subtypes, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

- Of embryonal tumors, medulloblastomas, atypical teratoid rhabdoid tumors, and all other embryonal tumors accounted for 68.8%, 16.8%, and 14.4%, respectively of brain and other CNS tumors in children.

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 2016-2020 occurred in adolescents ages 15-19 years for a total of 7,863 tumors diagnosed (**Table 9**). The distribution of these tumors by site is shown in **Figure 23A**.

- 36.9% of these tumors were diagnosed in the pituitary and craniopharyngeal duct.
- The frontal lobe, temporal lobe, occipital lobe, and parietal lobe accounted for 18% of tumors in this age group.

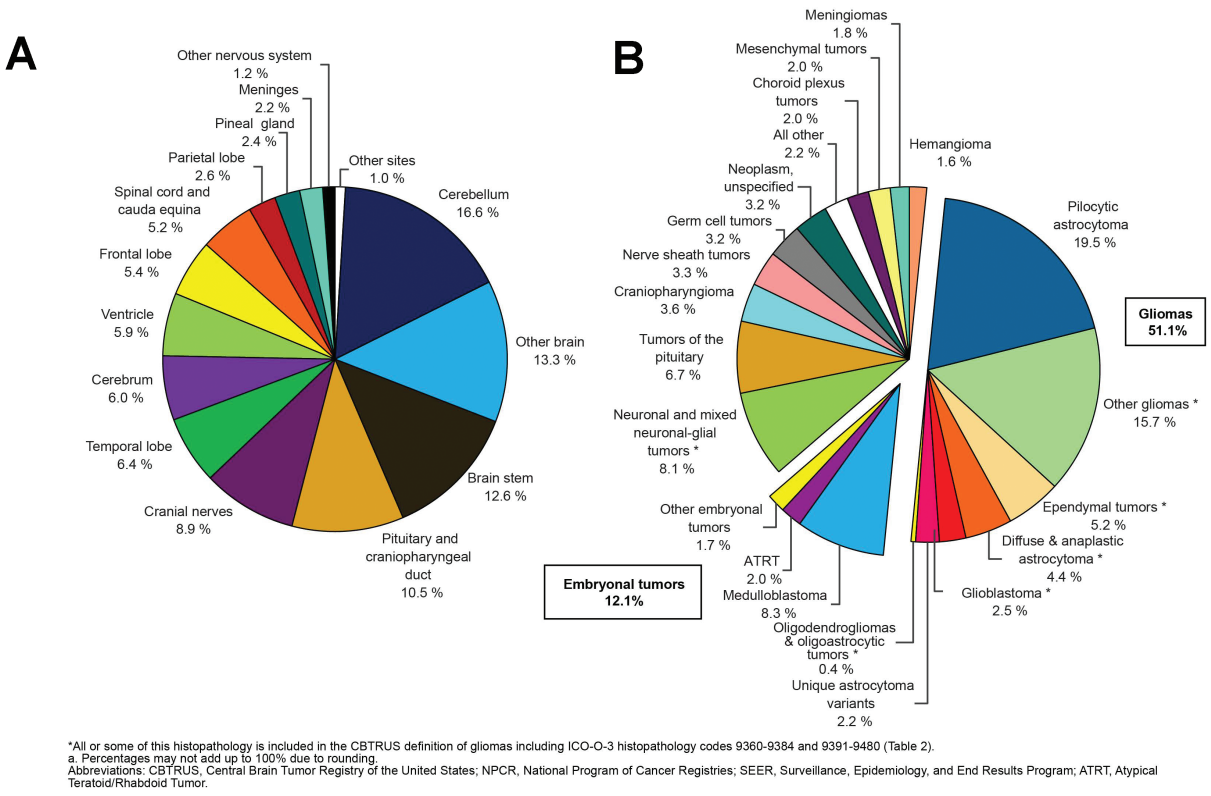
The distribution of brain and other CNS tumors in adolescents ages 15-19 years by histopathology is shown in **Figure 23B**.

- The most common histopathology in adolescents was tumors of the pituitary (34.6%).
- Gliomas accounted for 29.2% of tumors in adolescents. Of these gliomas, the histopathology pilocytic astrocytoma accounted for 8.0% of all tumors in this age group.

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

There were 64,238 primary brain and other CNS tumors diagnosed in AYA between 2016 and 2020, representing 14.2% of all brain and other CNS tumors (**Table 8**). The distribution of these tumors by site and histopathology is shown in **Figure 24A** and **Figure 24B**, respectively.

- The overall incidence rate in the AYA age group was 12.00 per 100,000 population. Incidence of **malignant** tumors was 3.21 per 100,000 population, and incidence of **non-malignant** tumors was 8.79 per 100,000 population (**Table 10**).
- The majority of AYA brain and other CNS tumors occurred in the pituitary and craniopharyngeal duct (38.1%), followed by the meninges (16.3%).
- Approximately 16.8% of tumors diagnosed in AYA were located within the frontal, temporal, and parietal lobes of the brain combined.
- Tumors of the sellar region diagnosed in AYA had the highest incidence (4.47 per 100,000 population), followed by tumors of the meninges (2.29 per 100,000 population).
- The most common histopathology in AYA was tumors of the pituitary (36.6%), followed by meningiomas (16.0%) and nerve sheath tumors (8.5%).
- Cerebrum, ventricle, cerebellum, and brain stem tumors combined accounted for about 9.8% of all AYA tumors.



*All or some of this histopathology is included in the CBTRUS definition of gliomas including ICO-O-3 histopathology codes 9360-9384 and 9391-9480 (Table 2).
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; ATRT, Atypical Teratoid/Rhabdoid Tumor.

Fig. 22 Distribution[a] in Children and Adolescents (Ages 0-14 Years) of Primary Brain and Central Nervous System Tumors (Five-Year Total=17,136; Annual Average Cases=3,427) by A) Site and B) Histopathology Subtypes, CBTRUS Statistical Report: US Cancer Statistics - NPCR and SEER, 2016-2020

- The predominately **non-malignant** tumors of the pituitary (37.5%), meningioma (16.2%), and nerve sheath (8.7%) represented over half of CNS tumors diagnosed in AYA.
- Gliomas accounted for approximately 24.5% of all brain and other CNS tumors in AYA, and about 82.2% of all **malignant** tumors in this age group.
- AYA had higher rates of relative survival than adults greater than 40 years of age 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 10**).

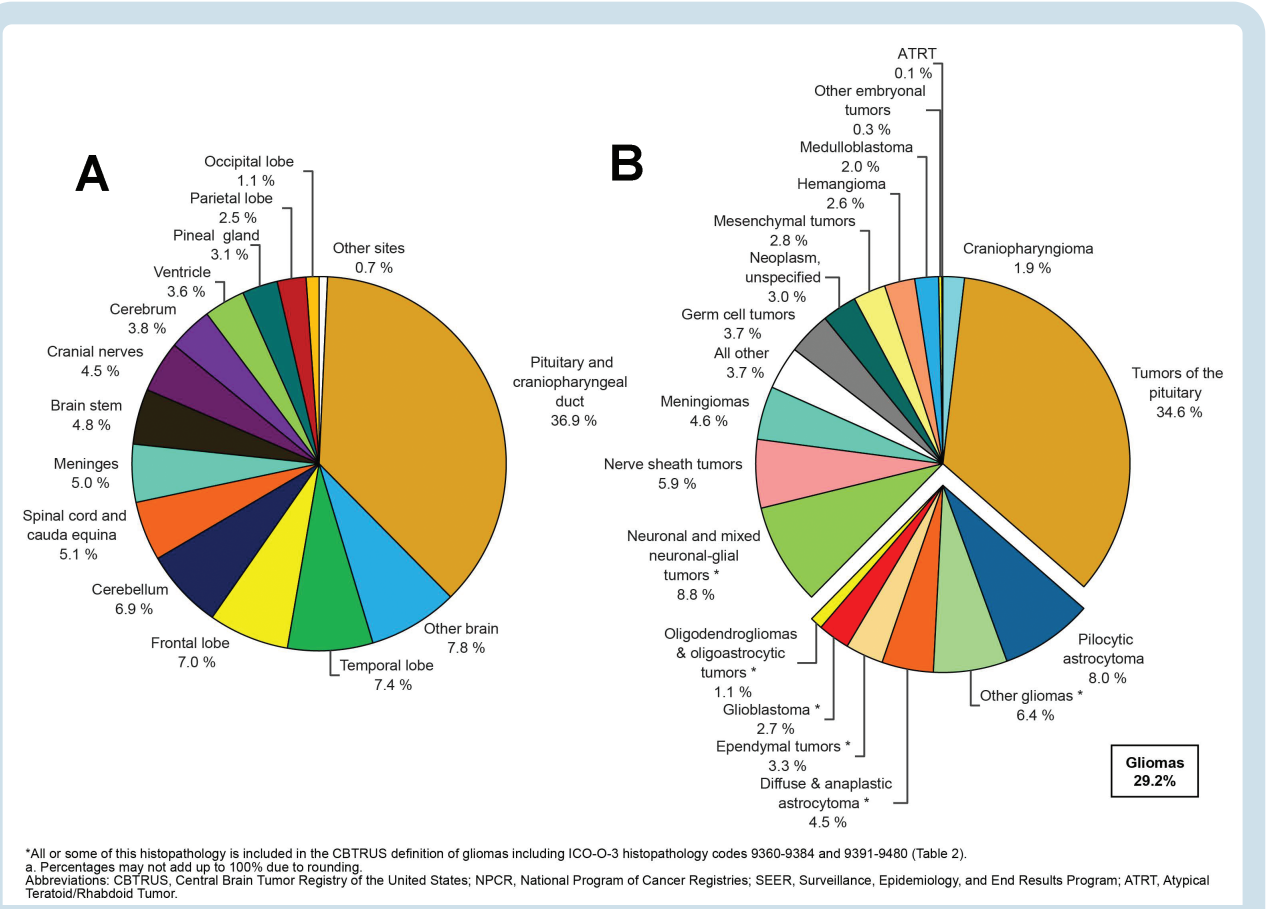
Distribution and Incidence Rates by CCR and Diagnostic Confirmation

The overall number of reported tumors is listed by CCR in **Table 11**. 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 and Indiana for diagnosis year 2020 due to data quality issues.

- Approximately 72.1% of tumors were **non-malignant**, but there was variation by CCR (range: 56.5%-82.7%) (**Table 11**).
- Overall, 52.4% of tumors were histopathologically-confirmed. A larger proportion of **malignant** tumors were histopathologically-confirmed (86.1%) compared to **non-malignant** tumors (39.3%) (**Table 12**).
- A slight majority of **non-malignant** brain and other CNS tumors were radiographically-confirmed (57.2%) (**Table 11**).

The overall AAAIRs by age, behavior, and CCR are shown in **Table 13** and **Figure 25**.

- There was less variation by region for **malignant** tumor incidence rates (**Figure 25A**) compared to incidence rates for **non-malignant** tumors (**Figure 25B**). 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 17.60 to



*All or some of this histopathology is included in the CBTRUS definition of gliomas including ICO-O-3 histopathology codes 9360-9384 and 9391-9480 (Table 2).
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; ATRT, Atypical Teratoid/Rhabdoid Tumor.

Fig. 23 Distribution[a] in Children and Adolescents (Ages 15-19 Years) of Primary Brain and Central Nervous System Tumors (Five-Year Total=7,863; Annual Average Cases=1,573) by A) Site and B) Histopathology Subtypes, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

45.42 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 4.86 to 8.00 per 100,000 population.
- Among adults 20 years of age and older, CCR-specific incidence rates ranged from 5.86 to 9.73 per 100,000 population for **malignant** tumors.
- In persons less than 20 years of age, incidence rates ranged from 2.26 to 4.72 per 100,000 population for **malignant** tumors.

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

The distribution of reported tumors with histopathologically-confirmed diagnosis from 2016 to 2020 is listed by histopathology and reported WHO grade in **Table 12**.

- Overall, 67.2% 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 (93.7%), anaplastic oligodendroglioma (93.1%), and oligodendroglioma (93.1%).

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 42.6% of tumors were **malignant** and 57.4% were **non-malignant**. The most common histopathologies were **non-malignant** meningiomas (27.3%), followed by glioblastoma (19.9%).

Distributions and Incidence by Sex

Distribution by Behavior and Sex

- Overall, 41.2% of all tumors diagnosed between 2016 and 2020 occurred in males (186,801 tumors) and 58.8% in females (266,822 tumors) (**Table 6**).

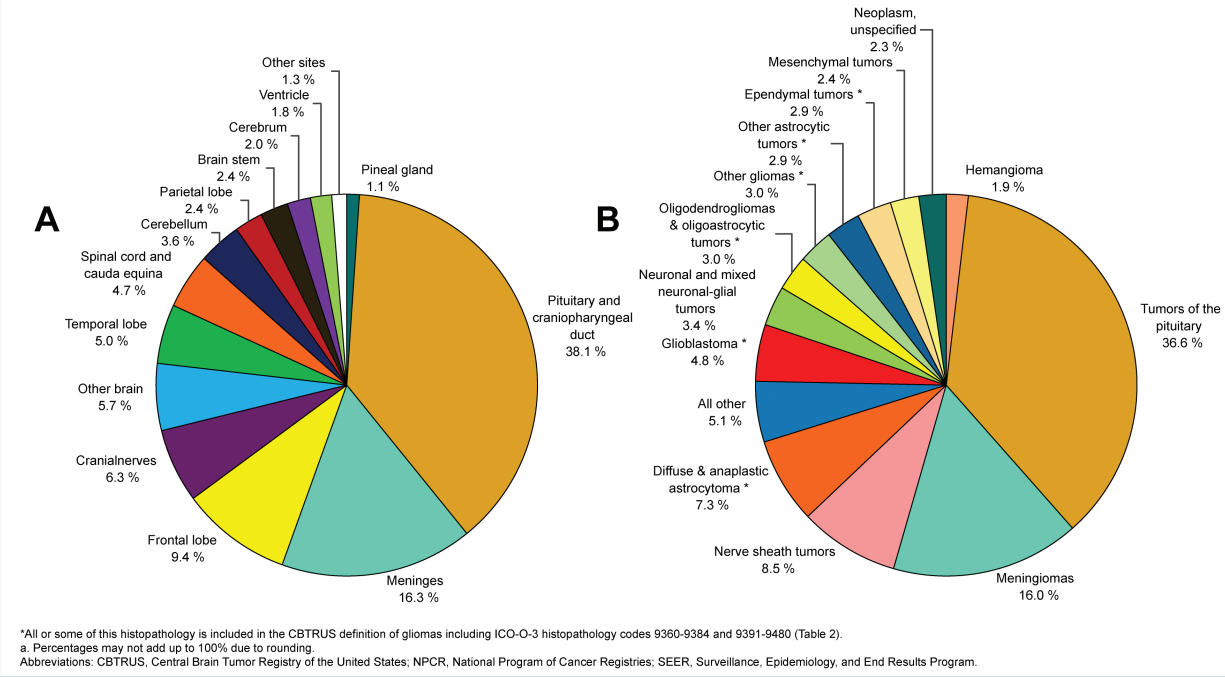


Fig. 24 Distribution[a] in Adolescents and Young Adults (Ages 15-39 Years) of Primary Brain and Other Central Nervous System Tumors (Five-Year Total=64,238; Annual Average Cases=12,848) by A) Site and B) Histopathology Subtypes, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

- Approximately 55.9% of the **malignant** tumors occurred in males (70,865 tumors between 2016 and 2020) and 44.1% in females (55,864 tumors between 2016 and 2020).
- Approximately 35.5% of the **non-malignant** tumors occurred in males (115,936 tumors between 2016 and 2020) and 64.5% in females (210,958 tumors between 2016 and 2020).

Incidence Rates by Site and Sex

Incidence counts and AAAIRs for brain and other CNS tumors by site and sex are shown in **Table 5**.

- Incidence rates were highest for tumors located in the meninges (9.78 per 100,000 population) and lowest for olfactory tumors of the nasal cavity (0.04 per 100,000 population).
- Incidence rates were higher in females than in males for tumors located in the meninges, cranial nerves, and pituitary, while males had higher incidence rates for tumors located in many other sites.

Incidence Rates by Histopathology and Sex

AAAIRs by sex and histopathology are shown in **Table 6**. Incidence rates for all primary brain and other CNS tumors combined were higher among females (27.85 per 100,000 population) than males (21.62 per 100,000 population).

- The incidence rate of tumors of meninges was higher in females (13.56 per 100,000 population) than in males (6.14 per 100,000 population).
- Incidence of glioblastoma was higher in males (4.09 per 100,000) than in females (2.55 per 100,000 population).

IRR (male:female) for selected histopathologies and histopathology groupings are shown in **Figure 26**.

- Incidence was higher in males for most histopathologies, such as germ cell tumors (male:female IRR=2.46 p<0.0001), most glial tumors, lymphomas (male:female IRR=1.19, p<0.0001), and embryonal tumors (male:female IRR=1.43, p<0.0001).
- In addition to **non-malignant** meningiomas (male:female IRR=0.43, p<0.0001), tumors of the pituitary (male:female IRR=0.77, p<0.0001) were also more common in females than in males.

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

The incidence rates for brain and other CNS tumors in children and adolescents by histopathology overall and by sex are shown in **Table 14**.

- Overall AAAIRs were highest for other astrocytic tumors (1.10 per 100,000 population) and tumors of the

Table 10. 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: US Cancer Statistics—NPCR and SEER, 2001-2019 (varying)

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Diffuse astrocytoma	0-14[g]	2,080	92.2 (91.0-93.3)	82.4 (80.7-84.1)	80.0 (78.1-81.8)	2,586	91.9 (90.8-92.9)	81.5 (79.9-83.0)	79.4 (77.6-81.0)	--	--	--	--
	15-39[h]	6,663	95.7 (95.1-96.1)	78.2 (77.1-79.3)	61.5 (59.9-63.0)	7,919	95.1 (94.6-95.6)	77.1 (76.1-78.1)	59.9 (58.5-61.2)	--	--	--	--
	40+	11,841	63.3 (62.4-64.2)	34.0 (33.1-35.0)	25.5 (24.5-26.5)	14,294	61.7 (60.8-62.5)	32.9 (32.0-33.7)	24.2 (23.3-25.1)	--	--	--	--
	All ages	20,584	76.8 (76.2-77.4)	53.5 (52.7-54.2)	43.0 (42.2-43.9)	24,799	75.6 (75.1-76.2)	52.3 (51.7-53.0)	41.8 (41.1-42.5)	55	86.5 (73.4-93.5)	78.0 (62.7-87.6)	64.9 (46.1-78.5)
Anaplastic astrocytoma	0-14	660	67.5 (63.7-70.9)	25.3 (21.8-28.9)	19.4 (16.0-23.1)	751	66.6 (63.1-69.9)	24.9 (21.6-28.2)	19.6 (16.5-22.9)	--	--	--	--
	15-39	4,138	92.3 (91.4-93.1)	63.0 (61.3-64.6)	46.8 (44.7-48.8)	4,815	91.4 (90.5-92.1)	61.5 (59.9-63.0)	45.6 (43.8-47.4)	--	--	--	--
	40+	10,277	57.5 (56.5-58.5)	20.4 (19.5-21.2)	14.5 (13.6-15.4)	12,169	55.9 (54.9-56.8)	19.8 (19.0-20.6)	14.2 (13.4-15.0)	--	--	--	--
	All ages	15,075	67.5 (66.7-68.2)	32.2 (31.3-33.0)	23.5 (22.7-24.4)	17,735	65.9 (65.2-66.7)	31.3 (30.5-32.1)	22.9 (22.2-23.7)	--	--	--	--
Glioblastoma	0-14	1,119	57.6 (54.6-60.5)	19.5 (17.0-22.0)	16.2 (13.8-18.8)	1,299	57.0 (54.2-59.7)	20.4 (18.1-22.8)	17.2 (15.0-19.6)	--	--	--	--
	15-39	6,567	76.9 (75.9-78.0)	27.3 (26.1-28.5)	19.0 (17.8-20.2)	7,658	76.1 (75.1-77.0)	27.0 (25.9-28.1)	19.0 (18.0-20.1)	--	--	--	--
	40+	119,220	40.9 (40.6-41.2)	5.6 (5.5-5.8)	3.4 (3.2-3.5)	137,363	39.4 (39.1-39.7)	5.3 (5.2-5.5)	3.3 (3.1-3.4)	--	--	--	--
	All ages	126,906	42.9 (42.6-43.2)	6.9 (6.8-7.1)	4.3 (4.2-4.5)	146,320	41.5 (41.2-41.8)	6.7 (6.5-6.8)	4.3 (4.1-4.4)	--	--	--	--
Oligodendroglioma	0-14	269	97.4 (94.6-98.8)	94.3 (90.6-96.5)	92.3 (87.9-95.1)	353	97.2 (94.8-98.5)	94.3 (91.2-96.3)	91.9 (88.2-94.5)	--	--	--	--
	15-39	3,949	98.6 (98.1-98.9)	92.7 (91.7-93.5)	79.0 (77.3-80.7)	4,823	98.6 (98.2-98.9)	92.4 (91.6-93.2)	78.2 (76.7-79.6)	--	--	--	--
	40+	5,526	92.8 (92.1-93.5)	78.2 (76.8-79.4)	64.5 (62.7-66.2)	6,750	92.1 (91.4-92.8)	77.1 (75.9-78.2)	63.0 (61.5-64.5)	--	--	--	--
	All ages	9,744	95.3 (94.8-95.7)	84.6 (83.7-85.4)	71.4 (70.1-72.6)	11,926	94.9 (94.4-95.3)	83.9 (83.1-84.7)	70.2 (69.1-71.3)	--	--	--	--

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Anaplastic oligodendroglioma	0-14	--	--	--	--	51	84.4 (71.1-91.9)	61.5 (46.2-73.6)	50.9 (35.3-64.6)	--	--	--	--
	15-39	--	--	--	--	1,575	95.6 (94.4-96.5)	78.5 (76.1-80.6)	64.1 (61.1-67.0)	--	--	--	--
	40+	3,032	86.2 (84.9-87.4)	61.0 (59.0-63.0)	48.1 (45.6-50.5)	3,713	84.4 (83.2-85.6)	57.2 (55.4-59.0)	44.7 (42.6-46.7)	--	--	--	--
	All ages	4,342	89.1 (88.0-90.0)	66.8 (65.2-68.4)	53.0 (51.0-55.0)	5,339	87.7 (86.8-88.6)	63.6 (62.2-65.1)	50.6 (48.9-52.3)	--	--	--	--
Oligoastrocytic tumors	0-14	147	91.2 (85.2-94.8)	78.5 (70.8-84.4)	76.1 (68.0-82.3)	187	90.4 (85.1-93.9)	76.2 (69.3-81.7)	74.3 (67.3-80.1)	--	--	--	--
	15-39	2,400	97.5 (96.8-98.1)	81.2 (79.5-82.7)	61.0 (58.7-63.2)	2,933	97.3 (96.6-97.8)	79.9 (78.3-81.3)	59.7 (57.7-61.7)	--	--	--	--
	40+	2,896	82.7 (81.2-84.0)	54.7 (52.8-56.6)	43.7 (41.7-45.8)	3,497	81.7 (80.4-83.0)	53.2 (51.4-54.9)	42.1 (40.2-43.9)	--	--	--	--
	All ages	5,443	89.5 (88.6-90.3)	67.1 (65.8-68.4)	52.3 (50.8-53.8)	6,617	88.9 (88.1-89.6)	65.7 (64.5-66.9)	50.9 (49.5-52.2)	--	--	--	--
Pilocytic astrocytoma	0-14	8,289	99.0 (98.7-99.2)	97.3 (96.9-97.7)	95.9 (95.3-96.4)	9,383	98.8 (98.6-99.0)	97.1 (96.7-97.4)	95.5 (95.0-96.0)	232	100.0 (**-**)	--	--
	15-39	3,977	98.5 (98.1-98.9)	94.7 (93.9-95.4)	93.0 (91.9-94.0)	4,608	98.4 (98.0-98.8)	94.6 (93.8-95.3)	92.9 (91.9-93.7)	--	--	--	--
	40+	1,351	91.9 (90.2-93.3)	79.6 (76.9-82.1)	77.2 (73.6-80.3)	1,547	91.5 (89.9-92.9)	79.0 (76.4-81.3)	77.1 (73.9-79.9)	--	--	--	--
	All ages	13,617	98.1 (97.9-98.4)	94.8 (94.4-95.2)	93.2 (92.6-93.7)	15,538	98.0 (97.7-98.2)	94.6 (94.1-94.9)	92.9 (92.4-93.4)	267	100.0 (**-**)	--	--
Unique astrocytoma variants	0-14	1,036	97.7 (96.5-98.4)	94.8 (93.1-96.1)	92.4 (90.1-94.2)	383	95.7 (93.1-97.4)	87.8 (83.8-90.9)	82.6 (77.5-86.7)	698	98.6 (97.3-99.3)	98.0 (96.4-98.8)	96.6 (94.3-98.0)
	15-39	968	96.8 (95.4-97.7)	86.8 (84.2-89.0)	82.0 (78.8-84.8)	719	96.6 (95.0-97.8)	82.5 (79.2-85.3)	77.7 (73.8-81.1)	342	97.0 (94.5-98.4)	94.2 (90.7-96.4)	91.0 (86.2-94.2)
	40+	349	84.0 (79.5-87.6)	59.3 (53.1-64.8)	51.1 (43.9-57.8)	300	81.6 (76.5-85.7)	52.8 (46.4-58.9)	48.0 (40.7-54.8)	83	91.5 (82.1-96.1)	82.6 (69.7-90.4)	64.6 (46.4-77.9)
	All ages	2,353	95.3 (94.3-96.1)	86.4 (84.7-87.8)	82.2 (80.2-84.0)	1,402	93.2 (91.7-94.4)	77.7 (75.2-79.9)	72.8 (69.9-75.5)	1,123	97.6 (96.5-98.4)	95.8 (94.2-96.9)	92.8 (90.5-94.6)

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Ependymal tumors	0-14	2,467	95.6 (94.7-96.4)	80.3 (78.5-82.0)	72.0 (69.7-74.1)	2,577	94.7 (93.7-95.5)	76.8 (75.0-78.5)	67.3 (65.1-69.4)	281	99.7 (97.0-100.0)	97.6 (94.3-99.0)	97.6 (94.3-99.0)
	15-39	5,029	98.4 (97.9-98.7)	94.8 (94.0-95.5)	91.8 (90.7-92.7)	3,244	97.2 (96.6-97.8)	91.2 (90.1-92.2)	87.2 (85.7-88.5)	2,252	99.5 (99.1-99.8)	99.1 (98.3-99.5)	97.8 (96.5-98.7)
	40+	9,571	94.9 (94.4-95.4)	90.9 (90.0-91.7)	87.7 (86.4-88.9)	5,801	93.0 (92.3-93.7)	86.6 (85.5-87.7)	83.0 (81.4-84.4)	4,602	96.7 (96.0-97.3)	95.2 (94.0-96.2)	92.9 (90.8-94.4)
	All ages	17,067	96.0 (95.7-96.4)	90.5 (89.9-91.0)	86.6 (85.8-87.4)	11,622	94.6 (94.1-95.0)	85.7 (84.9-86.4)	80.6 (79.7-81.6)	7,135	97.7 (97.3-98.1)	96.6 (95.8-97.2)	94.7 (93.4-95.8)
Glioma malignant, NOS	0-14	6,223	81.3 (80.3-82.3)	68.9 (67.7-70.1)	67.9 (66.6-69.1)	7,164	80.6 (79.7-81.5)	67.7 (66.6-68.9)	66.6 (65.5-67.8)	--	--	--	--
	15-39	3,805	91.3 (90.4-92.2)	78.7 (77.2-80.1)	72.1 (70.3-73.9)	4,316	90.9 (90.0-91.7)	77.7 (76.3-79.0)	70.9 (69.2-72.5)	--	--	--	--
	40+	8,027	53.0 (51.8-54.1)	35.7 (34.5-36.9)	29.8 (28.5-31.2)	9,359	51.5 (50.4-52.5)	34.1 (33.0-35.2)	28.4 (27.2-29.6)	--	--	--	--
	All ages	18,055	71.0 (70.3-71.7)	56.5 (55.7-57.3)	52.4 (51.5-53.2)	20,839	69.8 (69.2-70.5)	55.0 (54.3-55.8)	50.9 (50.1-51.7)	--	--	--	--
Other neuroepithelial tumors	0-14	64	98.5 (89.0-99.8)	91.4 (80.4-96.4)	91.4 (80.4-96.4)	55	98.2 (87.4-99.8)	89.9 (77.3-95.7)	89.9 (77.3-95.7)	--	--	--	--
	15-39	86	96.5 (89.2-98.9)	88.2 (78.1-93.8)	83.9 (70.9-91.4)	66	95.5 (86.3-98.5)	86.7 (74.7-93.3)	78.8 (63.4-88.3)	--	--	--	--
	40+	109	74.3 (64.6-81.8)	52.5 (41.0-62.7)	41.5 (28.8-53.7)	56	69.0 (54.7-79.6)	41.2 (26.8-55.1)	31.6 (17.6-46.5)	63	80.6 (67.5-88.8)	59.4 (43.3-72.2)	51.2 (33.2-66.6)
	All ages	259	87.8 (83.0-91.4)	74.6 (68.1-80.0)	68.8 (61.1-75.3)	177	88.0 (82.0-92.1)	73.5 (65.6-79.8)	67.2 (58.2-74.7)	106	88.7 (80.4-93.6)	76.0 (65.1-84.0)	72.1 (59.7-81.3)
Neuronal and mixed neuronal-glial tumors	0-14	3,337	98.8 (98.3-99.1)	96.1 (95.3-96.8)	95.3 (94.4-96.1)	293	92.4 (88.7-95.0)	81.0 (75.8-85.2)	79.5 (74.1-84.0)	3,097	99.3 (98.9-99.6)	97.4 (96.6-97.9)	96.5 (95.6-97.3)
	15-39	5,108	98.4 (98.0-98.8)	95.6 (94.9-96.2)	92.7 (91.7-93.7)	593	94.4 (92.1-96.0)	79.3 (75.5-82.6)	70.3 (65.6-74.4)	4,592	98.9 (98.5-99.2)	97.6 (97.0-98.1)	95.6 (94.7-96.4)
	40+	4,029	93.4 (92.5-94.2)	85.2 (83.7-86.5)	80.2 (78.1-82.1)	1,637	90.5 (88.8-91.9)	77.7 (75.1-80.1)	69.2 (65.6-72.4)	2,592	94.7 (93.7-95.6)	89.4 (87.7-90.9)	85.9 (83.4-88.0)
	All ages	12,474	96.9 (96.6-97.2)	92.4 (91.8-93.0)	89.4 (88.6-90.2)	2,523	91.6 (90.4-92.7)	78.5 (76.5-80.3)	70.8 (68.3-73.2)	10,281	98.0 (97.7-98.3)	95.5 (94.9-96.0)	93.5 (92.7-94.2)

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Choroid plexus tumors	0-14	948	95.9 (94.3-97.0)	90.0 (87.7-91.8)	88.0 (85.4-90.1)	276	87.9 (83.4-91.3)	65.7 (59.3-71.3)	59.8 (52.9-66.1)	710	98.3 (96.9-99.1)	97.2 (95.5-98.3)	96.6 (94.6-97.8)
	15-39	593	98.2 (96.7-99.0)	95.9 (93.7-97.4)	92.7 (89.3-95.0)	--	--	--	--	554	98.2 (96.6-99.1)	97.0 (95.0-98.2)	95.5 (92.4-97.4)
	40+	696	89.5 (86.8-91.7)	84.9 (81.1-88.0)	79.1 (73.4-83.6)	--	--	--	--	647	90.5 (87.8-92.7)	86.5 (82.6-89.6)	81.5 (75.5-86.1)
	All ages	2,237	94.5 (93.4-95.5)	90.0 (88.4-91.3)	86.6 (84.5-88.5)	373	87.2 (83.2-90.3)	67.3 (61.9-72.1)	58.5 (52.3-64.1)	1,911	95.7 (94.6-96.6)	93.7 (92.2-94.9)	91.4 (89.3-93.2)
Tumors of the pineal region	0-14	384	88.8 (85.1-91.6)	67.5 (62.1-72.2)	61.4 (55.5-66.8)	377	85.6 (81.5-88.8)	60.9 (55.4-65.9)	53.8 (47.9-59.4)	61	98.4 (88.5-99.8)	98.4 (88.5-99.8)	95.6 (81.6-99.0)
	15-39	712	95.5 (93.6-96.8)	87.2 (84.1-89.7)	81.9 (78.0-85.2)	427	93.6 (90.8-95.6)	75.7 (70.7-79.9)	66.3 (60.3-71.5)	339	97.1 (94.5-98.5)	96.8 (93.8-98.3)	94.9 (90.6-97.3)
	40+	762	90.4 (87.9-92.4)	80.0 (76.2-83.2)	69.8 (64.4-74.6)	352	86.6 (82.3-89.9)	69.1 (63.0-74.3)	56.0 (48.4-62.9)	443	92.5 (89.3-94.8)	87.3 (82.5-90.8)	79.7 (72.4-85.3)
	All ages	1,858	92.0 (90.6-93.2)	80.1 (77.9-82.1)	72.8 (69.9-75.5)	1,156	88.9 (86.8-90.6)	68.8 (65.7-71.6)	59.2 (55.5-62.6)	843	94.8 (92.9-96.2)	92.0 (89.3-94.0)	87.3 (83.3-90.5)
Embryonal tumors	0-14	6,023	82.0 (81.0-83.0)	64.1 (62.8-65.4)	59.0 (57.6-60.4)	7,125	81.6 (80.7-82.5)	63.2 (62.0-64.4)	58.2 (57.0-59.5)	--	--	--	--
	15-39	2,133	91.4 (90.1-92.6)	71.9 (69.8-73.9)	61.7 (59.2-64.2)	2,571	90.7 (89.5-91.8)	71.1 (69.2-73.0)	61.2 (59.0-63.3)	--	--	--	--
	40+	773	70.0 (66.5-73.1)	46.0 (42.1-49.7)	37.5 (33.2-41.7)	899	70.0 (66.8-72.9)	46.6 (43.0-50.0)	37.5 (33.7-41.3)	--	--	--	--
	All ages	8,929	83.2 (82.4-84.0)	64.4 (63.3-65.4)	57.7 (56.5-58.9)	10,595	82.8 (82.1-83.5)	63.7 (62.7-64.7)	57.2 (56.1-58.2)	--	--	--	--
Nerve sheath tumors	0-14	2,251	99.8 (99.4-99.9)	98.9 (98.2-99.3)	98.0 (97.2-98.6)	--	--	--	--	2,216	100.0 (0.0-100.0)	99.3 (98.7-99.6)	98.5 (97.7-99.0)
	15-39	13,549	99.3 (99.1-99.4)	98.5 (98.2-98.7)	97.6 (97.1-98.0)	--	--	--	--	13,406	99.5 (99.3-99.6)	98.8 (98.5-99.0)	98.0 (97.6-98.4)
	40+	73,152	99.2 (99.1-99.3)	99.2 (99.1-99.3)	99.2 (99.1-99.3)	496	86.2 (82.6-89.1)	76.9 (72.2-80.9)	72.9 (66.6-78.2)	72,783	99.3 (99.1-99.4)	99.3 (99.1-99.4)	99.3 (99.1-99.4)
	All ages	88,952	99.2 (99.1-99.3)	99.2 (99.1-99.3)	99.2 (99.1-99.3)	720	85.0 (82.0-87.5)	74.8 (71.0-78.1)	70.0 (65.3-74.2)	88,405	99.3 (99.2-99.4)	99.3 (99.2-99.4)	99.3 (99.2-99.4)

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Other tumors of cranial and spinal nerves	0-14	--	--	--	--	--	--	--	--	--	--	--	--
	15-39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	56	97.8 (79.9-99.8)	96.1 (75.2-99.4)	91.5 (62.2-98.4)	--	--	--	--	56	97.8 (79.9-99.8)	96.1 (75.2-99.4)	91.5 (62.2-98.4)
	All ages	69	96.7 (85.4-99.3)	93.8 (80.4-98.1)	90.2 (69.6-97.1)	--	--	--	--	69	96.7 (85.4-99.3)	93.8 (80.4-98.1)	90.2 (69.6-97.1)
Meningiomas	0-14	688	97.8 (96.3-98.7)	95.4 (93.4-96.8)	92.0 (89.1-94.2)	60	90.0 (78.9-95.4)	79.6 (66.8-87.9)	74.8 (60.8-84.5)	639	98.6 (97.3-99.3)	96.5 (94.6-97.8)	93.4 (90.4-95.4)
	15-39	24,271	98.8 (98.6-98.9)	97.0 (96.8-97.3)	94.9 (94.5-95.3)	420	93.8 (91.0-95.8)	84.4 (80.3-87.8)	78.7 (73.7-82.8)	23,943	98.9 (98.7-99.0)	97.2 (97.0-97.5)	95.2 (94.8-95.6)
	40+	372,963	92.9 (92.8-93.0)	87.4 (87.2-87.5)	82.2 (82.0-82.5)	4,678	83.1 (81.9-84.2)	65.1 (63.4-66.8)	58.0 (55.9-60.1)	369,249	93.0 (92.9-93.1)	87.6 (87.4-87.8)	82.5 (82.2-82.8)
	All ages	397,922	93.2 (93.1-93.3)	88.0 (87.8-88.2)	83.2 (82.9-83.4)	5,158	84.1 (82.9-85.1)	67.0 (65.4-68.5)	60.1 (58.1-62.0)	393,831	93.3 (93.2-93.4)	88.3 (88.1-88.4)	83.4 (83.2-83.7)
Mesenchymal tumors	0-14	1,285	97.8 (96.8-98.5)	94.3 (92.7-95.5)	92.4 (90.3-94.0)	200	85.7 (80.0-89.9)	69.1 (61.7-75.3)	62.1 (54.1-69.1)	1,118	99.4 (98.6-99.8)	97.7 (96.5-98.6)	96.5 (94.5-97.7)
	15-39	4,428	98.2 (97.7-98.6)	95.8 (95.0-96.4)	93.6 (92.5-94.5)	545	91.9 (89.2-93.9)	79.8 (75.9-83.1)	71.7 (67.0-75.9)	3,989	98.9 (98.5-99.2)	97.5 (96.8-98.0)	95.8 (94.8-96.7)
	40+	10,582	94.2 (93.7-94.7)	89.2 (88.3-90.0)	84.1 (82.7-85.4)	1,324	87.4 (85.3-89.2)	69.1 (66.0-72.0)	52.4 (48.3-56.2)	9,453	95.0 (94.5-95.5)	91.6 (90.7-92.4)	87.8 (86.3-89.0)
	All ages	16,295	95.6 (95.2-95.9)	91.4 (90.8-92.0)	87.4 (86.5-88.3)	2,069	88.4 (86.9-89.8)	72.1 (69.8-74.3)	59.0 (56.1-61.8)	14,560	96.4 (96.1-96.8)	93.7 (93.1-94.2)	90.7 (89.7-91.6)
Primary melanocytic lesions	0-14	--	--	--	--	--	--	--	--	--	--	--	--
	15-39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	191	70.2 (62.7-76.4)	47.1 (38.2-55.4)	31.3 (21.4-41.7)	133	61.8 (52.6-69.8)	34.2 (25.0-43.6)	20.5 (11.6-31.1)	76	86.1 (74.7-92.6)	63.6 (47.6-75.9)	44.9 (27.7-60.7)
	All ages	263	69.3 (63.0-74.7)	49.5 (42.2-56.4)	35.9 (27.7-44.1)	186	58.9 (51.3-65.8)	35.2 (27.5-43.0)	23.5 (15.7-32.3)	102	87.6 (78.5-93.0)	70.5 (57.8-80.0)	55.0 (39.7-67.8)
Lymphoma	0-14	176	91.8 (86.5-95.1)	86.5 (80.2-91.0)	80.5 (72.1-86.6)	197	91.7 (86.7-94.8)	86.4 (80.4-90.6)	81.7 (74.3-87.1)	--	--	--	--
	15-39	1,554	67.7 (65.3-70.0)	59.6 (57.0-62.1)	55.4 (52.5-58.2)	1,923	63.4 (61.2-65.5)	54.6 (52.3-56.9)	50.7 (48.2-53.1)	--	--	--	--
	40+	15,460	54.4 (53.6-55.3)	36.6 (35.7-37.5)	28.4 (27.4-29.5)	17,909	53.7 (53.0-54.5)	35.2 (34.4-36.1)	26.6 (25.7-27.6)	--	--	--	--
	All ages	17,190	56.1 (55.3-56.8)	39.4 (38.6-40.2)	31.8 (30.8-32.7)	20,029	55.1 (54.3-55.8)	37.8 (37.0-38.5)	29.8 (29.0-30.7)	--	--	--	--

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Other hematopoietic neoplasms	0-14	--	--	--	--	--	--	--	--	--	--	--	--
	15-39	--	--	--	--	--	--	--	--	--	--	--	--
	40+	141	83.1 (75.3-88.6)	67.0 (57.0-75.1)	63.2 (51.6-72.7)	174	82.5 (75.6-87.6)	64.4 (55.7-71.9)	59.9 (50.0-68.5)	--	--	--	--
	All ages	157	84.8 (77.7-89.8)	67.4 (58.1-75.1)	64.0 (53.3-72.9)	197	84.6 (78.3-89.1)	66.4 (58.3-73.3)	62.6 (53.5-70.4)	--	--	--	--
Germ cell tumors	0-14	1,414	93.5 (92.0-94.7)	89.5 (87.6-91.0)	86.7 (84.5-88.7)	1,429	93.0 (91.5-94.2)	87.8 (85.9-89.4)	84.3 (82.0-86.3)	186	92.6 (87.6-95.6)	92.0 (86.9-95.2)	92.0 (86.9-95.2)
	15-39	1,548	95.4 (94.2-96.4)	89.6 (87.7-91.1)	87.1 (85.0-89.0)	1,653	94.5 (93.3-95.5)	88.6 (86.8-90.1)	85.9 (83.8-87.7)	127	99.3 (93.4-99.9)	93.3 (86.2-96.8)	91.1 (83.0-95.4)
	40+	196	92.5 (87.3-95.7)	83.2 (75.5-88.6)	78.6 (69.7-85.2)	87	81.7 (71.3-88.6)	63.5 (51.1-73.6)	60.0 (45.7-71.6)	124	98.5 (90.2-99.8)	93.4 (82.7-97.6)	86.8 (74.4-93.4)
	All ages	3,158	94.3 (93.5-95.1)	89.1 (87.9-90.3)	86.5 (84.9-87.8)	3,169	93.5 (92.6-94.3)	87.5 (86.2-88.7)	84.5 (82.9-85.9)	437	96.2 (93.7-97.7)	92.7 (89.2-95.1)	90.2 (85.9-93.3)
Tumors of the pituitary	0-14	2,564	99.8 (99.5-99.9)	99.4 (98.9-99.7)	99.0 (98.2-99.4)	--	--	--	--	2,562	99.8 (99.5-99.9)	99.4 (98.9-99.7)	99.0 (98.2-99.4)
	15-39	55,228	99.7 (99.7-99.8)	99.4 (99.3-99.5)	98.9 (98.7-99.0)	--	--	--	--	55,155	99.7 (99.7-99.8)	99.4 (99.3-99.5)	98.9 (98.7-99.1)
	40+	121,454	97.5 (97.4-97.7)	95.9 (95.6-96.1)	93.4 (93.0-93.8)	371	88.4 (84.3-91.5)	79.4 (73.6-84.1)	70.0 (62.2-76.5)	121,153	97.6 (97.5-97.7)	95.9 (95.7-96.1)	93.5 (93.1-93.9)
	All ages	179,246	98.3 (98.2-98.3)	97.0 (96.9-97.2)	95.3 (95.0-95.6)	476	90.6 (87.3-93.1)	81.9 (77.2-85.7)	74.7 (68.4-79.9)	178,870	98.3 (98.2-98.4)	97.1 (96.9-97.2)	95.3 (95.1-95.6)
Craniopharyngioma	0-14	1,860	98.6 (98.0-99.1)	95.8 (94.6-96.7)	91.8 (90.1-93.3)	--	--	--	--	1,851	98.7 (98.0-99.1)	95.8 (94.7-96.7)	91.9 (90.1-93.3)
	15-39	1,920	96.3 (95.3-97.0)	91.5 (90.0-92.8)	87.6 (85.6-89.3)	--	--	--	--	1,918	96.2 (95.3-97.0)	91.6 (90.1-92.9)	87.7 (85.7-89.4)
	40+	4,386	88.9 (87.9-89.9)	78.5 (76.9-80.0)	69.9 (67.7-71.9)	--	--	--	--	4,377	89.0 (87.9-89.9)	78.5 (77.0-80.0)	69.9 (67.7-72.0)
	All ages	8,166	92.9 (92.3-93.5)	85.7 (84.7-86.5)	79.5 (78.2-80.7)	--	--	--	--	8,146	92.9 (92.3-93.5)	85.7 (84.8-86.6)	79.5 (78.2-80.8)
Hemangioma	0-14	598	99.4 (98.2-99.8)	98.0 (96.4-98.9)	98.0 (96.4-98.9)	--	--	--	--	598	99.4 (98.2-99.8)	98.0 (96.4-98.9)	98.0 (96.4-98.9)
	15-39	2,725	99.6 (99.2-99.8)	98.7 (97.9-99.1)	97.1 (95.8-98.0)	--	--	--	--	2,719	99.6 (99.3-99.8)	98.7 (98.0-99.2)	97.1 (95.8-98.0)
	40+	5,577	96.1 (95.4-96.6)	91.8 (90.6-92.9)	89.4 (87.3-91.1)	--	--	--	--	5,570	96.1 (95.4-96.7)	91.9 (90.7-93.0)	89.4 (87.4-91.2)
	All ages	8,900	97.4 (97.0-97.8)	94.4 (93.6-95.1)	92.5 (91.3-93.6)	--	--	--	--	8,887	97.4 (97.0-97.8)	94.5 (93.7-95.2)	92.6 (91.3-93.7)

Table 10. Continued

Histopathology	Age Groups (years)	All (2004-2019)				Malignant (2001-2019)[c]				Non-Malignant (2004-2019)[d]			
		N	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[f]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)	N[e]	1-Year RS (95% CI)	5-Year RS (95% CI)	10-Year RS (95% CI)
Neoplasm, unspecified	0-14	1,460	88.5 (86.7-90.0)	85.5 (83.5-87.2)	84.0 (81.9-86.0)	396	66.3 (61.4-70.8)	58.0 (52.8-62.8)	54.8 (49.4-59.9)	1,108	95.3 (93.9-96.5)	94.2 (92.6-95.5)	93.4 (91.5-94.9)
	15-39	4,268	93.5 (92.7-94.2)	90.2 (89.2-91.1)	87.9 (86.7-89.0)	869	79.3 (76.4-81.9)	68.6 (65.2-71.7)	63.2 (59.4-66.7)	3,560	96.1 (95.4-96.7)	94.1 (93.2-94.9)	92.3 (91.1-93.3)
	40+	21,433	54.4 (53.7-55.1)	45.3 (44.5-46.1)	40.2 (39.2-41.1)	9,806	27.3 (26.4-28.3)	17.7 (16.9-18.6)	15.2 (14.3-16.2)	13,267	71.4 (70.6-72.2)	62.3 (61.3-63.3)	55.7 (54.4-57.0)
	All ages	27,161	62.6 (62.0-63.2)	54.9 (54.2-55.6)	50.6 (49.8-51.4)	11,071	33.0 (32.1-34.0)	23.5 (22.6-24.3)	20.7 (19.7-21.6)	17,935	77.9 (77.3-78.6)	70.9 (70.1-71.7)	65.9 (64.9-66.9)
All other	0-14	416	89.9 (86.5-92.5)	85.0 (81.0-88.2)	85.0 (81.0-88.2)	124	60.5 (51.1-68.5)	39.7 (30.6-48.8)	38.2 (29.0-47.4)	310	99.5 (97.0-99.9)	99.5 (97.0-99.9)	99.5 (97.0-99.9)
	15-39	368	98.1 (96.0-99.1)	94.5 (91.2-96.6)	92.9 (88.7-95.7)	--	--	--	--	335	99.2 (97.1-99.8)	97.9 (94.9-99.1)	96.2 (91.7-98.3)
	40+	572	87.6 (84.2-90.3)	83.8 (78.7-87.7)	74.4 (67.0-80.4)	--	--	--	--	548	88.9 (85.4-91.6)	85.5 (80.3-89.4)	76.1 (68.3-82.2)
	All ages	1,356	91.2 (89.4-92.7)	87.1 (84.7-89.2)	83.3 (80.0-86.1)	194	65.9 (58.6-72.2)	43.8 (36.2-51.2)	40.8 (32.9-48.6)	1,193	94.6 (92.9-95.9)	92.8 (90.3-94.6)	88.6 (85.1-91.4)
TOTAL[i]	**0-14**	**46,102**	**91.6 (91.4-91.9)**	**83.2 (82.8-83.6)**	**80.7 (80.2-81.1)**	**35,281**	**87.4 (87.1-87.8)**	**75.0 (74.6-75.5)**	**71.8 (71.3-72.3)**	**16,035**	**98.9 (98.8-99.1)**	**97.6 (97.3-97.8)**	**96.4 (96.0-96.7)**
	15-39	**157,627**	**97.0 (96.9-97.1)**	**91.1 (90.9-91.2)**	**87.1 (86.9-87.3)**	**52,117**	**90.7 (90.5-91.0)**	**71.9 (71.5-72.3)**	**61.5 (61.0-62.0)**	**113,601**	**99.3 (99.2-99.3)**	**98.4 (98.3-98.4)**	**97.2 (97.0-97.3)**
	40+	**805,163**	**83.2 (83.1-83.3)**	**72.8 (72.7-72.9)**	**68.9 (68.7-69.0)**	**232,885**	**49.4 (49.2-49.6)**	**21.1 (20.9-21.3)**	**16.8 (16.6-17.0)**	**605,615**	**94.2 (94.2-94.3)**	**90.4 (90.3-90.5)**	**86.8 (86.6-87.0)**
	All ages	**1,008,892**	**85.8 (85.7-85.9)**	**76.3 (76.1-76.4)**	**72.4 (72.3-72.6)**	**320,283**	**60.4 (60.3-60.6)**	**35.7 (35.5-35.9)**	**30.6 (30.4-30.8)**	**735,251**	**95.1 (95.1-95.2)**	**91.9 (91.7-92.0)**	**88.8 (88.6-88.9)**

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time periods, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of cases alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]Assigned behavior code of /3 (see Tables 2).
[d]Assigned behavior code of /0 or /1 (see Table 2).
[e]Total number of cases that occurred within the included NPCR and SEER registries between 2004 and 2019.
[f]Total number of cases that occurred within the included NPCR and SEER registries between 2001 and 2019.
[g]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[h]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya.
[i]Total includes 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: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; CI, confidence interval; NOS, not otherwise specified; RS, Relative survival.

Table 11. 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, 2016-2020

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 (%)	5-Year Total	% Non-Malignant	Histopathologically Confirmed (%)	Radiographically Confirmed (%)	
Alaska	902	180	48	49	266	29.5	82	13.2	636	70.5	33.8	64	736,989
Alabama	5,656	1,131	54.5	37.5	1,962	34.7	74.8	6.1	3,694	65.3	43.7	54.1	4,893,188
Arkansas	4,042	808	50.5	45	1,202	29.7	82.3	10.7	2,840	70.3	37.1	59.4	3,011,868
Arizona	8,370	1,674	61.6	34.5	2,629	31.4	85.2	6.9	5,741	68.6	50.7	47.1	7,174,065
California	48,107	9,621	55.2	40.1	13,726	28.5	84.8	8.1	34,381	71.5	43.4	52.9	39,346,024
Colorado	8,831	1,766	46	51	2,085	23.6	83.7	11.1	6,746	76.4	34.4	63.4	5,684,925
Connecticut	5,055	1,011	62.8	34.3	1,633	32.3	89.3	7.4	3,422	67.7	50.1	47.2	3,570,549
District of Columbia	854	171	48.7	47.9	194	22.7	84.5	9.3	660	77.3	38.2	59.2	701,974
Delaware	1,130	226	62.2	35.4	406	35.9	86	9.8	724	64.1	48.9	49.7	967,679
Florida	34,539	6,908	49.7	46.7	9,170	26.6	84.1	10.3	25,369	73.4	37.2	59.9	21,216,924
Georgia	15,339	3,068	46	47.4	3,589	23.4	82.9	10.5	11,750	76.6	34.7	58.7	10,516,580
Hawaii	1,571	314	53.6	40.8	395	25.1	83.3	10.6	1,176	74.9	43.6	50.9	1,420,074
Iowa	4,769	954	53.9	43	1,387	29.1	84.2	10.6	3,382	70.9	41.4	56.3	3,150,000
Idaho	2,456	491	55.6	42.1	713	29	83.2	13.3	1,743	71	44.3	53.9	1,754,366
Illinois	18,747	3,749	50.9	46.1	4,843	25.8	87.9	7.2	13,904	74.2	38	59.7	12,716,167
Indiana[g]	6,325	1,265	53.6	42.3	2,150	34	83.9	9.9	4,175	66	37.9	59	5,345,891
Kansas	3,773	755	52.5	44.5	1,105	29.3	88.9	7.5	2,668	70.7	37.4	59.9	2,912,611
Kentucky	7,468	1,494	45.4	46.6	1,969	26.4	82.1	10.2	5,499	73.6	32.3	59.6	4,461,953
Louisiana	6,866	1,373	51.3	43.9	1,599	23.3	86	9.4	5,267	76.7	40.7	54.3	4,664,614
Massachusetts	8,454	1,691	65.7	29.6	2,988	35.3	87.7	6.8	5,466	64.7	53.6	42.1	6,873,003
Maryland	8,424	1,685	53.4	41.6	2,306	27.4	84.8	6.1	6,118	72.6	41.5	54.9	6,037,622
Maine	1,605	321	68.3	27.5	698	43.5	83.2	9.3	907	56.5	56.9	41.5	1,340,825
Michigan	12,103	2,421	57.4	37.3	3,955	32.7	85.9	5.8	8,148	67.3	43.6	52.6	9,973,901
Minnesota	7,232	1,446	63.9	33.4	2,409	33.3	88.2	8.3	4,823	66.7	51.7	46	5,600,160
Missouri	8,706	1,741	49.3	45.9	2,557	29.4	83.3	8.4	6,149	70.6	35.2	61.5	6,124,155
Mississippi	3,802	760	53.5	42.7	1,028	27	86.8	9.4	2,774	73	41.1	55	2,981,832
Montana	1,587	317	51.4	44.4	493	31.1	81.1	13.8	1,094	68.9	37.9	58.2	1,061,703

Table 11. 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 (%)	5-Year Total	% Non-Malignant	Histopathologically Confirmed (%)	Radiographically Confirmed (%)	
North Carolina	15,100	3,020	50.9	45.2	3,980	26.4	86.3	8.6	11,120	73.6	38.2	58.4	10,386,225
North Dakota	880	176	46.2	50.9	266	30.2	82.3	12.4	614	69.8	30.6	67.6	760,393
Nebraska	2,215	443	57.7	39	795	35.9	84.4	9.9	1,420	64.1	42.8	55.3	1,923,823
New Hampshire	2,016	403	54.8	42	654	32.4	89.8	5.8	1,362	67.6	38	59.4	1,355,242
New Jersey	14,497	2,899	48.8	45.6	3,789	26.1	84.7	8.9	10,708	73.9	36.1	58.6	8,885,418
New Mexico	2,087	417	68.4	25	707	33.9	87.4	5.7	1,380	66.1	58.7	34.9	2,097,021
Nevada[g]	3,155	631	50.9	44.6	852	27	84.6	7.4	2,303	73	38.4	58.3	1,178,330
New York	32,405	6,481	49.6	46.8	7,819	24.1	85.8	9.6	24,586	75.9	38	58.6	19,514,849
Ohio	14,086	2,817	62.2	33	4,977	35.3	87.6	6.2	9,109	64.7	48.3	47.7	11,675,276
Oklahoma	4,521	904	57.7	38.3	1,466	32.4	81.7	9.6	3,055	67.6	46.1	52	3,949,338
Oregon	5,014	1,003	63	31.9	1,722	34.3	84	7.1	3,292	65.7	52	44.8	4,176,345
Pennsylvania	20,269	4,054	48	47.5	5,815	28.7	81.5	9.3	14,454	71.3	34.5	62.9	12,794,878
Rhode Island	1,202	240	65.6	29.8	459	38.2	87.2	5.2	743	61.8	52.4	45	1,057,798
South Carolina	6,386	1,277	55.1	40.9	1,987	31.1	86.1	8.3	4,399	68.9	41.2	55.6	5,091,515
South Dakota	1,129	226	40.3	56.3	311	27.6	77.2	16.1	818	72.4	26.3	71.6	879,331
Tennessee	9,271	1,854	50	46.1	2,696	29.1	84.5	8.6	6,575	70.9	35.9	61.5	6,772,273
Texas	38,925	7,785	46.9	47.8	9,682	24.9	81.4	11.9	29,243	75.1	35.5	59.6	28,635,441
Utah	6,453	1,291	37.6	61	1,115	17.3	84.3	12	5,338	82.7	27.8	71.2	3,151,239
Virginia	9,900	1,980	57.6	38.3	3,155	31.9	84.6	6.3	6,745	68.1	45	53.2	8,509,357
Vermont	909	182	56.9	40.3	298	32.8	87.2	6	611	67.2	42.1	57	624,339
Washington	13,692	2,738	42	53.1	3,127	22.8	81.4	10.1	10,565	77.2	30.4	65.9	7,512,468
Wisconsin	9,251	1,850	48.4	48.6	2,569	27.8	82.8	12.4	6,682	72.2	35.1	62.5	5,806,974
West Virginia	2,837	567	46.7	48.3	808	28.5	84.8	8.9	2,029	71.5	31.5	63.9	1,807,424

Table 11. 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 (%)	5-Year Total	% Non-Malignant	Histopathologically Confirmed (%)	Radiographically Confirmed (%)	
Wyoming	710	142	60.6	36.3	223	31.4	87.4	7.6	487	68.6	48.2	49.5	581,347
TOTAL	**453,623**	**90,725**	**51.9**	**43.7**	**126,729**	**27.9**	**84.4**	**8.9**	**326,894**	**72.1**	**39.3**	**57.2**	**323,366,290**

[a]With the exception of Nevada and Indiana where total cases represent four years of diagnosis (2016,2017,2018,2019).
[b]Annual average cases are calculated by dividing the five-year total by five.
[c]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[d]Population estimates were obtained from the United States Bureau of the Census available on the SEER program website.
[e]Histopathologic confirmation includes tumors classified as having diagnosis confirmed by: positive histopathology, positive cytology, positive histopathology plus – positive immunophenotyping and/or positive genetic studies, or positive microscopic confirmation, method not specified.
[f]Radiographic confirmation includes tumors classified as having diagnosis confirmed by Radiography and/or other imaging techniques without microscopic confirmation.
[g]Data not available for diagnosis year 2020.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific category, or where the inclusion of the count and rate would allow for back-calculation of suppressed values. The suppressed cases are included in the counts and rates for Totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program.

Table 12. 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, 2016-2020

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 1/I	WHO Grade 2/II	WHO Grade 3/III	WHO Grade 4/IV		
Diffuse Astrocytic and Oligodendroglial Tumors	**84,389**	**94.4%**	**91.5%**	**8.5%**	**0.1%**	**0.5%**	**10.4%**	**12.0%**	**77.1%**	**31.6%**	**99.6%**
Diffuse astrocytoma	7,436	93.1%	84.3%	15.6%	0.1%	2.9%	71.6%	14.2%	11.2%	24.1%	99.4%
Anaplastic astrocytoma	6,729	99.4%	93.7%	6.3%	0.1%	0.2%	2.7%	88.8%	8.2%	38.3%	99.6%
Glioblastoma	64,548	93.8%	91.9%	8.0%	0.1%	0.3%	0.2%	0.7%	98.7%	32.0%	99.7%
Oligodendroglioma	3,599	97.0%	93.1%	6.9%	0.0%	1.3%	89.3%	7.9%	1.4%	22.5%	99.6%
Anaplastic oligodendroglioma	1,838	99.2%	93.1%	6.9%	0.1%	0.0%	5.1%	89.5%	5.3%	37.8%	99.5%
Oligoastrocytic tumors	239	95.8%	87.8%	12.2%	0.0%	2.0%	32.8%	52.7%	12.4%	50.6%	99.6%
Other Astrocytic Tumors	**6,351**	**85.5%**	**86.7%**	**13.0%**	**0.3%**	**86.8%**	**8.9%**	**3.6%**	**0.7%**	**3.4%**	**99.6%**
Pilocytic astrocytoma	5,417	87.0%	86.8%	12.9%	0.4%	95.9%	3.0%	0.5%	0.5%	2.6%	99.7%
Unique astrocytoma variants	934	76.6%	86.0%	13.8%	0.1%	26.8%	48.1%	23.7%	1.5%	8.0%	99.4%
Malignant	*529*	*97.5%*	*89.6%*	*10.3%*	*0.2%*	*3.2%*	*63.6%*	*31.5%*	*1.7%*	*13.8%*	*99.6%*
Non-Malignant	*405*	*49.1%*	*76.9%*	*23.1%*	*0.0%*	*98.7%*	*0.7%*	*0.0%*	*0.7%*	*0.5%*	*99.0%*
Ependymal Tumors	**6,858**	**84.4%**	**88.3%**	**11.5%**	**0.2%**	**37.0%**	**47.8%**	**14.4%**	**0.8%**	**12.2%**	**99.7%**
Malignant	*3,813*	*92.8%*	*89.5%*	*10.2%*	*0.3%*	*3.0%*	*72.8%*	*23.0%*	*1.2%*	*19.2%*	*99.8%*
Non-Malignant	*3,045*	*73.9%*	*86.4%*	*13.5%*	*0.0%*	*92.8%*	*6.8%*	*0.2%*	*0.2%*	*3.5%*	*99.6%*
Other Gliomas	**8,977**	**44.8%**	**52.3%**	**46.9%**	**0.8%**	**8.3%**	**20.5%**	**16.4%**	**54.8%**	**15.0%**	**99.3%**
Glioma malignant, NOS	8,877	44.3%	52.2%	47.0%	0.8%	8.3%	19.3%	16.4%	56.1%	14.9%	99.3%
Other neuroepithelial tumors	100	89.0%	58.4%	41.6%	0.0%	11.3%	66.0%	18.9%	3.8%	21.0%	100.0%
Malignant	*55*	*98.2%*	*40.7%*	*59.3%*	*0.0%*	*21.7%*	*26.1%*	*43.5%*	*8.7%*	*30.9%*	*100.0%*
Non-Malignant	*45*	*77.8%*	*85.7%*	*14.3%*	*0.0%*	*3.3%*	*96.7%*	*0.0%*	*0.0%*	*8.9%*	*100.0%*

Table 12. 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 1/I	WHO Grade 2/II	WHO Grade 3/III	WHO Grade 4/IV		
Neuronal and Mixed Neuronal-Glial Tumors	5,304	91.2%	60.3%	26.8%	12.9%	83.4%	13.0%	2.7%	0.9%	7.0%	99.5%
Malignant	*928*	*98.2%*	*20.7%*	*35.6%*	*43.7%*	*27.2%*	*6.6%*	*53.0%*	*13.2%*	*29.7%*	*99.5%*
Non-Malignant	*4,376*	*89.7%*	*76.6%*	*23.1%*	*0.3%*	*86.2%*	*13.4%*	*0.2%*	*0.2%*	*2.2%*	*99.6%*
Choroid Plexus Tumors	**808**	**87.1%**	**78.4%**	**21.4%**	**0.1%**	**62.6%**	**23.7%**	**13.0%**	**0.7%**	**1.7%**	**99.1%**
Malignant	*123*	*96.7%*	*74.8%*	*24.4%*	*0.8%*	*10.0%*	*4.4%*	*81.1%*	*4.4%*	*3.3%*	*99.2%*
Non-Malignant	*685*	*85.4%*	*79.1%*	*20.9%*	*0.0%*	*72.7%*	*27.3%*	*0.0%*	*0.0%*	*1.5%*	*99.1%*
Tumors of The Pineal Region	**740**	**79.6%**	**42.7%**	**0.0%**	**57.3%**	**0.0%**	**100.0%**	**0.0%**	**0.0%**	**21.5%**	**99.5%**
Malignant	*455*	*98.0%*	*43.6%*	*0.0%*	*56.4%*	*0.0%*	*100.0%*	*0.0%*	*0.0%*	*32.7%*	*99.3%*
Non-Malignant	*285*	*50.2%*	*39.7%*	*0.0%*	*60.3%*	*--%*	*--%*	*--%*	*--%*	*3.5%*	*100.0%*
Embryonal Tumors	**3,057**	**98.6%**	**83.6%**	**15.9%**	**0.5%**	**0.6%**	**0.5%**	**0.9%**	**98.0%**	**33.1%**	**99.8%**
Tumors of Cranial and Spinal Nerves	**36,614**	**47.6%**	**49.5%**	**50.5%**	**0.0%**	**99.5%**	**0.2%**	**0.1%**	**0.1%**	**7.3%**	**99.3%**
Nerve sheath tumors	36,586	47.6%	49.5%	50.5%	0.0%	99.5%	0.2%	0.1%	0.1%	7.3%	99.3%
Malignant	*213*	*82.2%*	*25.7%*	*74.3%*	*0.0%*	*62.2%*	*11.1%*	*20.0%*	*6.7%*	*16.0%*	*98.3%*
Non-Malignant	*36,373*	*47.4%*	*49.7%*	*50.3%*	*0.0%*	*99.7%*	*0.2%*	*0.0%*	*0.1%*	*7.3%*	*99.3%*
Other tumors of cranial and spinal nerves	28	46.4%	15.4%	84.6%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Tumors of Meninges	**191,055**	**36.2%**	**82.1%**	**17.9%**	**0.1%**	**80.0%**	**17.9%**	**2.0%**	**0.1%**	**3.1%**	**99.6%**
Meningiomas	185,195	34.9%	83.6%	16.4%	0.0%	80.1%	18.3%	1.5%	0.1%	2.9%	99.6%
Malignant	*1,571*	*79.0%*	*87.8%*	*12.2%*	*0.0%*	*21.0%*	*13.8%*	*64.1%*	*1.1%*	*17.3%*	*98.5%*
Non-Malignant	*183,624*	*34.5%*	*83.6%*	*16.4%*	*0.0%*	*81.4%*	*18.4%*	*0.2%*	*0.1%*	*2.8%*	*99.6%*
Mesenchymal tumors	5,718	76.7%	60.9%	38.1%	0.9%	77.7%	9.5%	12.2%	0.7%	6.9%	99.5%
Malignant	*783*	*96.6%*	*46.2%*	*49.1%*	*4.6%*	*8.8%*	*13.6%*	*74.0%*	*3.7%*	*27.2%*	*99.2%*

Table 12. 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 1/I	WHO Grade 2/II	WHO Grade 3/III	WHO Grade 4/IV		
Non-Malignant	*4,935*	*73.6%*	*64.0%*	*35.9%*	*0.1%*	*88.1%*	*8.9%*	*2.8%*	*0.2%*	*3.7%*	*99.5%*
Primary melanocytic lesions	142	88.7%	11.1%	84.9%	4.0%	57.1%	14.3%	7.1%	21.4%	18.3%	99.2%
Malignant	*93*	*91.4%*	*8.2%*	*85.9%*	*5.9%*	*42.9%*	*0.0%*	*14.3%*	*42.9%*	*19.4%*	*98.8%*
Non-Malignant	*49*	*83.7%*	*17.1%*	*82.9%*	*0.0%*	*71.4%*	*28.6%*	*0.0%*	*0.0%*	*16.3%*	*100.0%*
Lymphomas and Hematopoietic Neoplasms	**8,628**	**95.2%**	**1.3%**	**97.9%**	**0.7%**	**60.6%**	**2.8%**	**15.6%**	**21.1%**	**8.4%**	**99.2%**
Lymphoma	8,583	95.1%	1.3%	98.1%	0.6%	60.2%	2.8%	15.7%	21.3%	8.2%	99.2%
Other hematopoietic neoplasms	45	97.8%	2.3%	65.9%	31.8%	100.0%	0.0%	0.0%	0.0%	40.0%	93.2%
Germ Cell Tumors	**1,255**	**87.3%**	**9.5%**	**43.5%**	**47.0%**	**23.5%**	**8.8%**	**8.8%**	**58.8%**	**30.1%**	**99.1%**
Malignant	1,092	89.3%	6.2%	31.6%	34.2%	3.7%	11.1%	11.1%	74.1%	8.2%	99.3%
Non-Malignant	163	73.6%	10.9%	17.0%	18.4%	100.0%	0.0%	0.0%	0.0%	0.0%	97.5%
Tumors of Sellar Region	**81,166**	**42.5%**	**18.9%**	**0.3%**	**80.8%**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**1.3%**	**99.5%**
Tumors of the pituitary	78,082	40.9%	16.8%	0.0%	83.2%	100.0%	0.0%	0.0%	0.0%	0.9%	99.5%
Malignant	*98*	*59.2%*	*10.8%*	*0.0%*	*89.2%*	*--%*	*--%*	*--%*	*--%*	*6.1%*	*96.6%*
Non-Malignant	*77,984*	*40.9%*	*16.9%*	*0.0%*	*83.1%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.9%*	*99.5%*
Craniopharyngioma	3,084	83.3%	39.1%	3.4%	57.5%	100.0%	0.0%	0.0%	0.0%	10.9%	99.7%
Unclassified Tumors	**18,421**	**16.8%**	**11.4%**	**80.5%**	**8.1%**	**85.2%**	**4.7%**	**2.4%**	**7.7%**	**1.2%**	**94.6%**
Hemangioma	4,380	26.8%	14.8%	85.0%	0.2%	98.9%	1.1%	0.0%	0.0%	0.6%	98.0%
Neoplasm, unspecified	13,506	12.2%	8.9%	76.5%	14.6%	72.9%	7.8%	5.4%	14.0%	1.3%	91.4%
Malignant	*6,836*	*9.0%*	*6.1%*	*88.7%*	*5.2%*	*20.0%*	*14.3%*	*20.0%*	*45.7%*	*1.5%*	*90.1%*
Non-Malignant	*6,670*	*15.5%*	*10.5%*	*69.3%*	*20.2%*	*92.6%*	*5.3%*	*0.0%*	*2.1%*	*1.2%*	*92.2%*
All other	535	51.6%	12.7%	85.5%	1.8%	62.9%	11.4%	2.9%	22.9%	2.2%	98.9%
Malignant	*71*	*98.6%*	*35.7%*	*61.4%*	*2.9%*	*48.0%*	*16.0%*	*4.0%*	*32.0%*	*16.9%*	*100.0%*
Non-Malignant	*464*	*44.4%*	*4.9%*	*93.7%*	*1.5%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*98.5%*
TOTAL[f]	**453,623**	**52.4%**	**67.2%**	**18.0%**	**14.8%**	**40.9%**	**13.8%**	**7.2%**	**38.1%**	**9.2%**	**99.5%**

Table 12. 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 1/I	WHO Grade 2/II	WHO Grade 3/III	WHO Grade 4/IV		
Malignant	***126,729***	***86.1%***	***79.6%***	***18.6%***	***1.8%***	***5.7%***	***12.6%***	***12.8%***	***68.9%***	***25.4%***	***99.5%***
Non-Malignant	***326,894***	***39.3%***	***57.1%***	***17.6%***	***25.3%***	***84.4%***	***15.3%***	***0.2%***	***0.1%***	***2.9%***	***99.5%***

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

Table 13. 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, 2016-2020

Central Cancer Registry	All Ages									0-19 Years		
	All			Malignant			Non-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)
Alaska	902	180	24.89 (23.22-26.65)	266	53	7.11 (6.24-8.06)	636	127	17.78 (16.36-19.29)	68	14	6.88 (5.34-8.73)
Alabama	5,656	1,131	20.03 (19.49-20.58)	1,962	392	6.93 (6.62-7.26)	3,694	739	13.10 (12.67-13.55)	334	67	5.47 (4.90-6.09)
Arkansas	4,042	808	23.48 (22.74-24.24)	1,202	240	6.91 (6.51-7.32)	2,840	568	16.58 (15.95-17.22)	209	42	5.33 (4.63-6.10)
Arizona	8,370	1,674	20.31 (19.86-20.76)	2,629	526	6.37 (6.12-6.63)	5,741	1,148	13.94 (13.57-14.31)	524	105	5.71 (5.23-6.22)
California	48,107	9,621	22.66 (22.45-22.86)	13,726	2,745	6.48 (6.37-6.60)	34,381	6,876	16.17 (16.00-16.35)	2,559	512	5.12 (4.92-5.32)
Colorado	8,831	1,766	29.11 (28.49-29.74)	2,085	417	6.82 (6.52-7.13)	6,746	1,349	22.28 (21.74-22.84)	460	92	6.52 (5.93-7.14)
Connecticut	5,055	1,011	23.99 (23.30-24.69)	1,633	327	7.78 (7.39-8.19)	3,422	684	16.21 (15.64-16.78)	258	52	6.10 (5.37-6.89)
District of Columbia	854	171	24.65 (22.97-26.42)	194	39	5.72 (4.91-6.62)	660	132	18.93 (17.47-20.48)	39	8	5.58 (3.92-7.71)
Delaware	1,130	226	19.67 (18.48-20.92)	406	81	7.03 (6.33-7.79)	724	145	12.64 (11.69-13.65)	82	16	7.16 (5.69-8.89)
Florida	34,539	6,908	25.74 (25.46-26.03)	9,170	1,834	6.98 (6.83-7.14)	25,369	5,074	18.76 (18.52-19.00)	1607	321	6.84 (6.51-7.18)
Georgia	15,339	3,068	27.57 (27.13-28.02)	3,589	718	6.42 (6.21-6.64)	11,750	2,350	21.15 (20.77-21.55)	940	188	6.70 (6.28-7.14)
Hawaii	1,571	314	18.74 (17.78-19.73)	395	79	4.86 (4.37-5.39)	1,176	235	13.88 (13.06-14.74)	65	13	3.99 (3.08-5.09)
Iowa	4,769	954	26.37 (25.60-27.17)	1,387	277	7.58 (7.17-8.01)	3,382	676	18.80 (18.14-19.47)	262	52	6.35 (5.61-7.17)
Idaho	2,456	491	25.53 (24.51-26.60)	713	143	7.36 (6.81-7.94)	1,743	349	18.17 (17.31-19.07)	117	23	4.74 (3.92-5.68)
Illinois	18,747	3,749	26.36 (25.98-26.75)	4,843	969	6.84 (6.64-7.04)	13,904	2,781	19.52 (19.19-19.86)	962	192	6.02 (5.64-6.41)
Indiana[d]	6,325	1,265	21.44 (20.90-21.99)	2,150	430	7.31 (6.99-7.63)	4,175	835	14.13 (13.69-14.58)	412	82	5.86 (5.30-6.45)
Kansas	3,773	755	23.33 (22.57-24.12)	1,105	221	6.85 (6.44-7.28)	2,668	534	16.49 (15.84-17.15)	215	43	5.45 (4.75-6.23)
Kentucky	7,468	1,494	29.67 (28.98-30.37)	1,969	394	7.76 (7.41-8.12)	5,499	1,100	21.91 (21.32-22.52)	444	89	7.90 (7.19-8.67)
Louisiana	6,866	1,373	26.60 (25.95-27.26)	1,599	320	6.24 (5.93-6.57)	5,267	1,053	20.36 (19.79-20.93)	353	71	5.84 (5.25-6.48)
Massachusetts	8,454	1,691	21.39 (20.92-21.87)	2,988	598	7.59 (7.31-7.88)	5,466	1,093	13.79 (13.42-14.18)	475	95	6.00 (5.47-6.57)
Maryland	8,424	1,685	24.84 (24.30-25.40)	2,306	461	6.87 (6.58-7.16)	6,118	1,224	17.98 (17.52-18.45)	429	86	5.74 (5.21-6.31)
Maine	1,605	321	19.12 (18.12-20.15)	698	140	8.16 (7.52-8.84)	907	181	10.96 (10.20-11.75)	96	19	6.77 (5.48-8.27)
Michigan	12,103	2,421	20.85 (20.46-21.24)	3,955	791	6.83 (6.61-7.06)	8,148	1,630	14.02 (13.70-14.34)	582	116	4.78 (4.40-5.18)
Minnesota	7,232	1,446	23.14 (22.59-23.69)	2,409	482	7.75 (7.43-8.08)	4,823	965	15.39 (14.94-15.84)	472	94	6.53 (5.95-7.14)
Missouri	8,706	1,741	24.73 (24.19-25.27)	2,557	511	7.29 (7.00-7.59)	6,149	1,230	17.43 (16.98-17.89)	455	91	5.93 (5.40-6.50)
Mississippi	3,802	760	22.80 (22.06-23.56)	1,028	206	6.19 (5.80-6.59)	2,774	555	16.61 (15.98-17.26)	220	44	5.56 (4.85-6.35)
Montana	1,587	317	25.23 (23.93-26.58)	493	99	7.86 (7.14-8.63)	1,094	219	17.37 (16.30-18.50)	70	14	5.49 (4.28-6.94)
North Carolina	15,100	3,020	25.65 (25.23-26.07)	3,980	796	6.80 (6.59-7.02)	11,120	2,224	18.84 (18.48-19.21)	769	154	5.92 (5.51-6.36)

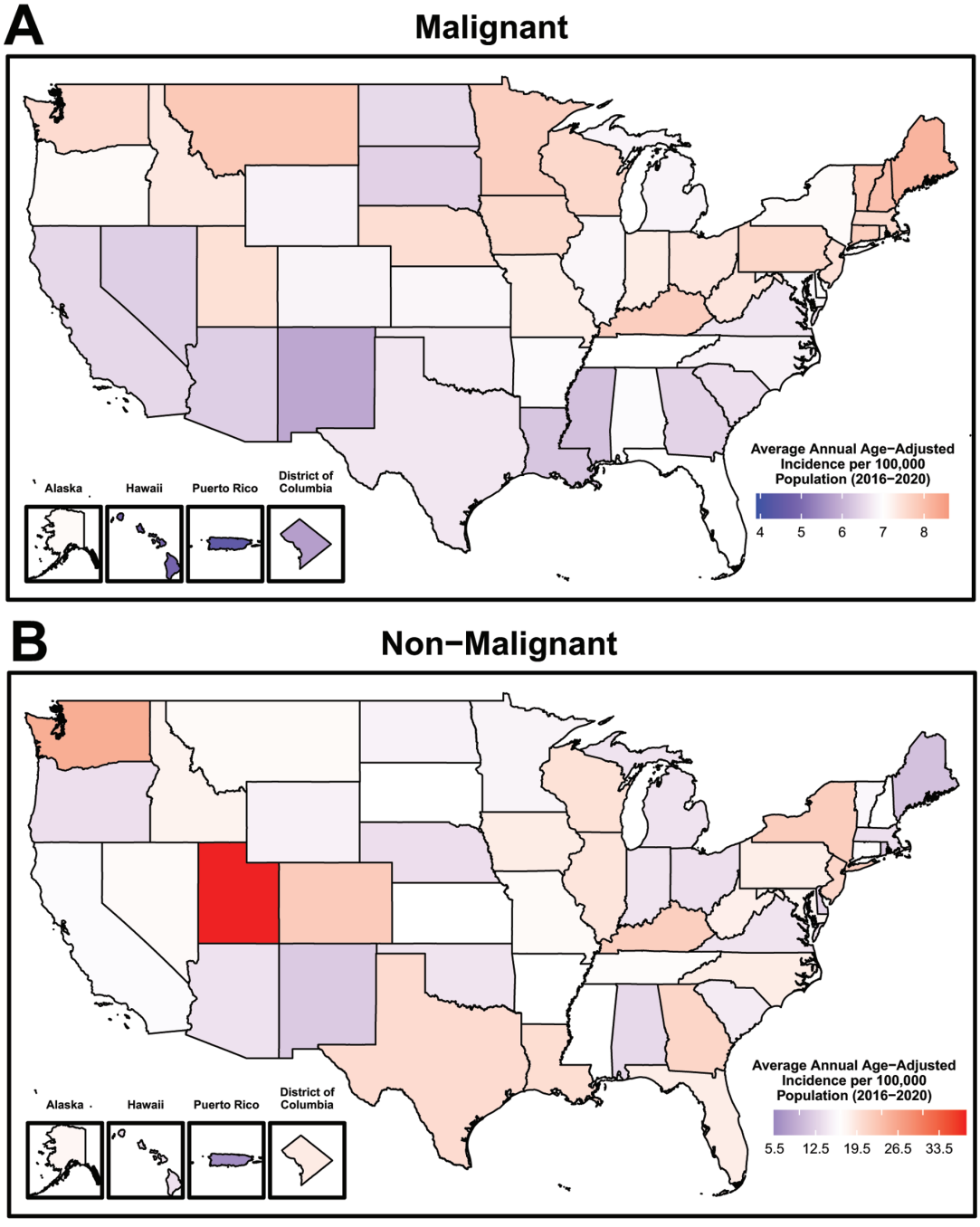
						20+ Years								
Malignant			Non-Malignant			All			Malignant			Non-Malignant		
5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
36	7	3.58 (2.50-4.96)	32	6	3.31 (2.26-4.67)	834	167	32.13 (29.88-34.51)	230	46	8.53 (7.41-9.77)	604	121	23.60 (21.67-25.66)
232	46	3.82 (3.34-4.34)	102	20	1.65 (1.35-2.00)	5,322	1,064	25.89 (25.17-26.62)	1,730	346	8.18 (7.79-8.59)	3,592	718	17.71 (17.11-18.32)
115	23	2.94 (2.43-3.53)	94	19	2.39 (1.93-2.92)	3,833	767	30.78 (29.78-31.81)	1,087	217	8.50 (7.99-9.04)	2,746	549	22.28 (21.43-23.16)
261	52	2.86 (2.52-3.23)	263	53	2.85 (2.51-3.21)	7,846	1,569	26.18 (25.59-26.79)	2,368	474	7.79 (7.47-8.12)	5,478	1,096	18.40 (17.90-18.91)
1,469	294	2.94 (2.79-3.10)	1,090	218	2.17 (2.05-2.31)	45,548	9,110	29.71 (29.43-29.99)	12,257	2,451	7.91 (7.77-8.05)	33,291	6,658	21.80 (21.56-22.04)
225	45	3.21 (2.80-3.65)	235	47	3.31 (2.90-3.76)	8,371	1,674	38.19 (37.36-39.04)	1,860	372	8.28 (7.89-8.67)	6,511	1,302	29.92 (29.18-30.67)
155	31	3.75 (3.18-4.39)	103	21	2.35 (1.92-2.86)	4,797	959	31.19 (30.27-32.12)	1,478	296	9.41 (8.91-9.92)	3,319	664	21.78 (21.01-22.57)
29	6	4.05 (2.68-5.89)		NA	NA (NA-NA)	815	163	32.32 (30.07-34.68)	165	33	6.39 (5.43-7.47)	650	130	25.93 (23.92-28.06)
49	10	4.28 (3.17-5.66)	33	7	2.88 (1.98-4.05)	1,048	210	24.70 (23.15-26.33)	357	71	8.14 (7.28-9.08)	691	138	16.56 (15.28-17.92)
894	179	3.81 (3.57-4.07)	713	143	3.03 (2.81-3.26)	32,932	6,586	33.35 (32.97-33.73)	8,276	1,655	8.26 (8.07-8.45)	24,656	4,931	25.09 (24.76-25.42)
434	87	3.12 (2.83-3.43)	506	101	3.58 (3.28-3.91)	14,399	2,880	35.97 (35.37-36.57)	3,155	631	7.74 (7.47-8.03)	11,244	2,249	28.22 (27.69-28.76)
39	8	2.36 (1.67-3.22)	26	5	1.64 (1.07-2.40)	1,506	301	24.67 (23.38-26.00)	356	71	5.86 (5.25-6.54)	1,150	230	18.80 (17.68-19.97)
148	30	3.61 (3.05-4.24)	114	23	2.75 (2.27-3.30)	4,507	901	34.43 (33.39-35.49)	1,239	248	9.18 (8.65-9.73)	3,268	654	25.25 (24.35-26.17)
57	11	2.35 (1.78-3.04)	60	12	2.39 (1.83-3.08)	2,339	468	33.90 (32.50-35.35)	656	131	9.38 (8.65-10.15)	1,683	337	24.52 (23.33-25.76)
527	105	3.33 (3.05-3.62)	435	87	2.69 (2.44-2.96)	17,785	3,557	34.54 (34.03-35.07)	4,316	863	8.25 (8.00-8.51)	13,469	2,694	26.29 (25.84-26.75)
257	51	3.67 (3.23-4.15)	155	31	2.19 (1.86-2.56)	5,913	1,183	27.70 (26.98-28.44)	1,893	379	8.77 (8.37-9.19)	4,020	804	18.93 (18.33-19.55)
122	24	3.10 (2.57-3.70)	93	19	2.36 (1.90-2.89)	3,558	712	30.53 (29.50-31.58)	983	197	8.36 (7.82-8.91)	2,575	515	22.17 (21.29-23.08)
244	49	4.35 (3.82-4.93)	200	40	3.56 (3.08-4.08)	7,024	1,405	38.42 (37.50-39.36)	1,725	345	9.13 (8.69-9.59)	5,299	1,060	29.29 (28.48-30.12)
197	39	3.24 (2.80-3.72)	156	31	2.60 (2.21-3.04)	6,513	1,303	34.95 (34.08-35.84)	1,402	280	7.45 (7.05-7.86)	5,111	1,022	27.50 (26.73-28.29)
273	55	3.52 (3.12-3.97)	202	40	2.48 (2.15-2.85)	7,979	1,596	27.58 (26.95-28.21)	2,715	543	9.23 (8.88-9.60)	5,264	1,053	18.34 (17.83-18.86)
235	47	3.16 (2.76-3.59)	194	39	2.58 (2.23-2.97)	7,995	1,599	32.53 (31.80-33.27)	2,071	414	8.36 (7.99-8.74)	5,924	1,185	24.17 (23.54-24.81)
66	13	4.72 (3.65-6.01)	30	6	2.05 (1.38-2.93)	1,509	302	24.08 (22.80-25.42)	632	126	9.54 (8.77-10.37)	877	175	14.54 (13.52-15.61)
357	71	2.96 (2.66-3.29)	225	45	1.81 (1.58-2.07)	11,521	2,304	27.31 (26.80-27.84)	3,598	720	8.39 (8.10-8.68)	7,923	1,585	18.93 (18.50-19.37)
267	53	3.68 (3.26-4.15)	205	41	2.84 (2.47-3.26)	6,760	1,352	29.82 (29.09-30.56)	2,142	428	9.39 (8.98-9.81)	4,618	924	20.43 (19.83-21.05)
280	56	3.66 (3.24-4.11)	175	35	2.27 (1.95-2.64)	8,251	1,650	32.29 (31.57-33.02)	2,277	455	8.76 (8.39-9.14)	5,974	1,195	23.53 (22.92-24.16)
132	26	3.34 (2.80-3.96)	88	18	2.22 (1.78-2.73)	3,582	716	29.73 (28.74-30.76)	896	179	7.33 (6.85-7.85)	2,686	537	22.40 (21.53-23.29)
41	8	3.21 (2.30-4.36)	29	6	2.28 (1.53-3.28)	1,517	303	33.16 (31.42-34.98)	452	90	9.73 (8.80-10.73)	1,065	213	23.44 (21.97-24.98)
468	94	3.64 (3.32-3.98)	301	60	2.28 (2.03-2.56)	14,331	2,866	33.58 (33.02-34.15)	3,512	702	8.07 (7.80-8.35)	10,819	2,164	25.50 (25.01-26.00)

Table 13. Continued

Central Cancer Registry	All Ages									0-19 Years		
	All			Malignant			Non-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)
North Dakota	880	176	21.84 (20.37-23.40)	266	53	6.50 (5.71-7.36)	614	123	15.35 (14.11-16.66)	51	10	5.10 (3.80-6.72)
Nebraska	2,215	443	21.18 (20.28-22.11)	795	159	7.51 (6.99-8.07)	1,420	284	13.67 (12.94-14.42)	182	36	6.91 (5.94-7.99)
New Hampshire	2,016	403	24.43 (23.32-25.59)	654	131	8.00 (7.36-8.68)	1,362	272	16.43 (15.52-17.38)	110	22	7.28 (5.97-8.78)
New Jersey	14,497	2,899	28.52 (28.04-29.00)	3,789	758	7.46 (7.22-7.71)	10,708	2,142	21.05 (20.65-21.47)	746	149	6.87 (6.38-7.38)
New Mexico	2,087	417	17.60 (16.82-18.41)	707	141	5.84 (5.40-6.30)	1,380	276	11.76 (11.13-12.43)	112	22	4.17 (3.43-5.02)
Nevada[d]	3,155	631	23.61 (22.77-24.47)	852	170	6.36 (5.92-6.81)	2,303	461	17.26 (16.54-18.00)	162	32	5.39 (4.59-6.29)
New York	32,405	6,481	29.09 (28.77-29.42)	7,819	1,564	7.07 (6.91-7.23)	24,586	4,917	22.02 (21.74-22.31)	1,785	357	7.81 (7.46-8.19)
Ohio	14,086	2,817	21.02 (20.66-21.38)	4,977	995	7.39 (7.18-7.61)	9,109	1,822	13.63 (13.34-13.92)	1,000	200	6.87 (6.45-7.31)
Oklahoma	4,521	904	20.84 (20.22-21.48)	1,466	293	6.71 (6.36-7.07)	3,055	611	14.13 (13.62-14.66)	282	56	5.30 (4.70-5.96)
Oregon	5,014	1,003	20.73 (20.14-21.34)	1,722	344	7.10 (6.76-7.46)	3,292	658	13.63 (13.15-14.13)	273	55	5.65 (5.00-6.37)
Pennsylvania	20,269	4,054	26.28 (25.91-26.67)	5,815	1,163	7.62 (7.41-7.82)	14,454	2,891	18.67 (18.35-18.99)	996	199	6.61 (6.21-7.04)
Rhode Island	1,202	240	19.42 (18.28-20.60)	459	92	7.37 (6.68-8.11)	743	149	12.05 (11.16-13.00)	70	14	5.93 (4.61-7.50)
South Carolina	6,386	1,277	21.22 (20.68-21.77)	1,987	397	6.56 (6.26-6.87)	4,399	880	14.66 (14.21-15.12)	329	66	5.27 (4.71-5.87)
South Dakota	1,129	226	23.00 (21.62-24.45)	311	62	6.40 (5.68-7.19)	818	164	16.60 (15.43-17.83)	43	9	3.62 (2.62-4.88)
Tennessee	9,271	1,854	24.03 (23.52-24.54)	2,696	539	7.00 (6.73-7.28)	6,575	1,315	17.03 (16.61-17.46)	462	92	5.51 (5.02-6.04)
Texas	38,925	7,785	27.19 (26.91-27.46)	9,682	1,936	6.66 (6.53-6.80)	29,243	5,849	20.52 (20.29-20.76)	2,636	527	6.45 (6.21-6.71)
Utah	6,453	1,291	45.42 (44.30-46.56)	1,115	223	7.48 (7.04-7.95)	5,338	1,068	37.93 (36.91-38.98)	345	69	6.80 (6.10-7.56)
Virginia	9,900	1,980	20.81 (20.39-21.24)	3,155	631	6.65 (6.41-6.89)	6,745	1,349	14.16 (13.82-14.52)	583	117	5.55 (5.11-6.02)
Vermont	909	182	23.67 (22.05-25.39)	298	60	7.93 (7.00-8.97)	611	122	15.74 (14.43-17.14)	41	8	6.30 (4.51-8.55)
Washington	13,692	2,738	33.10 (32.53-33.67)	3,127	625	7.55 (7.28-7.82)	10,565	2,113	25.55 (25.05-26.05)	667	133	7.34 (6.79-7.92)
Wisconsin	9,251	1,850	27.50 (26.92-28.09)	2,569	514	7.60 (7.30-7.91)	6,682	1,336	19.90 (19.40-20.40)	439	88	6.13 (5.57-6.73)
West Virginia	2,837	567	25.91 (24.91-26.94)	808	162	7.40 (6.87-7.97)	2,029	406	18.51 (17.66-19.38)	166	33	8.09 (6.91-9.42)
Wyoming	710	142	21.91 (20.27-23.66)	223	45	6.81 (5.91-7.81)	487	97	15.10 (13.74-16.57)	41	8	5.47 (3.92-7.42)
TOTAL	**453,623**	**90,725**	**24.83 (24.75-24.90)**	**126,729**	**25,346**	**6.94 (6.91-6.98)**	326,894	65,379	17.88 (17.82-17.95)	**24,999**	**5,000**	**6.13 (6.06-6.21)**

20+Years														
Malignant			Non-Malignant			All			Malignant			Non-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)
32	6	3.17 (2.17-4.49)	19	4	1.93 (1.16-3.02)	829	166	28.58 (26.58-30.68)	234	47	7.84 (6.82-8.96)	595	119	20.74 (19.04-22.55)
101	20	3.80 (3.10-4.62)	81	16	3.11 (2.47-3.86)	2,033	407	26.92 (25.73-28.16)	694	139	9.01 (8.33-9.72)	1,339	268	17.92 (16.94-18.94)
64	13	4.35 (3.35-5.56)	46	9	2.92 (2.14-3.91)	1,906	381	31.33 (29.86-32.85)	590	118	9.47 (8.67-10.31)	1,316	263	21.86 (20.64-23.15)
391	78	3.61 (3.26-3.99)	355	71	3.26 (2.93-3.61)	13,751	2,750	37.23 (36.59-37.87)	3,398	680	9.01 (8.70-9.33)	10,353	2,071	28.21 (27.66-28.78)
63	13	2.35 (1.81-3.01)	49	10	1.82 (1.34-2.40)	1,975	395	23.00 (21.96-24.09)	644	129	7.24 (6.67-7.85)	1,331	266	15.76 (14.89-16.67)
96	19	3.17 (2.57-3.88)	66	13	2.21 (1.71-2.82)	2,993	599	30.94 (29.81-32.10)	756	151	7.63 (7.09-8.22)	2,237	447	23.31 (22.33-24.32)
853	171	3.75 (3.50-4.01)	932	186	4.06 (3.81-4.33)	30,620	6,124	37.65 (37.22-38.09)	6,966	1,393	8.41 (8.20-8.61)	23,654	4,731	29.25 (28.86-29.63)
568	114	3.92 (3.60-4.25)	432	86	2.95 (2.68-3.24)	13,086	2,617	26.71 (26.24-27.19)	4,409	882	8.79 (8.52-9.07)	8,677	1,735	17.92 (17.53-18.32)
173	35	3.25 (2.78-3.77)	109	22	2.05 (1.69-2.48)	4,239	848	27.09 (26.26-27.95)	1,293	259	8.10 (7.65-8.57)	2,946	589	18.99 (18.30-19.71)
168	34	3.49 (2.98-4.06)	105	21	2.16 (1.77-2.62)	4,741	948	26.80 (26.01-27.60)	1,554	311	8.55 (8.12-9.00)	3,187	637	18.25 (17.60-18.92)
604	121	4.07 (3.75-4.41)	392	78	2.54 (2.30-2.81)	19,273	3,855	34.20 (33.69-34.71)	5,211	1,042	9.04 (8.79-9.30)	14,062	2,812	25.15 (24.72-25.59)
46	9	3.99 (2.92-5.32)	24	5	1.94 (1.24-2.90)	1,132	226	24.84 (23.35-26.40)	413	83	8.72 (7.87-9.65)	719	144	16.12 (14.91-17.40)
188	38	3.02 (2.60-3.48)	141	28	2.25 (1.89-2.65)	6,057	1,211	27.64 (26.91-28.37)	1,799	360	7.98 (7.60-8.37)	4,258	852	19.66 (19.04-20.28)
27	5	2.26 (1.49-3.29)	16	3	1.37 (0.78-2.22)	1,086	217	30.79 (28.91-32.77)	284	57	8.07 (7.11-9.11)	802	160	22.73 (21.11-24.44)
277	55	3.31 (2.93-3.72)	185	37	2.20 (1.90-2.54)	8,809	1,762	31.48 (30.80-32.16)	2,419	484	8.48 (8.14-8.84)	6,390	1,278	22.99 (22.41-23.58)
1,343	269	3.28 (3.10-3.46)	1,293	259	3.18 (3.01-3.36)	36,289	7,258	35.53 (35.16-35.90)	8,339	1,668	8.03 (7.85-8.21)	27,950	5,590	27.50 (27.17-27.83)
180	36	3.52 (3.03-4.08)	165	33	3.28 (2.80-3.82)	6,108	1,222	60.95 (59.41-62.53)	935	187	9.08 (8.50-9.69)	5,173	1,035	51.87 (50.45-53.33)
350	70	3.34 (3.00-3.71)	233	47	2.21 (1.93-2.51)	9,317	1,863	26.95 (26.39-27.52)	2,805	561	7.98 (7.68-8.28)	6,512	1,302	18.97 (18.50-19.45)
26	5	4.05 (2.64-5.93)		NA	NA (NA-NA)	868	174	30.66 (28.52-32.92)	272	54	9.50 (8.33-10.78)	596	119	21.16 (19.38-23.06)
353	71	3.84 (3.45-4.27)	314	63	3.50 (3.12-3.90)	13,025	2,605	43.46 (42.69-44.23)	2,774	555	9.04 (8.69-9.39)	10,251	2,050	34.42 (33.74-35.11)
262	52	3.69 (3.26-4.16)	177	35	2.44 (2.09-2.83)	8,812	1,762	36.09 (35.31-36.89)	2,307	461	9.17 (8.79-9.57)	6,505	1,301	26.92 (26.24-27.61)
91	18	4.49 (3.61-5.51)	75	15	3.61 (2.84-4.52)	2,671	534	33.08 (31.77-34.43)	717	143	8.58 (7.93-9.27)	1,954	391	24.50 (23.37-25.67)
23	5	3.06 (1.94-4.59)	18	4	2.41 (1.43-3.80)	669	134	28.53 (26.32-30.88)	200	40	8.32 (7.16-9.61)	469	94	20.21 (18.35-22.21)
13,888	**2,778**	**3.42 (3.36-3.48)**	11,111	2,222	2.71 (2.66-2.76)	**428,624**	**85,705**	**32.35 (32.25-32.45)**	**112,841**	**22,568**	**8.36 (8.31-8.41)**	315,783	63,157	23.99 (23.90-24.07)

[a]With the exception of Nevada and Indiana where total cases represent four years of diagnosis (2016,2017,2018,2019).
[b]Annual average cases are calculated by dividing the five-year total by five.
[c]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[d]Data are not available for diagnosis year 2020.
- 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.

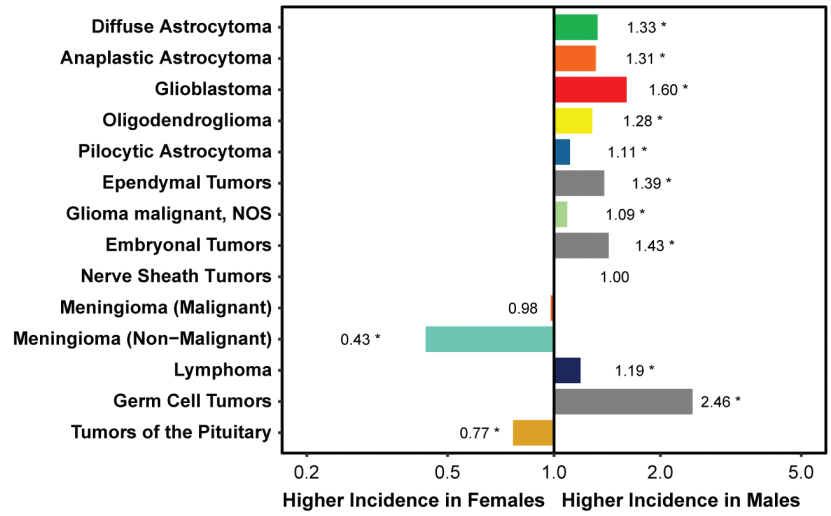


a. Rates per 100,000 and age-adjusted to the 2000 United States standard population. Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; US, United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results.

Fig. 25 Average Annual Age-Adjusted Incidence Rates[a] of A) Malignant and B) Non-Malignant Primary Brain and Other Central Nervous System Tumors by Central Cancer Registry, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

sellar region (1.13 per 100,000 population). Among these tumors, the most common histopathologies were pilocytic astrocytoma (0.98 per 100,000 population) and tumors of the pituitary (0.94 per 100,000 population).

- There were notable differences in incidence rates between males and females for ependymal tumors, neuronal and mixed neuronal-glial tumors, embryonal tumors, germ cell tumors, and tumors of the sellar region.



* Incidence Rate is significantly different between groups at the p<0.05 level.
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; NOS, not otherwise specified.

Fig. 26 Incidence Rate Ratios by Sex (Males:Females) for Selected Primary Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

Incidence Rates by Race, Ethnicity, and Histopathology

Incidence rates by race and histopathology are shown in **Table 15**.

- Incidence rates for all primary brain and other CNS tumors combined were lower for individuals who are AIAN (15.09 per 100,000 population) compared to individuals who are White (24.73 per 100,000 population), Black (25.47 per 100,000 population), and API (15.73 per 100,000 population).
- Incidence rates for **malignant** primary brain and other CNS tumors were highest in individuals who are White (7.43 per 100,000 population) compared to individuals who are Black (4.40 per 100,000 population), AIAN (3.54 per 100,000 population), and API (3.37 per 100,000 population).
- Incidence rates for **non-malignant** primary brain and other CNS tumors were highest in individuals who are Black (21.07 per 100,000 population) compared to individuals who are White (17.30 per 100,000 population), AIAN (11.55 per 100,000 population), and API (12.36 per 100,000 population).

IRR (White:Black) for selected histopathologies are shown in **Figure 27A**.

- Incidence rates for glioblastoma, all other astrocytoma, and nerve sheath tumors (all p<0.0001) were approximately 2 times greater in individuals who are White than in individuals who are Black.
- Incidence of oligodendroglioma was 2.78 times greater in individuals who are White than in individuals who are Black (p<0.0001).
- Incidence rates for pilocytic astrocytoma (White:Black IRR=1.41, p<0.0001), ependymal tumors (White:Black IRR=1.64, p<0.0001), embryonal tumors (White:Black IRR=1.52, p<0.0001), lymphoma (all p<0.0001), and germ cell tumors (White:Black IRR=1.32, p=0.0017) were also higher among individuals who are White than individuals who are Black.
- Incidence rates for **non-malignant** (White:Black IRR=0.83, p<0.0001) and **malignant** (White:Black IRR=0.76, p=0.0006) meningioma and tumors of the pituitary (White:Black IRR=0.56, p<0.0001) were higher among individuals who are Black than individuals who are White.

IRR (White:API) for selected histopathologies are shown in **Figure 27B**.

- Incidence rates for glioblastoma (p<0.0001) were 2.78 times greater in individuals who are White than in individuals who are API.
- Incidence of nerve sheath tumors (p<0.0001) was approximately 1.2 times higher in individuals who are White than in individuals who are API.
- Germ cell tumors (p<0.0001) were 0.65 times greater among individuals who are API than individuals who are White.

Table 14. 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, 2016-2020

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	**1,907**	**381**	**0.47 (0.45-0.49)**	**1,041**	**208**	**0.50 (0.47-0.53)**	**866**	**173**	**0.43 (0.41-0.46)**
Diffuse astrocytoma	808	162	0.20 (0.18-0.21)	424	85	0.20 (0.18-0.22)	384	77	0.19 (0.17-0.21)
Anaplastic astrocytoma	298	60	0.07 (0.07-0.08)	169	34	0.08 (0.07-0.09)	129	26	0.06 (0.05-0.08)
Glioblastoma	642	128	0.16 (0.15-0.17)	366	73	0.18 (0.16-0.19)	276	55	0.14 (0.12-0.16)
Oligodendroglioma	125	25	0.03 (0.03-0.04)	62	12	0.03 (0.02-0.04)	63	13	0.03 (0.02-0.04)
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**4,456**	**891**	**1.10 (1.07-1.13)**	**2,383**	**477**	**1.15 (1.10-1.20)**	**2,073**	**415**	**1.04 (1.00-1.09)**
Pilocytic astrocytoma	3,963	793	0.98 (0.95-1.01)	2,117	423	1.02 (0.98-1.06)	1,846	369	0.93 (0.89-0.97)
Unique astrocytoma variants	493	99	0.12 (0.11-0.13)	266	53	0.13 (0.11-0.15)	227	45	0.11 (0.10-0.13)
Malignant	*215*	*43*	*0.05 (0.05-0.06)*	*104*	*21*	*0.05 (0.04-0.06)*	*111*	*22*	*0.06 (0.05-0.07)*
Non-Malignant	*278*	*56*	*0.07 (0.06-0.08)*	*162*	*32*	*0.08 (0.07-0.09)*	*116*	*23*	*0.06 (0.05-0.07)*
Ependymal Tumors	**1,151**	**230**	**0.28 (0.27-0.30)**	**663**	**133**	**0.32 (0.30-0.34)**	**488**	**98**	**0.24 (0.22-0.27)**
Malignant	*926*	*185*	*0.23 (0.21-0.24)*	*526*	*105*	*0.25 (0.23-0.28)*	*400*	*80*	*0.20 (0.18-0.22)*
Non-Malignant	*225*	*45*	*0.05 (0.05-0.06)*	*137*	*27*	*0.07 (0.05-0.08)*	*88*	*18*	*0.04 (0.04-0.05)*
Other Gliomas	**3,193**	**639**	**0.79 (0.76-0.82)**	**1,549**	**310**	**0.75 (0.71-0.79)**	**1,644**	**329**	**0.83 (0.79-0.87)**
Glioma malignant, NOS	3,167	633	0.78 (0.75-0.81)	--	--	--	--	--	--
Other neuroepithelial tumors	26	5	0.01 (0.00-0.01)	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	**2,087**	**417**	**0.51 (0.49-0.53)**	**1,178**	**236**	**0.57 (0.53-0.60)**	**909**	**182**	**0.46 (0.43-0.49)**
Malignant	*123*	*25*	*0.03 (0.03-0.04)*	*59*	*12*	*0.03 (0.02-0.04)*	*64*	*13*	*0.03 (0.02-0.04)*
Non-Malignant	*1,964*	*393*	*0.48 (0.46-0.50)*	*1,119*	*224*	*0.54 (0.51-0.57)*	*845*	*169*	*0.42 (0.40-0.45)*
Choroid Plexus Tumors	**395**	**79**	**0.10 (0.09-0.11)**	**223**	**45**	**0.11 (0.09-0.12)**	**172**	**34**	**0.09 (0.07-0.10)**
Malignant	*94*	*19*	*0.02 (0.02-0.03)*	*55*	*11*	*0.03 (0.02-0.03)*	*39*	*8*	*0.02 (0.01-0.03)*
Non-Malignant	*301*	*60*	*0.07 (0.07-0.08)*	*168*	*34*	*0.08 (0.07-0.09)*	*133*	*27*	*0.07 (0.06-0.08)*
Tumors of The Pineal Region	**206**	**41**	**0.05 (0.04-0.06)**	**103**	**21**	**0.05 (0.04-0.06)**	**103**	**21**	**0.05 (0.04-0.06)**
Malignant	*172*	*34*	*0.04 (0.04-0.05)*	--	--	--	--	--	--

Table 14. 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)
Non-Malignant	*34*	*7*	*0.01 (0.01-0.01)*	--	--	--	--	--	--
Embryonal Tumors	**2,266**	**453**	**0.56 (0.54-0.58)**	**1,341**	**268**	**0.65 (0.61-0.68)**	**925**	**185**	**0.47 (0.44-0.50)**
Medulloblastoma	*1,590*	*318*	*0.39 (0.37-0.41)*	*1,007*	*201*	*0.49 (0.46-0.52)*	*583*	*117*	*0.29 (0.27-0.32)*
Atypical teratoid/ rhabdoid tumor	*356*	*71*	*0.09 (0.08-0.10)*	*182*	*36*	*0.09 (0.08-0.10)*	*174*	*35*	*0.09 (0.08-0.10)*
All other embryonal	*320*	*64*	*0.08 (0.07-0.09)*	*152*	*30*	*0.07 (0.06-0.09)*	*168*	*34*	*0.08 (0.07-0.10)*
Tumors of Cranial and Spinal Nerves	**1,031**	**206**	**0.25 (0.24-0.27)**	**547**	**109**	**0.26 (0.24-0.28)**	**484**	**97**	**0.24 (0.22-0.26)**
Nerve sheath tumors	--	--	--	547	109	0.26 (0.24-0.28)	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,250**	**250**	**0.31 (0.29-0.32)**	**618**	**124**	**0.30 (0.27-0.32)**	**632**	**126**	**0.32 (0.29-0.34)**
Meningiomas	667	133	0.16 (0.15-0.18)	321	64	0.15 (0.14-0.17)	346	69	0.17 (0.15-0.19)
Malignant	*19*	*4*	*< 0.01*	--	--	--	--	--	--
Non-Malignant	*648*	*130*	*0.16 (0.15-0.17)*	--	--	--	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**122**	**24**	**0.03 (0.02-0.04)**	**68**	**14**	**0.03 (0.03-0.04)**	**54**	**11**	**0.03 (0.02-0.04)**
Lymphoma	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**848**	**170**	**0.21 (0.19-0.22)**	**576**	**115**	**0.28 (0.25-0.30)**	**272**	**54**	**0.14 (0.12-0.16)**
Malignant	760	152	0.19 (0.17-0.20)	522	104	0.25 (0.23-0.27)	238	48	0.12 (0.11-0.14)
Non-Malignant	88	18	0.02 (0.02-0.03)	54	11	0.03 (0.02-0.03)	34	7	0.02 (0.01-0.02)
Tumors of Sellar Region	**4,635**	**927**	**1.13 (1.09-1.16)**	**1,416**	**283**	**0.68 (0.64-0.71)**	**3,219**	**644**	**1.59 (1.54-1.65)**
Tumors of the pituitary	3,872	774	0.94 (0.91-0.97)	1,003	201	0.48 (0.45-0.51)	2,869	574	1.42 (1.37-1.47)
Craniopharyngioma	763	153	0.19 (0.18-0.20)	413	83	0.20 (0.18-0.22)	350	70	0.18 (0.16-0.20)
Unclassified Tumors	**1,452**	**290**	**0.36 (0.34-0.38)**	**774**	**155**	**0.37 (0.35-0.40)**	**678**	**136**	**0.34 (0.31-0.37)**
Hemangioma	485	97	0.12 (0.11-0.13)	263	53	0.13 (0.11-0.14)	222	44	0.11 (0.10-0.13)
Neoplasm, unspecified	784	157	0.19 (0.18-0.21)	413	83	0.20 (0.18-0.22)	371	74	0.19 (0.17-0.21)
Malignant	*225*	*45*	*0.06 (0.05-0.06)*	*117*	*23*	*0.06 (0.05-0.07)*	*108*	*22*	*0.05 (0.04-0.07)*

Table 14. 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)
Non-Malignant	*559*	*112*	*0.14 (0.13-0.15)*	*296*	*59*	*0.14 (0.13-0.16)*	*263*	*53*	*0.13 (0.12-0.15)*
All other	183	37	0.05 (0.04-0.05)	98	20	0.05 (0.04-0.06)	85	17	0.04 (0.03-0.05)
Malignant	*45*	*9*	*0.01 (0.01-0.01)*	*22*	*4*	*0.01 (0.01-0.02)*	*23*	*5*	*0.01 (0.01-0.02)*
Non-Malignant	*138*	*28*	*0.03 (0.03-0.04)*	*76*	*15*	*0.04 (0.03-0.05)*	*62*	*12*	*0.03 (0.02-0.04)*
TOTAL[c]	**24,999**	**5,000**	**6.13 (6.06-6.21)**	**12,480**	**2,496**	**6.00 (5.90-6.11)**	**12,519**	**2,504**	**6.27 (6.16-6.38)**
Malignant	***13,888***	***2,778***	***3.42 (3.36-3.48)***	***7,554***	***1,511***	***3.64 (3.56-3.72)***	***6,334***	***1,268***	***3.19 (3.11-3.27)***
Non-Malignant	***11,111***	***2,222***	***2.71 (2.66-2.76)***	***4,926***	***985***	***2.36 (2.30-2.43)***	***6,185***	***1,237***	***3.08 (3.00-3.16)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Refers to all brain tumors including 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 15. Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Histopathology and Race[c], CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

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	**74,961**	**14,992**	**4.86 (4.82-4.89)**	**5,482**	**1,096**	**2.45 (2.38-2.52)**	**464**	**93**	**2.23 (2.03-2.45)**	**1,895**	**379**	**1.74 (1.66-1.83)**
Diffuse astrocytoma	6,413	1,283	0.49 (0.48-0.50)	573	115	0.25 (0.23-0.28)	53	11	0.23 (0.17-0.31)	198	40	0.18 (0.16-0.21)
Anaplastic astrocytoma	5,938	1,188	0.43 (0.42-0.44)	450	90	0.20 (0.18-0.22)	35	7	0.16 (0.11-0.23)	175	35	0.16 (0.14-0.19)
Glioblastoma	57,633	11,527	3.55 (3.52-3.58)	4,149	830	1.85 (1.79-1.91)	321	64	1.60 (1.42-1.79)	1,365	273	1.26 (1.19-1.33)
Oligodendroglioma	3,150	630	0.26 (0.25-0.26)	197	39	0.09 (0.08-0.11)	38	8	0.16 (0.11-0.22)	92	18	0.08 (0.07-0.10)
Anaplastic oligodendroglioma	1,618	324	0.12 (0.12-0.13)	97	19	0.04 (0.04-0.05)	--	--	--	--	--	--
Oligoastrocytic tumors	209	42	0.02 (0.01-0.02)	16	3	0.01 (0.00-0.01)	--	--	--	--	--	--
Other Astrocytic Tumors	**5,064**	**1,013**	**0.46 (0.44-0.47)**	**773**	**155**	**0.33 (0.30-0.35)**	**58**	**12**	**0.21 (0.16-0.28)**	**181**	**36**	**0.18 (0.15-0.21)**
Pilocytic astrocytoma	4,324	865	0.39 (0.38-0.40)	659	132	0.28 (0.26-0.30)	--	--	--	--	--	--
Unique astrocytoma variants	740	148	0.06 (0.06-0.07)	114	23	0.05 (0.04-0.06)	--	--	--	--	--	--
Malignant	*433*	*87*	*0.04 (0.03-0.04)*	*47*	*9*	*0.02 (0.01-0.03)*	--	--	--	--	--	--
Non-Malignant	*307*	*61*	*0.03 (0.02-0.03)*	*67*	*13*	*0.03 (0.02-0.04)*	--	--	--	--	--	--
Ependymal Tumors	**5,787**	**1,157**	**0.44 (0.43-0.46)**	**622**	**124**	**0.27 (0.25-0.29)**	**51**	**10**	**0.22 (0.16-0.29)**	**190**	**38**	**0.18 (0.15-0.20)**
Malignant	*3,153*	*631*	*0.25 (0.24-0.26)*	*393*	*79*	*0.17 (0.15-0.19)*	*25*	*5*	*0.10 (0.07-0.16)*	*127*	*25*	*0.12 (0.10-0.14)*
Non-Malignant	*2,634*	*527*	*0.20 (0.19-0.20)*	*229*	*46*	*0.10 (0.09-0.12)*	*26*	*5*	*0.12 (0.07-0.17)*	*63*	*13*	*0.06 (0.04-0.07)*
Other Gliomas	**7,316**	**1,463**	**0.57 (0.56-0.59)**	**1,020**	**204**	**0.45 (0.42-0.47)**	**55**	**11**	**0.25 (0.18-0.33)**	**267**	**53**	**0.26 (0.23-0.30)**
Glioma malignant, NOS	7,242	1,448	0.57 (0.55-0.58)	1,004	201	0.44 (0.41-0.47)	--	--	--	--	--	--
Other neuroepithelial tumors	74	15	0.01 (0.00-0.01)	16	3	0.01 (0.00-0.01)	--	--	--	--	--	--
Malignant	*39*	*8*	*< 0.01*	--	--	--	--	--	--	--	--	--
Non-Malignant	*35*	*7*	*< 0.01*	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	4,302	860	0.36 (0.35-0.37)	555	111	0.24 (0.22-0.26)	39	8	0.16 (0.11-0.22)	217	43	0.21 (0.18-0.24)
Malignant	*792*	*158*	*0.06 (0.05-0.06)*	*64*	*13*	*0.03 (0.02-0.04)*	--	--	--	--	--	--
Non-Malignant	*3,510*	*702*	*0.30 (0.29-0.31)*	*491*	*98*	*0.21 (0.19-0.23)*	--	--	--	--	--	--
Choroid Plexus Tumors	**665**	**133**	**0.06 (0.05-0.06)**	**78**	**16**	**0.03 (0.03-0.04)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	*98*	*20*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*567*	*113*	*0.05 (0.04-0.05)*	--	--	--	--	--	--	--	--	--

Table 15. 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 The Pineal Region	**576**	**115**	**0.05 (0.04-0.05)**	**109**	**22**	**0.05 (0.04-0.06)**	**--**	**--**	**--**	--	--	--
Malignant	*350*	*70*	*0.03 (0.03-0.03)*	*71*	*14*	*0.03 (0.02-0.04)*	--	--	--	--	--	--
Non-Malignant	*226*	*45*	*0.02 (0.02-0.02)*	*38*	*8*	*0.02 (0.01-0.02)*	--	--	--	--	--	--
Embryonal Tumors	**2,420**	**484**	**0.22 (0.21-0.23)**	**356**	**71**	**0.15 (0.13-0.16)**	**32**	**6**	**0.12 (0.08-0.17)**	**125**	**25**	**0.13 (0.10-0.15)**
Tumors of Cranial and Spinal Nerves	**30,759**	**6,152**	**2.09 (2.07-2.12)**	**2,358**	**472**	**1.05 (1.01-1.10)**	**243**	**49**	**1.11 (0.97-1.26)**	**1,954**	**391**	**1.75 (1.68-1.83)**
Nerve sheath tumors	30,735	6,147	2.09 (2.07-2.12)	2,357	471	1.05 (1.01-1.10)	--	--	--	--	--	--
Malignant	*177*	*35*	*0.01 (0.01-0.02)*	*19*	*4*	*0.01 (0.00-0.01)*	--	--	--	--	--	--
Non-Malignant	*30,558*	*6,112*	*2.08 (2.06-2.10)*	*2,338*	*468*	*1.04 (1.00-1.09)*	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	24	5	< 0.01	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**153,511**	**30,702**	**9.83 (9.78-9.88)**	**24,664**	**4,933**	**11.65 (11.50-11.80)**	**1,224**	**245**	**6.50 (6.12-6.89)**	**7,227**	**1,445**	**6.93 (6.77-7.10)**
Meningiomas	148,808	29,762	9.48 (9.43-9.53)	23,976	4,795	11.35 (11.20-11.50)	1,180	236	6.30 (5.93-6.69)	7,011	1,402	6.74 (6.58-6.90)
Malignant	*1,223*	*245*	*0.08 (0.07-0.08)*	*219*	*44*	*0.10 (0.09-0.12)*	--	--	--	--	--	--
Non-Malignant	*147,585*	*29,517*	*9.40 (9.35-9.45)*	*23,757*	*4,751*	*11.25 (11.10-11.39)*	--	--	--	--	--	--
Mesenchymal tumors	4,582	916	0.34 (0.33-0.35)	--	--	--	--	--	--	--	--	--
Malignant	*631*	*126*	*0.05 (0.04-0.05)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*3,951*	*790*	*0.29 (0.28-0.30)*	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	121	24	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Malignant	*77*	*15*	*0.01 (0.00-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*44*	*9*	< 0.01	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**7,181**	**1,436**	**0.44 (0.43-0.45)**	**692**	**138**	**0.32 (0.29-0.34)**	**50**	**10**	**0.26 (0.19-0.34)**	**497**	**99**	**0.47 (0.43-0.51)**
Lymphoma	7,150	1,430	0.44 (0.43-0.45)	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	31	6	< 0.01	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**925**	**185**	**0.08 (0.08-0.09)**	**148**	**30**	**0.06 (0.05-0.07)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	796	159	0.07 (0.07-0.08)	--	--	--	--	--	--	--	--	--
Non-Malignant	129	26	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	**57,456**	**11,491**	**4.24 (4.20-4.28)**	**16,457**	**3,291**	**7.47 (7.36-7.59)**	**730**	**146**	**3.33 (3.08-3.59)**	**3,441**	**688**	**3.14 (3.03-3.25)**
Tumors of the pituitary	55,251	11,050	4.07 (4.04-4.11)	15,849	3,170	7.21 (7.09-7.32)	697	139	3.18 (2.94-3.43)	3,299	660	3.01 (2.90-3.11)

Table 15. 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	*74*	*15*	*0.01 (0.00-0.01)*	*17*	*3*	*0.01 (0.00-0.01)*	--	--	--	--	--	--
Non-Malignant	*55,177*	*11,035*	*4.07 (4.03-4.10)*	*15,832*	*3,166*	*7.20 (7.09-7.32)*	--	--	--	--	--	--
Craniopharyngioma	2,205	441	0.17 (0.16-0.18)	608	122	0.26 (0.24-0.29)	33	7	0.14 (0.10-0.21)	142	28	0.13 (0.11-0.16)
Unclassified Tumors	**15,172**	**3,034**	**1.03 (1.01-1.05)**	**2,025**	**405**	**0.96 (0.92-1.01)**	**116**	**23**	**0.61 (0.50-0.74)**	**582**	**116**	**0.57 (0.53-0.62)**
Hemangioma	3,554	711	0.26 (0.26-0.27)	480	96	0.22 (0.20-0.24)	--	--	--	--	--	--
Neoplasm, unspecified	11,192	2,238	0.73 (0.72-0.75)	1,484	297	0.72 (0.68-0.76)	87	17	0.49 (0.39-0.61)	382	76	0.39 (0.35-0.43)
Malignant	*5,863*	*1,173*	*0.37 (0.36-0.38)*	*608*	*122*	*0.30 (0.28-0.33)*	*42*	*8*	*0.25 (0.18-0.35)*	*188*	*38*	*0.20 (0.17-0.23)*
Non-Malignant	*5,329*	*1,066*	*0.37 (0.36-0.38)*	*876*	*175*	*0.42 (0.39-0.45)*	*45*	*9*	*0.23 (0.17-0.32)*	*194*	*39*	*0.19 (0.17-0.22)*
All other	426	85	0.03 (0.03-0.04)	61	12	0.03 (0.02-0.03)	--	--	--	--	--	--
Malignant	*49*	*10*	< 0.01	--	--	--	--	--	--	--	--	--
Non-Malignant	*377*	*75*	*0.03 (0.03-0.03)*	--	--	--	--	--	--	--	--	--
TOTAL[d]	**366,095**	**73,219**	**24.73 (24.65-24.82)**	**55,339**	**11,068**	**25.47 (25.25-25.69)**	**3,087**	**617**	**15.09 (14.54-15.66)**	**16,749**	**3,350**	**15.73 (15.49-15.97)**
Malignant	***109,638***	***21,928***	***7.43 (7.39-7.48)***	***9,870***	***1,974***	***4.40 (4.31-4.49)***	***750***	***150***	***3.54 (3.28-3.82)***	***3,571***	***714***	***3.37 (3.26-3.48)***
Non-Malignant	***256,457***	***51,291***	***17.30 (17.23-17.37)***	***45,469***	***9,094***	***21.07 (20.87-21.27)***	***2,337***	***467***	***11.55 (11.07-12.05)***	***13,178***	***2,636***	***12.36 (12.14-12.57)***

[a]Annual average cases are calculated by dividing the five- year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Individuals with unknown race were excluded (N = 12,353).
[d]Refers 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

Incidence rates by Hispanic ethnicity and histopathology are shown in **Table 16** and **Supplementary Figure 4**.

- The overall incidence rate for primary brain and other CNS tumors was 22.61 per 100,000 population among people who are Hispanic and 25.24 per 100,000 population among people who are non-Hispanic.
- Lymphomas and other hematopoietic neoplasms, tumors of the sellar region, and unclassified tumors were the only histopathologies that were higher in individuals who are Hispanic than in individuals who are non-Hispanic.
- The overall incidence rate for primary brain and other CNS tumors was higher among individuals who are White Hispanic (22.31 per 100,000 population) compared to individuals who are Black Hispanic (14.44 per 100,000 population). People who were White Hispanic had higher AAAIR in all histopathologies.

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 Race, Ethnicity, and Histopathology in Children and Adolescents (Ages 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 18**.

- Incidence rates were highest among children and adolescents who are White (6.36 per 100,000 population) compared to children and adolescents who are Black (4.79 per 100,000 population), AIAN (3.12 per 100,000 population), or API (3.40 per 100,000 population).
- Incidence rates were highest among children and adolescents who are non-Hispanic (6.38 per 100,000 population) compared to children and adolescents who are Hispanic (5.33 per 100,000 population).
- Incidence rates were highest among children and adolescents who are White Hispanic (5.33 per 100,000 population) compared to children and adolescents who are Black Hispanic (2.80 per 100,000 population).

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 2016-2020 by state and sex are shown in **Table 19** and **Figure 28**.

- The aggregate total number of observed deaths was 86,030, for an AAAMR rate of 4.42 per 100,000 population.
- There was considerable variation by individual state, which ranged from a low of 2.93 deaths per 100,000 population to a high of 5.64 deaths per 100,000 population. Rates may vary by state for multiple reasons, including demographic variation and procedures for deciding primary cause of death on a death certificate.
- Males had a higher mortality rate for **malignant** brain and other CNS tumors than females in the US population, with 5.40 per 100,000 population as compared to 3.57 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 20**. Survival curves for the most common histopathologies are shown by age group in **Figure 29A**.

- Median survival was lowest for glioblastoma (8 months) and highest for oligodendroglioma (205 months, or approximately 17 years).
- Median survival was not able to be estimated for pilocytic astrocytoma, unique astrocytoma variants, ependymal tumors, neuronal and mixed neuronal-glial 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 16-year follow up period.
- Many other published survival estimates (including many of those previously published by CBTRUS[66-68]) 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 21** for all individuals irrespective 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 29B**.

- AYA ages 15-39 years had better overall survival as compared to children ages 0-14 years in almost half of the histopathologies evaluated. Children and AYA age groups had similar survival in germ cell tumors.
- Older adults (40+ years) had poorer survival than children ages 0-14 years in nearly every histopathology with the exception of primary melanocytic lesions.
- Females generally had better survival outcomes in glioblastoma and germ cell tumors.
- Individuals who are Black, non-Hispanic had poorer survival outcomes as compared to individuals who are White, non-Hispanic with the exception of glioblastoma, and neoplasm unspecified.
- Individuals who are AIAN, non-Hispanic had poorer survival as compared to individuals who are white,

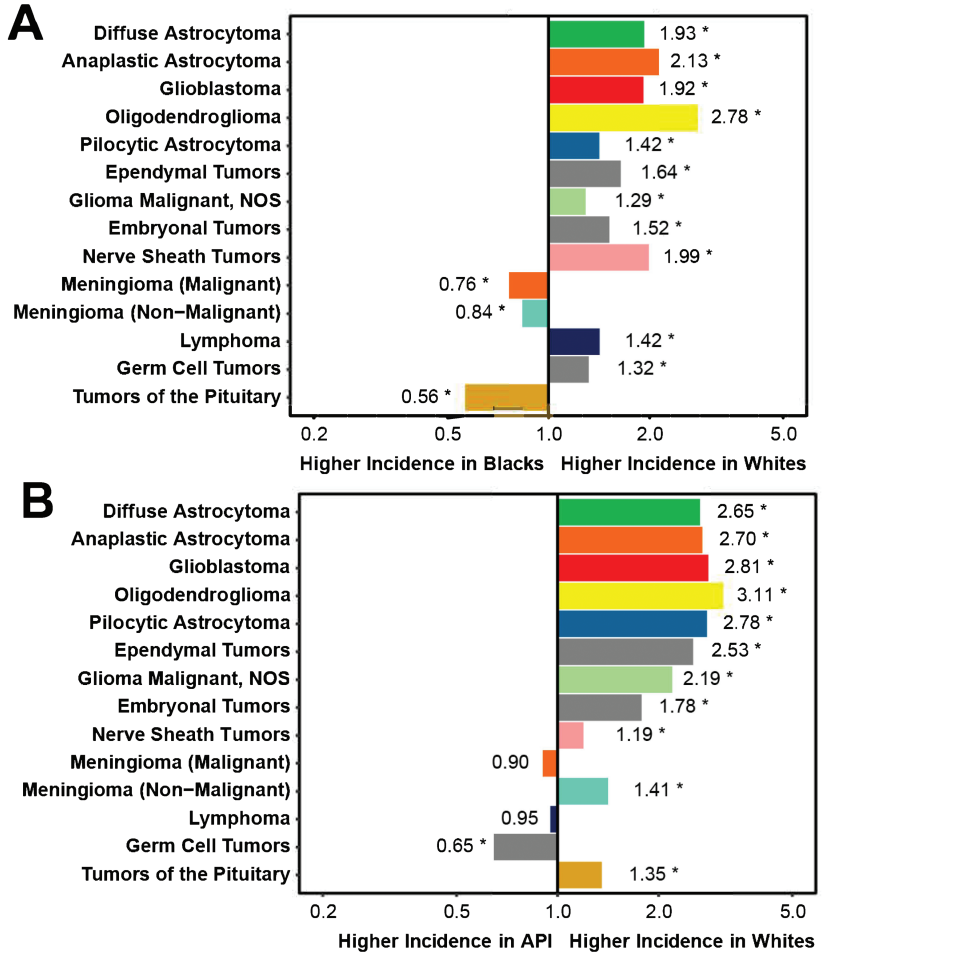


Fig. 27 Incidence Rate Ratios by Race (White:Black and White:Asian Or Pacific Islander [API]) for Selected Primary Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics—NPCR and SEER, 2016-2020

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.
- Hispanic ethnicity was associated with improved survival in most histopathologies.
- Many other published survival estimates, including many previously published by CBTRUS[66-68], incorporate treatment patterns which may explain differences between these population-level estimates and other published estimates.

When interpreting these results, it is important to remember that these models do not incorporate important 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 22**.

- 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 18.5% (tumors in the overlapping lesion of the brain) to 95.7% (tumors in the optic nerves).

The five-year survival for **non-malignant** tumors ranged from 78.0% (tumors in the overlapping lesion of the brain) to 99.5% (tumors in the cranial nerves and acoustic nerve).

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, Hispanic Ethnicity[c], and Race, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

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	**76,332**	**15,266**	**4.62 (4.58-4.65)**	**7,879**	**1,576**	**3.42 (3.34-3.50)**	**7,186**	**1,437**	**3.44 (3.36-3.52)**	**209**	**42**	**1.92 (1.65-2.22)**
Diffuse astrocytoma	6,568	1,314	0.47 (0.46-0.49)	849	170	0.32 (0.30-0.34)	762	152	0.32 (0.30-0.35)	24	5	0.16 (0.10-0.25)
Anaplastic astrocytoma	6,049	1,210	0.41 (0.40-0.42)	663	133	0.25 (0.23-0.27)	595	119	0.25 (0.23-0.27)	21	4	0.15 (0.09-0.24)
Glioblastoma	58,804	11,761	3.36 (3.33-3.39)	5,621	1,124	2.57 (2.50-2.64)	5,152	1,030	2.59 (2.52-2.66)	152	30	1.52 (1.27-1.80)
Oligodendroglioma	3,119	624	0.24 (0.23-0.25)	469	94	0.17 (0.16-0.19)	419	84	0.17 (0.15-0.19)	--	--	--
Anaplastic oligodendroglioma	1,578	316	0.11 (0.11-0.12)	252	50	0.10 (0.08-0.11)	235	47	0.10 (0.09-0.11)	--	--	--
Oligoastrocytic tumors	214	43	0.02 (0.01-0.02)	25	5	0.01 (0.01-0.01)	23	5	0.01 (0.01-0.02)	--	--	--
Other Astrocytic Tumors	**5,273**	**1,055**	**0.47 (0.45-0.48)**	**1,069**	**214**	**0.31 (0.30-0.33)**	**936**	**187**	**0.31 (0.29-0.34)**	**35**	**7**	**0.18 (0.12-0.27)**
Pilocytic astrocytoma	4,529	906	0.40 (0.39-0.42)	880	176	0.26 (0.24-0.27)	768	154	0.26 (0.24-0.27)	--	--	--
Unique astrocytoma variants	744	149	0.06 (0.06-0.07)	189	38	0.06 (0.05-0.07)	168	34	0.06 (0.05-0.07)	--	--	--
Malignant	*426*	*85*	*0.03 (0.03-0.04)*	*102*	*20*	*0.03 (0.03-0.04)*	*90*	*18*	*0.03 (0.03-0.04)*	--	--	--
Non-Malignant	*318*	*64*	*0.03 (0.03-0.03)*	*87*	*17*	*0.03 (0.02-0.03)*	*78*	*16*	*0.03 (0.02-0.03)*	--	--	--
Ependymal Tumors	**5,826**	**1,165**	**0.42 (0.41-0.43)**	**1,022**	**204**	**0.36 (0.34-0.38)**	**910**	**182**	**0.36 (0.34-0.38)**	**32**	**6**	**0.19 (0.13-0.28)**
Malignant	*3,181*	*636*	*0.24 (0.23-0.25)*	*628*	*126*	*0.21 (0.20-0.23)*	*562*	*112*	*0.22 (0.20-0.23)*	--	--	--
Non-Malignant	*2,645*	*529*	*0.19 (0.18-0.19)*	*394*	*79*	*0.15 (0.13-0.16)*	*348*	*70*	*0.14 (0.13-0.16)*	--	--	--
Other Gliomas	**7,657**	**1,531**	**0.57 (0.56-0.59)**	**1,294**	**259**	**0.46 (0.43-0.48)**	**1,129**	**226**	**0.45 (0.42-0.48)**	**55**	**11**	**0.39 (0.28-0.54)**
Glioma malignant, NOS	7,577	1,515	0.57 (0.56-0.58)	1,274	255	0.45 (0.42-0.48)	1,112	222	0.44 (0.41-0.47)	--	--	--
Other neuroepithelial tumors	80	16	0.01 (0.00-0.01)	20	4	0.01 (0.00-0.01)	17	3	0.01 (0.00-0.01)	--	--	--
Malignant	*40*	*8*	< 0.01	--	--	--	--	--	--	--	--	--
Non-Malignant	*40*	*8*	< 0.01	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	4,505	901	0.36 (0.35-0.37)	790	158	0.25 (0.23-0.27)	690	138	0.25 (0.23-0.27)	29	6	0.17 (0.11-0.26)
Malignant	*797*	*159*	*0.05 (0.05-0.06)*	*129*	*26*	*0.05 (0.04-0.06)*	*118*	*24*	*0.05 (0.04-0.06)*	--	--	--
Non-Malignant	*3,708*	*742*	*0.31 (0.30-0.32)*	*661*	*132*	*0.20 (0.19-0.22)*	*572*	*114*	*0.20 (0.18-0.22)*	--	--	--
Choroid Plexus Tumors	**655**	**131**	**0.05 (0.05-0.06)**	**146**	**29**	**0.05 (0.04-0.06)**	**129**	**26**	**0.05 (0.04-0.06)**	**--**	**--**	**--**
Malignant	*94*	*19*	*0.01 (0.01-0.01)*	*29*	*6*	*0.01 (0.01-0.01)*	*24*	*5*	*0.01 (0.01-0.01)*	--	--	--
Non-Malignant	*561*	*112*	*0.04 (0.04-0.05)*	*117*	*23*	*0.04 (0.03-0.05)*	*105*	*21*	*0.04 (0.03-0.05)*	--	--	--

Table 16. 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	**632**	**126**	**0.05 (0.04-0.05)**	**108**	**22**	**0.04 (0.03-0.04)**	**98**	**20**	**0.04 (0.03-0.04)**	**--**	**--**	**--**
Malignant	*385*	*77*	*0.03 (0.03-0.03)*	*70*	*14*	*0.02 (0.02-0.03)*	*64*	*13*	*0.02 (0.02-0.03)*	--	--	--
Non-Malignant	*247*	*49*	*0.02 (0.02-0.02)*	*38*	*8*	*0.01 (0.01-0.02)*	*34*	*7*	*0.01 (0.01-0.02)*	--	--	--
Embryonal Tumors	**2,343**	**469**	**0.21 (0.20-0.22)**	**701**	**140**	**0.21 (0.19-0.22)**	**628**	**126**	**0.21 (0.19-0.23)**	**26**	**5**	**0.11 (0.07-0.17)**
Tumors of Cranial and Spinal Nerves	**33,098**	**6,620**	**2.11 (2.08-2.13)**	**3,448**	**690**	**1.39 (1.34-1.44)**	**3,044**	**609**	**1.36 (1.31-1.41)**	**103**	**21**	**0.88 (0.70-1.07)**
Nerve sheath tumors	33,072	6,614	2.11 (2.08-2.13)	--	--	--	--	--	--	--	--	--
Malignant	*175*	*35*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*32,897*	*6,579*	*2.09 (2.07-2.12)*	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	26	5	< 0.01	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**171,165**	**34,233**	**10.20 (10.15-10.25)**	**19,550**	**3,910**	**9.28 (9.14-9.42)**	**17,498**	**3,500**	**9.12 (8.98-9.27)**	**589**	**118**	**6.08 (5.57-6.63)**
Meningiomas	166,132	33,226	9.86 (9.81-9.91)	18,734	3,747	8.98 (8.84-9.11)	16,775	3,355	8.83 (8.69-8.97)	576	115	5.99 (5.47-6.53)
Malignant	*1,354*	*271*	*0.08 (0.08-0.08)*	*216*	*43*	*0.11 (0.09-0.12)*	*206*	*41*	*0.11 (0.10-0.13)*	--	--	--
Non-Malignant	*164,778*	*32,956*	*9.78 (9.73-9.82)*	*18,518*	*3,704*	*8.87 (8.74-9.01)*	*16,569*	*3,314*	*8.71 (8.58-8.85)*	--	--	--
Mesenchymal tumors	4,904	981	0.34 (0.33-0.35)	--	--	--	--	--	--	--	--	--
Malignant	*657*	*131*	*0.05 (0.04-0.05)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*4,247*	*849*	*0.29 (0.28-0.30)*	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	129	26	0.01 (0.01-0.01)	--	--	--	--	--	--	--	--	--
Malignant	*84*	*17*	*0.01 (0.00-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*45*	*9*	< 0.01	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**7,539**	**1,508**	**0.44 (0.43-0.45)**	**1,073**	**215**	**0.50 (0.47-0.54)**	**998**	**200**	**0.51 (0.48-0.55)**	**19**	**4**	**0.21 (0.12-0.32)**
Lymphoma	7,503	1,501	0.43 (0.42-0.44)	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	36	7	< 0.01	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**966**	**193**	**0.08 (0.08-0.09)**	**286**	**57**	**0.08 (0.07-0.09)**	**256**	**51**	**0.08 (0.07-0.10)**	**--**	**--**	**--**
Malignant	833	167	0.07 (0.07-0.08)	256	51	0.07 (0.06-0.08)	228	46	0.07 (0.06-0.08)	--	--	--
Non-Malignant	133	27	0.01 (0.01-0.01)	30	6	0.01 (0.01-0.01)	28	6	0.01 (0.01-0.02)	--	--	--
Tumors of Sellar Region	**67,356**	**13,471**	**4.63 (4.60-4.67)**	**13,646**	**2,729**	**5.22 (5.13-5.31)**	**11,981**	**2,396**	**5.09 (4.99-5.18)**	**489**	**98**	**3.77 (3.42-4.15)**
Tumors of the pituitary	64,800	12,960	4.45 (4.41-4.48)	--	--	--	--	--	--	--	--	--

Table 16. 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)
Malignant	*83*	*17*	*0.01 (0.00-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*64,717*	*12,943*	*4.44 (4.41-4.48)*	--	--	--	--	--	--	--	--	--
Craniopharyngioma	2,556	511	0.19 (0.18-0.19)	523	105	0.18 (0.17-0.20)	456	91	0.18 (0.16-0.20)	25	5	0.15 (0.09-0.22)
Unclassified Tumors	**16,003**	**3,201**	**1.02 (1.00-1.04)**	**2,381**	**476**	**1.05 (1.01-1.10)**	**2,137**	**427**	**1.04 (1.00-1.09)**	**49**	**10**	**0.45 (0.32-0.62)**
Hemangioma	3,681	736	0.26 (0.25-0.27)	685	137	0.25 (0.23-0.27)	618	124	0.26 (0.23-0.28)	16	3	0.11 (0.06-0.19)
Neoplasm, unspecified	11,902	2,380	0.73 (0.72-0.74)	1,581	316	0.76 (0.72-0.80)	1,417	283	0.75 (0.71-0.79)	32	6	0.34 (0.22-0.49)
Malignant	*6,157*	*1,231*	*0.36 (0.35-0.37)*	*665*	*133*	*0.36 (0.33-0.39)*	*615*	*123*	*0.36 (0.33-0.39)*	--	--	--
Non-Malignant	*5,745*	*1,149*	*0.37 (0.36-0.38)*	*916*	*183*	*0.40 (0.37-0.42)*	*802*	*160*	*0.38 (0.36-0.41)*	--	--	--
All other	420	84	0.03 (0.03-0.03)	115	23	0.04 (0.03-0.05)	102	20	0.04 (0.03-0.05)	--	--	--
Malignant	*57*	*11*	*0.01 (0.00-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*363*	*73*	*0.03 (0.02-0.03)*	--	--	--	--	--	--	--	--	--
TOTAL[d]	**399,350**	**79,870**	**25.24 (25.16-25.32)**	**53,393**	**10,679**	**22.61 (22.41-22.81)**	**47,620**	**9,524**	**22.31 (22.10-22.52)**	**1,650**	**330**	**14.44 (13.69-15.23)**
Malignant	***112,379***	***22,476***	***7.17 (7.12-7.21)***	***14,084***	***2,817***	***5.77 (5.67-5.87)***	***12,757***	***2,551***	***5.80 (5.70-5.91)***	***394***	***79***	***3.15 (2.81-3.52)***
Non-Malignant	***286,971***	***57,394***	***18.07 (18.00-18.14)***	***39,309***	***7,862***	***16.84 (16.67-17.02)***	***34,863***	***6,973***	***16.50 (16.32-16.69)***	***1,256***	***251***	***11.30 (10.63-12.00)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Hispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).
[d]Refers to all brain tumors including 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) by Histopathology and Race[c], CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

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	**1,505**	**301**	**0.49 (0.47-0.52)**	**236**	**47**	**0.35 (0.30-0.39)**	**17**	**3**	**0.22 (0.13-0.35)**	**69**	**14**	**0.26 (0.20-0.33)**
Diffuse astrocytoma	638	128	0.21 (0.19-0.23)	92	18	0.13 (0.11-0.16)	--	--	--	23	5	0.08 (0.05-0.13)
Anaplastic astrocytoma	241	48	0.08 (0.07-0.09)	34	7	0.05 (0.03-0.07)	--	--	--	--	--	--
Glioblastoma	493	99	0.16 (0.15-0.18)	92	18	0.14 (0.11-0.17)	--	--	--	30	6	0.11 (0.08-0.16)
Oligodendroglioma	104	21	0.03 (0.03-0.04)	--	--	--	--	--	--	--	--	--
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**3,522**	**704**	**1.17 (1.13-1.21)**	**558**	**112**	**0.81 (0.75-0.88)**	**47**	**9**	**0.59 (0.43-0.79)**	**115**	**23**	**0.42 (0.34-0.50)**
Pilocytic astrocytoma	3,147	629	1.04 (1.01-1.08)	487	97	0.71 (0.65-0.77)	--	--	--	96	19	0.35 (0.28-0.43)
Unique astrocytoma variants	375	75	0.12 (0.11-0.14)	71	14	0.10 (0.08-0.13)	--	--	--	19	4	0.07 (0.04-0.11)
Malignant	*168*	*34*	*0.05 (0.05-0.06)*	*24*	*5*	*0.04 (0.02-0.05)*	--	--	--	--	--	--
Non-Malignant	*207*	*41*	*0.07 (0.06-0.08)*	*47*	*9*	*0.07 (0.05-0.09)*	--	--	--	--	--	--
Ependymal Tumors	**907**	**181**	**0.30 (0.28-0.32)**	**145**	**29**	**0.21 (0.18-0.25)**	**--**	**--**	**--**	**46**	**9**	**0.16 (0.12-0.22)**
Malignant	*716*	*143*	*0.24 (0.22-0.26)*	*128*	*26*	*0.18 (0.15-0.22)*	--	--	--	--	--	--
Non-Malignant	*191*	*38*	*0.06 (0.05-0.07)*	*17*	*3*	*0.02 (0.01-0.04)*	--	--	--	--	--	--
Other Gliomas	**2,443**	**489**	**0.81 (0.78-0.84)**	**453**	**91**	**0.66 (0.60-0.72)**	**29**	**6**	**0.37 (0.25-0.53)**	**112**	**22**	**0.41 (0.34-0.49)**
Glioma malignant, NOS	2,426	485	0.81 (0.77-0.84)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	17	3	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	1,636	327	0.54 (0.51-0.56)	270	54	0.39 (0.35-0.45)	20	4	0.26 (0.16-0.40)	82	16	0.31 (0.24-0.38)
Malignant	*105*	*21*	*0.03 (0.03-0.04)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*1,531*	*306*	*0.50 (0.48-0.53)*	--	--	--	--	--	--	--	--	--
Choroid Plexus Tumors	**316**	**63**	**0.11 (0.09-0.12)**	**45**	**9**	**0.06 (0.05-0.09)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	*72*	*14*	*0.02 (0.02-0.03)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*244*	*49*	*0.08 (0.07-0.09)*	--	--	--	--	--	--	--	--	--
Tumors of The Pineal Region	**141**	**28**	**0.05 (0.04-0.05)**	**50**	**10**	**0.07 (0.05-0.10)**	**--**	**--**	**--**	**--**	**--**	**--**
Malignant	*113*	*23*	*0.04 (0.03-0.04)*	--	--	--	--	--	--	--	--	--

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)
Non-Malignant	*28*	*6*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Embryonal Tumors	**1,762**	**352**	**0.59 (0.56-0.62)**	**272**	**54**	**0.39 (0.35-0.44)**	**23**	**5**	**0.29 (0.18-0.43)**	**112**	**22**	**0.40 (0.33-0.48)**
Medulloblastoma	*1,248*	*250*	*0.42 (0.39-0.44)*	*171*	*34*	*0.25 (0.21-0.29)*	*19*	*4*	*0.24 (0.14-0.37)*	*81*	*16*	*0.29 (0.23-0.36)*
Atypical teratoid/ rhabdoid tumor	*267*	*53*	*0.09 (0.08-0.10)*	*49*	*10*	*0.07 (0.05-0.09)*	--	--	--	--	--	--
All other embryonal	*247*	*49*	*0.08 (0.07-0.09)*	*52*	*10*	*0.07 (0.06-0.10)*	--	--	--	--	--	--
Tumors of Cranial and Spinal Nerves	**806**	**161**	**0.26 (0.25-0.28)**	**117**	**23**	**0.17 (0.14-0.20)**	**--**	**--**	**--**	**34**	**7**	**0.13 (0.09-0.18)**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**952**	**190**	**0.31 (0.29-0.33)**	**183**	**37**	**0.27 (0.23-0.31)**	**--**	**--**	**--**	**38**	**8**	**0.14 (0.10-0.19)**
Meningiomas	504	101	0.16 (0.15-0.18)	112	22	0.16 (0.14-0.20)	--	--	--	17	3	0.06 (0.04-0.10)
Mesenchymal tumors	--	--	--)	--	--	--	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**92**	**18**	**0.03 (0.02-0.04)**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**
Lymphoma	--	--	--	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**613**	**123**	**0.20 (0.19-0.22)**	**104**	**21**	**0.15 (0.12-0.18)**	**--**	**--**	**--**	**93**	**19**	**0.35 (0.28-0.43)**
Malignant	547	109	0.18 (0.16-0.19)	--	--	--	--	--	--	--	--	--
Non-Malignant	66	13	0.02 (0.02-0.03)	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	**3,499**	**700**	**1.13 (1.09-1.17)**	**657**	**131**	**0.96 (0.89-1.04)**	**54**	**11**	**0.71 (0.53-0.92)**	**164**	**33**	**0.62 (0.52-0.72)**
Tumors of the pituitary	2,938	588	0.94 (0.91-0.98)	529	106	0.78 (0.71-0.85)	**--**	**--**	**--**	131	26	0.49 (0.41-0.59)
Craniopharyngioma	561	112	0.19 (0.17-0.20)	128	26	0.19 (0.16-0.22)	--	--	--	33	7	0.12 (0.08-0.17)
Unclassified Tumors	**1,135**	**227**	**0.37 (0.35-0.40)**	**179**	**36**	**0.26 (0.22-0.30)**	**--**	**--**	**--**	**35**	**7**	**0.13 (0.09-0.18)**
Hemangioma	396	79	0.13 (0.12-0.14)	47	9	0.07 (0.05-0.09)	--	--	--	--	--	--
Neoplasm, unspecified	597	119	0.20 (0.18-0.21)	104	21	0.15 (0.12-0.18)	--	--	--	17	3	0.06 (0.04-0.10)
Malignant	*164*	*33*	*0.05 (0.05-0.06)*	*39*	*8*	*0.06 (0.04-0.08)*	--	--	--	--	--	--

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)
Non-Malignant	*433*	*87*	*0.14 (0.13-0.16)*	*65*	*13*	*0.10 (0.07-0.12)*	--	--	--	--	--	--
All other	142	28	0.05 (0.04-0.06)	28	6	0.04 (0.03-0.06)	--	--	--	--	--	--
Malignant	*29*	*6*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*113*	*23*	*0.04 (0.03-0.05)*	--	--	--	--	--	--	--	--	--
TOTAL[d]	**19,329**	**3,866**	**6.36 (6.27-6.45)**	**3,284**	**657**	**4.79 (4.62-4.95)**	**244**	**49**	**3.12 (2.74-3.54)**	**925**	**185**	**3.40 (3.19-3.63)**
Malignant	***10,759***	***2,152***	***3.56 (3.50-3.63)***	***1,824***	***365***	***2.65 (2.53-2.78)***	***125***	***25***	***1.58 (1.32-1.888)***	***541***	***108***	***1.97 (1.81-2.15)***
Non-Malignant	***8,570***	***1,714***	***2.79 (2.73-2.85)***	***1,460***	***292***	***2.14 (2.03-2.25)***	***119***	***24***	***1.54 (1.27-1.84)***	***384***	***77***	***1.43 (1.29-1.58)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Individuals with unknown race were excluded (N = 1,217).
[d]Refers 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 Children and Adolescents (Ages 0-19 Years) by Histopathology and Ethnicity[c], CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

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	**1,566**	**313**	**0.51 (0.49-0.54)**	**339**	**68**	**0.33 (0.30-0.37)**	**296**	**59**	**0.33 (0.30-0.37)**	**--**	**--**	**--**
Diffuse astrocytoma	673	135	0.22 (0.20-0.24)	134	27	0.13 (0.11-0.16)	111	22	0.13 (0.10-0.15)	--	--	--
Anaplastic astrocytoma	247	49	0.08 (0.07-0.09)	50	10	0.05 (0.04-0.07)	43	9	0.05 (0.04-0.07)	--	--	--
Glioblastoma	510	102	0.17 (0.15-0.18)	132	26	0.13 (0.11-0.15)	120	24	0.14 (0.11-0.16)	--	--	--
Oligodendroglioma	110	22	0.04 (0.03-0.04)	--	--	--	--	--	--	--	--	--
Anaplastic oligodendroglioma	--	--	--	--	--	--	--	--	--	--	--	--
Oligoastrocytic tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other Astrocytic Tumors	**3,639**	**728**	**1.20 (1.16-1.24)**	**811**	**162**	**0.79 (0.74-0.85)**	**712**	**142**	**0.80 (0.74-0.86)**	**24**	**5**	**0.36 (0.23-0.53)**
Pilocytic astrocytoma	3,261	652	1.07 (1.04-1.11)	697	139	0.68 (0.63-0.73)	612	122	0.69 (0.63-0.74)	--	--	--
Unique astrocytoma variants	378	76	0.12 (0.11-0.14)	114	23	0.11 (0.09-0.13)	100	20	0.11 (0.09-0.14)	--	--	--
Malignant	*167*	*33*	*0.05 (0.05-0.06)*	*47*	*9*	*0.05 (0.03-0.06)*	*41*	*8*	*0.05 (0.03-0.06)*	--	--	--
Non-Malignant	*211*	*42*	*0.07 (0.06-0.08)*	*67*	*13*	*0.07 (0.05-0.08)*	*59*	*12*	*0.07 (0.05-0.09)*	--	--	--
Ependymal Tumors	**893**	**179**	**0.29 (0.27-0.31)**	**257**	**51**	**0.25 (0.22-0.28)**	**228**	**46**	**0.26 (0.22-0.29)**	**--**	**--**	**--**
Malignant	*716*	*143*	*0.24 (0.22-0.25)*	*209*	*42*	*0.20 (0.18-0.23)*	*185*	*37*	*0.21 (0.18-0.24)*	--	--	--
Non-Malignant	*177*	*35*	*0.06 (0.05-0.07)*	*48*	*10*	*0.05 (0.04-0.06)*	*43*	*9*	*0.05 (0.04-0.07)*	--	--	--
Other Gliomas	**2,552**	**510**	**0.84 (0.81-0.87)**	**634**	**127**	**0.62 (0.57-0.67)**	**546**	**109**	**0.61 (0.56-0.67)**	**29**	**6**	**0.40 (0.27-0.58)**
Glioma malignant, NOS	2,533	507	0.84 (0.80-0.87)	--	--	--	--	--	--	--	--	--
Other neuroepithelial tumors	19	4	0.01 (0.00-0.01)	--	--	--	--	--	--	--	--	--
Neuronal and Mixed Neuronal-Glial Tumors	1,699	340	0.55 (0.53-0.58)	385	77	0.38 (0.34-0.42)	334	67	0.38 (0.34-0.42)	--	--	--
Malignant	*94*	*19*	*0.03 (0.02-0.04)*	*29*	*6*	*0.03 (0.02-0.04)*	*26*	*5*	*0.03 (0.02-0.04)*	--	--	--
Non-Malignant	*1,605*	*321*	*0.52 (0.50-0.55)*	*356*	*71*	*0.35 (0.32-0.39)*	*308*	*62*	*0.35 (0.31-0.39)*	--	--	--
Choroid Plexus Tumors	**305**	**61**	**0.10 (0.09-0.11)**	**87**	**17**	**0.08 (0.07-0.10)**	**76**	**15**	**0.09 (0.07-0.11)**	**--**	**--**	**--**
Malignant	*71*	*14*	*0.02 (0.02-0.03)*	*23*	*5*	*0.02 (0.01-0.03)*	*18*	*4*	*0.02 (0.01-0.03)*	--	--	--
Non-Malignant	*234*	*47*	*0.08 (0.07-0.09)*	*64*	*13*	*0.06 (0.05-0.08)*	*58*	*12*	*0.07 (0.05-0.09)*	--	--	--
Tumors of The Pineal Region	**165**	**33**	**0.05 (0.05-0.06)**	**41**	**8**	**0.04 (0.03-0.05)**	**36**	**7**	**0.04 (0.03-0.06)**	**--**	**--**	**--**
Malignant	*139*	*28*	*0.05 (0.04-0.05)*	--	--	--	--	--	--	--	--	--
Non-Malignant	*26*	*5*	*0.01 (0.01-0.01)*	--	--	--	--	--	--	--	--	--

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)
Embryonal Tumors	**1,754**	**351**	**0.58 (0.55-0.61)**	**500**	**100**	**0.49 (0.44-0.53)**	**440**	**88**	**0.50 (0.45-0.54)**	**24**	**5**	**0.34 (0.22-0.51)**
Medulloblastoma	*1,224*	*245*	*0.41 (0.38-0.43)*	*360*	*72*	*0.35 (0.32-0.39)*	*317*	*63*	*0.36 (0.32-0.40)*	--	--	--
Atypical teratoid/ rhabdoid tumor	*284*	*57*	*0.09 (0.08-0.11)*	*71*	*14*	*0.07 (0.05-0.09)*	*64*	*13*	*0.07 (0.06-0.09)*	--	--	--
All other embryonal	*246*	*49*	*0.08 (0.07-0.09)*	*69*	*14*	*0.07 (0.05-0.08)*	*59*	*12*	*0.07 (0.05-0.09)*	--	--	--
Tumors of Cranial and Spinal Nerves	**821**	**164**	**0.27 (0.25-0.28)**	**209**	**42**	**0.21 (0.18-0.24)**	**178**	**36**	**0.20 (0.17-0.23)**	**--**	**--**	**--**
Nerve sheath tumors	--	--	--	--	--	--	--	--	--	--	--	--
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**958**	**192**	**0.31 (0.29-0.33)**	**290**	**58**	**0.29 (0.26-0.32)**	**259**	**52**	**0.29 (0.26-0.33)**	**--**	**--**	**--**
Meningiomas	532	106	0.17 (0.16-0.19)	134	27	0.13 (0.11-0.16)	121	24	0.14 (0.11-0.16)	--	--	--
Mesenchymal tumors	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*349*	*70*	*0.11 (0.10-0.13)*	*132*	*26*	*0.13 (0.11-0.16)*	--	--	--	--	--	--
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--
Lymphomas and Hematopoietic Neoplasms	**97**	**19**	**0.03 (0.03-0.04)**	**24**	**5**	**0.02 (0.02-0.04)**	**22**	**4**	**0.02 (0.02-0.04)**	**--**	**--**	**--**
Lymphoma	--	--	--	--	--	--	--	--	--	--	--	--
Other hematopoietic neoplasms	--	--	--	--	--	--	--	--	--	--	--	--
Germ Cell Tumors	**631**	**126**	**0.21 (0.19-0.22)**	**214**	**43**	**0.21 (0.18-0.24)**	--	--	--	**--**	**--**	**--**
Malignant	555	111	0.18 (0.17-0.20)	--	--	--	--	--	--	--	--	--
Non-Malignant	76	15	0.03 (0.02-0.03)	--	--	--	--	--	--	--	--	--
Tumors of Sellar Region	**3,366**	**673**	**1.08 (1.04-1.12)**	**1,261**	**252**	**1.26 (1.20-1.34)**	**1,106**	**221**	**1.25 (1.18-1.33)**	**42**	**8**	**0.68 (0.49-0.92)**
Tumors of the pituitary	2,789	558	0.89 (0.86-0.92)	1,076	215	1.08 (1.02-1.15)	942	188	1.07 (1.00-1.14)	--	--	--
Craniopharyngioma	577	115	0.19 (0.18-0.21)	185	37	0.18 (0.16-0.21)	164	33	0.18 (0.16-0.21)	--	--	--
Unclassified Tumors	**1,101**	**220**	**0.36 (0.34-0.38)**	**349**	**70**	**0.34 (0.31-0.38)**	**302**	**60**	**0.34 (0.30-0.38)**	**--**	**--**	**--**
Hemangioma	365	73	0.12 (0.11-0.13)	119	24	0.12 (0.10-0.14)	104	21	0.12 (0.10-0.14)	--	--	--
Neoplasm, unspecified	606	121	0.20 (0.18-0.21)	177	35	0.17 (0.15-0.20)	151	30	0.17 (0.14-0.20)	--	--	--
Malignant	*184*	*37*	*0.06 (0.05-0.07)*	*41*	*8*	*0.04 (0.03-0.05)*	*36*	*7*	*0.04 (0.03-0.06)*	--	--	--
Non-Malignant	*422*	*84*	*0.14 (0.12-0.15)*	*136*	*27*	*0.13 (0.11-0.16)*	*115*	*23*	*0.13 (0.11-0.16)*	--	--	--
All other	130	26	0.04 (0.04-0.05)	53	11	0.05 (0.04-0.07)	47	9	0.05 (0.04-0.07)	--	--	--
Malignant	*37*	*7*	*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)
Non-Malignant	*93*	*19*	*0.03 (0.02-0.04)*	--	--	--	--	--	--	--	--	--
TOTAL[d]	**19,547**	**3,909**	**6.38 (6.30-6.48)**	**5,401**	**1,080**	**5.33 (5.18-5.47)**	**4,729**	**946**	**5.33 (5.18-5.49)**	**187**	**37**	**2.80 (2.41-3.24)**
Malignant	***11,068***	***2,214***	***3.64 (3.57-3.71)***	***2,788***	***558***	***2.73 (2.63-2.83)***	***2,437***	***487***	***2.74 (2.63-2.85)***	***110***	***22***	***1.57 (1.29-1.90)***
Non-Malignant	***8,479***	***1,696***	***2.74 (2.69-2.80)***	***2,613***	***522***	***2.60 (2.50-2.70)***	***2,292***	***458***	***2.59 (2.49-2.70)***	***77***	***15***	***1.23 (0.97-1.54)***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Hispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).
[d]Refers to all brain tumors including 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.

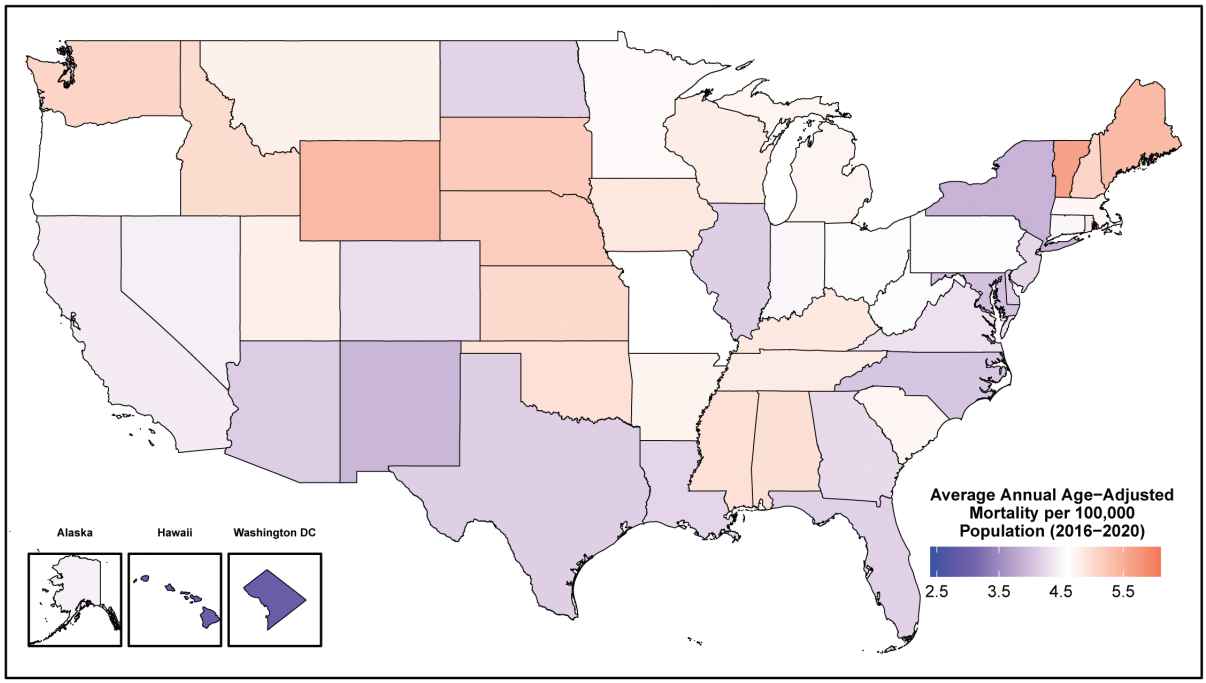
Table 19. Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Mortality[b] Rates[c] with 95% Confidence Intervals for Malignant Brain and Other Central Nervous System Cancers Overall and by State and Sex, CBTRUS Statistical Report: US Cancer Statistics – NCHS and NVSS, 2016-2020

State	Total			Female			Male		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Alaska	165	33	4.45 (3.76-5.23)	66	13	3.84 (2.94-4.93)	99	20	5.07 (4.05-6.28)
Alabama	1,505	301	4.95 (4.70-5.22)	682	136	4.11 (3.79-4.44)	823	165	5.91 (5.50-6.34)
Arkansas	883	177	4.75 (4.44-5.09)	394	79	3.88 (3.50-4.30)	489	98	5.71 (5.21-6.26)
Arizona	1,825	365	4.14 (3.95-4.34)	776	155	3.32 (3.08-3.57)	1,049	210	5.06 (4.75-5.38)
California	9,649	1,930	4.40 (4.31-4.49)	4,132	826	3.52 (3.41-3.63)	5,517	1,103	5.41 (5.27-5.56)
Colorado	1,369	274	4.30 (4.07-4.54)	593	119	3.56 (3.28-3.87)	776	155	5.11 (4.75-5.50)
Connecticut	1,025	205	4.51 (4.23-4.81)	435	87	3.57 (3.22-3.94)	590	118	5.69 (5.23-6.19)
Washington DC	105	21	2.93 (2.39-3.57)	52	10	2.72 (2.01-3.59)	53	11	3.20 (2.38-4.22)
Delaware	262	52	4.16 (3.65-4.73)	112	22	3.22 (2.62-3.92)	150	30	5.31 (4.47-6.28)
Florida	6,141	1,228	4.18 (4.07-4.29)	2,680	536	3.37 (3.24-3.51)	3,461	692	5.08 (4.90-5.25)
Georgia	2,449	490	4.26 (4.09-4.44)	1,067	213	3.38 (3.18-3.60)	1,382	276	5.31 (5.02-5.60)
Hawaii	259	52	2.94 (2.58-3.33)	112	22	2.36 (1.93-2.88)	147	29	3.56 (2.99-4.21)
Iowa	941	188	4.87 (4.55-5.20)	407	81	4.14 (3.73-4.59)	534	107	5.73 (5.24-6.26)
Idaho	509	102	4.99 (4.55-5.45)	205	41	3.87 (3.35-4.46)	304	61	6.18 (5.48-6.94)
Illinois	3,121	624	4.16 (4.01-4.32)	1,365	273	3.35 (3.17-3.54)	1,756	351	5.15 (4.90-5.40)
Indiana	1,777	355	4.51 (4.30-4.73)	766	153	3.62 (3.36-3.89)	1,011	202	5.54 (5.20-5.91)
Kansas	851	170	5.02 (4.68-5.38)	374	75	4.21 (3.78-4.68)	477	95	5.94 (5.40-6.51)
Kentucky	1,314	263	4.85 (4.58-5.13)	578	116	4.01 (3.67-4.36)	736	147	5.83 (5.40-6.28)
Louisiana	1,150	230	4.22 (3.98-4.48)	510	102	3.44 (3.14-3.77)	640	128	5.14 (4.74-5.57)
Massachusetts	1,995	399	4.70 (4.49-4.92)	862	172	3.71 (3.45-3.97)	1,133	227	5.89 (5.54-6.26)
Maryland	1,414	283	4.02 (3.80-4.24)	627	125	3.28 (3.02-3.55)	787	157	4.91 (4.56-5.27)
Maine	507	101	5.37 (4.89-5.89)	198	40	3.96 (3.39-4.60)	309	62	7.01 (6.21-7.89)
Michigan	2,964	593	4.74 (4.56-4.92)	1,271	254	3.77 (3.55-3.99)	1,693	339	5.87 (5.59-6.17)
Minnesota	1,542	308	4.67 (4.44-4.92)	635	127	3.70 (3.41-4.01)	907	181	5.78 (5.40-6.18)
Missouri	1,735	347	4.60 (4.38-4.83)	759	152	3.73 (3.46-4.02)	976	195	5.62 (5.26-5.99)
Mississippi	874	175	4.93 (4.60-5.28)	412	82	4.29 (3.87-4.74)	462	92	5.73 (5.21-6.30)
Montana	331	66	4.77 (4.25-5.35)	149	30	4.20 (3.52-4.99)	182	36	5.41 (4.63-6.31)
North Carolina	2,531	506	4.07 (3.91-4.24)	1,116	223	3.30 (3.10-3.50)	1,415	283	5.00 (4.74-5.28)
North Dakota	180	36	4.20 (3.59-4.89)	78	16	3.42 (2.68-4.30)	102	20	5.03 (4.07-6.15)

Table 19. Continued

State	Total			Female			Male		
	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)	5-Year Total	Annual Average	Rate (95% CI)
Nebraska	570	114	5.16 (4.73-5.61)	243	49	4.20 (3.67-4.79)	327	65	6.21 (5.54-6.95)
New Hampshire	457	91	5.07 (4.59-5.58)	195	39	4.11 (3.52-4.78)	262	52	6.16 (5.40-7.00)
New Jersey	2,310	462	4.23 (4.05-4.41)	1,048	210	3.50 (3.29-3.73)	1,262	252	5.10 (4.81-5.39)
New Mexico	515	103	3.94 (3.59-4.30)	229	46	3.29 (2.87-3.77)	286	57	4.67 (4.13-5.26)
Nevada	784	157	4.44 (4.12-4.77)	350	70	3.76 (3.37-4.19)	434	87	5.17 (4.69-5.70)
New York	4,612	922	3.90 (3.78-4.01)	2,010	402	3.10 (2.97-3.25)	2,602	520	4.83 (4.64-5.02)
Ohio	3,377	675	4.65 (4.49-4.81)	1,473	295	3.74 (3.54-3.94)	1,904	381	5.70 (5.44-5.97)
Oklahoma	1,128	226	4.93 (4.64-5.24)	531	106	4.30 (3.93-4.69)	597	119	5.68 (5.22-6.17)
Oregon	1,211	242	4.58 (4.32-4.86)	504	101	3.63 (3.31-3.98)	707	141	5.66 (5.24-6.10)
Pennsylvania	3,778	756	4.56 (4.41-4.71)	1,608	322	3.57 (3.39-3.76)	2,170	434	5.71 (5.46-5.96)
Rhode Island	332	66	4.86 (4.33-5.43)	144	29	3.78 (3.17-4.49)	188	38	6.15 (5.28-7.13)
South Carolina	1,522	304	4.73 (4.49-4.99)	689	138	3.98 (3.68-4.31)	833	167	5.63 (5.24-6.04)
South Dakota	272	54	5.17 (4.55-5.86)	109	22	3.83 (3.11-4.67)	163	33	6.75 (5.72-7.92)
Tennessee	1,961	392	4.83 (4.61-5.06)	852	170	3.91 (3.64-4.19)	1,109	222	5.92 (5.57-6.29)
Texas	6,066	1,213	4.16 (4.06-4.27)	2,647	529	3.40 (3.27-3.53)	3,419	684	5.06 (4.89-5.24)
Utah	679	136	4.79 (4.43-5.17)	283	57	3.88 (3.43-4.37)	396	79	5.78 (5.22-6.40)
Virginia	2,153	431	4.32 (4.14-4.51)	947	189	3.51 (3.28-3.75)	1,206	241	5.30 (4.99-5.61)
Vermont	232	46	5.64 (4.89-6.47)	103	21	4.65 (3.74-5.74)	129	26	6.74 (5.56-8.11)
Washington	2,200	440	5.07 (4.86-5.30)	927	185	4.06 (3.80-4.34)	1,273	255	6.20 (5.85-6.56)
Wisconsin	1,745	349	4.82 (4.59-5.06)	742	148	3.85 (3.57-4.15)	1,003	201	5.86 (5.49-6.25)
West Virginia	568	114	4.57 (4.18-4.98)	259	52	3.89 (3.40-4.43)	309	62	5.32 (4.72-5.98)
Wyoming	185	37	5.38 (4.60-6.26)	78	16	4.38 (3.42-5.54)	107	21	6.51 (5.29-7.93)
TOTAL	**86,030**	**17,206**	**4.42 (4.39-4.45)**	**37,384**	**7,477**	**3.57 (3.53-3.61)**	**48,646**	**9,729**	**5.40 (5.35-5.45)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Mortality - All COD, Aggregated with State, Total US (1990-2016) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, released January 2018. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).
[c]Rates 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: CBTRUS, Central Brain Tumor Registry of the United States; NCHS, National Center for Health Statistics; CI, confidence interval.



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; US, United States; NVSS, National Vital Statistics System.

Fig. 28 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, 2016-2020

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 23** and **Supplementary Table 12**.

- There was large variation in survival estimates for all ages depending upon tumor histopathology; five-year survival rates were 99.4% 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 63.6%.
- 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 AYA 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 2016-2020* 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 (assignment of a specific histopathology) or treatment occurs and is then transmitted to the CCR, which further transmits this information to NPCR and/or SEER. Those CCRs 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, 2016-2020, 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 39 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

Table 20. Sixteen-Year Total Deaths, and Median Survival in Months with 95% Confidence Intervals for Primary Malignant Brain and Other CNS Tumor Selected Histopathologies, CBTRUS Statistical Report: NPCR, 2001-2019

Histopathology	N	Deaths	Median Survival (95% CI)
Diffuse astrocytoma	24,819	13,755	63 (60-66)
Anaplastic astrocytoma	17,735	12,514	21 (20-21)
Glioblastoma	146,320	131,036	8 (8-9)
Oligodendroglioma	11,926	3,780	205 (196-209)
Anaplastic oligodendroglioma	5,339	2,533	108 (101-116)
Oligoastrocytic tumors	6,617	3,504	113 (107-120)
Pilocytic astrocytoma	312	1	*** (**-**)
Unique astrocytoma variants	2,484	422	** (**-**)
Ependymal tumors	18,645	3,407	** (**-**)
Glioma malignant, NOS	20,839	10,035	95 (86-104)
Choroid plexus tumors	2,285	358	** (**-**)
Other neuroepithelial tumors	280	84	215 (198-**)
Neuronal and mixed neuronal-glial tumors	12,725	1,619	** (**-**)
Tumors of the pineal region	1,948	538	** (216-**)
Embryonal tumors	10,595	4,204	** (**-**)
Medulloblastoma	*7,007*	*2,075*	*** (**-**)*
Atypical teratoid/rhabdoid tumor	*1,129*	*726*	*14 (12-17)*
Other embryonal tumors	*2,459*	*1,403*	*43 (36-50)*
Nerve sheath tumors	89,222	9,235	** (**-**)
Other tumors of cranial and spinal nerves	69	8	** (**-**)
Meningiomas	398,870	114,855	184 (181-186)
Mesenchymal tumors	16,523	3,054	** (**-**)
Primary melanocytic lesions	282	171	30 (22-60)
Lymphoma	20,028	13,624	16 (16-18)
Other hematopoietic neoplasms	196	96	138 (94-**)
Germ cell tumor	3,601	529	** (**-**)
Tumors of the pituitary	179,087	22,448	** (**-**)
Craniopharyngioma	7,997	1,724	** (**-**)
Hemangioma	8,891	1,029	** (**-**)
Neoplasm, unspecified	29,036	16,254	45 (42-49)
All other	1,285	222	** (**-**)

* *** 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 Brian 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.

studies has been evaluated[69,70] 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.[2,33,34,71,72] 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.[73,74] This also

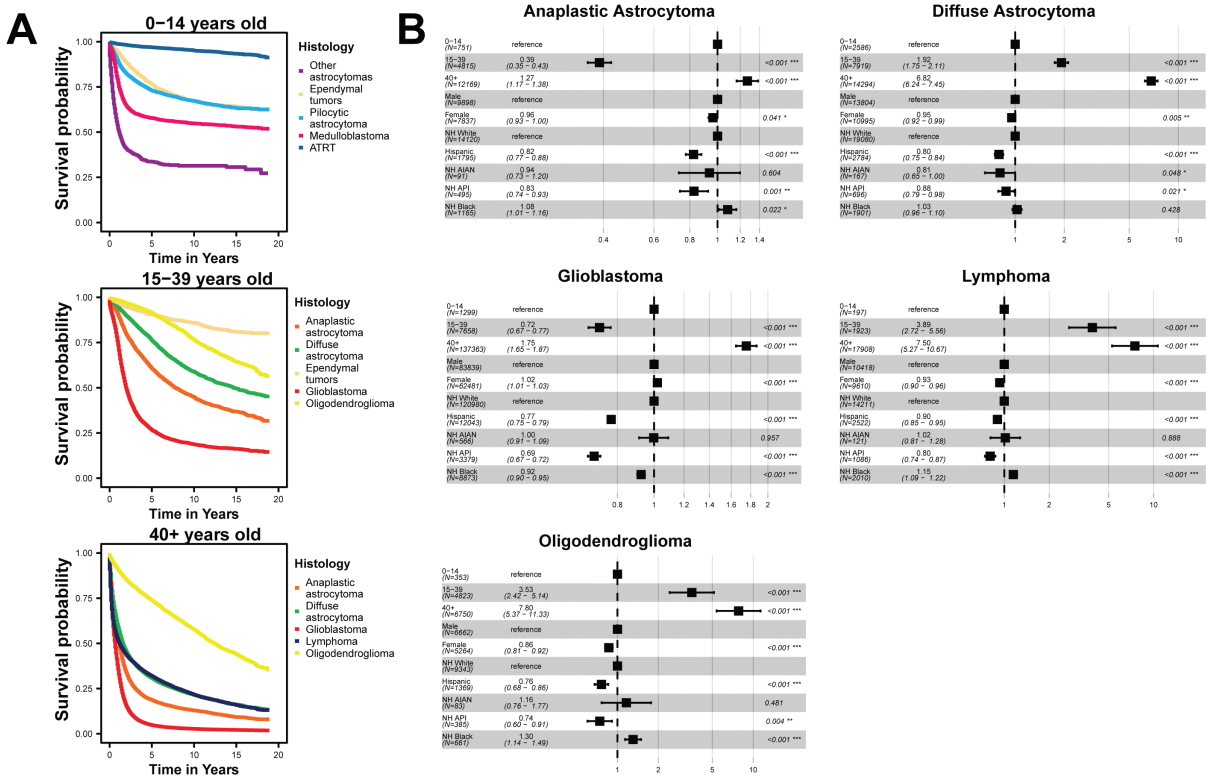


Fig. 29 A) Kaplan-Meier Survival Curves for the Five Most Common Histopathologies within Age Group at Diagnosis (Ages 0-14, 15-39 and 40+ Years) and B) Hazard Ratios and 95% Confidence Intervals for Sex, Age at Diagnosis, Race, and Ethnicity for the Five Most Common Histopathologies Overall, National Data provided by CDC's NPCR, 2001-2019

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.

United States 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 (when pathologic confirmation is not available and 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. It is important to consider the decreased level of certainty of specifying the correct histopathology in these tumors.

Technical Notes

Variable Completeness in Cancer Registration

Obtaining the most accurate and complete cancer registration data possible are essential to generate accurate population-level statistics to guide public health planning. Agencies such as NAACCR and IARC have developed stringent standards for evaluation of cancer registry data quality, and they evaluate each specific registry by multiple metrics before including it in analytic datasets.[75,76] 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 not be found in the patient record for those cases that had diagnosis confirmed via radiography as compared to histopathological examination. The 2023 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.

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

Table 21. Hazards Ratios with 95% Confidence Intervals for Age Group, Sex, Race, and Ethnicity for Primary Malignant Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: NPCR, 2001-2019 (varying)

Histopathology	N	Deaths	Age Groups[a]				Sex[b]		Race & Ethnicity[c]							
			(15-39) Years		40+ Years		Female		Black, Non-Hispanic		Hispanic		AIAN, Non-Hispanic		API, Non-Hispanic	
			HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value	HR (95% CI)	P-value
Diffuse astrocytoma	24,819	13,755	1.91 (1.74-2.10)	<0.0001	6.79 (6.21-7.42)	<0.0001	0.95 (0.92-0.99)	0.0046	1.03 (0.96-1.09)	0.4422	0.80 (0.75-0.84)	<0.0001	0.81 (0.65-1.00)	0.0487	0.88 (0.79-0.98)	0.0216
Anaplastic astrocytoma	17,735	12,514	0.39 (0.35-0.43)	<0.0001	1.27 (1.17-1.38)	<0.0001	0.96 (0.93-1.00)	0.0407	1.08 (1.01-1.16)	0.0220	0.82 (0.77-0.88)	<0.0001	0.94 (0.73-1.20)	0.6044	0.83 (0.74-0.93)	0.0011
Glioblastoma	146,320	131,036	0.72 (0.67-0.77)	<0.0001	1.75 (1.65-1.87)	<0.0001	1.02 (1.01-1.03)	0.0003	0.92 (0.90-0.95)	<0.0001	0.77 (0.75-0.79)	<0.0001	1.00 (0.91-1.09)	0.9572	0.69 (0.67-0.72)	<0.0001
Oligodendroglioma	11,926	3,780	3.53 (2.42-5.14)	<0.0001	7.80 (5.37-11.33)	<0.0001	0.86 (0.81-0.92)	<0.0001	1.30 (1.14-1.49)	0.0001	0.76 (0.68-0.86)	<0.0001	1.16 (0.76-1.77)	0.4807	0.74 (0.60-0.91)	0.0044
Anaplastic oligo-dendroglioma	5,339	2,533	0.75 (0.50-1.13)	0.1694	1.56 (1.04-2.34)	0.0311	0.90 (0.83-0.97)	0.0071	1.25 (1.06-1.46)	0.0072	0.80 (0.70-0.92)	0.0012	1.16 (0.71-1.90)	0.5575	0.81 (0.66-0.99)	0.0431
Oligoastrocytic tumors	6,617	3,504	1.75 (1.30-2.35)	0.0002	3.65 (2.72-4.89)	<0.0001	0.90 (0.84-0.96)	0.0016	1.37 (1.20-1.57)	<0.0001	0.85 (0.76-0.95)	0.0061	1.21 (0.80-1.82)	0.3633	0.90 (0.74-1.09)	0.2609
Pilocytic astrocytoma	312	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unique astrocytoma variants	2,484	422	2.36 (1.80-3.09)	<0.0001	8.83 (6.72-11.60)	<0.0001	0.79 (0.65-0.96)	0.0153	0.96 (0.72-1.27)	0.7553	0.87 (0.66-1.16)	0.3545	1.59 (0.71-3.57)	0.2616	1.12 (0.68-1.86)	0.6520
Ependymal tumors	18,645	3,407	0.33 (0.29-0.37)	<0.0001	0.87 (0.80-0.95)	0.0017	0.78 (0.73-0.84)	<0.0001	1.40 (1.25-1.57)	<0.0001	1.10 (1.00-1.22)	0.0502	1.15 (0.77-1.74)	0.4942	0.80 (0.63-1.01)	0.0597
Glioma malignant, NOS	20,839	10,035	0.77 (0.72-0.83)	<0.0001	3.48 (3.32-3.65)	<0.0001	1.00 (0.96-1.04)	0.9476	1.11 (1.04-1.18)	0.0013	1.03 (0.97-1.09)	0.3591	0.93 (0.70-1.23)	0.6048	0.95 (0.85-1.06)	0.3764
Choroid plexus tumors	2,285	358	0.56 (0.40-0.80)	0.0013	2.56 (2.02-3.24)	<0.0001	0.87 (0.71-1.08)	0.2084	1.71 (1.22-2.38)	0.0016	0.98 (0.73-1.32)	0.9026	1.08 (0.35-3.39)	0.8887	1.14 (0.65-1.99)	0.6532
Other neuroepithelial tumors	280	84	2.53 (0.82-7.80)	0.1059	15.51 (5.54-43.43)	<0.0001	0.87 (0.55-1.38)	0.5643	0.91 (0.44-1.88)	0.8077	0.65 (0.32-1.34)	0.2420	** (**-**)	**	0.91 (0.33-2.53)	0.8568
Neuronal and mixed neuronal-glial tumors	12,725	1,619	1.44 (1.19-1.73)	0.0001	6.26 (5.31-7.39)	<0.0001	0.80 (0.72-0.88)	<0.0001	1.43 (1.23-1.66)	<0.0001	1.17 (1.01-1.37)	0.0399	2.01 (1.20-3.34)	0.0075	1.03 (0.79-1.36)	0.8209
Tumors of the pineal region	1,948	538	0.51 (0.40-0.64)	<0.0001	1.06 (0.85-1.31)	0.6176	0.59 (0.50-0.70)	<0.0001	1.36 (1.09-1.69)	0.0065	1.22 (0.96-1.55)	0.1039	1.08 (0.45-2.62)	0.8628	0.65 (0.33-1.26)	0.1982
Embryonal tumors	10,595	4,204	0.83 (0.77-0.90)	<0.0001	1.94 (1.77-2.13)	<0.0001	1.01 (0.95-1.07)	0.8149	1.21 (1.10-1.33)	<0.0001	0.96 (0.89-1.03)	0.2636	0.64 (0.42-0.98)	0.0412	1.01 (0.86-1.18)	0.9495
Medulloblastoma	*7,007*	*2,075*	*0.88 (0.79-0.97)*	*0.0092*	*1.68 (1.45-1.94)*	*<0.0001*	*0.92 (0.84-1.01)*	*0.0769*	*1.08 (0.94-1.25)*	*0.2638*	*0.97 (0.88-1.08)*	*0.6141*	*0.54 (0.29-1.00)*	*0.0509*	*0.78 (0.61-1.00)*	*0.0504*
Atypical teratoid/ rhabdoid tumor	*1,129*	*726*	*0.80 (0.55-1.17)*	*0.2529*	*0.90 (0.51-1.60)*	*0.7251*	*0.95 (0.82-1.10)*	*0.4820*	*1.31 (1.06-1.61)*	*0.0122*	*1.09 (0.91-1.30)*	*0.3666*	*0.78 (0.29-2.09)*	*0.6216*	*1.50 (1.09-2.06)*	*0.0124*
Other embryonal tumors	*2,459*	*1,403*	*1.34 (1.18-1.53)*	*<0.0001*	*2.51 (2.20-2.86)*	*<0.0001*	*0.92 (0.82-1.02)*	*0.1005*	*1.22 (1.04-1.44)*	*0.0125*	*0.90 (0.78-1.04)*	*0.1633*	*0.98 (0.47-2.07)*	*0.9632*	*1.07 (0.81-1.40)*	*0.6461*

Table 21. Continued

Histopathology	N	Deaths	Age Groups[a]				Sex[b]		Race & Ethnicity[c]							
			(15-39) Years		40+ Years		Female		Black, Non-Hispanic		Hispanic		AIAN, Non-Hispanic		API, Non-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
Nerve sheath tumors	89,222	9,235	1.59 (1.21-2.09)	0.0009	6.19 (4.78-8.01)	<0.0001	0.83 (0.80-0.86)	<0.0001	1.19 (1.10-1.30)	<0.0001	0.84 (0.77-0.91)	<0.0001	1.29 (0.99-1.67)	0.0610	0.57 (0.51-0.65)	<0.0001
Other tumors of cranial and spinal nerves	69	< 50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meningiomas	398,870	114,855	0.77 (0.59-1.02)	0.0670	5.64 (4.31-7.39)	<0.0001	0.69 (0.68-0.70)	<0.0001	1.01 (1.00-1.03)	0.1330	0.72 (0.70-0.74)	<0.0001	0.82 (0.75-0.89)	<0.0001	0.64 (0.61-0.66)	<0.0001
Mesenchymal tumors	16,523	3,054	0.84 (0.67-1.06)	0.1451	3.17 (2.58-3.88)	<0.0001	0.85 (0.79-0.91)	<0.0001	1.10 (0.98-1.24)	0.1060	0.89 (0.80-1.00)	0.0604	0.94 (0.64-1.37)	0.7476	0.71 (0.56-0.89)	0.0031
Primary melanocytic lesions	282	171	0.30 (0.16-0.55)	0.0001	0.64 (0.38-1.07)	0.0885	0.91 (0.67-1.25)	0.5621	1.41 (0.76-2.62)	0.2766	0.96 (0.60-1.55)	0.8814	--	--	1.00 (0.32-3.16)	0.9998
Lymphoma	20,028	13,624	3.89 (2.72-5.56)	<0.0001	7.50 (5.27-10.67)	<0.0001	0.93 (0.90-0.96)	<0.0001	1.15 (1.09-1.22)	<0.0001	0.90 (0.85-0.95)	0.0002	1.02 (0.81-1.28)	0.8880	0.80 (0.74-0.87)	<0.0001
Other hematopoietic neoplasms	196	96	** (**-**)	**	** (**-**)	**	1.15 (0.76-1.73)	0.5091	0.73 (0.43-1.22)	0.2282	0.59 (0.30-1.17)	0.1304	1.90 (0.46-7.89)	0.3797	1.65 (0.71-3.85)	0.2434
Germ cell tumor	3,601	529	1.04 (0.86-1.25)	0.7058	2.20 (1.65-2.94)	<0.0001	1.32 (1.09-1.59)	0.0047	0.87 (0.63-1.20)	0.3961	1.11 (0.90-1.37)	0.3253	1.57 (0.59-4.22)	0.3696	1.03 (0.76-1.41)	0.8373
Tumors of the pituitary	179,087	22,448	2.13 (1.37-3.31)	0.0008	21.59 (13.92-33.47)	<0.0001	0.74 (0.72-0.76)	<0.0001	1.13 (1.10-1.17)	<0.0001	0.71 (0.68-0.74)	<0.0001	0.97 (0.82-1.15)	0.7058	0.63 (0.58-0.68)	<0.0001
Craniopharyngioma	7,997	1,724	1.92 (1.53-2.40)	<0.0001	6.50 (5.37-7.87)	<0.0001	0.86 (0.78-0.95)	0.0019	1.69 (1.51-1.89)	<0.0001	1.05 (0.90-1.22)	0.5478	1.68 (1.05-2.67)	0.0302	0.61 (0.44-0.83)	0.0017
Hemangioma	8,891	1,029	1.15 (0.66-2.01)	0.6139	8.01 (4.81-13.36)	<0.0001	0.63 (0.55-0.71)	<0.0001	1.28 (1.06-1.56)	0.0103	0.79 (0.65-0.96)	0.0206	** (**-**)	**	0.63 (0.43-0.94)	0.0226
Neoplasm, unspecified	29,036	16,254	0.79 (0.68-0.92)	0.0019	5.90 (5.19-6.71)	<0.0001	0.94 (0.91-0.96)	<0.0001	0.74 (0.70-0.78)	<0.0001	0.66 (0.63-0.70)	<0.0001	0.76 (0.61-0.94)	0.0130	0.80 (0.72-0.89)	<0.0001
All other	1,285	222	1.19 (0.61-2.33)	0.6110	9.43 (5.56-16.01)	<0.0001	0.73 (0.56-0.96)	0.0218	1.36 (0.92-2.02)	0.1237	0.98 (0.67-1.44)	0.9353	3.02 (0.74-12.24)	0.1223	0.67 (0.25-1.80)	0.4238

[a]Reference group is children (<15 years old) as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[b]Reference group is males.
[c]Reference group is White Non-Hispanic.
** Cannot be calculated.
--Survival estimates are not presented when fewer than 100 cases were reported for the specific category.
Abbreviations: CBTRUS, Central Brain Tumor of the United States; NPCR, National program of Cancer Registries; HR, Hazard ratio; AIAN, American Indian/Alaska Native; API, Asian or Pacific Islander; CI, confidence interval; NOS, not otherwise specified.

Table 22. 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: US Cancer Statistics—NPCR and SEER, 2001-2019 (varying)

Site (ICD-O Topography Code)	All				Malignant[c]				Non-Malignant[d]			
	N	1 Year RS (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[e]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[f]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)
Olfactory tumors of the nasal cavity (C30.0)[g]	**1,805**	**91.3 (89.8-92.6)**	**81.1 (78.7-83.3)**	**72.4 (68.9-75.5)**	**1,807**	**92.3 (90.9-93.6)**	**82.4 (80.1-84.5)**	**73.4 (70.2-76.4)**	--	--	--	--
Frontal, temporal, parietal, and occipital lobes of the brain	**192,387**	**60.0 (59.8-60.3)**	**31.8 (31.6-32.1)**	**26.5 (26.3-26.8)**	**174,553**	**58.1 (57.8-58.3)**	**27.5 (27.2-27.7)**	**21.7 (21.4-21.9)**	**19,631**	**90.9 (90.5-91.4)**	**86.8 (86.2-87.4)**	**83.4 (82.6-84.2)**
Frontal lobe	83,162	62.2 (61.9-62.6)	37.0 (36.6-37.4)	30.6 (30.2-31.0)	75,991	61.4 (61.0-61.7)	34.3 (33.9-34.7)	27.2 (26.9-27.6)	7,954	89.3 (88.5-90.0)	84.1 (83.0-85.1)	80.0 (78.5-81.3)
Temporal lobe	61,389	60.9 (60.5-61.3)	29.1 (28.7-29.5)	24.5 (24.0-24.9)	54,808	58.3 (57.9-58.7)	23.2 (22.8-23.6)	18.0 (17.6-18.4)	6,791	93.9 (93.2-94.5)	91.1 (90.2-91.9)	89.2 (88.0-90.2)
Parietal lobe	37,603	54.2 (53.7-54.7)	25.3 (24.8-25.8)	20.9 (20.4-21.4)	35,004	51.6 (51.0-52.1)	20.7 (20.3-21.2)	16.2 (15.8-16.7)	3,396	88.6 (87.3-89.7)	83.9 (82.3-85.4)	80.0 (77.8-82.0)
Occipital lobe	10,233	58.4 (57.4-59.3)	30.2 (29.2-31.2)	26.2 (25.1-27.2)	8,750	54.1 (53.0-55.2)	22.1 (21.1-23.0)	18.0 (17.1-19.0)	1,490	91.6 (89.9-93.0)	88.2 (85.9-90.2)	83.2 (80.0-86.0)
Cerebrum	18,037	58.1 (57.4-58.9)	38.3 (37.5-39.0)	34.4 (33.6-35.3)	15,440	52.8 (52.0-53.6)	29.8 (29.0-30.5)	26.0 (25.2-26.8)	3,249	89.3 (88.1-90.4)	84.8 (83.2-86.3)	80.6 (78.3-82.6)
Ventricle, NOS	10,770	86.5 (85.8-87.2)	79.1 (78.2-80.0)	75.0 (73.9-76.0)	5,006	77.0 (75.8-78.2)	64.3 (62.9-65.7)	59.5 (57.9-61.0)	6,166	94.5 (93.8-95.0)	91.5 (90.5-92.3)	88.5 (87.1-89.7)
Cerebellum, NOS	23,386	88.3 (87.9-88.8)	79.1 (78.5-79.7)	75.5 (74.8-76.2)	15,552	85.7 (85.1-86.3)	72.8 (72.0-73.5)	68.1 (67.3-69.0)	9,254	95.1 (94.5-95.5)	92.3 (91.5-93.1)	90.3 (89.1-91.4)
Brain stem	16,072	77.2 (76.5-77.9)	62.1 (61.2-62.9)	57.2 (56.3-58.1)	13,476	72.3 (71.5-73.0)	53.2 (52.3-54.1)	48.2 (47.3-49.2)	3,937	92.6 (91.7-93.5)	88.5 (87.2-89.7)	84.7 (82.8-86.4)
Other Brain	**78,884**	**53.3 (52.9-53.6)**	**34.8 (34.5-35.2)**	**30.8 (30.4-31.2)**	**66,786**	**46.9 (46.5-47.3)**	**25.5 (25.2-25.9)**	**21.5 (21.1-21.9)**	**15,122**	**86.1 (85.5-86.6)**	**80.7 (79.9-81.4)**	**76.5 (75.4-77.5)**
Overlapping lesion of brain	33,581	45.7 (45.2-46.3)	21.3 (20.8-21.8)	17.1 (16.6-17.6)	32,448	44.2 (43.7-44.8)	18.5 (18.0-18.9)	14.2 (13.8-14.7)	2,218	83.3 (81.6-84.9)	78.0 (75.8-80.0)	73.2 (70.5-75.7)
Brain, NOS	45,303	58.9 (58.5-59.4)	44.9 (44.3-45.4)	41.0 (40.4-41.5)	34,338	49.4 (48.9-50.0)	32.2 (31.6-32.7)	28.4 (27.8-28.9)	12,904	86.5 (85.9-87.2)	81.1 (80.3-82.0)	77.0 (75.9-78.1)
Spinal cord and cauda equina	**31,275**	**96.1 (95.8-96.3)**	**93.0 (92.6-93.4)**	**91.2 (90.6-91.8)**	**9,903**	**89.8 (89.2-90.5)**	**81.7 (80.8-82.6)**	**77.9 (76.8-79.0)**	**22,009**	**99.1 (98.8-99.2)**	**98.5 (98.1-98.9)**	**98.0 (97.2-98.5)**
Spinal cord	30,155	96.0 (95.8-96.3)	92.9 (92.5-93.3)	91.0 (90.3-91.6)	9,674	89.8 (89.2-90.4)	81.6 (80.7-82.5)	77.7 (76.6-78.8)	21,092	99.1 (98.9-99.3)	98.6 (98.1-98.9)	97.9 (97.1-98.5)

Table 22. Continued

Site (ICD-O Topography Code)	All				Malignant[c]				Non-Malignant[d]			
	N	1 Year RS (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[e]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[f]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)
Cauda equina	1,120	96.8 (95.3-97.8)	94.6 (92.2-96.3)	94.4 (91.8-96.2)	229	90.8 (85.8-94.0)	86.4 (79.8-91.0)	85.4 (77.3-90.8)	917	98.2 (96.8-99.0)	97.3 (94.4-98.7)	97.0 (93.9-98.6)
Cranial nerves	**74,090**	**99.3 (99.2-99.4)**	**99.3 (99.2-99.4)**	**99.3 (99.2-99.4)**	**4,309**	**97.4 (96.8-97.9)**	**94.3 (93.5-95.0)**	**93.1 (92.0-94.0)**	**70,185**	**99.5 (99.4-99.6)**	**99.5 (99.4-99.6)**	**99.5 (99.4-99.6)**
Olfactory nerve	100	94.7 (87.1-97.9)	88.9 (77.2-94.8)	85.7 (69.5-93.7)	34	92.0 (74.7-97.6)	76.0 (54.5-88.3)	68.3 (44.4-83.6)	69	96.4 (85.9-99.1)	93.3 (77.4-98.2)	93.3 (77.4-98.2)
Optic nerve	4,385	98.5 (98.1-98.9)	96.3 (95.6-97.0)	95.5 (94.5-96.3)	3,852	98.1 (97.6-98.5)	95.7 (95.0-96.4)	94.8 (93.9-95.6)	897	100.0 (**-**)	98.4 (94.2-99.5)	96.9 (91.4-98.9)
Acoustic nerve	56,707	99.5 (99.4-99.6)	99.5 (99.4-99.6)	99.5 (99.4-99.6)	146	95.0 (89.0-97.7)	93.2 (86.3-96.7)	93.1 (81.6-97.5)	56,597	99.5 (99.4-99.6)	99.5 (99.4-99.6)	99.5 (99.4-99.6)
Cranial nerve, NOS	12,898	98.9 (98.6-99.2)	98.8 (98.4-99.1)	98.8 (98.4-99.1)	277	89.0 (84.3-92.3)	76.0 (69.7-81.2)	70.7 (62.5-77.4)	12,622	99.2 (99.0-99.5)	99.2 (98.8-99.5)	99.2 (98.8-99.5)
Other nervous system	**6,208**	**79.8 (78.8-80.9)**	**72.2 (70.9-73.5)**	**67.8 (66.2-69.4)**	**3,101**	**63.8 (62.0-65.5)**	**50.5 (48.5-52.5)**	**44.7 (42.3-47.0)**	**3,043**	**97.3 (96.5-97.9)**	**94.6 (93.3-95.6)**	**91.8 (89.8-93.3)**
Overlapping lesion of brain & CNS	806	75.1 (71.8-78.0)	66.4 (62.5-70.0)	61.1 (56.2-65.7)	453	61.7 (56.9-66.2)	46.1 (40.9-51.3)	39.6 (33.6-45.5)	356	94.2 (90.7-96.4)	90.4 (85.5-93.7)	86.3 (78.3-91.5)
Nervous system, NOS	5,402	80.5 (79.4-81.6)	73.0 (71.6-74.4)	68.8 (67.1-70.5)	2,648	64.1 (62.2-66.0)	51.2 (49.0-53.4)	45.5 (43.0-48.1)	2,687	97.7 (96.9-98.3)	95.0 (93.6-96.1)	92.5 (90.4-94.1)
Meninges	**400,534**	**93.2 (93.1-93.3)**	**88.0 (87.8-88.2)**	**83.2 (82.9-83.4)**	**6,053**	**83.7 (82.7-84.7)**	**67.4 (65.9-68.8)**	**60.4 (58.5-62.1)**	**394,835**	**93.4 (93.3-93.5)**	**88.4 (88.2-88.5)**	**83.6 (83.3-83.8)**
Cerebral meninges	326,051	93.2 (93.1-93.3)	87.9 (87.7-88.0)	82.9 (82.6-83.2)	4,350	84.6 (83.4-85.8)	67.3 (65.6-69.0)	60.2 (58.1-62.3)	321,967	93.3 (93.2-93.4)	88.2 (88.0-88.4)	83.2 (83.0-83.5)
Spinal meninges	17,771	97.4 (97.0-97.7)	96.2 (95.5-96.8)	94.2 (92.9-95.2)	446	86.2 (82.4-89.2)	75.9 (70.7-80.2)	72.2 (65.7-77.8)	17,345	97.7 (97.4-98.0)	96.8 (96.0-97.3)	94.9 (93.6-95.9)
Meninges, NOS	56,712	92.1 (91.8-92.4)	86.1 (85.6-86.5)	81.2 (80.5-81.9)	1,257	79.6 (77.1-81.9)	64.5 (61.1-67.6)	56.3 (52.2-60.2)	55,523	92.4 (92.1-92.7)	86.6 (86.2-87.1)	81.9 (81.2-82.6)
Pituitary and craniopharyngeal duct	**190,594**	**98.0 (97.9-98.0)**	**96.4 (96.2-96.6)**	**94.4 (94.1-94.6)**	**1,341**	**87.5 (85.5-89.3)**	**76.5 (73.7-79.0)**	**68.6 (65.1-71.8)**	**189,384**	**98.0 (97.9-98.1)**	**96.5 (96.4-96.7)**	**94.6 (94.3-94.8)**
Pituitary gland	185,121	98.1 (98.0-98.2)	96.8 (96.6-96.9)	94.9 (94.6-95.2)	1,315	87.8 (85.8-89.6)	76.9 (74.1-79.5)	69.0 (65.5-72.2)	183,937	98.2 (98.1-98.3)	96.9 (96.7-97.1)	95.1 (94.8-95.4)

Table 22. Continued

Site (ICD-O Topography Code)	All				Malignant[c]				Non-Malignant[d]			
	N	1 Year RS (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[e]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)	N[f]	1 Year Relative Survival (95% CI)	5 Year Relative Survival (95% CI)	10 Year Relative Survival (95% CI)
Craniopharyngeal duct	5,473	92.5 (91.7-93.2)	84.8 (83.6-85.9)	77.7 (76.0-79.2)	26	72.9 (50.4-86.5)	--	--	5,447	92.6 (91.8-93.3)	85.0 (83.8-86.1)	77.9 (76.2-79.4)
Pineal gland	4,344	91.8 (90.9-92.6)	82.4 (81.0-83.6)	77.6 (75.9-79.2)	2,956	90.0 (88.8-91.0)	76.8 (75.1-78.4)	71.4 (69.4-73.3)	1,661	94.5 (93.2-95.6)	91.0 (89.0-92.6)	87.1 (84.3-89.5)

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively.
[c]Assigned behavior code of /3 (see Table 2).
[d]Assigned behavior code of /0 or /1 (see Table 2).
[e]Total number of cases that occurred within the included NPCR and SEER registries between 2001 and 2019.
[f]Total number of cases that occurred within the included NPCR and SEER registries between 2004-2019.
[g]ICD-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 of the United States; NPCR, National program of Cancer Registries; RS, relative survival; CI, confidence interval; NOS, not otherwise specified.

ratios) and relative survival rates (for more information on definitions of terms and measures used see: https://cbtrus.org/cbtrus-glossary/).

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.

Defining Average Annual Age-Adjusted Incidence Rates (AAAIR), Average Annual Age-Adjusted Mortality Rates (AAAMR) and Incidence Rate Ratios (IRR)

Crude rates (both incidence and mortality) are calculated by dividing the total number of cases or deaths by the total population and cannot be compared to crude rates from other populations where the age distribution is different. These rates are adjusted to allow for comparison across populations that vary in age structure, by generated age-specific rates which are then projected to a standard distribution of population by ages (in this report, the 2000 US census population). 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. This technique is applied to generate both AAAIR and AAAMR.

IRR were generated based on these age-adjusted incidence rates. **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 was 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 of <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.

Defining Incidence Time Trends and Expected Future Numbers

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.[77] 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 annual 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.

To project expected future cases, Joinpoint was also used to fit regression models to newly diagnosed brain and other CNS tumors case counts,[78] which were used to predict numbers of cases in future years using the parameter from the selected models. 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.[77] 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 15-21 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.**

Defining Point Prevalence

Prevalence is an estimate of the total number of people living with a disease, regardless of when they were diagnosed. All prevalence estimates presented in this report are based on statistical models. These models use new case counts and overall survival time to predict the

number of individuals that will be alive with a brain or other CNS tumor on a specific date. For many diseases, including brain tumors, it is not possible to count the true number of all living cases in a large population at a single point in time. The models used for prevalence estimation require making assumptions which may not always reflect the dynamics in the 'true' population. Due to limitations on data availability for **non-malignant** tumors prior to 2004, prevalence is likely underestimated due to exclusion of individuals who may have been diagnosed prior to 2004. Similarly, the data used for estimation of prevalence for **malignant** tumors only go back 44 years, meaning cases diagnosed before that time frame are not included. **Caution should be used when utilizing these estimates.**

Defining Survival Measures

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 percentage 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 **relative 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 statistical software utilizes life-table (actuarial) methods to compute survival estimates and accounts for current follow-up.

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. NAACCR data item #1787, survival months presumed alive, was used to ascertain follow-up information.

The hazard ratio (HR) 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.

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. **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 2016-2020*. This current report supersedes all previous reports in terms of coverage of the US population and completeness 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 453,623 tumors included in this report came from 447,870 individuals. Of these 447,870 individuals, there were 5,409 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.[79,80] 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. The Counting Veterans Act, which would require reporting of cancer diagnoses at VA facilities to state CCRs, was introduced by Senators Mark Kelly and Thom Tillis on June 14, 2023,[81] and aims to solve the above challenges to completeness of data.
- 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.[62,82,83]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.[84] 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 evidence of potential underreporting of **non-malignant** brain and other CNS tumors, the extent to which cannot be quantified at this time, but which is under investigation.[84]

- 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.[85,86]

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. They also include the exclusion of site and histopathology combinations considered invalid by the CBTRUS consulting neuropathologists who revised the CBTRUS site/histopathology validation list in 2021. Editing changes, such as the Multiple Primary and Histology Rules issued in 2007 and revised in 2018,[87,88] also incorporate updates to the cancer registration coding rules that influence case ascertainment and data collection.[37]

Concluding Comment

The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2016-2020* comprehensively describes the most up-to-date (October 2023) population-based incidence, mortality, and relative survival of primary **malignant** and **non-malignant** brain and other CNS tumors collected and reported by CCRs 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.[89]

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 CNS 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.

Supplementary Material

Supplementary material is available online at *Neuro-Oncology* (http://neuro-oncology.oxfordjournals.org/).

Supplementary Table 1. Main and Extended Classification for International Classification of Childhood Cancer (ICCC) Recode ICD-O-3/WHO 2008, based on ICCC, Third Edition based on ICD-O-3/IARC 2017, for Selected Histopathologies occurring in Brain and Other Central Nervous System Sites

Supplementary Table 2. Coding Definitions for the Brain Molecular Markers (BMM) Data Item (NAACCR Data Item #3816)

Supplementary Table 3. New Histopathology Codes Added for Diagnosis Year 2018

Supplementary Table 4. Summary of Biomarkers Identified for Primary Brain and Other Central Nervous System Tumors and Status by Central Cancer Registries Collection Standards

Supplementary Table 5. Annual Percent Change (APC) and 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Behavior, Sex, Race, and Ethnicity, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2004-2019

Supplementary Table 6. Annual Percent Change (APC) and 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Behavior, Histopathology and Sex, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019 (varying)

Supplementary Table 7. Annual Percent Change (APC) and 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Behavior, Histopathology and Ethnicity, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019

Supplementary Table 8. Annual Percent Change (APC) and 95% Confidence Intervals for Malignant Brain and Other Central Nervous System Tumors by Histopathology and Race, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2000-2019

Supplementary Table 9. Annual Percent Change (APC) and 95% Confidence Intervals for Non-Malignant Brain and Other Central Nervous System Tumors by Histopathology and Race, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2004-2019

Supplementary Table 10. Five-Year Total, Annual Average Total, and Average Annual Age-Adjusted Incidence Rates with 95% Confidence Intervals for Adults (Ages 20+ Years), Brain and Other Central Nervous System Tumors by Histopathology and Age at Diagnosis, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

Supplementary Table 11. Five-Year Total, Annual Average Total, and Age-Adjusted and Age-Specific Incidence Rates with 95% Confidence Intervals for Children and Adolescents (Ages 0-19 Years), Brain and Other Central

Nervous System Tumors: Malignant and Non-Malignant by International Classification of Childhood Cancer (ICCC), CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020
Supplementary Table 12. One-, Five-, and Ten-Year Relative Survival Rates, with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors By Histopathology and Behavior, by Age Groups, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2001-2019 (varying)
Supplementary Figure 1. Distribution of Schwannoma (9560/0) by Site (Five-Year Total=27,697; Annual Average Cases=5,539), CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020
Supplementary Figure 2. Average Annual Age-Adjusted Incidence Rates of Malignant and Non-Malignant Primary Brain and Other Central Nervous System Tumors Combined by Central Cancer Registry, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020
Supplementary Figure 3. Distribution of All Primary Brain and Other CNS Tumors Diagnosed in Puerto Rico by Behavior (Five-Year Total=2,054; Annual Average Cases=411), CBTRUS Statistical Report: US Cancer Statistics – NPCR, 2016-2020
Supplementary Figure 4. Incidence Rate Ratios by Ethnicity (Non-Hispanic:Hispanic) for Selected Primary Brain and Other Central Nervous System Tumor Histopathologies, CBTRUS Statistical Report: US Cancer Statistics – NPCR and SEER, 2016-2020

ABBREVIATIONS

AAAIR, Average Annual Age-Adjusted Incidence Rate;
AAAMR, Average Annual Age-Adjusted Mortality Rate;
ABTA, American Brain Tumor Association;
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;
BMM, Brain Molecular Marker;
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;
COVID, Corona Virus Disease 2019;
CSSSF, Collaborative State Site-Specific Factor;
DCEG, Division of Cancer Epidemiology and Genetics;
IACR, International Association of Cancer Registries;
ICD-O-3, International Classification of Diseases for Oncology, Third Edition;
ICCC, International Classification of Childhood Cancer;
IDH1/2, Isocitrate Dehydrogenase 1/2;
IRR, Incidence Rate Ratio;
MGMT, O-6-Methylguanine-DNA Methyltransferase;
NAACCR, North American Association of Central Cancer Registries;
NCHS, National Center for Health Statistics;
NCI, National Cancer Institute;
NOS, Not Otherwise Specified;
NPCR, National Program of Cancer Registries; NPCR-CSS, NPCR Cancer Surveillance System;
NVSS, National Vital Statistics System;
SEER, Surveillance, Epidemiology, and End Results;
SHH, Sonic Hedgehog;
SSDI, Site-Specific Data Items;
SSF, Site-Specific Factors;
TP53, 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;
WNT, Wingless

DISCLAIMER

CBTRUS is a not-for-profit corporation which gathers and disseminates epidemiologic data on primary brain and other CNS 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.
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John Villano, M.D., Ph.D., Professor, Division of Medical Oncology, University of Kentucky Markey Cancer Center, Lexington, KY

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.

Forjaz G, et al. An updated histology recode for the analysis of primary malignant and nonmalignant brain and other central nervous system tumors in the Surveillance, Epidemiology, and End Results Program. Neurooncol Adv. 2020 Dec 8;3(1):vdaa175. doi: 10.1093/noajnl/vdaa175. PMID: 33506208; PMCID: PMC7813198.
*This manuscript describes the development of an updated classification scheme for brain and other CNS tumors for inclusion in the SEER*explorer system and other SEER data products.*

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.

Neff C, et al. "Complete prevalence of primary malignant and non-malignant brain tumors in comparison to other cancers in the United States." 2023 Aug 15;129(16):2514-2521. doi: 10.1002/cncr.34837.
This analysis included the first complete estimates for the prevalence of both primary malignant and non-malignant brain and other central nervous system tumors in the United States as of 2019, an update to previous results.

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."
2022 Sep 6;24(Suppl 3):iii1-iii38. doi: 10.1093/neuonc/noac161.
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 AYA (ages 15-39).

Ostrom QT, et al. "National-level overall survival patterns for molecularly-defined diffuse glioma types in the United States." Neuro Oncol. 2023 Apr 6;25(4):799-807. doi: 10.1093/neuonc/noac198. PMID: 35994777; PMCID: PMC10076944.
This manuscript describes the initial patterns of survival observed in common molecularly defined brain and other CNS histopathologies using newly defined ICD-O-3 histology codes and brain molecular marker (BMM) data, and it emphasizes the importance of collecting these data for cancer surveillance.

Ostrom Q, et al. "The Central Brain Tumor Registry of the United States Histopathological Grouping Scheme Provides Clinically Relevant Brain and other Central Nervous System Categories for Cancer Registry Data." J Registry Manag. 2022 Winter;49(4):139-152.
This analysis confirms that patterns of brain and other CNS tumor incidence are largely consistent across independent cancer registry databases, including those from CBTRUS and CiNA, when using the CBTRUS histopathology grouping, which further supports the use of this grouping in CNS cancer surveillance and research.

Ostrom QT, et al. "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.

Price M, et al. "Capturing evolving definitions of 12 select rare CNS tumors: a timely report from CBTRUS and NCI-CONNECT." J Neurooncol.
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.

Price M, et al. "Childhood, adolescent, and adult primary brain and central nervous system tumor statistics for practicing healthcare providers in neuro-oncology, CBTRUS 2015-2019." Neurooncol Pract.
A special, condensed CBTRUS Statistical Report designed to be a streamlined and useful resource for practicing clinicians.

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.

Walsh KM, et al. "The joint impacts of sex and race/ethnicity on incidence of grade 1 versus grades 2-3 meningioma across the lifespan." Neurooncol Adv. 2023 Jun 3;5(Suppl 1):i5-i12. doi: 10.1093/noajnl/vdad020. PMID: 37287573; PMCID: PMC10243865.
This manuscript assesses the relationship between sex, age, and race/ethnicity on the incidence of grade 1 and grades 2-3 meningioma in the United States.

Affiliations

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

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