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CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2011–2015

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Introduction

The objective of the *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2011–2015* is to provide a comprehensive summary of the current descriptive epidemiology of primary brain and other central nervous system (CNS) tumors in the United States (US) population. CBTRUS obtained the latest available population-based data on all newly diagnosed primary brain and CNS tumors from the Centers for Disease Control and Prevention's (CDC) National Program of Cancer Registries (NPCR), and the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) program for diagnosis years 2011–2015. Incidence counts and rates of primary malignant and non-malignant brain and other CNS tumors are presented by histology, sex, age, race, and Hispanic ethnicity. Mortality rates calculated using the National Vital Statistics System (NVSS) data from 2011–2015, and relative survival rates for selected malignant and non-malignant histologies calculated using SEER data for the period 2000–2015 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 US (for more information on CBTRUS see: http://www.cbtrus.org/aboutus.html).[1] CBTRUS was incorporated as a nonprofit 501(c)(3) in 1992 following a study conducted by the American Brain Tumor Association (ABTA) to determine the feasibility of a central registry focused on primary brain and other CNS tumors in the US.

This report represents the twenty-sixth (26th) anniversary of CBTRUS and the twenty-first (21st) statistical report published by CBTRUS. For this seventh (7th) report published as a supplement to *Neuro-Oncology*, the official journal of the Society for Neuro-Oncology (http://www.soc-neuro-onc.org), CBTRUS continues its past efforts to provide the most up-to-date population-based incidence rates for all primary brain and other CNS tumors by histology, age, sex, race, and Hispanic ethnicity. These data have been organized by clinically relevant histology groupings and reflect the *2007 World Health Organization (WHO) Classification of Tumours of the Central Nervous System*.[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 lead to clues that will stimulate research into the causes of this group of diseases, which cause significant morbidity and mortality.

CBTRUS is currently the only population-based site-specific registry in the US that works in partnership with a public cancer surveillance organization, the CDC's NPCR, and from which data are directly received through the NPCR Cancer Surveillance System (NPCR-CSS) Submission Specifications mechanism[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] and 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] 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 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 insure that these data are as accurate and complete as possible. As a surveillance partner, CBTRUS reports high-quality data on brain and other CNS tumors with histological specificity useful to the communities it serves.

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

Technical Notes

Data Collection

CBTRUS does not collect data directly from patients' medical records. Registration of individual cases is conducted by cancer registrars at the institution where diagnosis or treatment occurs and is then transmitted to the CCR, which further transmits this information to NPCR or SEER. As noted, data for CBTRUS analyses come from the NPCR and SEER programs. By law, all primary malignant and non-malignant brain and other CNS tumors are reportable diseases. Hence, tumor registrars in treatment centers collect these data and send this information to the CCR in their state where they are collated, de-identified, and sent to NPCR and SEER. Brain and other CNS tumors are reported using the site definition described in Public Law 107–260.[6] CCR play an essential role in the collection process. These data are population-based and represent a comprehensive documentation of all cancers diagnosed within a geographic region for the years included in this report.

CBTRUS obtained incidence data from 52 CCR (47 NPCR and 5 SEER) that include cases of malignant and non-malignant (benign and uncertain) primary brain and other CNS tumors. The population-based CCR include 50 state registries, the District of Columbia, and Puerto Rico. **Data were requested for all newly-diagnosed primary malignant and non-malignant tumors from 2011 to 2015 at any of the following anatomic sites: brain, meninges, spinal cord, cranial nerves, and other parts of the central nervous system, pituitary and pineal glands, and olfactory tumors of the nasal cavity** (Table 1).[11]

NPCR provided data on 388,786 primary brain and other CNS tumors diagnosed from 2011 to 2015. An additional 16,633 primary brain and CNS tumor case records for the period were obtained from SEER. These data were combined into a single data set for analyses. A total of 10,105 records (2.5%) were deleted from the final analytic data set for one or more of the following reasons: invalid site/histology combination according to the CBTRUS histology grouping scheme, duplicate records that included a less accurate reporting source than microscopic confirmation (e.g. radiographic versus microscopic confirmation. Microscopic confirmation may also be referred to as histologic confirmation), duplicate records for bilateral vestibular schwannoma or meningioma, duplicate record for recurrent disease, and errors in time sequence of diagnosis. The final analytic data set included 392,982 records from the 50 state CCR and the District of Columbia, and an additional 2,332 cases from Puerto Rico. **Cases from Puerto Rico were included only in a supplementary analysis available online, and these cases are not included in the overall statistics presented by this report.**

Age-adjusted incidence rates per 100,000 population for the entire US 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.[10] This database includes both NPCR and SEER data and represents the entire US population.

Survival data for malignant brain and other CNS tumors were obtained from 18 SEER registries for the years 2000 to 2015, and survival data for non-malignant brain and other CNS tumors were obtained from 18 SEER registries for the years 2004 to 2015. This dataset provides population-based information for approximately 28% of the US population,[12] and is a subset of the data used for the incidence calculations presented in this report. Survival information derived from active patient follow-up is not available in the data that CBTRUS receives from NPCR registries, so the SEER data are used for the generation of these tables. SEER registries are chosen to be representative of the total US population, but it is possible that the results obtained from analysis of this subset of cases may not be generalizable to the overall population.

Mortality data used in this report are from the National Center for Health Statistics and include deaths where primary brain or other CNS tumor was listed as cause of death on the death certificate for individuals from all 50 states and the District of Columbia. These data were obtained from the NVSS[13] (which 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, and these data are not included under cancer registration mandates. 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 classified as non-cancer deaths if cancer is not listed as the underlying cause of death.

Definitions

Measures in Surveillance Epidemiology

This report presents the following population-based measures: incidence rates, mortality rates, and relative survival rates (for more information on definitions of terms and measures used see: http://www.cbtrus.org/glossary/glossary1.html).

Classification by Behavior, Histology, and World Health Organization (WHO) Grade

There are over 100 histologically distinct types of primary CNS tumors, each with its own spectrum of clinical

presentations, treatments, and outcomes. This report uses the most recent 2012 CBTRUS histology grouping scheme (Table 2). This classification scheme utilizes ICD-O-3 codes[11] and may include morphology codes that were not previously reported to CBTRUS.[14] In this report, incidence rates are provided by major histology grouping and specific histology.

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

This report also utilizes the International Classification of Childhood Cancer (ICCC) grouping system for pediatric cancers. ICCC categories for this report were generated using the SEER Site/Histology ICCC-3 Recode[15] based on the ICCC, Third edition[16] and 2007 WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues[17] (See online Supplementary Table 1 for more information on this classifications scheme). The ICCC was developed in order to provide a standard classification of childhood tumors for comparing incidence and survival across regions and time periods. As shown, the online Supplementary Table 8 age group category total, age 0–19 year age group count, and age-specific and age-adjusted rates are equivalent to those presented throughout this report, even though the histology grouping scheme differs from that used by CBTRUS.

Unlike other types of cancer, primary brain and other CNS tumors are not staged. They are classified according to the *WHO 2000 Classification of Tumours of the Central Nervous System*[18] which assigns a grade (grade I through grade IV) based on predicted clinical behavior. Though the WHO classification scheme was also updated in 2007[2] and 2016[19] these updated schema will not be fully implemented by US CCR until collection year 2018 or reporting year 2021. Updates made in 2007 may affect diagnostic practices used in characterization of individual tumors included in this report, though the newest revision would not affect any cases included in this report. With the increased recognition of the value of biomarkers for specific brain tumor histologies in classification, the *WHO Classification of Tumours of the Central Nervous System* has included biomarkers in its 2016 revision. However, implementing the collection of these markers in cancer registration is multi-faceted, and this collection began in the United States in 2018.

WHO grading assignments are recorded by cancer registrars as Collaborative Stage Site-Specific Factor 1 - WHO Grade Classification according to the American Joint Commission on Cancer's (AJCC) Collaborative Staging (CS) schema.[20] This variable has been a required component of cancer registry data collection for brain and other CNS tumors since 2004 for SEER registries, and since 2011 for NPCR registries, and completeness of this variable has improved significantly over time.[21] Completeness of this variable is defined as having a value equal to WHO grade I, II, III, or IV. Cases where WHO grade is marked as not applicable or not documented are considered incomplete. It is not possible to conclusively determine WHO grade, which is based on the appearance of tumor cells, when a tumor is radiographically confirmed only. Some tumor types (including tumors of the pituitary and lymphomas) are not assigned a WHO grade. This information may also be assigned but not included in the pathology report.

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 broadly based on the categories and site codes defined in the SEER Site/Histology Validation List.[22] See Table 1 for an overview of CBTRUS primary site groupings. The CBTRUS Site/Validation List can be found on the CBTRUS website (http://www.cbtrus.org).

Measurement and Statistical Methods

Counts, means, rates, ratios, proportions, and other relevant statistics were calculated using R 3.4.3 statistical software[23] and/or SEER*Stat 8.3.5.[24] Figures were created in R 3.4.3 using rgeos, rgdal, maptools, ggplot2, plotrix, and SEER2R statistical packages.[23,25–30] 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.

Population data for each geographic region were obtained from the SEER program website[31] for the purpose of rate calculation. All rates presented in this statistical report are **age-adjusted**. Crude incidence rates are calculated by dividing the total number of cases by the total population, and cannot be compared to crude rates from other populations where the age distribution is different. Age-adjustment is a technique that is used to enable comparison between groups with different age distributions, such as rates between different states. Rates that have been age-adjusted are estimates of what the crude rate would be if the age distribution was equivalent to a standard population. Age-adjusted incidence rates and 95% confidence intervals were estimated per 100,000 population, based on one-year age groupings and standardized to the 2000 US standard population.[32] The age distribution of the 2000 US standard population is shown online in Supplementary Table 2. Combined populations for the regions included in this report are also shown online in Supplementary Table 3 and Supplementary Table 4.

CBTRUS presents statistics on the pediatric and adolescent age group 0–19 years as suggested by clinicians for clinical relevance. However, the 0–14 year age group is a standard age category for childhood cancer used by other cancer surveillance organizations and has been included in this report for consistency and comparison purposes. Race categories in this report are all races, White, Black, American Indian/Alaskan Native (AIAN), and Asian/Pacific Islander (API). Other race, unspecified, and unknown race are included in statistics that are not race-specific. Hispanic ethnicity was defined using the NAACCR Hispanic

Identification Algorithm, version 2, data element, which utilizes a combination of cancer registry data fields (Spanish/Hispanic Origin data element, birthplace, race, and surnames) to directly and indirectly classify cases as Hispanic or non-Hispanic.[33] The United States Department of Agriculture's 2013 Rural Urban Continuum Codes (RUCCs), which classify counties by population size and proximity to a metropolitan area, were used to classify counties as rural or urban (rural RUCC = 4–9; urban RUCC = 1–3).[34]

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 through the use of 95% confidence intervals (95% CI), which were calculated for all presented rates. 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 confidence intervals of two estimates do not overlap, these values are considered significantly different with a less than 5% probability of happening by chance. The second method used is the calculation of p-values. A p-value is the probability of finding the observed or more extreme results by chance alone, and a p-value of <0.05 (or <5% chance of results being due to chance) is conventionally used as a cut-off for considering a value statistically significant. Therefore, a p-value <0.0001 could be interpreted as meaning the observed value (or a more extreme value) had a <0.01% chance of occurring by chance alone and the difference can be considered statistically significant at the 0.01% level.

Brain Tumor Definition Differences

NPCR, SEER, and NAACCR report brain tumors differently from CBTRUS. The definition of 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 central nervous system tumors (C70.0–9, C71.0–9, and C72.0–9), but *excludes* lymphoma and leukemia histologies (9590–9989) from all brain and other CNS sites.[3] In contrast, CBTRUS reports data on all tumor morphologies located within the Consensus Conference site definition including lymphoma and other hematopoietic histologies, as well as olfactory tumors of the nasal cavity [C30.0 (9522–9523)].[14] Additionally, CBTRUS reports data on all brain and other CNS tumors irrespective of behavior, whereas many reporting organizations may only publish rates for malignant brain and other CNS tumors. **These differences in definition therefore influence the direct comparison of published rates.**

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

Estimation of Expected Numbers of Brain and Other CNS Tumors in 2018 and 2019

Estimated numbers of expected malignant and non-malignant brain and other CNS tumors were calculated for 2018 and 2019. To project estimates of newly diagnosed brain and other CNS tumors in 2018 and 2019, age-adjusted annual brain tumor incidence rates were generated for 2000–2015 for malignant tumors, and 2006–2015 for non-malignant tumors. These were generated by state, age, and histologic type. Joinpoint 4.2.0.2[35] was used to fit regression models to these incidence rates,[36] which were used to predict numbers of cases in future years using the parameter from the selected models. Joinpoint regression allows for multiple lines to be fit to incidence data across time, rather than assuming a consistent trend across the whole period. The points where these lines intersect are called 'joinpoints'. The models allowed for a maximum of two joinpoints (one for non-malignant tumors), a minimum of three observations from a joinpoint to the initial or final observation, and a minimum of three observations between joinpoints.[37] Modified Bayesian Information Criterion procedures included in Joinpoint were used to select the best fitting model. The overall totals presented are based on total malignant and non-malignant incidence, and the presented stratified rates may not add up to these totals. Estimated numbers of cases are highly dependent on input data. Different patterns of incidence within strata can significantly affect the projected estimates, especially when the number of cases within a stratum is low. As a result, strata-specific estimates may not equal the total estimate presented. **Caution should be used when utilizing these estimates.**

Estimation of Mortality Rates for Brain and Other CNS Tumors

Age-adjusted mortality rates for deaths resulting from all malignant brain and other CNS tumors were calculated using the mortality data available in SEER*Stat Online Database provided by National Center for Health Statistics (NCHS) per 100,000 population.[13] In addition to the total age-adjusted rate for the US, age-adjusted rates are presented by sex and state.

Estimation of Survival Rates

SEER*Stat 8.3.5 statistical software was used to estimate one-, two-, three-, four-, five-, and ten-year relative survival rates for primary malignant brain and other CNS tumor cases diagnosed between 2000–2015 in 18 SEER areas[24,38] and for primary non-malignant brain and other CNS tumor cases diagnosed between 2004–2015. This software utilizes life-table (actuarial) methods to compute survival estimates and accounts for current follow-up. Second or later primary tumors, cases diagnosed at autopsy, cases in which race or sex is coded as other or unknown, and cases known to be alive but for whom follow-up time could not be calculated, were excluded from survival data analyses.

Estimation of Time Trends

Joinpoint 4.2.0.2[35] was used to estimate incidence time trends, and generate annual percentage changes (APC) and

95% confidence intervals. The models allowed for a maximum of two joinpoints (two 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.[37] APC is the average percent change in incidence per year over the period included in the trend segment. Time trends analysis methods were used to estimate if the APC is 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 the initial or final observation.

Data Interpretation

The CBTRUS works diligently to support the broader surveillance efforts aimed at improving the collection and reporting of primary brain and other CNS tumors. CCR data provided to NPCR and SEER and, subsequently, to CBTRUS vary from year-to-year due to ongoing updates in collection and data refinement aimed to improve completeness and accuracy. **Therefore, it is important to note that data from previous CBTRUS Reports cannot be compared to data in this current report, *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2011–2015. This current report supersedes all previous reports in terms of coverage of the US population with the most up-to-date information, 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 counted primary tumor cases to the data included in this report. The 392,982 tumors cases included in this report came from 387,954 individuals. Of these 387,954 individuals, there were 4,806 individuals (1.2%) that contributed information on multiple tumors (two or more) to this report.
- Random fluctuations in average annual rates are common, especially for rates based on small case counts. The CBTRUS policy to suppress data presentation for cells with counts of fewer than 16 cases is consistent with the NPCR policy.
- A 2007 policy change guiding the Veterans Health Administration (VHA) resulted in underreporting of cancer data—especially for men—to CCR. 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.[39,40]
- 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.[41,42] The SEER program allows for reporting delay of up to 22 months prior to public data release, but additional cases may still be discovered after that point.[43] 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. Type of diagnostic confirmation may also lead to increased reporting delay, with histologically confirmed tumors being subject to less reporting delay than radiographically confirmed tumors. In 2016, a study assessing the incidence of non-malignant brain and other CNS tumors corroborated the large variation in incidence between CCR reported in this statistical report.[44] The reasons for this variation remain inconclusive but what 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 CCR, there is potential evidence of underreporting of non-malignant brain and other CNS tumors; the extent to which cannot be quantified.[44]
- 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.[45,46]

CBTRUS editing practices are conducted yearly. These practices are aimed at refining the data for accuracy and clinical relevance and play a role in interpreting these report data. Exclusion of site and histology combinations considered invalid by the consulting neuropathologists who revised the CBTRUS site/histology validation list in 2012 may have the impact of underestimating the incidence of brain and other CNS tumors. Editing changes, such as the Multiple Primary and Histology Rules issued in 2007 and revised in 2018,[47,48] also incorporate updates to the cancer registration coding rules that influence case ascertainment and data collection.[3]

Supplemental Online-only data

CBTRUS has made supplemental additional figures and tables available online only. These materials are noted in the text as online supplementary tables and figures.

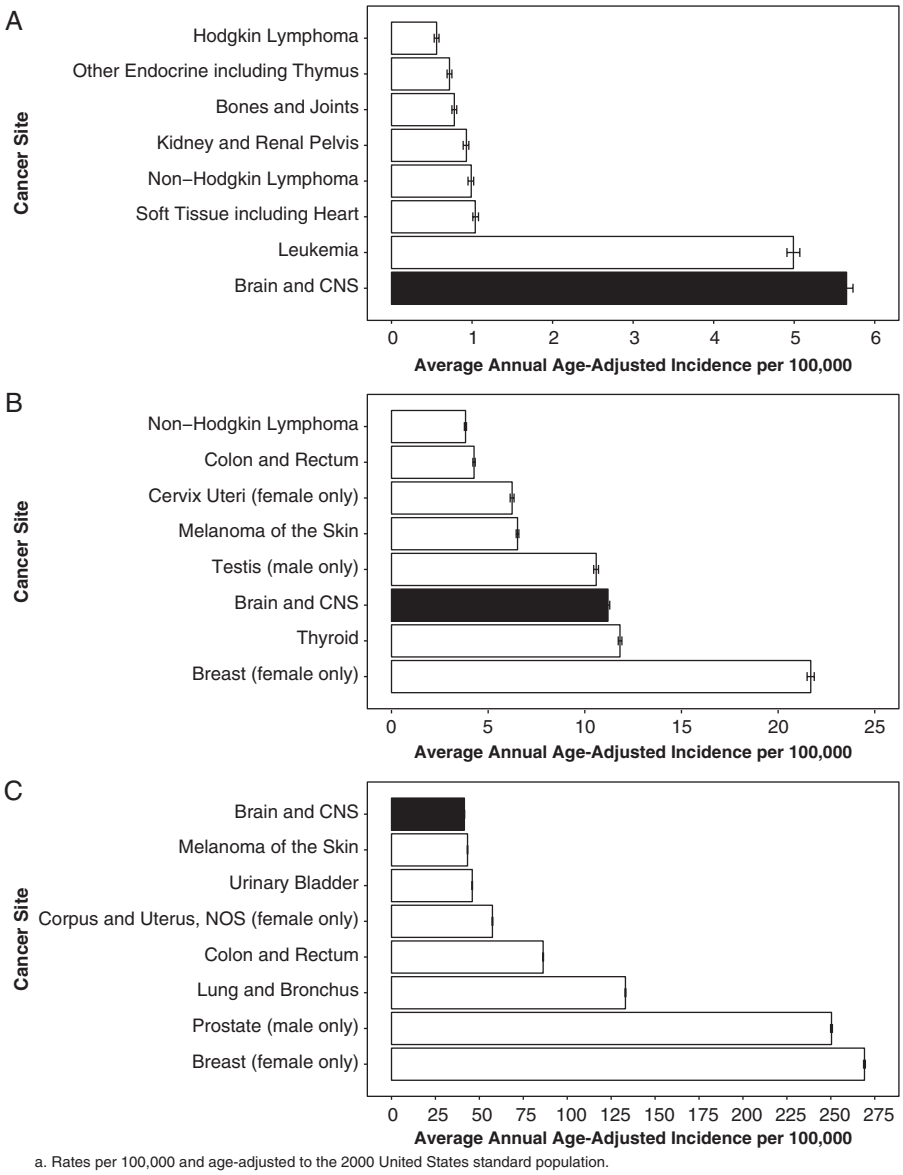
Results

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

Average annual age-adjusted incidence rates for primary brain and other CNS tumors (2011–2015) and a

selection of common cancers (USCS, 2011–2015) in the US are presented by age in Fig. 1A Children (Age 0–14 Years), Fig. 1B: Adolescents and Young Adults (Age 15–39 Years), and Fig. 1C: Older Adults (Age 40+ Years). Incidence rates stratified by sex are presented by age online in Supplementary Figure 1 and Supplementary Figure 2, respectively.

- Brain and other CNS tumors (both **malignant** and **non-malignant**) were the most common cancer site in persons age 0–14 years, with an average annual age-adjusted incidence rate of 5.65 per 100,000 population. Brain and other CNS tumors were the most common cancer in both males and females in this age group.
- Leukemia was the second most common neoplasm in persons age 0–14 years, with an average annual age-adjusted incidence rate of 4.99 per 100,000 population. Leukemia was the second most common cancer in both males and females in this age group.
- Testicular cancer was the most common cancer in males age 15–39 years, with an average annual age-adjusted incidence rate of 10.59 per 100,000.
- Breast cancer was the most common cancer among females age 15–39 years, with an average annual age-adjusted incidence rate of 21.69 per 100,000.
- Brain and other CNS tumors (both **malignant** and **non-malignant**) among those age 15–39 years had an average annual age-adjusted incidence of 11.20 per 100,000



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

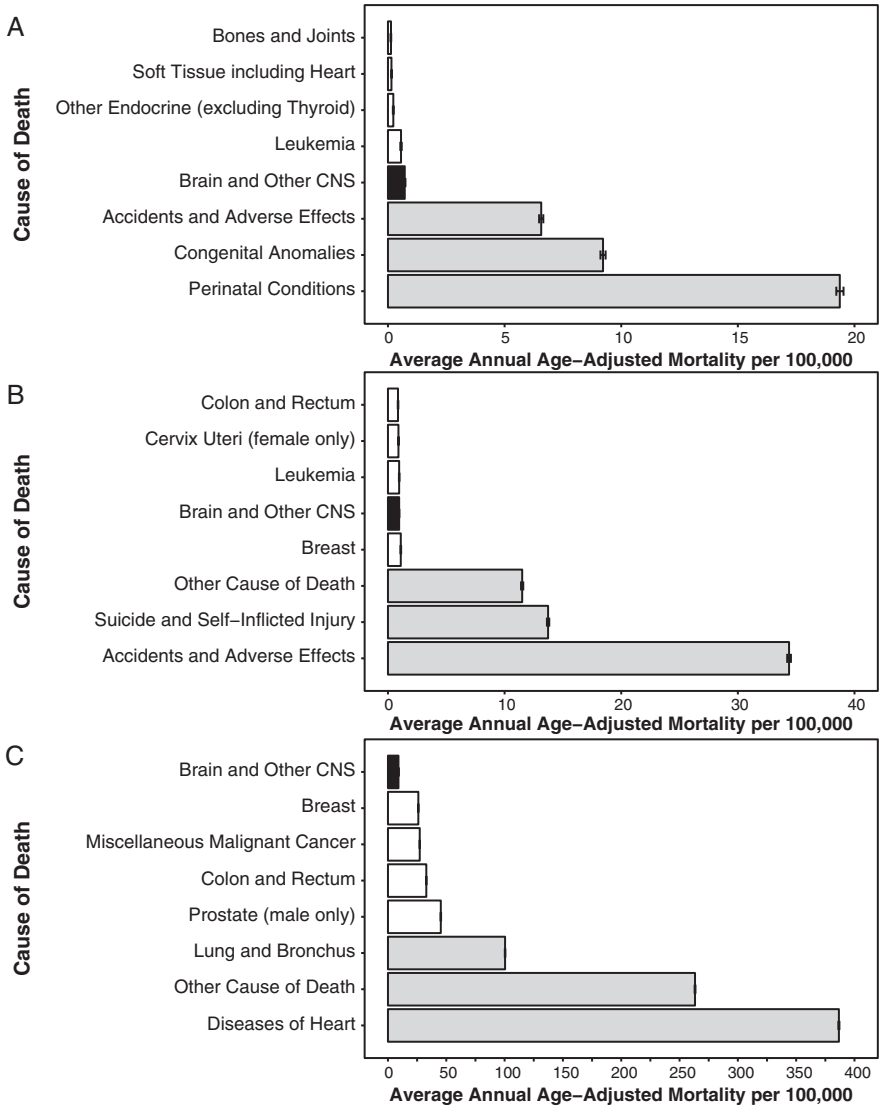
Fig. 1 Average Annual Age-Adjusted Incidence Rates[a] with 95% Confidence Intervals of All Primary Brain and Other CNS Tumors in Comparison to the Top Eight Highest Incidence Cancers for A) Children Age 0–14 Years, B) Adolescents and Young Adults Age 15–39 Years, and C) Older Adults Age 40+ Years, CBTRUS Statistical Report: NPCR and SEER 2011–2015, USCS 2011–2015.

population. These tumors were the second most common cancer in males in this age group, and the third most common cancer in females in this age group.

- Prostate and breast cancer were the most common cancers among those age 40+ years in the US, with average annual age-adjusted incidence rates of 250.91 per 100,000 population (males only) and 269.15 per 100,000 population (females only), respectively.[10]
- Brain and other CNS tumors (both **malignant** and **non-malignant**) were the eighth most common cancer among persons age 40+ years with an average annual age-adjusted incidence of 44.47 per 100,000 population. These tumors were the eighth most common cancer among males and the fifth most common cancer among females in this age group.

Average annual age-adjusted mortality rates for primary malignant brain and other CNS tumors, a selection of common cancers, and the top three non-cancer causes of death in the US are presented by age in Fig. 2A: (Age 0–14 Years), Fig. 2B: (Age 15–39 Years), and Fig. 2B: (Age 40+ Years). Mortality rates for males only and females only are presented by age in online Supplementary Figure 3 and Supplementary Figure 4, respectively.

- The most common causes of death in persons age 0–14 years were conditions originating in the perinatal period (19.37 per 100,000). **Malignant** brain and other CNS tumors among persons age 0–14 years had an average annual age-adjusted mortality rate of 0.72 per 100,000 and were the eighth most common cause of death in this age group, and the most common cause of cancer death.



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

Fig. 2 Average Annual Age-Adjusted Mortality Rates[a] with 95% Confidence Intervals of All Primary Brain and Other CNS Tumors in Comparison to the Top Five Causes of Cancer Death and Top Three Non-Cancer Causes of Death for A) Children Age 0–14 Years, B) Adolescents and Young Adults Age 15–39 Years, and C) Older Adults Age 40+ Years, CBTRUS Statistical Report: NVSS 2011–2015.

- Childhood brain and other CNS tumors, while rare, contributes substantially to cancer-related mortality in this population, surpassing other cancers as the top reason for cancer mortality in those age 0–14 at diagnosis.[49]
- Accidents and adverse effects were the leading causes of death in persons age 15–39 years (34.39 per 100,000). **Malignant** brain and other CNS tumors among persons age 15–39 years had an average annual age-adjusted mortality rate of 0.96 per 100,000 and were the thirteenth most common cause of death in this age group and the second most common cause of cancer death, where their average annual age-adjusted mortality rate was equal to that of leukemia.
- Heart disease was the largest contributor to mortality in persons age 40+ years in the US, with an average annual age-adjusted mortality rate of 386.63 per 100,000 for major cardiovascular diseases. **Malignant** brain and other CNS tumors among persons age 40+ years had an average annual age-adjusted mortality rate of 9.01 per 100,000, and were the twenty-ninth most common cause of death and the fourteenth most common cause of cancer death.

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

Counts and rates from the 392,982 incident brain and other CNS tumors (121,277 malignant; 271,705 non-malignant shown in Fig. 3) reported during 2011–2015 by histology and demographic characteristics for all ages are presented in Table 3. Counts and rates are shown by histology and behaviors for selected histologies where there are sufficient amounts of cases to calculate rates. The predominant tumor categories by behavior are presented online in Supplementary Figures 5–6.

Incidence by Year and Behavior

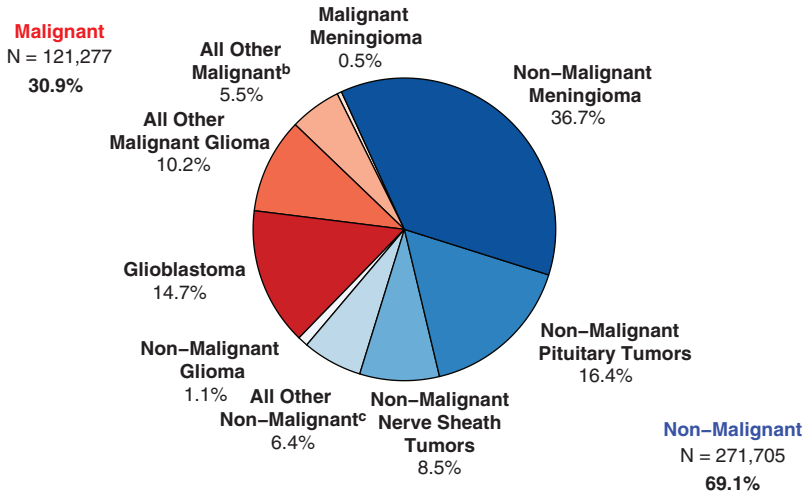
Fig. 4 presents the overall annual age-adjusted incidence rates of all primary brain and other CNS tumors by year, 2011–2015, and behavior. The incidence rates for all primary brain and other CNS tumors, 2011–2015, did not differ substantially by year (both overall and by behavior). Annual age-adjusted incidence rates stratified by sex are presented online in Supplementary Figures 7–8.

Distribution of Tumors by Site and Histology

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

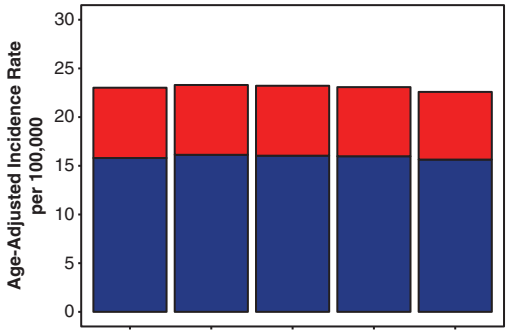
- Overall, the most common tumor site was the meninges, representing 36.8% of all tumors.
- Frontal (8.2%), temporal (6.0%), parietal (3.5%), and occipital lobes (1.0%) accounted for 18.7% of all tumors.
- The cranial nerves and the spinal cord/cauda equina accounted for 10.1% of all tumors.
- The pituitary and craniopharyngeal duct accounted for 17.5% of all tumors.
- For **malignant** tumors, frontal (23.9%), temporal (17.5%), parietal (10.4%), and occipital (2.7%) accounted for 54.5% of tumors (Fig. 5B).
- For **non-malignant** tumors, 53.0% of all tumors occurred in the meninges (Fig. 5C).

Distribution of brain and other CNS tumors by site in males only is shown online in Supplementary Figure 9, and



a. Percentages may not add up to 100% due to rounding; b. Includes histologies with ICD-O-3 behavior code of /3 (Malignant) 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, other neoplasms related to the meninges, lymphoma, other hematopoietic neoplasms, germ cell tumors, cysts and heterotopias, tumors of the pituitary, craniopharyngioma, hemangioma, neoplasm unspecified, and all other (Table 2); c. Includes histologies with ICD-O-3 behavior code of /0 or /1 (Benign or Uncertain) 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 neoplasms related to the meninges, other hematopoietic neoplasms, germ cell tumors, cysts and heterotopias, craniopharyngioma, hemangioma, neoplasm unspecified, and all other (Table 2).

Fig. 3 Distribution[a] of Primary Brain and Other CNS Tumors by Behavior (N = 392,982), CBTRUS Statistical Report: NPCR and SEER, 2011–2015.



	2011	2012	2013	2014	2015
Malignant	7.22	7.17	7.18	7.10	6.95
Non–Malignant	15.80	16.13	16.04	15.98	15.64

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

Fig. 4 Annual Age-Adjusted Incidence Rates[a] of Primary Brain and Other CNS Tumors by Year and Behavior, CBTRUS Statistical Report: NPCR and SEER, 2011–2015.

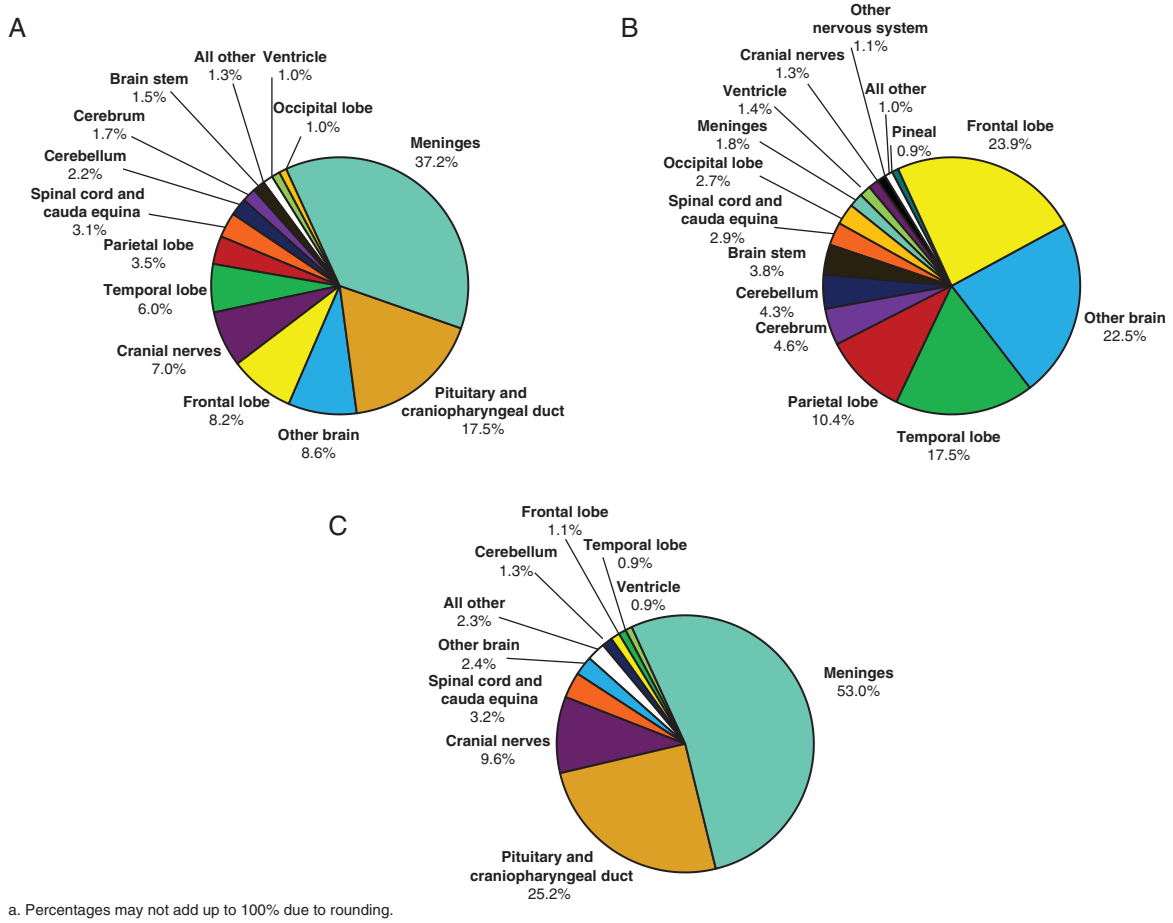
distribution of brain and other CNS tumors by site in females only is shown online in Supplementary Figure 10.

The distribution by brain and other CNS histologies is shown in Fig. 6A.

- **The most frequently reported histology overall was meningioma** (37.1%), followed by tumors of the pituitary (16.5%) and glioblastoma (14.7%).
- Tumors of the pituitary and nerve sheath tumors combined accounted for slightly less than one-fourth of all tumors (25.1%), the vast majority of which were non-malignant.

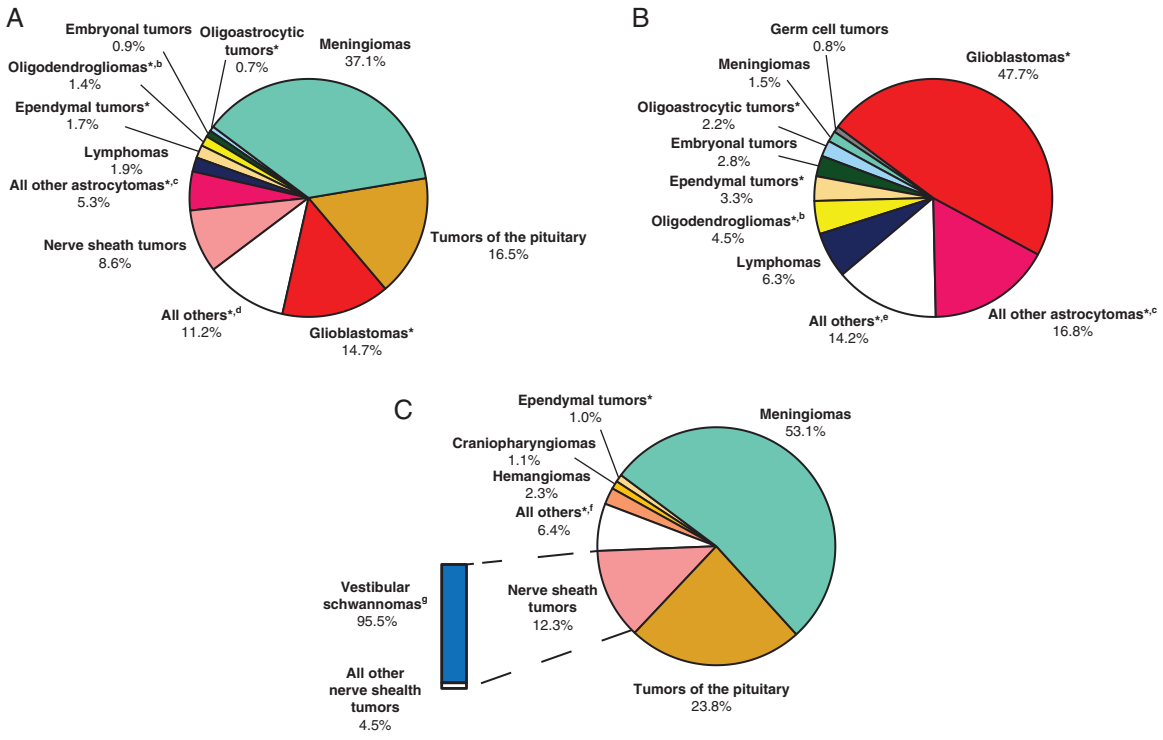
The distribution of malignant and non-malignant brain and other CNS tumors by histology are shown in Fig. 6B and Fig. 6C, respectively, as well as in Table 3.

- The most common of all **malignant** brain and other CNS tumors was glioblastoma (47.7%).
- The most common of all **non-malignant** brain and other CNS tumors was meningioma (53.1%).



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

Fig. 5 Distribution[a] of Primary Brain and Other CNS Tumors by Site and Behavior, A) Overall (N = 392,982), B) Malignant (N = 121,277), and C) Non-Malignant (N = 271,705), CBTRUS Statistical Report: NPCR and SEER, 2011–2015.



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Includes oligodendroglioma and anaplastic oligodendroglioma (Table 2); c. Includes pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); d. Includes glioma malignant, NOS, choroid plexus tumors, other neuroepithelial tumors, neuronal and mixed neuronal-glial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, other hematopoietic neoplasms, hemangioma, neoplasm, unspecified, and all other (Table 2); e. Includes glioma malignant, NOS, choroid plexus tumors, other neuroepithelial tumors, neuronal and mixed neuronal-glial tumors, tumors of the pineal region, nerve sheath tumors, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, other hematopoietic neoplasms, hemangioma, neoplasm, unspecified, and all other (Table 2); f. Includes unique astrocytoma variants, choroid plexus tumors, other neuroepithelial tumors, 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 neoplasms related to the meninges, other hematopoietic neoplasms, germ cell tumors, neoplasm, unspecified, and all other (Table 2).

Fig. 6 Distribution[a] of Primary Brain and Other CNS Tumors by CBTRUS Histology Groupings and Histology and Behavior, A) Overall (N = 392,982), B) Malignant (N = 121,277), and C) Non-Malignant (N = 271,705), CBTRUS Statistical Report: NPCR and SEER, 2011–2015.

- The most common **non-malignant** nerve sheath tumor (based on multiple sites in the brain and CNS) was vestibular schwannoma (defined by histology code 9560, also formerly called acoustic neuromas) (95.5%).

Distribution of brain and other CNS tumors by histology in males only is shown online in Supplementary Figure 11, and distribution of brain and other CNS tumors by histology in females only is shown online in Supplementary Figure 12.

Distribution of Gliomas by Site and Histology

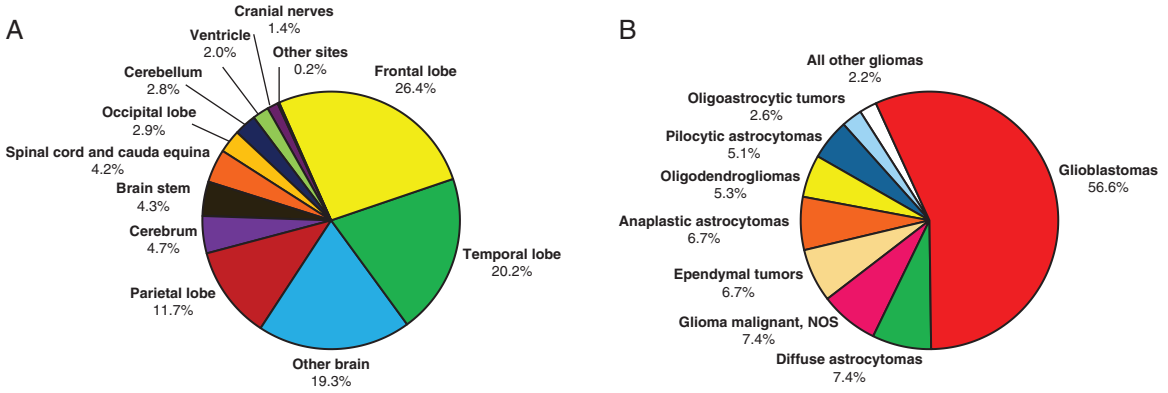
The broad category glioma (ICD-O-3 histology codes 9380–9384, 9391–9460, see Table 2 for more information) represented approximately 26% of all primary brain and other CNS tumors and 81% of malignant tumors. The distribution of gliomas by histology and site are shown in Fig. 7A and Fig. 7B, respectively.

- Glioblastoma accounted for the majority of gliomas (56.6%).
- Astrocytic tumors, including glioblastoma, accounted for 75.8% of all gliomas.
- The majority of gliomas occurred in the supra-tentorium (frontal, temporal, parietal, and occipital lobes combined) (61.2%). Only a very small proportion of gliomas occurred in areas of the CNS other than the brain.

Incidence Rates by Major Histology Grouping, Specific Histologies, and Behavior

Incidence rates overall by major histology grouping, specific histology, and behavior are provided in Table 3.

- Among CBTRUS major histology groupings, incidence rates were highest for tumors of the meninges (8.60 per 100,000 population), followed by tumors of the neuroepithelial tissue (6.57 per 100,000 population), tumors of the sellar region (4.12 per 100,000 population), and tumors of the cranial and spinal nerves (1.96 per 100,000 population).
- Among CBTRUS specific histology groupings, incidence rates were highest for meningiomas (8.33 per 100,000 population), tumors of the pituitary (3.94 per 100,000 population), glioblastomas (3.21 per 100,000 population), and nerve sheath tumors (1.96 per 100,000 population).
- For **malignant** tumors, the incidence rate was highest for glioblastoma (3.21 per 100,000 population), followed by diffuse astrocytoma (0.46 per 100,000 population) and lymphoma (0.43 per 100,000 population).
- For **non-malignant** tumors, the incidence rate was highest for meningioma (8.33 per 100,000 population), followed by tumors of the pituitary (3.94 per 100,000 population).



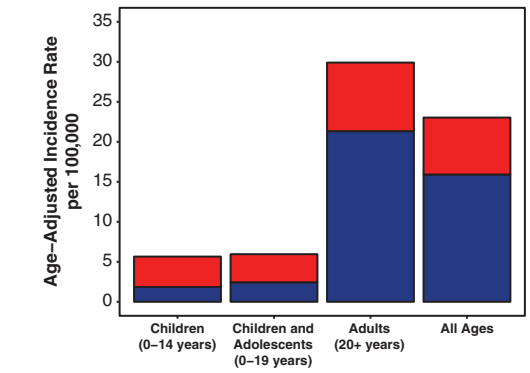
a. Percentages may not add up to 100% due to rounding; b. ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).

Fig. 7 Distribution[a] of Primary Brain and Other CNS Gliomas[b] (N = 102,086) by A) Site and B) Histology Subtypes, CBTRUS Statistical Report: NPCR and SEER, 2011–2015.

Distributions and Incidence by Age

Incidence Rates by Age

The overall average annual age-adjusted incidence rate for 2011–2015 for **all** primary brain and other CNS tumors was 23.03 per 100,000 population (Table 3). The overall incidence rate was 5.65 per 100,000 population for children age 0–14 years, 11.20 per 100,000 population for adolescents and young adults age 15–39 years, and 41.47 per 100,000 population for adults age 40+ years (Table 4). The overall incidence rates of tumors by behavior and age group (age 0–19 years and 20+ years) are shown in Fig. 8. Annual age-adjusted incidence rates stratified by sex are presented in online Supplementary Figures 13–14.



	Children (0–14 years)	Children and Adolescents (0–19 years)	Adults (20+ years)	All Ages
Malignant	3.80	3.51	8.57	7.12
Non-Malignant	1.85	2.44	21.33	15.91

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

Fig. 8 Average Annual Age-Adjusted Incidence Rates[a] of Primary Brain and Other CNS Tumors by Age and Behavior, CBTRUS Statistical Report: NPCR and SEER, 2011–2015.

Incidence Rates by Age and Histology

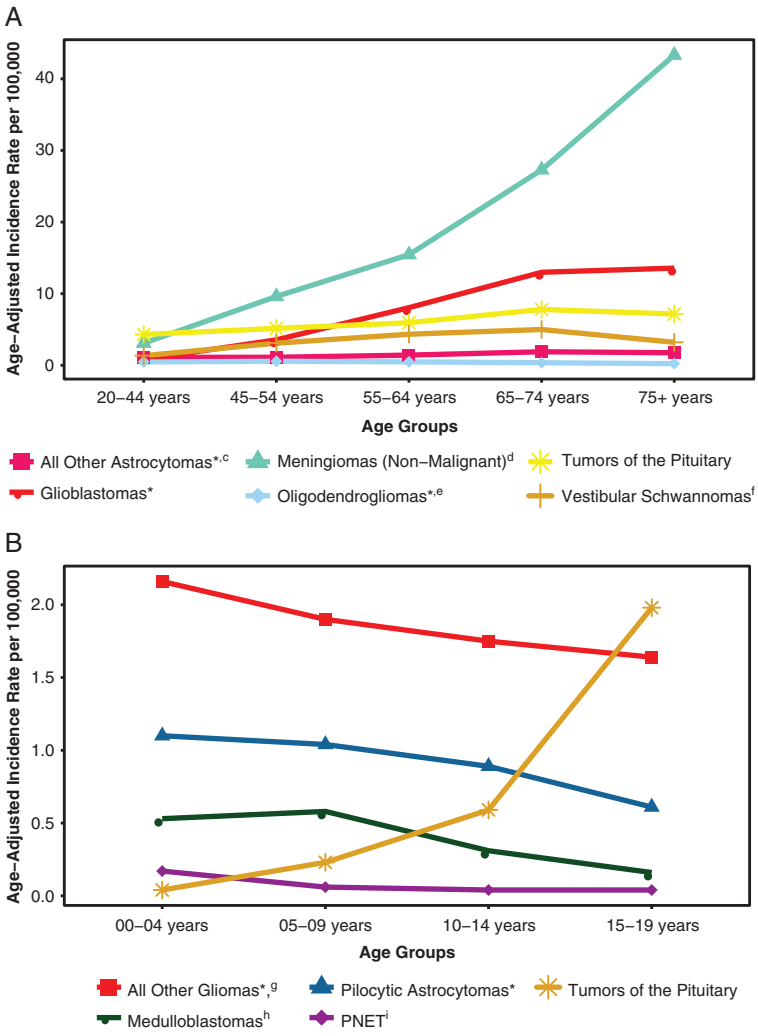
The age-adjusted incidence rates by age and histology at diagnosis are presented in Tables 4–6, as well as in Fig. 9A (Age 20+ Years), and Fig. 9B (Age 0–19 Years).

- The incidence rate for **all** brain and other CNS tumors was highest among age 85+ years (83.75per 100,000 population) and lowest among children and adolescents age 0–19 years (5.94 per 100,000 population).
- Incidence rates of pilocytic astrocytoma, germ cell tumors, and embryonal tumors were higher in the younger age groups and decrease with advancing age.
- Incidence rates of meningioma increased with age.
- Incidence rates declined with increasing age for those ages 0–19 years, particularly for the gliomas and embryonal tumors (primitive neuroectodermal tumor (PNET) and medulloblastoma).
- After peaking in the 0–9 year age group, incidence rates of pilocytic astrocytoma decreased in the age groups 10–14 and 15–19 years.
- The incidence of tumors of the pituitary increased substantially between the 10–14 years age group and 15–19 years age group.
- The incidence rate of PNET peaked in the 0–4 years age group.
- The incidence of medulloblastoma peaked in those age 9 years and younger.

Median Age at Diagnosis

The median age at diagnosis for **all** primary brain and other CNS tumors was 60 years (Table 3).

- The histology-specific median ages ranged from 8 years for embryonal tumors to 69 years for neoplasm, unspecified.
- Pilocytic astrocytoma, choroid plexus tumors, neuronal and mixed neuronal-glial tumors, tumors of the pineal region, embryonal tumors, and germ cell tumors and



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Rates per 100,000 and age-adjusted to the 2000 United States standard population; b. Scales of plot vary by age group; c. ICD-O-3 histology codes: 9381, 9384, 9424, 9400, 9401, 9410, 9411, and 9420, all ICD-O-3 behavior codes; d. ICD-O-3 histology and behavior codes: 9530/0, 9530/1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, and 9539/1; e. ICD-O-3 histology codes: 9450, 9451, and 9460, with ICD-O-3 behavior code of 3; f. ICD-O-3 histology code: 9560, with ICD-O-3 behavior code of 3 (Malignant); g. ICD-O-3 histology codes: 9380-9384, 9391-9420, 9422-9460, and 9480, all ICD-O-3 behavior codes; h. ICD-O-3 histology codes: 9470, 9471, 9472, and 9474, with ICD-O-3 behavior code of 3 (Malignant); i. ICD-O-3 histology code: 9473, with ICD-O-3 behavior code of 3 (Malignant).

Fig. 9 Age-Adjusted Incidence Rates[a] of Brain and Other CNS Tumors by Selected Histologies and Age Group A) Age 20+ Years[b] and B) Age 0–19 Years[b], CBTRUS Statistical Report: NPCR and SEER, 2011–2015.

cysts were histologies with younger median ages at diagnosis compared to other histologies.
- Meningioma and glioblastoma were primarily diagnosed at older ages (median age of 66 and 65 years, respectively).

Distributions and Incidence by Sex

Distribution by Sex and Behavior

- Overall, 42.0% of **all** tumors diagnosed between 2011 and 2015 occurred in males (165,148 tumors) and 58.0% in females (227,834 tumors) (Table 3).
- Approximately 55.4% of the **malignant** tumors occurred in males (67,210 tumors between 2011 and 2015) and 44.6% in females (54,067 tumors between 2011 and 2015).
- Approximately 36.0% of the **non-malignant** tumors occurred in males (97,938 tumors between 2011 and 2015) and 64.0% in females (173,767 tumors between 2011 and 2015).

Incidence Rates by Site and Sex

Incidence counts and average annual age-adjusted rates for brain and other CNS tumors by site and sex are provided in Table 7.

- Incidence rates were highest for tumors located in the meninges (8.35 per 100,000 population) and lowest for

olfactory tumors of the nasal cavity (0.04 per 100,000 population).
- Incidence rates were higher in females than in males for tumors located in the meninges, pituitary and craniopharyngeal duct, and cranial nerves.
- Males had higher incidence rates of tumors located in the frontal lobe, occipital lobe, temporal lobe, parietal lobe, cerebrum, ventricle, cerebellum, brain stem, other brain, spinal cord and cauda equina, other nervous system, pineal, and olfactory tumors of the nasal cavity compared to females.

Incidence Rates by Sex and Histology

Incidence rates by sex and histology are presented in Table 3. Incidence rates for **all** primary brain and other CNS tumors combined were higher among females (25.31 per 100,000 population) than males (20.59 per 100,000 population).

- The incidence rate of tumors of neuroepithelial tissue was higher in males (7.70 per 100,000 population) than in females (5.57 per 100,000 population).
- The incidence rate of tumors of meninges was higher in females (11.54 per 100,000 population) than in males (5.26 per 100,000 population).

Incidence rate ratios (male:female) for selected histologies and histology groupings are shown in Fig. 10.

- Incidence was higher in males for many histologies, such as germ cell tumors ($P < 0.001$), most glial tumors, lymphomas ($P < 0.001$), and embryonal tumors ($P < 0.001$).
- In addition to non-malignant ($P < 0.001$) and malignant ($P = 0.0022$) meningiomas, tumors of the pituitary ($P < 0.001$) were also more common in females than in males.

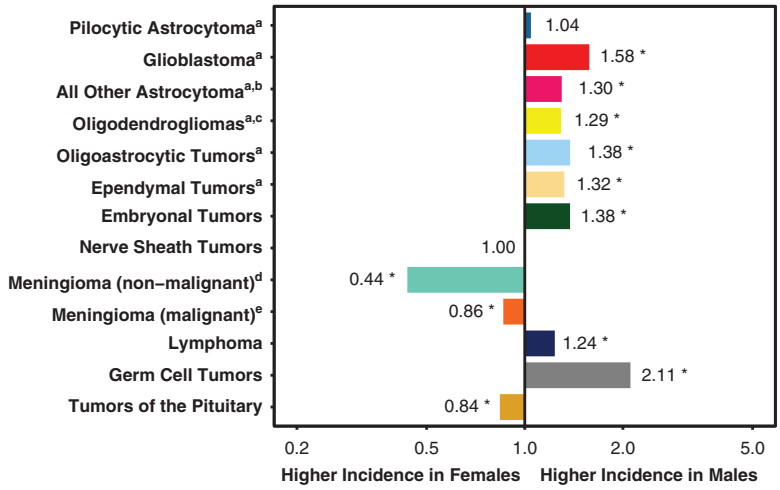
Distribution and Incidence Rates by CCR, Age, Diagnostic Confirmation, and Behavior

The overall number of reported tumors is listed by CCR in Table 8. While most malignant tumors are diagnosed by histologic confirmation (where the patient receives surgery and diagnosis is confirmed by a pathologist), brain and other CNS tumors may also be diagnosed by radiographic confirmation only (where the tumor was visualized on MRI, CT, X-ray, or other imaging technology but surgery was not performed).

- Approximately 69.1% of tumors were **non-malignant**, but there was variation by cancer registry (range: 79.2%-92.8%).
- Overall, 57.6% of tumors were histologically confirmed. A larger proportion of **malignant** tumors were histologically confirmed (85.3%) compared to **non-malignant** tumors (45.3%).
- A slight majority of **non-malignant** brain and other CNS tumors were radiographically confirmed (51.5%).

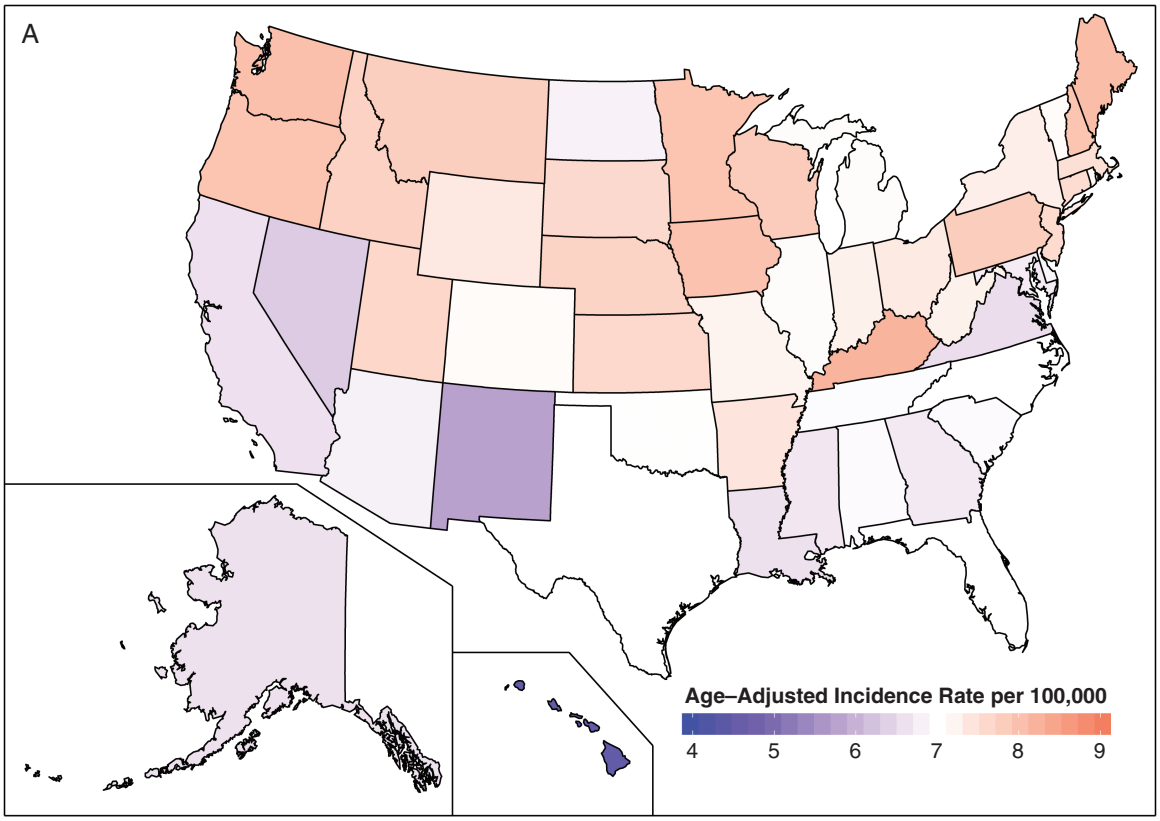
The overall average annual age-adjusted incidence rates by age, behavior, and CCR are presented in Table 9 and Fig. 11.

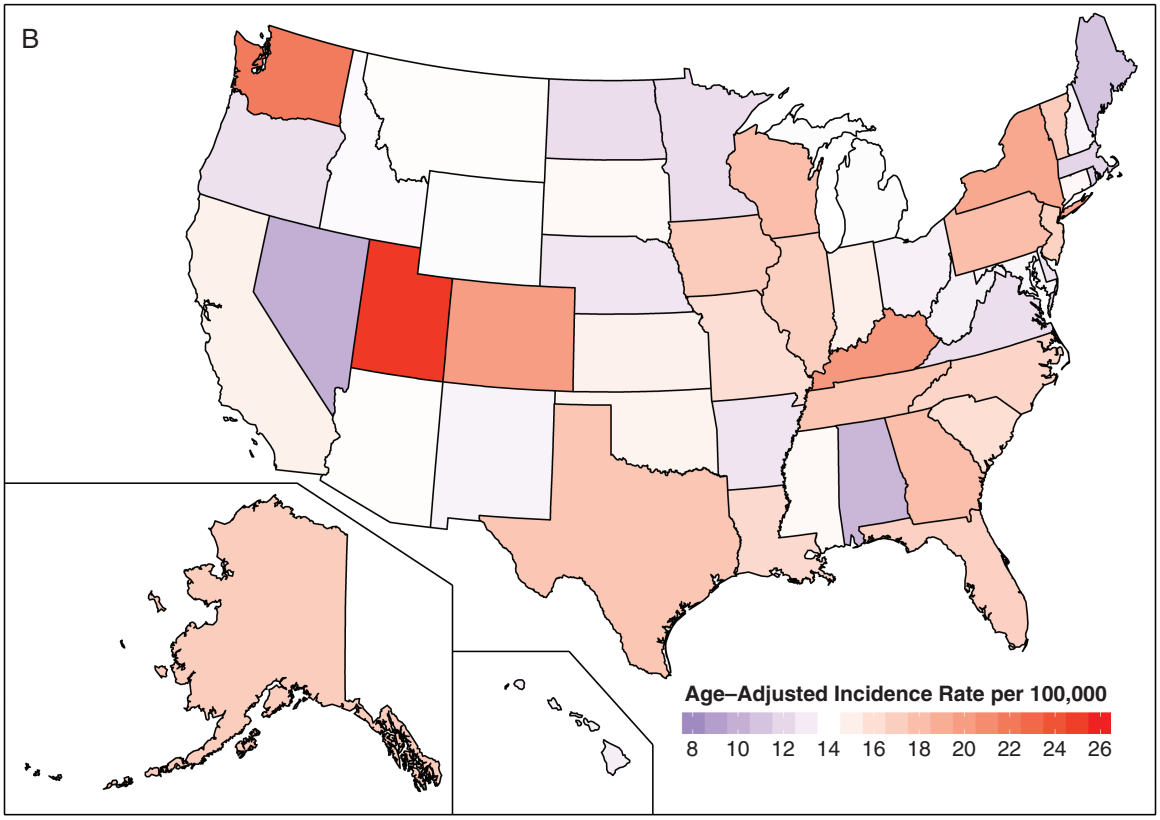
- There was less variation by region for **malignant** tumor incidence rates (Fig. 11A) compared to incidence rates for **non-malignant** tumors (Fig. 11B). CCR and regional variations likely reflect differences in reporting and case ascertainment practices.
- The overall average annual age-adjusted incidence rates of all tumors (**malignant** and **non-malignant**) for each individual CCR ranged from 16.21 to 32.88 per 100,000 population. Please see online Supplementary Figure 13



* Incidence Rate is significantly different between groups at the p<0.05 level.
a. All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2); b. ICD-O-3 histology codes: 9381, 9384, 9424, 9400, 9401, 9410, 9411, and 9420, all ICD-O-3 behavior codes; c. ICD-O-3 histology and behavior codes: 9450/3, 9451/3, and 9460/3; d. ICD-O-3 histology and behavior codes: 9530/0,9530/1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, and 9539/1; e. ICD-O-3 histology and behavior codes: 9530/3, 9538/3, and 9539/3.

Fig. 10 Incidence Rate Ratios by Sex (Males:Females) for Selected CBTRUS Histology Groupings and Histology, CBTRUS Statistical Report: NPCR and SEER, 2011–2015.





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

Fig. 11 Average Annual Age-Adjusted Incidence Rates[a] of A) Malignant Primary Brain and Other CNS Tumors and B) Non-Malignant Primary Brain and Other CNS Tumors by Central Cancer Registry, CBTRUS Statistical Report: NPCR and SEER, 2011-2015[b].

for combined incidence of **malignant** and **non-malignant** tumors by CCR.

- Average annual age-adjusted incidence rates of all primary **malignant** tumors ranged from 4.53 to 8.18 per 100,000 population, and average annual age-adjusted incidence rates of all primary **non-malignant** tumors ranged from 9.88 to 25.25 per 100,000 population.
- Among adults 20 years of age and older, CCR-specific incidence rates ranged from 5.56 to 9.77 per 100,000 population for **malignant** tumors and from 13.29 to 34.26 per 100,000 population for **non-malignant** tumors.
- In persons less than 20 years of age, incidence rates ranged from 1.99 to 4.76 per 100,000 population for **malignant** tumors and from 1.27 to 3.73 per 100,000 population for **non-malignant** tumors.

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

The distribution of reported tumors with histologically confirmed diagnosis from 2011 to 2015 is listed by histology and reported WHO grade in Table 10.

- Overall, 62.0% of tumors had complete WHO grade information, but there was substantial variation by histology.
- The histologic types with the highest WHO grade completeness were anaplastic oligodendroglioma (95.1%), oligoastrocytic tumors (95.1%), and anaplastic astrocytoma (94.2%).

Incidence by Urban or Rural Residence

Incidence counts and average annual age-adjusted rates for brain and other CNS tumors are shown by urban/rural residence and histology online in Supplementary Table 9. Incidence of selected histologies by urban/rural residence is show in Fig. 12.

- The overall incidence of **all** brain and other CNS tumors was 12% higher in urban areas as compared to rural areas (22.87 per 100,000 population and 20.46 per 100,000 population, respectively, $P < 0.0001$).
- Incidence of **malignant** brain and other CNS tumors was slightly higher in urban areas (6.93 per 100,000 population) as compared to rural areas (6.79 per 100,000 population, $P = 0.0132$).
- Incidence of **non-malignant** brain and other CNS tumors was 17% higher in urban areas as compared to rural areas (15.93 per 100,000 population and 13.67 per 100,000 population, respectively, $P < 0.0001$).
- Incidence rates of embryonal tumors (1%, $P = 0.7989$) and glioblastoma (3%, $P = 0.0059$) were higher in urban as compared to rural areas, though the difference was only statistically significant for glioblastoma.
- **Non-malignant** histologies were primarily diagnosed more frequently in urban areas, including meningioma (18% higher, $P < 0.0001$), nerve sheath tumors (20% higher, $P < 0.0001$), and tumors of the pituitary (21% higher, $P < 0.0001$).

Distribution of Tumors in Puerto Rico

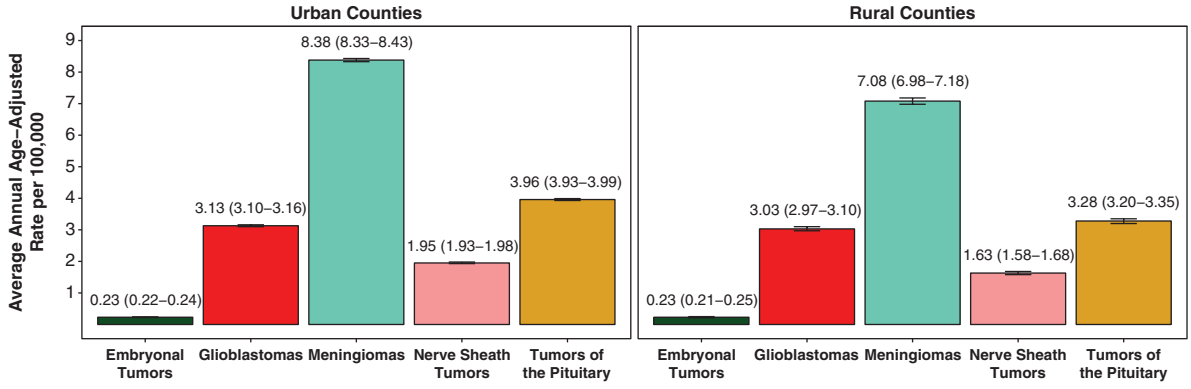
The distribution of brain and other CNS tumors diagnosed among residents of Puerto Rico by histology is shown online in Supplementary Figure 14.

- Approximately 40.8% of tumors were **malignant** and 59.2% were **non-malignant**.
- **Non-malignant** meningioma was the most common tumor type (25.9%), followed by glioblastoma (17.9%).

Incidence Rates by Race and Histology

Incidence rates by race and histology are shown in Table 11.

- Incidence rates for **all** primary brain and other CNS tumors combined were lower for race groups AIAN (14.27 per 100,000 population) compared to Whites (23.15 per 100,000 population), Blacks (22.89 per 100,000 population), and API (20.90 per 100,000 population).



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population; b. Defined using the United States Department of Agriculture's 2013 Rural Urban Continuum Codes (RUCCs, rural RUCC = 4-9; urban RUCC = 1-3).

Fig. 12 Average Annual Age-Adjusted Incidence Rates[a] with 95% Confidence Intervals of Selected Primary Brain and Other CNS Tumor Histologies by Urban or Rural Location of Residence[b], CBTRUS Statistical Report: NPCR and SEER, 2011-2015.

- Incidence rates for **non-malignant** primary brain and other CNS tumors were highest in Blacks (18.37 per 100,000 population) compared to Whites (15.53 per 100,000 population), AIAN (10.65 per 100,000 population), and API (16.12 per 100,000 population).
- Incidence rates for **malignant** primary brain and other CNS tumors were highest in Whites (7.62 per 100,000 population) compared to Blacks (4.52 per 100,000 population), AIAN (3.62 per 100,000 population), and API (4.78 per 100,000 population).
- Incidence rates of meningioma, tumors of the pituitary, and craniopharyngioma observed for Blacks exceeded those observed for Whites, AIAN, and API.
- The average annual incidence rate for tumors of the cranial and spinal nerves in the API group was the highest for all racial groups.

Incidence rate ratios (White:Black) for selected histologies are shown in Fig. 13.

- Incidence rates for glioblastoma ($P < 0.0001$), all other astrocytoma ($P < 0.0001$), and nerve sheath tumors ($P < 0.0001$) were approximately 2 times greater in Whites than in Blacks.
- Incidence of oligodendroglioma was approximately 2.3 times greater in Whites than in Blacks ($P < 0.0001$).
- Incidence rates for pilocytic astrocytoma ($P < 0.0001$), ependymal tumors ($P < 0.0001$), embryonal tumors ($P < 0.0001$), lymphoma ($P < 0.0001$), and germ cell tumors ($P < 0.0001$) were also higher among Whites than Blacks.
- Incidence rates for **non-malignant** ($P < 0.0001$) and **malignant** ($P < 0.0001$) meningioma and tumors of the pituitary ($P < 0.0001$) were higher among Blacks than Whites.

Incidence rate ratios (White:API) for selected histologies are shown online in Supplementary Figure 15.

- Incidence rates for glioblastoma ($P < 0.0001$) were over 2 times greater in Whites than in API.
- Incidence of germ cell tumors was approximately 54% higher in API compared to Whites ($P < 0.0001$).
- Incidence of nerve sheath tumors ($P < 0.0001$) was approximately 15% higher in API compared to Whites.

Incidence Rates by Hispanic Ethnicity and Histology

Incidence rates by Hispanic ethnicity and histology are shown in Table 12.

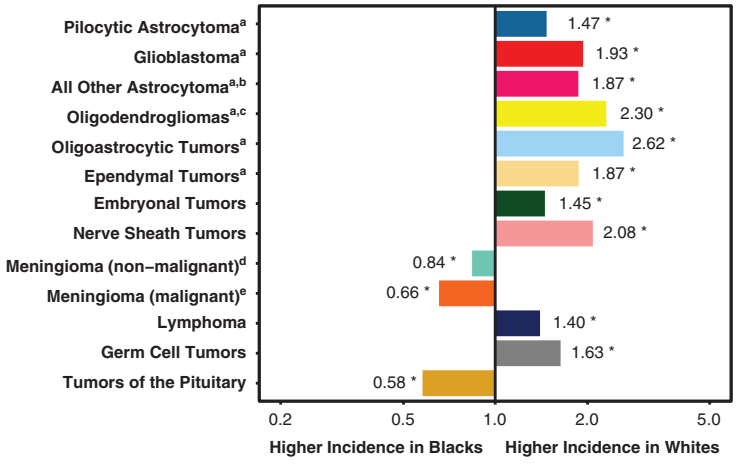
- The overall incidence rate for primary brain and other CNS tumors was 21.02 per 100,000 population among Hispanics and 23.44 per 100,000 population among non-Hispanics.
- Tumors of the pituitary, neoplasm unspecified, and other hematopoietic neoplasms were the only histologies that were higher in Hispanics than in non-Hispanics.

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

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

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

Brain and other CNS tumors are the most common form of solid tumors in children.[49,50] and account for the majority of cancer mortality in this age group.[51] About 6.2% of



* Incidence Rate is significantly different between groups at the p<0.05 level.
a. All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460, (Table 2); b. ICD-O-3 histology codes: 9381, 9384, 9424, 9400, 9401, 9410, 9411, and 9420, all ICD-O-3 behavior codes; c. ICD-O-3 histology and behavior codes: 9450/3, 9451/3, and 9460/3; d. ICD-O-3 histology and behavior codes: 9530/0,9530/1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, and 9539/1; e. ICD-O-3 histology and behavior codes: 9530/3, 9538/3, and 9539/3.

Fig. 13 Incidence Rate Ratios by Race (Whites:Blacks) for Selected CBTRUS Histology Groupings and Histologies, CBTRUS Statistical Report: NPCR and SEER, 2011-2015.

the reported brain and other CNS tumors during 2011–2015 occurred in children and adolescents age 0–19 years, and approximately 4.4% of all reported tumors occurred in children age 0–14 years. The distribution of brain and other CNS tumors for children and adolescents age 0–19 years by site is shown in Fig. 14A.

- The largest percentages of tumors in childhood and adolescence were located in the pituitary and craniopharyngeal duct (15.9%).
- A similar proportion of tumors were located within the frontal, temporal, parietal, and occipital lobes of the brain combined (16.9%).
- Cerebrum, ventricle, brain stem, and cerebellum tumors accounted for 5.2%, 5.5%, 10.9%, and 12.9% of all brain and other CNS tumors in childhood and adolescence, respectively.
- Tumors of the meninges represented 3.0% of all tumors in childhood and adolescence.
- The cranial nerves and the spinal cord and cauda equina accounted for 7.2% and 4.8% of all brain and other CNS tumors in childhood and adolescence, respectively.

Fig. 14B presents the most common brain and other CNS histologies in children and adolescents age 0–19 years.

- For children and adolescents age 0–19 years, pilocytic astrocytoma, glioma malignant, NOS, and embryonal tumors accounted for 15.3%, 11.4%, and 10.4%, respectively.
- Tumors of the pituitary were the most common **non-malignant** histology, and accounted for 12.2% of all tumors in this age group.
- Gliomas accounted for approximately 46.5% of tumors in children and adolescents age 0–19 years.
- Medulloblastoma accounted for 63.3% of all embryonal tumors in this age group.

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

The distribution of brain and other CNS tumors for children age 0–14 years by site is shown in Fig. 15A.

- Tumors of other brain (15.3%) comprised the largest proportion of tumors followed by the cerebellum (15.1%) and brain stem (13.3%).

Fig. 15B presents the most common brain and other CNS histologies in children age 0–14 years.

- For children age 0–14 years, pilocytic astrocytoma, glioma malignant, NOS, and embryonal tumors accounted for 17.9%, 13.8%, and 13.3%, respectively.
- Gliomas accounted for approximately 52.1% of tumors in children age 0–14 years.

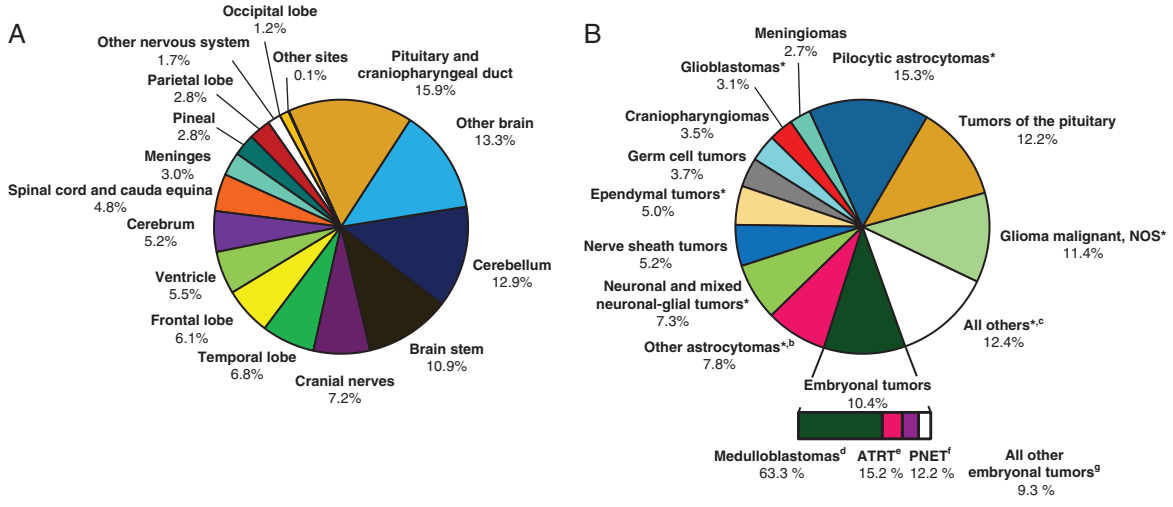
Of embryonal tumors, medulloblastoma, atypical teratoid rhabdoid tumor (ATRT), and primitive neuroectodermal tumor (PNET) accounted for 62.4%, 16.6%, and 11.8%, respectively.

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

About 1.8% of all brain and other CNS tumors occurred in adolescents age 15–19 years for a total of 7,259 tumors diagnosed between 2011 and 2015 (Table 5). The distribution of these tumors by site is presented in Fig. 16A.

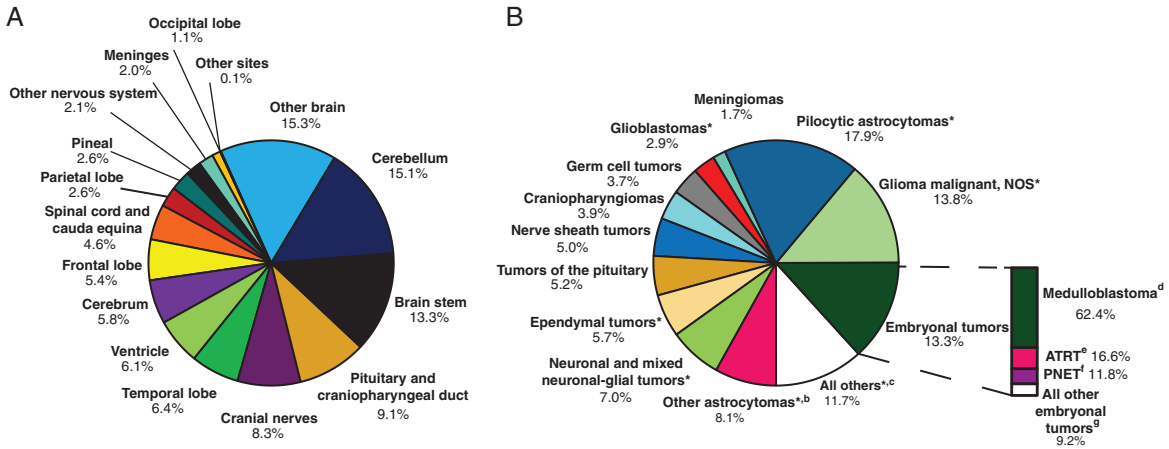
- 31.9% of these tumors were diagnosed in the pituitary and craniopharyngeal duct.
- The frontal lobe, temporal lobe, occipital lobe, and parietal lobe accounted for 19.8% of tumors in this age group.

The distribution of brain and other CNS tumors in adolescents age 15–19 years by histology is presented in Fig. 16B.



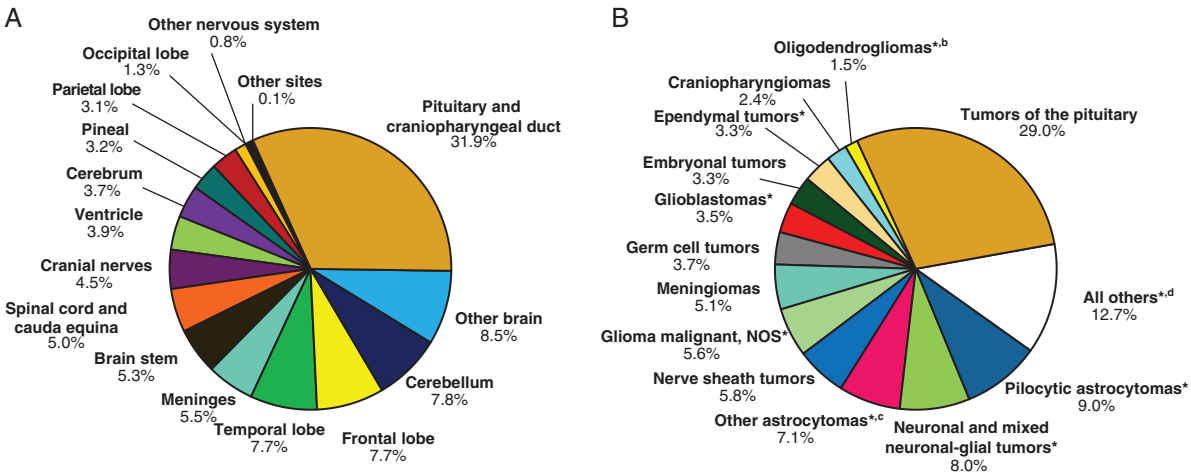
* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Includes diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); c. Includes oligodendrogliomas and anaplastic oligodendrogliomas, choroid plexus tumors, other neuroepithelial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, other hematopoietic neoplasms, hemangioma, neoplasm unspecified, and all other (Table 2); d. ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3; e. ICD-O-3 histology and behavior code: 9473/3; f. ICD-O-3 histology and behavior code: 9508/3; g. ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/0, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.

Fig. 14 Distribution[a] in Children and Adolescents (Age 0-19 Years) of Primary Brain and CNS Tumors (N = 24,532) by A) Site and B) Histology, CBTRUS Statistical Report: NPCR and SEER, 2011-2015.



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Includes diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); c. Includes oligodendrogliomas and anaplastic oligodendrogliomas, choroid plexus tumors, other neuroepithelial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, other hematopoietic neoplasms, hemangioma, neoplasm unspecified, and all other (Table 2); d. ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3; e. ICD-O-3 histology and behavior code: 9473/3; f. ICD-O-3 histology and behavior code: 9508/3; g. ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/0, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.

Fig. 15 Distribution[a] in Children (Age 0-14 Years) of Primary Brain and Other CNS Tumors (N = 17,273) by A) Site and B) Histology, CBTRUS Statistical Report: NPCR and SEER, 2011-2015.



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Includes oligodendrogliomas and anaplastic oligodendrogliomas (Table 2); c. Includes diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); d. Includes choroid plexus tumors, other neuroepithelial tumors, tumors of the pineal region, other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, other hematopoietic neoplasms, hemangioma, neoplasm unspecified, and all other (Table 2).

Fig. 16 Distribution[a] in Adolescents[b] (Age 15-19 Years) of Primary Brain and Other CNS Tumors (N = 7,259) by A) Site and B) Histology, CBTRUS Statistical Report: NPCR and SEER, 2011-2015.

- The most common histology in adolescents was tumors of the pituitary (29.0%).
- Gliomas accounted for approximately 33.0% of tumors in adolescents. Of these gliomas, the histology pilocytic astrocytoma accounted for 9.0% of all tumors in this age group.

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

The incidence rates of the most common brain and other CNS tumors in children and adolescents by major histology grouping, histology, and sex are shown in Table 13.

- Average annual incidence rates were highest for tumors of neuroepithelial tissue (3.82 per 100,000 population). Among these tumors, the most common histologies were pilocytic astrocytoma (0.91 per 100,000 population), glioma malignant, NOS (0.68 per 100,000 population), and embryonal tumors (0.62 per 100,000 population).
- There were notable differences in incidence rates between males and females for ependymal tumors, embryonal tumors, germ cell tumors, and tumors of the pituitary.

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

Table 14 shows incidence rates for brain and other CNS tumors by histology and race for children and adolescents age 0–19 years.

- Incidence rates were highest among API (6.43 per 100,000 population) compared to Whites (6.17 per 100,000 population), Blacks (4.63 per 100,000 population), and AIAN (3.45 per 100,000 population).

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

Incidence rates of brain and other CNS tumors for children and adolescents age 0–19 years by Hispanic ethnicity are shown in Table 15.

- Incidence rates for non-Hispanics (6.23 per 100,000 population; 19,596 total tumors) were higher than those for Hispanics (5.05 per 100,000 population; 4,936 total tumors).
- The largest differences between non-Hispanics and Hispanics were in incidence rates of tumors of neuroepithelial tissue and tumors of cranial and spinal nerves.
- Incidence of most histologic types was higher among non-Hispanics than Hispanics, with the exception of tumors of the pituitary where incidence was 0.88 per 100,000 population in Hispanics and 0.67 per 100,000 population in non-Hispanics.

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

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

- Overall, incidence rates for age groups 0–4 years (6.11 per 100,000 population) and 15–19 years (6.83 per 100,000 population) exceeded those observed in age groups 5–9 years (5.30 per 100,000 population) and 10–14 years (5.55 per 100,000 population).
- Individual histology distributions varied substantially within these age groups.
- Incidence rates of pilocytic astrocytoma, glioma malignant, NOS, ependymal tumors, choroid plexus tumors, and embryonal tumors decreased with increasing age.

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

Supplementary Table 8 online presents the CBTRUS brain and other CNS tumor data for children and adolescents used for this report according to the International Classification of Childhood Cancer (ICCC) grouping system for pediatric cancers (See Supplementary Table 1 online for more additional information on the ICCC classification scheme).[16]

Estimated Numbers of Expected Cases, Mortality Rates, and Relative Survival

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

Overall total rates presented are based on total **malignant** and **non-malignant** incidence, and presented stratified rates may not add up to these totals. Estimated numbers of cases are highly dependent on input data. Different patterns of incidence within strata can substantively affect the projected estimates, and strata-specific estimates may not equal the total estimate presented. Caution should be used when utilizing these estimates.

- The total number of new cases of primary brain and other CNS tumors for all 50 states and the District of Columbia in 2018 is estimated to be 85,440, with 25,800 **malignant** and 59,640 **non-malignant** cases.
- For 2019, the estimate is 86,970 new cases of primary brain and other CNS tumors of which 26,170 and 60,800 are expected to be **malignant** and **non-malignant**, respectively.

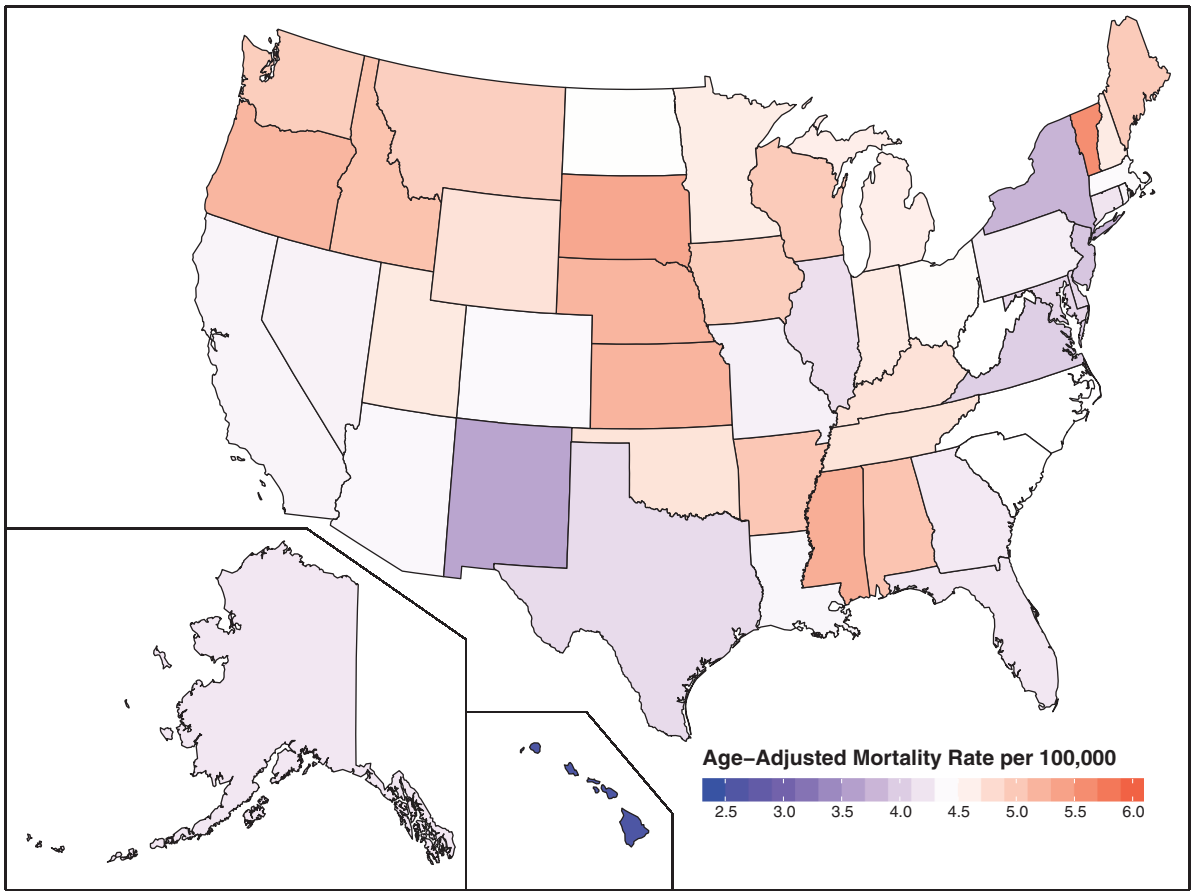
Estimated Number of Expected Cases of All Primary Brain and Other CNS Tumors by Histology, Histology Grouping, and Age

The estimated number of cases of **all** primary brain and other CNS tumors for 2018 and 2019 by histology and age are shown in Table 17.

- Meningiomas have the highest number of all estimated new cases, with 31,500 cases projected in 2018 and 31,990 in 2019.
- Glioblastoma has the highest number of cases of all **malignant** tumors, with 13,010 cases projected in 2018 and 13,310 in 2019.
- For 2018, the highest number of new cases is predicted in those age 65+ years, with 36,410 cases. For 2019, the highest number of new cases is estimated to be in those age 65+ years, with 37,700 cases.
- For 2018 and 2019, children age 0–14 years are estimated to have 3,670 and 3,720 new cases of primary brain and other CNS tumors each year, respectively.
- For 2018 and 2019, children age 0–19 years are estimated to have 5,200 and 5,270 new cases of primary brain and other CNS tumors each year, respectively.

Estimated Mortality Rates for Malignant Brain and Other CNS Tumors by State, Sex, and Urban/ Rural Residence

Table 18 and Fig. 17 show average annual age-adjusted mortality rates for primary **malignant** brain and other CNS tumors in the US during 2011–2015 by state and sex. Average annual age-adjusted mortality rates for primary **malignant** brain and other CNS tumors by state and urban/ rural residence are shown online in Supplementary Table 10.



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

Fig. 17 Average Annual Age-Adjusted Mortality Rates[a] for Malignant Primary Brain and Other CNS Tumors by Central Cancer Registry, CBTRUS Statistical Report: NCHS, 2011-2015.

- The aggregate total number of observed deaths was 77,375, for an average annual age-adjusted mortality rate of 4.37 per 100,000 population.
- There was considerable variation by individual state, where mortality rates ranged from a low of 2.57 per 100,000 population to a high of 5.59 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 5.33 per 100,000 population as compared to 3.55 per 100,000 population.
- Mortality rates for **malignant** brain and other CNS tumors were higher in rural areas (4.63 per 100,000 population) as compared to urban areas (4.32 per 100,000 population).
- There was considerable variation by state, where mortality rates in urban areas ranged from 2.37 per 100,000 population to 6.42 per 100,000 population, and mortality rates in rural areas ranged from 3.34 per 100,000 population to 5.52 per 100,000 population.

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

Relative survival estimates by site and behavior are presented in Table 19.

- The highest five-year survival was for tumors occurring in the cranial nerves (93.7%).
- The lowest five-year survival was for tumors of the parietal lobe (20.2%).

Survival Rates for Malignant Brain and Other CNS Tumors by Histology and Age

Survival estimates for **malignant** brain and other CNS tumors by histology and age at diagnosis are presented in Tables 20–21. Histology-specific rates are presented for the CBTRUS histology groupings which contain a substantial number of incident malignant tumors.

- The estimated five- and ten-year relative survival rates for all **malignant** brain and other CNS tumors were 35.0% and 29.3%, respectively.

- There was large variation in survival estimates depending upon tumor histology; five-year survival rates were 94.1% for pilocytic astrocytoma but are 5.6% for glioblastoma.
- Survival generally decreased with older age at diagnosis; children and young adults generally had better survival outcomes for most histologies.

Survival Rates for Non-Malignant Brain and Other CNS Tumors by Histology and Age

Survival estimates for **non-malignant** brain and other CNS tumors by histology and age at diagnosis are presented in Table 22. Histology-specific rates are presented for the CBTRUS histology groupings which contain a substantial number of incident non-malignant tumors.

- Overall, 90.7% of persons with **non-malignant** tumor survived five years after diagnosis.
- Five-year survival was lowest in craniopharyngioma and meningioma, which had five-year relative survival of 83.5% and 86.7%, respectively.
- Five-year survival was highest in nerve sheath tumors and ependymal tumors, which had five-year relative survival of 99.3% and 97.4%, respectively.
- Overall, five-year survival in adolescents and young adults was highest (97.9%) compared to children (96.8%) and adults (89.1%).

Survival Rates for Malignant Brain and Other CNS Tumors by Urban/Rural Residence

Survival estimates for **malignant** and **non-malignant** brain and other CNS tumors are show by urban/rural residence and selected histologies in online Supplementary Table 11 and Supplementary Table 12. Overall, one-, five-, and ten-year survival were higher in urban areas as compared to rural areas.

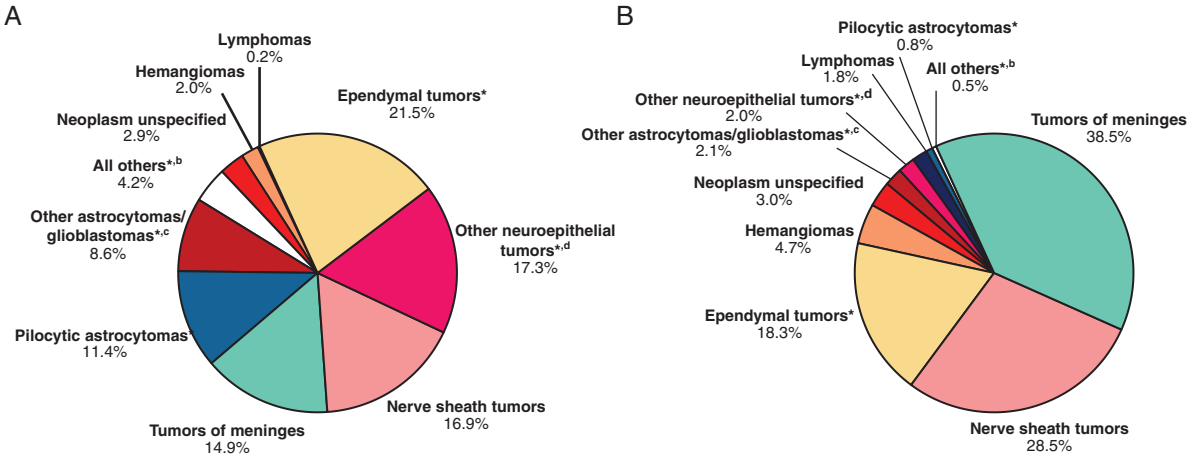
Descriptive Summary of Spinal Cord Tumors

Although spinal cord tumors account for a relatively small percentage of brain and other CNS tumors, they result in significant morbidity. The most common histologies found in the spinal cord, spinal meninges, and cauda equina are presented in Fig. 18 for both children (age 0–19 years, Fig. 18A) and adults (age 20+ years, Fig. 18B), respectively.

- The predominant histology group for those age 0–19 years was ependymal tumors (21.5%) followed by other neuroepithelial tumors (17.3%).
- Tumors of meninges (38.5%) accounted for the largest proportion of spinal cord tumors among those age 20 years and older.
- Five-year survival after diagnosis with a **malignant** tumor of the spinal cord and cauda equina was 81.5%, with a ten-year relative survival of 76.9% (Table 19).

Descriptive Summary of Meningioma, Glioblastoma, and Embryonal Tumors

The data in the CBTRUS Statistical Report 2011–2015 are synthesized to describe the three of the most common histologic types: meningioma and glioblastoma for adults, and embryonal tumors for children and adolescents.



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Includes embryonal tumors, other tumors of cranial and spinal nerves, other hematopoietic neoplasms, germ cell tumors, neoplasm unspecified, and all other (Table 2); c. Includes diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); d. Includes oligodendroglioma, anaplastic oligodendroglioma, oligoastrocytic tumors, glioma malignant, NOS, choroid plexus tumors, other neuroepithelial tumors, and neuronal and mixed neuronal-glial tumors (Table 2).

Fig. 18 Distribution[a] of Primary Spinal Cord, Spinal Meninges, and Cauda Equina Tumors by CBTRUS Histology Groupings and Histology in A) Children and Adolescents (Age 0-19 Years, N = 1,269) and B) Adults (Age 20+ Years, N = 17,479), CBTRUS Statistical Report: NPCR and SEER, 2011-2015.

Meningioma

- **Meningioma was the most frequently reported brain and other CNS tumor, accounting for 37.1% of tumors overall** (Fig. 6A). Most meningiomas (79.8%) were located in the cerebral meninges, 4.2% were located in the spinal meninges, and approximately 15.2% did not have a specific meningeal site listed.
- **Non-malignant** meningioma with ICD-O-3 behavior codes /0 (benign) or /1 (uncertain) accounted for 98.8% of meningiomas reported to CBTRUS (Table 3).
- Of meningioma with documented WHO grade (77.1%, Table 10), 80.6% of meningioma were WHO grade I, 17.6% were WHO grade II, and 1.7% were WHO grade III.
- Meningioma was most common in adults age 65 years and older (Table 6), and one of the least common in children age 0–14 years (Table 4).
- Incidence of meningioma increased with age, with a dramatic increase after age 65 years. Even among the population age 85 years and older, these rates continued to be high (Table 6).
- **Non-malignant** meningiomas overall were 1.16 times more common in females compared to males (Fig. 10). Incidence rate ratios were lowest between males and females in persons <20 years old (where incidence rates for males and females were approximately equal), and highest from 35–54, where incidence rates were 3 times higher in females (See online Supplementary Figure 18).
- Incidence of meningioma was significantly higher in Blacks than in Whites (Fig. 13).
- Ten-year relative survival for **malignant** meningioma was 53.5% (Table 20). Age had a large effect on survival after diagnosis with **malignant** meningioma: 10-year relative survival was 78.7% for the population age 20–44 years, and 34.3% for age 75+ years (Table 21).
- Ten-year relative survival for **non-malignant** meningioma was 81.5% (Table 22). Age had a large effect on survival after diagnosis with **non-malignant** meningioma: 10-year relative survival was 97.4% in children 0–14, 94.5% in AYA, and 80.5% in adults 40+ years old.
- Site of meningioma had an effect on survival after diagnosis with meningioma. For **non-malignant** meningioma, 10-year relative survival was 80.4% for tumors in the cerebral meninges, but 93.2% for tumors in the spinal meninges.
- Survival was also higher in **malignant** meningioma for spinal tumors, where 10-year relative survival was 67.9%, as compared to 54.8% for tumors in the cerebral meninges (See online Supplementary Figure 19).

Glioblastoma

- **Glioblastoma was the third most frequently reported CNS histology and the most common malignant tumor overall** (Fig. 6A-6B).
- Glioblastoma accounted for 14.7% of all primary brain and other CNS tumors (Fig. 6A) and 47.7% of primary **malignant** brain tumors (Fig. 6B).
- Glioblastoma was more common in older adults (Table 9) and was less common in children (Table 5); these tumors comprised approximately 3.1% of all brain and other CNS tumors reported among age 0–19 years.
- Incidence of glioblastoma increased with age, with rates highest in individuals age 75 to 84 years (Table 9).
- Glioblastoma was 1.58 times more common in males (Fig. 10).
- Glioblastoma was 1.93 times higher among Whites compared to Blacks (Fig. 13).
- Relative survival estimates for glioblastoma were quite low; 5.6% of patients survived five years post-diagnosis (Table 20). These survival estimates were somewhat higher for the small number of patients who were diagnosed under age 20 years (Table 21).

Embryonal Tumors

- **Embryonal tumors were the most frequently reported brain and other CNS tumor histology grouping in children age 0–4 years, and the second most common tumor type overall in children and adolescents age 0–19 years** (Table 5, Fig. 14B).
- Embryonal tumors accounted for 13.3% of all primary brain and other CNS tumors in children age 0–14 years (Fig. 15B), 10.4% of tumors in children and adolescents age 0–19 years (Fig. 14B), and 0.9% of tumors diagnosed overall (Fig. 6A).
- Embryonal tumors within the CBTRUS histologic grouping scheme includes multiple different histologies: primitive neuroectodermal tumor (PNET) (ICD-O-3 histology code 9473), medulloblastoma (ICD-O-3 histology codes 9470–9472), atypical teratoid rhabdoid tumor (ATRT) (ICD-O-3 histology code 9508), and several other histologies (Table 2).
- Incidence of medulloblastoma decreased with age. Incidence was 0.53 per 100,000 population, 0.58 per 100,000 population, 0.31 per 100,000 population, and 0.16 per 100,000 population in children age 0–4, 5–9, 10–14 years, and adolescents age 15–19 years, respectively (Table 5).
- Incidence of PNET was 0.17 per 100,000 population, 0.07 per 100,000 population, 0.04 per 100,000 population, and 0.04 per 100,000 population in children age 0–4, 5–9, 10–14 years, and adolescents age 15–19 years, respectively (Table 5).
- Incidence of ATRT was 0.34 per 100,000 population and 0.03 per 100,000 population in children age 0–4 and 5–9 years, respectively. There were too few of these cases in older age groups to report (Table 5).
- Relative survival estimates for embryonal tumors were low but varied significantly by histology. 10-year survival was 64.9% for medulloblastoma, 40.8% for PNET, and 28.6% for ATRT (Table 20).
- Embryonal tumors were more common in males than females (Table 3). This difference was greatest in medulloblastoma, which occurred 1.7 times as frequently in males 0–14 years as compared to females in this age group (See online Supplementary Figure 20). Incidence of ATRT and PNET in children 0–14 was not significantly different between males and females.

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

Brain and other CNS tumors are less common in adolescents and young adults (AYA; age 15–39 years)[52] compared

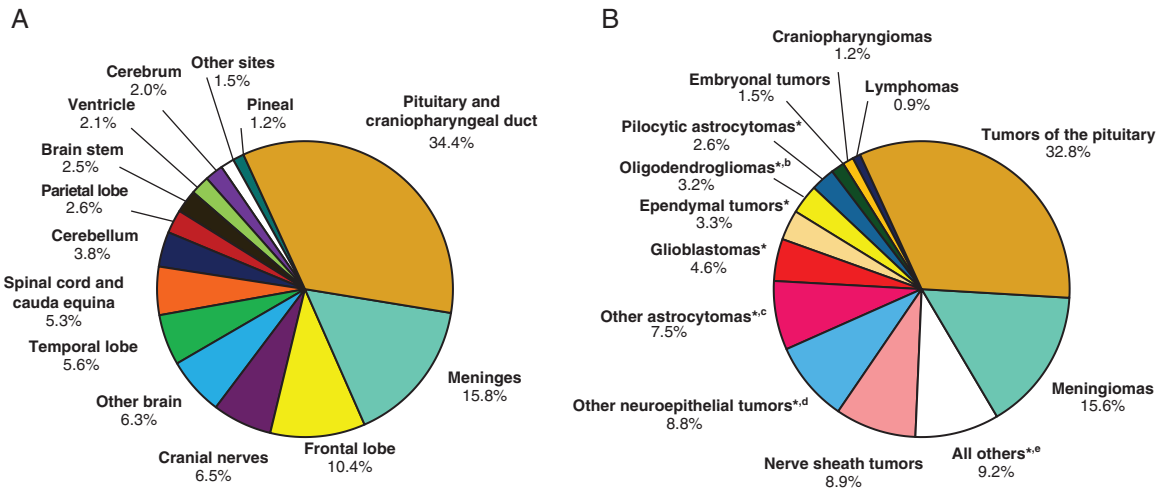
to older adults (Table 4). **These tumors are the third most commonly occurring cancer in persons age 15–39 years in the US, and the third most common cause of cancer death.**[53]

- There were 57,821 primary brain and other CNS tumors diagnosed in AYA between 2011 and 2015, representing 15% of all brain and other CNS tumors (Fig. 19).
- The overall incidence rate in this age group was 11.20 per 100,000 population (Table 4). Incidence of **malignant** tumors was 3.26 per 100,000 population, and incidence of **non-malignant** tumors was 7.94 per 100,000 population (Table 4).
- Tumors of the sellar region had the highest incidence (3.76 per 100,000 population), followed by tumors of the neuroepithelial tissue (3.48 per 100,000 population) (Table 4).
- The most common histology in AYA was tumors of the pituitary (3.63 per 100,000 population), followed by meningioma (1.84 per 100,000 population) and nerve sheath tumors (1.01 per 100,000 population) (Table 4).
- The majority of AYA brain and other CNS tumors occurred in the pituitary and craniopharyngeal duct (34.4%), followed by the meninges (15.8%) (Fig. 19A).
- Approximately 18.6% of tumors diagnosed in AYA were located within the frontal, temporal, parietal, and occipital lobes of the brain combined (Fig. 19A).
- Cerebrum, ventricle, cerebellum, and brain stem tumors combined accounted for about 11% of all AYA tumors (Fig. 19A).
- The predominately **non-malignant** tumors of the pituitary (32.8%), meningioma (15.6%), and nerve sheath (8.9%) represented over half of CNS tumors diagnosed in AYA (Fig. 19B).
- Glioma accounted for approximately 26.7% of all brain and other CNS tumors in AYA, and about 82.7% of all **malignant** tumors (Fig. 19B).
- AYA are estimated to have 12,130 new primary brain and other CNS tumors in 2018 and 12,290 in 2019 (Table 17).
- AYA had higher rates of relative survival than adults greater than 40 years old for all **malignant** histologic types. Though 1-year relative survival for most tumor types was higher for AYA than children, 5- and 10-year survival were usually higher for children as compared to AYA (Table 20).

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

Time trends in cancer incidence rates are an important measure of the changing burden of cancer in a population over time. Incidence rates of cancer overall, and many specific cancer histologies, have decreased over time.[54] Overall, changes in incidence rates of brain and other CNS tumors between 2000 and 2015 (2004 and 2015 for **non-malignant** tumors), have been small. There are many things that can affect incidence rates over time that are not related to 'true' changes in incidence of these tumors, including demographic changes, changes in histologic classification, and changes in cancer registration procedures. CBTRUS has previously reported that there was increasing incidence of **non-malignant** brain tumors during the first years of their collection (2004–2006).[55,56]

Many factors may lead to fluctuations in rates over time and all of these must be considered when interpreting time trends results. When assessing trends in incidence



* All or some of this histology are included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384 and 9391-9460 (Table 2).
a. Percentages may not add up to 100% due to rounding; b. Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/adolescent-young-adult; c. Includes diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2); d. Includes oligoastrocytic tumors, glioma malignant, NOS, choroid plexus tumors, other neuroepithelial tumors, neuronal and mixed neuronal-glial tumors, and tumors of the pineal region (Table 2); e. Includes other tumors of cranial and spinal nerves, mesenchymal tumors, primary melanocytic lesions, other neoplasms related to the meninges, hemangioma, neoplasm unspecified, and all other (Table 2).

Fig. 19 Distribution[a] in Adolescents and Young Adultsb (Age 15-39 Years) of Primary Brain and Other CNS Tumors (N = 57,821) by A) Site and B) Histology, CBTRUS Statistical Report: NPCR and SEER, 2011-2015.

over time it is critical to use the most recent data available, as delay in reporting may cause small fluctuations in incidence. Time trends analysis methods are used to estimate if the annual percent change (APC) is significantly different from 0% (meaning no change in incidence from year to year). **In addition to assessing statistical significance of changes in incidence over time, the size of this change must also be considered because with datasets as large as CBTRUS very small fluctuations in incidence over time may be statistically significant but not truly represent a large change in proportion of individuals over time.**

All Malignant Brain and Other CNS Tumors

- From 2008–2015, there was a slight decrease in overall incidence (Annual percentage change [APC] of -0.9% [95% CI: -1.2%, -0.7%], Fig. 20).
- There was a small but statistically significant increase in incidence in children (age 0–14 years, APC = 0.6% [95% CI: 0.3%, 0.9%], Fig. 21), a small but statistically significant decrease in AYA (age 15–39 years, APC = -0.4% [95% CI: -0.6%, -0.2%], Fig. 21) from 2000–2015, and a small but statistically significant decrease in older adults from 2007–2015 (age 40+ years, APC = -1.0% [95% CI: -1.3%, -0.8%], Fig. 21).

Glioma

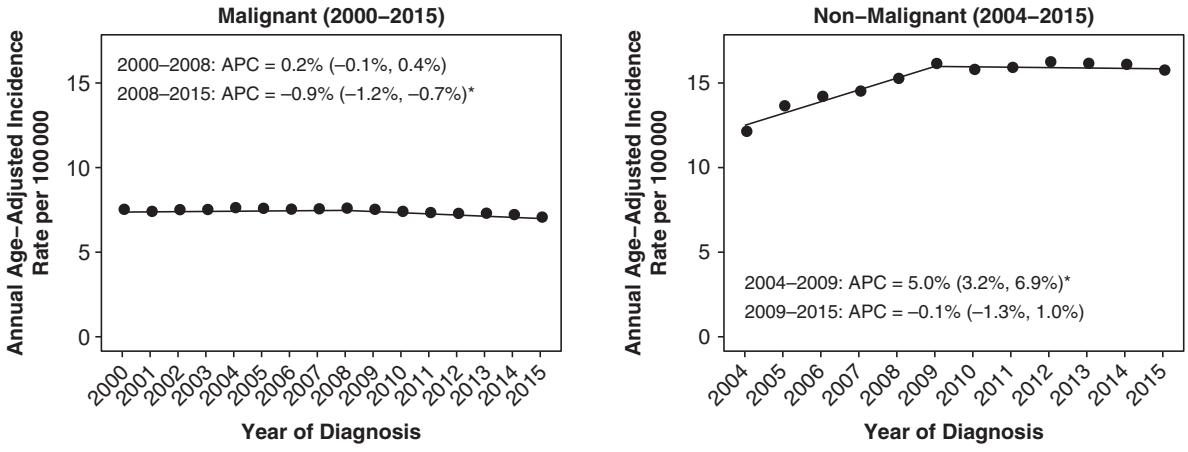
- There was a slight increase in incidence between 2000 and 2007 (APC = 0.8% [95% CI: 0.4%, 1.3%], (See online Supplementary Figure 21), followed by a small but significant decrease in incidence from 2007–2015 (APC = -0.6% [95% CI: -1.0%, -0.2%], (See online Supplementary Figure 21).
- There was a significant increase in incidence in children (age 0–14 years, APC = 1.9% [95% CI: 1.4%, 2.4%]) from 2000–2013, and a significant increase in incidence in AYA from 2000–2006 (age 15–39 years, APC = 2.3% [95% CI: 0.7%, 3.8%], (See online Supplementary Figure 21).
- Incidence in older adults (age 40+ years) was relatively stable: there was a statistically significant increase from 2000–2007 (APC = 0.6%, [95% CI: 0.2%, 1.1%]), followed by a statistically significant decrease from 2007–2015 (APC = -0.9% [95% CI: -1.2%, -0.5%], (See online Supplementary Figure 21).
- There was a small but significant increase in incidence of glioblastoma from 2000–2005 (APC = 1.0 [95% CI: 0.1, 1.8]), with no significant change between 2005 and 2015 (See online Supplementary Figure 22).

Malignant Meningioma

- There was a significant decrease in incidence between 2000 and 2015 (APC = -4.5% [95% CI: -5.4%, -3.6%], (See online Supplementary Figure 22).
- **Changes were made to histological classification of meningioma in both the 2000 and 2007 revisions of the WHO classification, and gradual uptake of these classification changes may result in changing incidence of these tumors.**[58]

All Non-Malignant Brain and Other CNS Tumors

- There was a significant increase in incidence of non-malignant brain tumors from 2004–2009 (APC = 5.0% [95% CI: 2.9%, 7.0%], Fig. 20), and no significant change between 2009 and 2015.
- There was a small but statistically significant increase in incidence of these tumors in children (2004–2015, APC = 2.3% [95% CI: 1.6%, 2.9%], Fig. 21), in AYA (2004–2009, APC = 6.3% [95% CI: 3.6%, 9.0%], Fig. 21), and older adults (2004–2009, APC = 4.8% [95% CI: 3.2%, 6.5%], Fig. 21).
- When analysis was limited to histologically confirmed tumors only, there was a small but significant increase in incidence of **non-malignant** brain and other CNS tumors



* Annual Percentage Change (APC) is statistically significant at the p<0.05 level.

Fig. 20 Annual Age-Adjusted Incidence Rates of Primary Brain and Other CNS Tumors, and Incidence Trends by Behavior, CBTRUS Statistical Report: NPCR and SEER, 2000-2015 (varying).

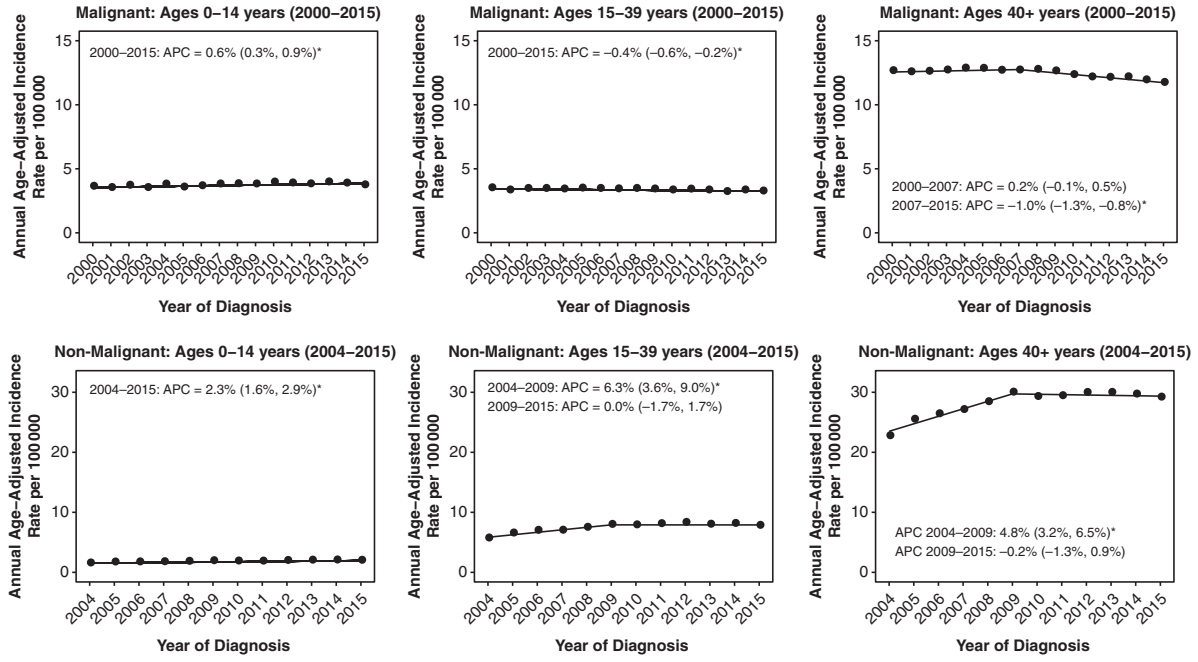


Fig. 21 Annual Age-Adjusted Incidence Rates of Primary Brain and Other CNS Tumors, and Incidence Trends by Behavior and Age Group, CBTRUS Statistical Report: NPCR and SEER, 2000-2015 (varying).

from 2004–2009 (APC = 1.6% [95% CI: 0.6%, 2.6%]), followed by a small but significant decrease from 2009–2015 (APC = -1.3% [95% CI: -2.0%, -0.6%]).

- There was a statistically significant increase in incidence of radiographically confirmed **non-malignant** tumors from 2004–2009 (APC = 9.4% [95% CI: 6.3%, 12.5%]), with no significant change from 2009–2015.
- **The increases in incidence in the non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.**

Non-Malignant Meningioma

- There was a significant increase of **non-malignant** meningioma between 2004 and 2009 (APC = 5.0% [95% CI: 3.5%, 6.4%], (See online Supplementary Figure 23), but there was no significant change after 2009.
- When analysis was limited to histologically confirmed cases, there was no substantial change in incidence from 2004–2009 and there was a slight decrease (APC = -1.8% [95% CI: -2.5%, -1.0%]) from 2009–2015.
- There was a significant increase in incidence of radiographically diagnosed cases from 2004–2006 (APC = 14.5% [95% CI: 9.8%, 19.4%]), 2006–2009 (APC = 6.5% [95% CI: 2.8%, 1.4%]), and 2009–2015 (APC = 0.8% [95% CI: 0.3%, 1.4%]), though APCs decreased over time.
- **The increases in incidence in these non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.**

Non-Malignant Nerve Sheath Tumors

- There was a small but significant increase in the incidence of **non-malignant** nerve sheath tumors between 2004 and 2015 (APC = 1.0% [95% CI: 0.4%, 1.6%], (shown online in Supplementary Figure 23).
- When analysis was limited to histologically confirmed cases only, there was no significant change in incidence (APC = -0.2% [95% CI: -1.0%, 0.5%]) from 2004–2013.
- There was a significant increase in incidence of radiographically diagnosed tumors between 2006 and 2015 (APC = 1.6%, [95% CI: 0.4%, 2.9%]).
- **The increases in incidence in these non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time.**

Non-Malignant Tumors of the Pituitary

- There was a significant increase in **non-malignant** tumors of the pituitary from 2004–2009 (APC = 7.4% [95% CI: 5.1%, 9.7%], (shown online in Supplementary Figure 23), but no significant change in incidence from 2009–2015.
- When analysis was limited to histologically confirmed tumors only, there was a significant increase (APC = 4.5% [95% CI: 3.5%, 5.6%]) from 2004–2009, followed by a small but significant decrease from 2009–2015 (APC = -1.9% [95% CI: -2.6%, -1.3%]).
- There was a significant increase in incidence of radiographically diagnosed tumors of the pituitary from 2006–2012 (APC = 7.3% [95% CI: 4.1%, 10.5%]), with no significant change in incidence from 2012–2015.

- **The increases in incidence in these non-malignant tumors are partially attributable to improved collection of radiographically diagnosed cases as well as improvement in collection of non-malignant cases in general over time**.

Prevalence of Primary Malignant Brain and Other CNS Tumors

Prevalence is an estimate of the total number of individuals with a disease who currently exist within a population, as compared to incidence, which is a calculation based on **new diagnoses** only. These calculations take into account not only the number of new cases being diagnosed, but also the length of time that individuals survive after diagnosis. CBTRUS previously estimated the 2010 prevalence rate for all primary malignant brain and CNS tumors to be 47.6 per 100,000 population, or a total of 103,634 cases.[58] Prevalence in children (0–14 years old) was estimated to be 22.31 per 100,000 population (13,657 cases), while prevalence in AYA (15–39 years old) was estimated to be 48.49 per 100,000 (31,299 cases). These ages represent **age at time of prevalence calculation** and not the age at which individuals were diagnosed. Please refer to Zhang, et al.[58] for more details. CBTRUS also previously estimated the 2014 prevalence of selected adult malignant brain tumor histologies. Glioblastoma had the highest prevalence rate, at 9.23 per 100,000 population (23,327 cases), followed by diffuse astrocytoma (Prevalence Rate of 4.68 per 100,000 population; 10,868 cases), and oligodendroglioma (Prevalence Rate of 3.57 per 100,000 population; 8,217 cases). Please refer to Gittleman, et al.[59] for more details, including sex-, race-, and ethnicity-specific prevalence estimates.

Lifetime Risk of Primary Malignant Brain and Other CNS Tumors

From birth, a person in the US has a 0.62% chance of ever being diagnosed with a primary malignant brain and other CNS tumor (excluding lymphomas, leukemias, tumors of the pituitary and pineal glands, and olfactory tumors of the nasal cavity) and a 0.47% chance of dying from a primary malignant brain/other CNS tumor.[60–63]

- For males (all races), the risk of developing a primary **malignant** brain/other CNS tumor is 0.70%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.53%.
- For females (all races), the risk of developing a primary **malignant** brain/other CNS tumor is 0.54%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.41%.
- For White non-Hispanics (both sexes), the risk of developing a primary **malignant** brain/other CNS tumor is 0.72%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.55%.
- For White Hispanics (both sexes), the risk of developing a primary **malignant** brain/other CNS tumor is 0.54%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.40%.
- For Blacks (both sexes), the risk of developing a primary **malignant** brain/other CNS tumor is 0.34%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.26%.
- For API (both sexes), the risk of developing a primary **malignant** brain/other CNS tumor is 0.40%, and the risk of dying from a primary **malignant** brain/CNS tumor is 0.30%.

Risk Factors for Primary Brain and Other CNS Tumors

Many environmental and behavioral risk factors have been investigated for brain and other CNS tumors. The only well-validated factors are increased risk for these tumors (particularly meningiomas) with exposure to ionizing radiation[64] (the type of radiation generated by atomic bombs, therapeutic radiation treatment, and some forms of medical imaging) and decreased risk for these tumors (particularly glioma) in persons with a history of allergy or other atopic disease[65] (including eczema, psoriasis, and asthma). Having a first-degree family member (including parents, children, and full siblings) that has been diagnosed with a brain tumor has been shown to increase risk approximately two-fold.[66–70] Several recent review articles have elaborated on the current state of risk factor research in primary brain and other CNS tumors.[71–73]

Biomarkers for Primary Brain and Other CNS Tumors

Primary brain and other CNS tumors are a highly heterogeneous group of diseases, and characterization of unique tumor histologies within this group has been refined over time. The development of technologies for characterizing DNA, RNA, and DNA methylation has led to the discovery of several factors (known as 'biomarkers') that can be used to more accurately classify these tumors than histologic appearance alone. See Table 23 for a brief overview of selected biomarkers for primary brain and other CNS tumors.

Gliomas, as the most common malignant primary brain and other CNS tumor type, have been subject to the greatest amount of investigation. A recent review has described in detail the current state of glioma biomarker research.[74] One of the earliest discoveries in glioma biomarkers was that oligodendroglioma often had large deletions (missing parts of the chromosome, also known as loss of heterozygosity) in the short arm of chromosome 1 (1p) and the long arm of chromosome 19 (19q).[75] In general, these deletions significantly predict positive response to chemotherapy and radiation treatment in oligodendroglioma and anaplastic oligodendroglioma.[76–78] Mutations to the genes in isocitrate dehydrogenase 1 (*IDH1*) and in isocitrate dehydrogenase 2 (*IDH2*) have also been shown to be associated with improved prognosis in glioma. These mutations are common in lower grade gliomas (WHO grade II and WHO grade III), but are rare in glioblastoma.[79] Both of these alterations are thought to occur relatively early in the development of gliomas; the prevalence of this mutation varies by anatomic location in the brain.[80,81] The combination of these two factors can be used to more accurately stratify glioma by prognosis than the previously utilized histological criteria,[82,83] and have been incorporated into the definition of oligodendroglioma and astrocytoma in the 2016 revision to the WHO classification.[19] **These classification changes are not reflected in the data presented**

in this report, which was collected prior to the adoption of these biomarkers as diagnostic criteria. ***These new biomarkers began to be collected in the United States starting in 2018.***

Another alteration that is associated with improved survival in glioma is increased methylation (where methyl molecules are bonded to the DNA) of the promotor region of the gene O-6-methylguanine-DNA methyltransferase (*MGMT*).[84,85] The promoter region of a gene is located upstream of the coding part of the gene and exerts control over whether a gene is transcribed into RNA. Methylation of this region effectively silences the gene, and prevents transcription into RNA. *MGMT* is a DNA repair protein, and it is assumed that the decreases in protein levels increase sensitivity to the alkylating chemotherapies (e.g. temozolomide) often used in the treatment of gliomas that combat tumor growth through DNA damage.[86] This alteration is common in glioblastoma and less common in lower grade glioma. Recent analyses of data generated by The Cancer Genome Atlas have shown that genome-wide DNA methylation predicts improved prognosis in addition to methylation of specific genes.[82] Persons whose tumor has a higher proportion of methylation across the genome are termed to have glioma-CpG island methylator phenotype (G-CIMP).[87] G-CIMP and *MGMT* methylation are correlated,[88] but G-CIMP is much rarer in glioblastoma than *MGMT* methylation.

Medulloblastoma is another tumor type that has been subject to significant molecular analysis. Using an analysis of gene expression (based on quantity of RNA transcribed from a gene), medulloblastoma was able to be subdivided into four distinct subtypes: wingless (WNT), sonic hedgehog (SHH), group 3 (also called group C), and group 4 (also called group D).[89] These groups are associated with specific age groups, with SHH being most common in infants and adults, and all other groups being more common in childhood. Several review articles have elaborated on the details of these subgroups and their implications for diagnosis and treatment.[90–92]

Diffuse intrinsic pontine glioma (DIPG) is an aggressive tumor of the brain stem that occurs primarily in children, and accounts for ~75% of brain stem tumors in children. Survival is very poor after diagnoses with these tumors. Due to the location of these tumors, they are often not biopsied and, therefore, have not been molecularly characterized to the extent of many other primary brain and other CNS tumor types. Recently, biopsy and autopsy protocols have allowed for collection of primary tumor samples that have been used for genomic profiling.[93–95] These tumors have been found to be highly heterogeneous. Mutations in histone H3, Activin A receptor, type I (*ACVR1*), tumor protein p53 (*TP53*), platelet-derived growth factor receptor A (*PDGFRA*), phosphatidylinositol 3-kinase catalytic subunit alpha (*PIK3CA*), and Myc (*MYC*) have been identified as characteristic of these tumors.[94,95,97] A recent review has further summarized recent developments in the genomics of DIPG.[98]

As of 2011, SEER registries currently collect information on three validated biomarkers for primary brain and other CNS tumors as Site Specific Factors (SSF): promoter methylation status of *MGMT* (SSF 4), deletion of the 1p (SSF 5), and deletion of 19q (SSF 6).[99] Completeness of these biomarker data varies significantly by histology, but is gradually improving over time.

Starting with diagnosis year 2018, the US cancer registry system will be collecting information on multiple brain and other CNS markers, including *IDH1/2* mutation, 1p/19q codeletion, and medulloblastoma molecular subtype.

Strengths and Limitations of Cancer Registry Data

CBTRUS is the largest population-based registry focused exclusively on primary brain and other CNS tumors in the US and represents cases collected from the entire US population. The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2011–2015* contains the most up-to-date population-based data on all primary brain tumor and other CNS tumors available through the surveillance system in the US.

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

Currently, there is no publicly available data source for the collection of survival and outcomes data from all geographic regions in the US via the cancer registry system. SEER registries are specifically funded to collect active follow-up on patients, and as a result, have highly accurate survival data for patients who are diagnosed within the geographic regions covered by these registries. The SEER 18 population dataset used for the survival analyses is a subset of the larger CBTRUS dataset used to generate incidence and covers approximately 28% of the US population.[12] Survival estimates obtained from the SEER dataset may be less reliable as representations of 'real' relative survival rates for the US than if they were based on data from a larger portion of the population. Survival data are collected by NPCR registries—primarily through linkage with death records—and the feasibility of these data for use in survival studies has been evaluated.[100,101] These data are currently available for public use from a limited number of NPCR registries.

No mechanism currently exists for central pathology review of cases within the US cancer registry system, and histology code assignment at case registration is based on histology information contained in the patient's medical record. The *WHO Classification of Tumours of the Central Nervous System* underwent revision in 1993,[102] 2000,[18] 2007,[2] and 2016.[19] As of 2018, the US cancer registry system is using the 2016 classification for data abstraction, but tumors included in this report may have been diagnosed using any of the available classifications prior to 2013 due to the variation in adoption of new standards by individual physicians and medical practices. As a result, histologies are reflective of the prevailing criteria for a histology

at the time of registration. This means that despite changes to the histology schema that may occur over time, it is not possible, without additional variables, to go back and reclassify any tumors based on new criteria. In addition to changes in histologic criteria over time, there is significant inter-rater variability in histopathological diagnosis of glioma.[103,104] This also means that incomplete, incorrect, or alternatively stated diagnoses included in a pathology report or other medical record can result in an incorrect reporting of the details of an individual case. For example, an anaplastic oligodendroglioma recorded in a pathology record as oligodendroglioma WHO grade III may be incorrectly recorded as an oligodendroglioma when the accurate category is an anaplastic oligodendroglioma.

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

The 2016 *WHO Classification of Tumours of the Central Nervous System*[19] contains significant revision to diagnostic criteria for glioma. Oligoastrocytoma has been long considered an entity that is distinct from astrocytoma and oligodendroglioma, and is included as a unique histologic grouping within the CBTRUS classification scheme. Recent molecular analyses suggest that these tumors are not molecularly distinct from oligodendrogliomas or astrocytomas[105] and can be separated into as astrocytoma and oligodendroglioma using molecular markers; the diagnosis of oligoastrocytoma is strongly discouraged and qualified with a "not otherwise specified" designation under the 2016 revision to the *WHO Classification of Tumours of the Central Nervous System*. With this recent revision to the WHO criteria for central nervous system tumors,[19] *IDH1/2* mutation and 1p/19q codeletion will become the primary factors by which gliomas are classified. While data on *IDH1/2* mutation status was not collected in the US cancer registry system during the time period covered by this report, these data are required to be collected by cancer registrars (as available in the medical record) of January 1, 2018. Cancer registry systems have collected 1p/19q deletion data for some of the report years, but data vary significantly in completeness by histology.[99] It is likely that these changes to diagnostic criteria may affect the incidence of these tumor types in future years.

Concluding Comment

The *CBTRUS Statistical Report: Primary Brain and Other Central Nervous System Tumors Diagnosed in the United States in 2011–2015* comprehensively describes the current population-based incidence, mortality, and relative survival of primary malignant and non-malignant brain and other CNS tumors collected and reported by central cancer registries covering the entire US population. This report aims to serve as a useful resource for researchers, clinicians, patients, and families. In keeping with its mission, 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, the 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.

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Abbreviations

AIAN – American Indian/Alaskan Native
AJCC – American Joint Commission on Cancer
APC – Annual Percent Change
API – Asian or Pacific Islander
AYA – Adolescents and Young Adults
ATRT – Atypical Teratoid Rhabdoid Tumor
CBTRUS – Central Brain Tumor Registry of the United States
CCR – Central Cancer Registry
CDC – Centers for Disease Control and Prevention
CS – Collaborative Staging
CSS – Cancer Surveillance System
CI – Confidence interval
CNS – Central nervous system
ICD-O-3 – International Classification of Diseases for Oncology, Third Edition
ICCC – International Classification of Childhood Cancer
IDH1/2 – Isocitrate dehydrogenase 1/2
MGMT – O-6-methylguanine-DNA methyltransferase
NAACCR – North American Association of Central Cancer Registries
NCHS – National Center for Health Statistics
NCI – National Cancer Institute
NOS – Not otherwise specified
NPCR – National Program of Cancer Registries

NVSS – National Vital Statistics System
PNET – Primitive Neuroectodermal Tumor
SEER – Surveillance, Epidemiology, and End Results
US – United States
USCS – United States Cancer Statistics
VHA – Veteran's Health Administration
WHO – World Health Organization.

Supplementary Material

Supplementary material is available at *Neuro-Oncology* online.

References

1. Kruchko C, Ostrom QT, Gittleman H, Barnholtz-Sloan JS. The CBTRUS story: providing accurate population-based statistics on brain and other central nervous system tumors for everyone. *Neuro Oncol*. 2018;20(3):295–298.
2. Louis D, Wiestler O, Cavanee W, eds. *WHO Classification of Tumours of the Central Nervous System*. Lyon, France: International Agency for Research on Cancer; 2007.
3. Ostrom QT, Gittleman H, Liao P, et al. CBTRUS Statistical Report: primary brain and central nervous system tumors diagnosed in the United States in 2007–2011. *Neuro Oncol*. 2014; 16(s4):iv1–iv63.
4. Centers for Disease Control and Prevention (CDC). *National Program of Cancer Registries Cancer Surveillance System Rationale and Approach*. 1999; http://www.cdc.gov/cancer/npcr/pdf/npcr_css.pdf.
5. *Cancer Registries Amendment Act*, 102nd Cong. § 515 (1992). http://www.gpo.gov/fdsys/pkg/STATUTE-106/pdf/STATUTE-106-Pg3372.pdf.
6. *Benign Brain Tumor Cancer Registries Amendment Act, 107th Cong. § 260 (2002)*. http://www.gpo.gov/fdsys/pkg/PLAW-107publ260/pdf/PLAW-107publ260.pdf.
7. National Cancer Institute. *Overview of the SEER Program*. http://seer.cancer.gov/about/overview.html.
8. Wöhrer A, Waldhör T, Heinzl H, et al. The Austrian Brain Tumour Registry: a cooperative way to establish a population-based brain tumour registry. *J Neurooncol*. 2009;95(3):401–411.
9. Asklund T, Malmstrom A, Bergqvist M, Bjor O, Henriksson R. Brain tumors in Sweden: data from a population-based registry 1999–2012. *Acta Oncologica*. 2015; 54(3):377–384.
10. U.S. Cancer Statistics Working Group. . United States Cancer Statistics: 1999-2015 Incidence and Mortality Web-based Report. Available from URL: http://www.cdc.gov/uscs.
11. Fritz A, PC, Jack A, Shanmugaratnam K, Sobin L, Perkin DM, Whelan S, eds. *International Classification of Diseases for Oncology, Third edition*. World Health Organization; 2000.
12. Surveillance Epidemiology and End Results (SEER) Program. Number of Persons by Race and Hispanic Ethnicity for SEER Participants (2010 Census Data). 2015; http://seer.cancer.gov/registries/data.html.
13. Surveillance Epidemiology and End Results (SEER) Program. *SEER*Stat Database: Mortality - All COD, Aggregated With State, Total U.S. (1969–2015) <Katrina/Rita Population Adjustment>*, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).
14. McCarthy BJ, Surawicz T, Bruner JM, Kruchko C, Davis F. Consensus conference on brain tumor definition for registration. November 10, 2000. *Neuro Oncol*. 2002;4(2):134–145. http://www.ncbi.nlm.nih.gov/pubmed/11916506.
15. Surveillance Research Program - National Cancer Institute. *ICCC Recode ICD-O-3/WHO*. 2008. http://seer.cancer.gov/iccc/iccc-who2008.html.
16. Steliarova-Foucher E, Stiller C, Lacour B, Kaatsch P. International classification of childhood cancer, third edition. *Cancer* 2005; 103(7):1457–1467.
17. Swerdlow SH, Campo E, Harris NL, et al. *WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues, Fourth Edition*. World Health Organization; 2007.
18. Kleihues P, Cavenee W, eds. *Tumours of the Nervous System: World Health Organization Classification of Tumours*. Lyon, France: IARC Press; 2000.
19. Louis DN, OH, Wiestler OD, Cavanee WK, eds. *WHO Classification of Tumours of the Central Nervous System*. Lyon, France: International Agency for Research on Cancer; 2016.
20. American Joint Committee on Cancer. *Collaborative Stage Data Collection System*. 2015; http://www.cancerstaging.org/cstage/.
21. Lym RL, Ostrom QT, Kruchko C, et al. Completeness and concordancy of WHO grade assignment for brain and central nervous system tumors in the United States, 2004–2011. *J Neurooncol*. 2015.
22. Surveillance Research Program - National Cancer Institute. *ICD-0–3 SEER Site/Histology Validation List*. 2012; http://seer.cancer.gov/icd-o-3/sitetype.icdo3.d20121205.pdf.
23. R Core Team. *R: A language and environment for statistical computing*. 2018; http://www.R-project.org/.
24. Surveillance Epidemiology and End Results (SEER) Program. *SEER*Stat software version 8.3.5*. 2018; www.seer.cancer.gov/seerstat.
25. Lemon J. Plotrix: a package in the red light district of R. *R-News*. 2006; 6(4):8–12.
26. Wickham H. *ggplot2: elegant graphics for data analysis*. 2009; http://had.co.nz/ggplot2/book.
27. Bivand R, Rundel C. *rgeos: Interface to Geometry Engine - Open Source (GEOS). R package version 0.3–11*. 2015; http://CRAN.R-project.org/package=rgeos.
28. Bivand R, Keitt T, Rowlingson B. *rgdal: Bindings for the Geospatial Data Abstraction Library. R package version 1.0–4*. 2015; http://CRAN.R-project.org/package=rgdal.
29. Luo J. *SEER2R: reading and writing SEER*STAT data files. R package version 1.0*. 2012; http://CRAN.R-project.org/package=SEER2R.
30. Bivand R, Lewin-Koh N. *maptools: Tools for Reading and Handling Spatial Objects. R package version 0.8–36*. 2015; http://CRAN.R-project.org/package=maptools.
31. Surveillance Epidemiology and End Results (SEER) Program. *SEER*Stat Database: Populations - Total U.S. (1990–2016) - Linked To County Attributes - Total U.S., 1969–2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released October 2017*. http://seer.cancer.gov/popdata/.
32. Tiwari RC, Clegg LX, Zou Z. Efficient interval estimation for age-adjusted cancer rates. *Stat Methods Med Res*. 2006;15(6):547–569. http://www.ncbi.nlm.nih.gov/pubmed/17260923.
33. NAACCR Race and Ethnicity Work Group. *NAACCR Guideline for Enhancing Hispanic/Latino Identification: Revised NAACCR Hispanic/Latino Identification Algorithm [NHIA v2.2.1]*. September 2012.
34. United States Department of Agriculture. *2013 Rural Urban Continuum Codes*. 2013; https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation.aspx.
35. Joinpoint Regression Program, *Version 4.2.0.2* - June 2015; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute.

36. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med*. 2000;19(3):335–351.
37. Zhu L, Pickle LW, Ghosh K, et al. Predicting US- and state-level cancer counts for the current calendar year: Part II: evaluation of spatiotemporal projection methods for incidence. *Cancer*. 2012;118(4):1100–1109.
38. Surveillance Epidemiology and End Results (SEER) Program. *SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2016 Sub (1973–2015 varying) - Linked To County Attributes - Total U.S., 1969–2016 Counties*, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2018, based on the November 2017 submission.
39. Edwards BK, Noone AM, Mariotto AB, et al. Annual Report to the Nation on the status of cancer, 1975–2010, featuring prevalence of comorbidity and impact on survival among persons with lung, colorectal, breast, or prostate cancer. *Cancer*. 2014; 120(9):1290–1314.
40. Zullig LL, Jackson GL, Dorn RA, et al. Cancer incidence among patients of the U.S. Veterans Affairs Health Care System. *Mil Med*. 2012;177(6): 693–701.
41. Clegg LX, Feuer EJ, Midthune DN, Fay MP, Hankey BF. Impact of reporting delay and reporting error on cancer incidence rates and trends. *J Natl Cancer Inst*. 2002;94(20):1537–1545.
42. Midthune DN, Fay MP, Clegg LX, Feuer EJ. Modeling reporting delays and reporting corrections in cancer registry data. *J Am Stat Assoc*. 2005; 100(469):61–70.
43. Surveillance Epidemiology and End Results (SEER) Program. *Cancer Incidence Rates Adjusted for Reporting Delay*. 2016; http://surveillance.cancer.gov/delay/.
44. Li XR, Kruchko C, Wu XC, et al. Are benign and borderline brain tumors underreported? *J Registry Manag*. 2016;43(4):187–194.
45. Anderson RN, Rosenberg HM. Report of the second workshop on age adjustment. *Vital Health Stat. 4*. 1998(30):I–vi, 1–37.
46. Anderson RN, Rosenberg HM. Age standardization of death rates: implementation of the year 2000 standard. *Natl Vital Stat Rep*. 1998; 47(3):1–16, 20.
47. L D, Johnson C, Adams S, Negoita S. *Solid Tumor Rules*. Rockville, MD: National Cancer Institute; 2018.
48. Johnson C, Peace S, Adamo P, Fritz A, Percy-Laurry A, Edwards B. *The 2007 Multiple Primary and Histology Coding Rules*. Bethesda, MD: National Cancer Institute; 2007.
49. Ostrom QT, de Blank PM, Kruchko C, et al. Alex's lemonade stand foundation infant and childhood primary brain and central nervous system tumors diagnosed in the United States in 2007–2011. *Neuro. Oncol*. 2015; 16(Suppl 10):x1–x36.
50. Gurney JG, SM, Bunin GR. Chapter III: CNS and miscellaneous intracranial and intraspinal neoplasms. In: Ries LAG, SM, Gurney JG, et al., eds. *Cancer Incidence and Survival among Children and Adolescents: United States SEER Program 1975–1995, National Cancer Institute, SEER Program. . NIH Pub. No. 99–4649*. Bethesda, MD; 1999.
51. de Blank PM, Ostrom QT, Rouse C, et al. Years of life lived with disease and years of potential life lost in children who die of cancer in the United States, 2009. *Cancer Med*. 2015.
52. National Cancer Institute at the National Institutes of Health. *Adolescents and Young Adults with Cancer*. http://www.cancer.gov/cancertopics/aya.
53. Ostrom QT, Gittleman H, de Blank PM, 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; 18(Suppl 1):i1–i50.
54. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2016. *CA Cancer J Clin*. 2016;66(1):7–30.
55. McCarthy BJ, Kruchko C, Dolecek TA. The impact of the Benign Brain Tumor Cancer Registries Amendment Act (Public Law 107-260) on non-malignant brain and central nervous system tumor incidence trends. *J Registry Manag*. 2013;40(1):32–35.
56. Gittleman HR, Ostrom QT, Rouse CD, et al. Trends in central nervous system tumor incidence relative to other common cancers in adults, adolescents, and children in the United States, 2000 to 2010. *Cancer*. 2015; 121(1):102–112.
57. Kshettry VR, Ostrom QT, Kruchko C, Al-Mefty O, Barnett GH, Barnholtz-Sloan JS. Descriptive epidemiology of World Health Organization grades II and III intracranial meningiomas in the United States. *Neuro Oncol*. 2015;17(8):1166–1173.
58. Zhang AS, Ostrom QT, Kruchko C, Rogers L, Peereboom DM, Barnholtz-Sloan JS. Complete prevalence of malignant primary brain tumors registry data in the United States compared with other common cancers, 2010. *Neuro Oncol*. 2016.
59. Gittleman H, Boscia A, Ostrom QT, et al. Survivorship in adults with malignant brain and other central nervous system tumor from 2000–2014. *Neuro Oncol*. 2018.
60. *DevCan: Probability of Developing or Dying of Cancer Software, Version 6.2.0*. Statistical Research and Applications Branch, National Cancer Institute, 2007. http://srab.cancer.gov/devcan/ [computer program].
61. Fay MP, Pfeiffer R, Cronin KA, Le C, Feuer EJ. Age-conditional probabilities of developing cancer. *Stat Med*. 2003;22(11):1837–1848.
62. Fay MP. Estimating age conditional probability of developing disease from surveillance data. *Popul Health Metr*. 2004;2(1):6.
63. Surveillance Epidemiology and End Results (SEER) Program. *DevCan database: "SEER 18 Incidence and Mortality, 2000–2014, with Kaposi Sarcoma and Mesothelioma"*. National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released August 2017, based on the November 2016 submission. Underlying mortality data provided by NCHS.
64. Braganza MZ, Kitahara CM, Berrington de González A, Inskip PD, Johnson KJ, Rajaraman P. Ionizing radiation and the risk of brain and central nervous system tumors: a systematic review. *Neuro Oncol*. 2012;14(11):1316–1324.
65. Turner MC. Epidemiology: allergy history, IgE, and cancer. *Cancer Immunol Immunother*. 2012;61(9):1493–1510.
66. Malmer B, Henriksson R, Grönberg H. Familial brain tumours-genetics or environment? A nationwide cohort study of cancer risk in spouses and first-degree relatives of brain tumour patients. *Int J Cancer*. 2003;106(2):260–263.
67. Wrensch M, Lee M, Miike R, et al. Familial and personal medical history of cancer and nervous system conditions among adults with glioma and controls. *Am J Epidemiol*. 1997;145(7):581–593.
68. Malmer B, Grönberg H, Bergenheim AT, Lenner P, Henriksson R. Familial aggregation of astrocytoma in northern Sweden: an epidemiological cohort study. *Int J Cancer*. 1999;81(3):366–370.
69. Hill DA, Inskip PD, Shapiro WR, et al. Cancer in first-degree relatives and risk of glioma in adults. *Cancer Epidemiol Biomarkers Prev*. 2003;12(12):1443–1448.
70. Scheurer ME, Etzel CJ, Liu M, et al. Aggregation of cancer in first-degree relatives of patients with glioma. *Cancer Epidemiol Biomarkers Prev*. 2007;16(11):2491–2495.
71. Ostrom QT, Bauchet L, Davis FG, et al. The epidemiology of glioma in adults: a "state of the science" review. *Neuro Oncol*. 2014;16(7): 896–913.
72. Johnson KJ, Cullen J, Barnholtz-Sloan JS, et al. Childhood brain tumor epidemiology: a brain tumor epidemiology consortium review. *Cancer Epidemiol Biomarkers Prev*. 2014;23(12):2716–2736.

73. Wiemels J, Wrensch M, Claus EB. Epidemiology and etiology of meningioma. *J Neurooncol*. 2010;99(3):307–314.
74. Reifenberger G, Wirsching HG, Knobbe-Thomsen CB, Weller M. Advances in the molecular genetics of gliomas - implications for classification and therapy. *Nat Rev Clin Oncol*. 2017;14(7):434–452.
75. Cairncross JG, Ueki K, Zlatescu MC, et al. Specific genetic predictors of chemotherapeutic response and survival in patients with anaplastic oligodendrogliomas. *J Natl Cancer Inst*. 1998;90(19):1473–1479.
76. Cairncross G, Wang M, Shaw E, et al. Phase III trial of chemoradiotherapy for anaplastic oligodendroglioma: long-term results of RTOG 9402. *J Clin Oncol*. 2013;31(3):337–343.
77. Vogelbaum MA, Hu C, Peereboom DM, et al. Phase II trial of preirradiation and concurrent temozolomide in patients with newly diagnosed anaplastic oligodendrogliomas and mixed anaplastic oligoastrocytomas: long term results of RTOG BR0131. *J Neurooncol*. 2015;124(3):413–420.
78. van den Bent MJ, Brandes AA, Taphoorn MJ, et al. Adjuvant procarbazine, lomustine, and vincristine chemotherapy in newly diagnosed anaplastic oligodendroglioma: long-term follow-up of EORTC brain tumor group study 26951. *J Clin Oncol*. 2013;31(3):344–350.
79. Yan H, Parsons DW, Jin G, et al. IDH1 and IDH2 mutations in gliomas. *N Engl J Med*. 2009;360(8):765–773.
80. Qi S, Yu L, Li H, et al. Isocitrate dehydrogenase mutation is associated with tumor location and magnetic resonance imaging characteristics in astrocytic neoplasms. *Oncol Lett*. 2014;7(6):1895–1902.
81. Paldor I, Pearce FC, Drummond KJ, Kaye AH. Frontal glioblastoma multiforme may be biologically distinct from non-frontal and multilobar tumors. *J Clin Neurosci*. 2016;34:128–132.
82. Ceccarelli M, Barthel FP, Malta TM, et al.; TCGA Research Network. Molecular profiling reveals biologically discrete subsets and pathways of progression in diffuse glioma. *Cell*. 2016;164(3):550–563.
83. Brat DJ, Verhaak RG, et al.; The Cancer Genome Atlas Research Network. Comprehensive, integrative genomic analysis of diffuse lower-grade gliomas. *N Engl J Med*. 2015; 372(26):2481–2498.
84. Hegi ME, Diserens AC, Gorlia T, et al. MGMT gene silencing and benefit from temozolomide in glioblastoma. *N Engl J Med*. 2005;352(10):997–1003.
85. Hegi ME, Liu L, Herman JG, et al. Correlation of O6-methylguanine methyltransferase (MGMT) promoter methylation with clinical outcomes in glioblastoma and clinical strategies to modulate MGMT activity. *J Clin Oncol*. 2008;26(25):4189–4199.
86. Stupp R, Hegi ME, Gilbert MR, Chakravarti A. Chemoradiotherapy in malignant glioma: standard of care and future directions. *J Clin Oncol*. 2007;25(26):4127–4136.
87. Noushmehr H, Weisenberger DJ, Diefes K, et al.; Cancer Genome Atlas Research Network. Identification of a CpG island methylator phenotype that defines a distinct subgroup of glioma. *Cancer Cell*. 2010;17(5):510–522.
88. van den Bent MJ, Erdem-Eraslan L, Idbaih A, et al. MGMT-STP27 methylation status as predictive marker for response to PCV in anaplastic Oligodendrogliomas and Oligoastrocytomas. A report from EORTC study 26951. *Clin Cancer Res*. 2013;19(19):5513–5522.
89. Kool M, Korshunov A, Remke M, et al. Molecular subgroups of medulloblastoma: an international meta-analysis of transcriptome, genetic aberrations, and clinical data of WNT, SHH, Group 3, and Group 4 medulloblastomas. *Acta Neuropathol*. 2012;123(4):473–484.
90. Northcott PA, Dubuc AM, Pfister S, Taylor MD. Molecular subgroups of medulloblastoma. *Expert Rev Neurother*. 2012;12(7):871–884.
91. Northcott PA, Jones DT, Kool M, et al. Medulloblastomics: the end of the beginning. *Nat Rev Cancer*. 2012;12(12):818–834.
92. Northcott PA, Buchhalter I, Morrissy AS, et al. The whole-genome landscape of medulloblastoma subtypes. *Nature*. 2017;547(7663):311–317.
93. Jones C, Baker SJ. Unique genetic and epigenetic mechanisms driving paediatric diffuse high-grade glioma. *Nat Rev Cancer*. 2014; 14(10).
94. Wu G, Diaz AK, Paugh BS, et al. The genomic landscape of diffuse intrinsic pontine glioma and pediatric non-brainstem high-grade glioma. *Nat Genet*. 2014;46(5):444–450.
95. Mackay A, Burford A, Carvalho D, et al. Integrated molecular meta-analysis of 1000 pediatric high-grade and diffuse intrinsic pontine glioma. *Cancer Cell*. 2017; 32(4):520–537.e525.
96. Hoffman LM, DeWire M, Ryall S, et al. Spatial genomic heterogeneity in diffuse intrinsic pontine and midline high-grade glioma: implications for diagnostic biopsy and targeted therapeutics. *Acta Neuropathol Commun*. 2016;4:1.
97. Grill J, Puget S, Andreiuolo F, Philippe C, MacConaill L, Kieran MW. Critical oncogenic mutations in newly diagnosed pediatric diffuse intrinsic pontine glioma. *Pediatr Blood Cancer*. 2012;58(4):489–491.
98. Lapin DH, Tsoli M, Ziegler DS. Genomic insights into diffuse intrinsic pontine glioma. *Front Oncol*. 2017;7:57.
99. Ostrom QT, Gittleman H, Kruchko C, et al. Completeness of required site-specific factors for brain and CNS tumors in the Surveillance, Epidemiology and End Results (SEER) 18 database (2004–2012, varying). *J Neuro Oncol*. 2016.
100. Weir HK, Johnson CJ, Mariotto AB, et al. Evaluation of North American Association of Central Cancer Registries' (NAACCR) data for use in population-based cancer survival studies. *J Natl Cancer Inst Monogr*. 2014;2014(49):198–209.
101. Wilson RJ, O'Neil ME, Ntekop E, Zhang K, Ren Y. Coding completeness and quality of relative survival-related variables in the National Program of Cancer Registries Cancer Surveillance System, 1995–2008. *J Registry Manag*. 2014; 41(2):65–71; quiz 96-67.
102. Kleihues P, Burger PC, Scheithauer BW. The new WHO classification of brain tumours. *Brain Pathol*. 1993;3(3):255–268.
103. van den Bent MJ. Interobserver variation of the histopathological diagnosis in clinical trials on glioma: a clinician's perspective. *Acta Neuropathol*. 2010;120(3):297–304.
104. Aldape K, Simmons ML, Davis RL, et al. Discrepancies in diagnoses of neuroepithelial neoplasms: the San Francisco Bay Area Adult Glioma Study. *Cancer*. 2000;88(10):2342–2349.
105. Sahm F, Reuss D, Koelsche C, et al. Farewell to oligoastrocytoma: in situ molecular genetics favor classification as either oligodendroglioma or astrocytoma. *Acta Neuropathol*. 2014;128(4):551–559.

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
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	C71.8–C71.9
Overlapping lesion of brain	*C71.8*
Brain, NOS	*C71.9*
Spinal cord and cauda equina	C72.0–C72.1
Spinal cord	*C72.0*
Cauda equina	*C72.1*
Cranial nerves	C72.2–C72.5
Olfactory nerve	*C72.2*
Optic nerve	*C72.3*
Acoustic nerve	*C72.4*
Cranial nerve, NOS	*C72.5*
Other nervous system	C72.8–C72.9
Overlapping lesion of brain and central nervous system	*C72.8*
Nervous system, NOS	*C72.9*
Meninges (cerebral & spinal)	C70.0–C70.9
Cerebral meninges	*C70.0*
Spinal meninges	*C70.1*
Meninges, NOS	*C70.9*
Pituitary and craniopharyngeal duct	C75.1–C75.2
Pituitary gland	*C75.1*
Craniopharyngeal duct	*C75.2*
Pineal gland	C75.3
Olfactory tumors of the nasal cavity[b]	C30.0

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

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

Histology	ICD-O-3[a] Histology Code[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant (ICD-O-3 Behavior Code /3)	Non-Malignant (ICD-O-3 Behavior Code /0 and /1)
Tumors of Neuroepithelial Tissue			
Pilocytic astrocytoma*	9421[c], 9425[d]	9421/1[c], 9425/3[d]	*None*
Diffuse astrocytoma*	9400, 9410, 9411, 9420	9400/3, 9410/3, 9411/3, 9420/3	*None*
Anaplastic astrocytoma*	9401	9401/3	*None*
Unique astrocytoma variants*	9381, 9384, 9424	9381/3, 9424/3	9384/1
Glioblastoma*	9440, 9441, 9442/3[e]	9440/3, 9441/3, 9442/3	*None*
Oligodendroglioma*	9450	9450/3	*None*
Anaplastic oligodendroglioma*	9451, 9460	9451/3, 9460/3	*None*
Oligoastrocytic tumors*	9382	9382/3	*None*
Ependymal tumors*	9383, 9391, 9392, 9393, 9394	9391/3, 9392/3, 9393/3	9383/1, 9394/1
Glioma malignant, NOS*	9380, 9431[c], 9432[c]	9380/3, 9431/1, 9432/1	*None*
Choroid plexus tumors	9390	9390/3	9390/0,1
Other neuroepithelial tumors*	9363, 9423, 9430, 9444/1[f]	9423/3, 9430/3	9363/0, 9444/1
Neuronal and mixed neuronal-glial tumors*	8680, 8681, 8690, 8693, 9412, 9413, 9442/1[e], 9492 (excluding site C75.1), 9493, 9505, 9506, 9522, 9523	8680/3, 8693/3, 9505/3, 9522/3, 9523/3	8680/0,1, 8681/1, 8690/1, 8693/1, 9412/1, 9413/0, 9442/1, 9492/0 (excluding site C75.1), 9493/0, 9505/1, 9506/1, 9509/1,
Tumors of the pineal region	9360, 9361, 9362, 9395[d]	9362/3, 9395/3[d]	9360/1, 9361/1
Embryonal tumors	8963, 9364, 9470-9474, 9480, 9490, 9500-9502, 9508	8963/3, 9364/3, 9470/3, 9471/3, 9472/3, 9473/3, 9474/3, 9480/3, 9490/3, 9500/3, 9501/3, 9502/3, 9508/3	9490/0
Tumors of Cranial and Spinal 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 spinal nerves	9562	*None*	9562/0

Table 2 *Continued*

Histology	ICD-O-3[a] Histology Code[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant (ICD-O-3 Behavior Code /3)	Non-Malignant (ICD-O-3 Behavior Code /0 and /1)
Tumors of Meninges			
Meningioma	9530-9534, 9537-9539	9530/3, 9538/3, 9539/3	9530/0,1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, 9539/1
Mesenchymal tumors	8324, 8800-8806, 8810, 8815, 8824, 8830, 8831, 8835, 8836, 8850-8854, 8857, 8861, 8870, 8880, 8890, 8897, 8900-8902, 8910, 8912, 8920, 8921, 8935, 8990, 9040, 9136, 9150, 9170, 9180, 9210, 9241, 9260, 9373	8800/3, 8801/3, 8802/3, 8803/3, 8804/3, 8805/3, 8806/3, 8810/3, 8815/3, 8830/3, 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, 8990/3, 9040/3, 9150/3, 9170/3, 9180/3, 9260/3	8324/0, 8800/0, 8810/0, 8815/0, 8824/0,1, 8830/0,1, 8831/0, 8835/1, 8836/1, 8850/0,1, 8851/0, 8852/0, 8854/0, 8857/0, 8861/0, 8870/0, 8880/0, 8890/0,1, 8897/1, 8900/0, 8920/1, 8935/0,1, 8990/0,1, 9040/0, 9136/1, 9150/0,1, 9170/0, 9180/0, 9210/0, 9241/0, 9373/0
Primary melanocytic lesions	8720, 8728, 8770, 8771	8720/3, 8728/3, 8770/3, 8771/3	8728/0,1, 8770/0, 8771/0
Other neoplasms related to the meninges	9161, 9220, 9231, 9240, 9243, 9370-9372, 9535	9220/3, 9231/3, 9240/3, 9243/3, 9370/3, 9371/3, 9372/3	9161/1, 9220/0,1, 9535/0
Lymphomas and Hematopoietic Neoplasms			
Lymphoma	9590, 9591, 9596, 9650-9655, 9659, 9661-9665, 9667, 9670, 9671, 9673, 9675, 9680, 9684, 9687, 9690, 9691, 9695, 9698, 9699, 9701, 9702, 9705, 9714, 9719, 9728, 9729	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, 9690/3, 9691/3, 9695/3, 9698/3, 9699/3, 9701/3, 9702/3, 9705/3, 9714/3, 9719/3, 9728/3, 9729/3	*None*
Other hematopoietic neoplasms	9727, 9731, 9733, 9734, 9740, 9741, 9750-9758, 9760, 9766, 9823, 9826, 9827, 9832, 9837, 9860, 9861, 9866, 9930, 9970	9727/3, 9731/3, 9733/3, 9734/3, 9740/3, 9741/3, 9750/3, 9754/3, 9755/3, 9756/3, 9757/3, 9758/3, 9760/3, 9823/3, 9826/3, 9827/3, 9832/3, 9837/3, 9860/3, 9861/3, 9866/3, 9930/3	9740/1, 9751/1, 9752/1, 9753/1, 9766/1, 9970/1
Germ Cell Tumors and Cysts			
Germ cell tumors, cysts and heterotopias	8020, 8440, 9060, 9061, 9064, 9065, 9070-9072, 9080-9085, 9100, 9101	8020/3, 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, 9084/0
Tumors of Sellar Region			
Tumors of the pituitary	8040, 8140, 8146, 8246, 8260, 8270-8272, 8280, 8281, 8290, 8300, 8310, 8323, 9492 (Site C75.1 only), 9582	8140/3, 8246/3, 8260/3, 8270/3, 8272/3, 8280/3, 8281/3, 8290/3, 8300/3, 8310/3, 8323/3	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, 9492/0 (site C75.1 only), 9582/0
Craniopharyngioma	9350, 9351, 9352	*None*	9350/1, 9351/1, 9352/1

Table 2 *Continued*

Histology	ICD-O-3[a] Histology Code[b]	ICD-O-3[a] Histology and Behavior Code[b]	
		Malignant (ICD-O-3 Behavior Code /3)	Non-Malignant (ICD-O-3 Behavior Code /0 and /1)
Unclassified Tumors			
Hemangioma	9120-9123, 9125, 9130, 9131, 9133, 9140	9120/3, 9130/3, 9133/3, 9140/3	9120/0, 9121/0, 9122/0, 9123/0, 9125/0, 9130/0,1, 9131/0, 9133/1
Neoplasm, unspecified	8000-8005, 8010, 8021	8000/3, 8001/3, 8002/3, 8003/3, 8004/3, 8005/3, 8010/3, 8021/3	8000/0,1, 8001/0,1, 8005/0, 8010/0
All other	8320, 8452, 8710, 8711, 8713, 8811, 8840, 8896, 8980, 9173, 9503, 9580	8320/3, 8710/3, 8711/3, 8811/3, 8840/3, 8896/3, 8980/3, 9503/3, 9580/3	8452/1, 8711/0, 8713/0, 8811/0, 8840/0, 9173/0, 9580/0

[a]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[b]See the CBTRUS website for additional information about the specific histology codes included in each group: http://www.cbtrus.org.
[c]WHO Classification listed as having uncertain behavior (ICD-O-3, behavior code /1) but included in population-based cancer registry reporting as CNS tumor with malignant behavior (ICD-O-3, behavior code /3).
[d]Histology only included starting with diagnosis year 2015. See NAACCR website: http://www.naaccr.org/LinkClick.aspx?fileticket1⁄44Hx-2XJJqFo%3d&tabid1⁄4161&mid1⁄4523.
[e]ICD-O-3 histology and behavior code 9442/3 only.
[f]ICD-O-3 histology and behavior code 9442/1 only.
* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology code 9380-9384 and 9391-9460.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified

Table 3 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 Major Histology Grouping, Histology, Behavior, and Sex, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	Total						Male						Female					
	5-Year Total	Annual Average	% of All Tumors	Median Age	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI
Tumors of Neuroepithelial Tissue	**110,861**	**22,172**	**28.2%**	**57**	**6.57**	**6.53-6.61**	**62,126**	**12,425**	**93.0%**	**7.0%**	**7.70**	**7.64-7.76**	**48,735**	**9,747**	**92.3%**	**7.7%**	**5.57**	**5.52-5.62**
Pilocytic astrocytoma	5,212	1,042	1.3%	12	0.35	0.34-0.36	2,701	540	100.0%	0.0%	0.36	0.35-0.37	2,511	502	100.0%	0.0%	0.35	0.33-0.36
Diffuse astrocytoma	7,562	1,512	1.9%	48	0.46	0.45-0.48	4,193	839	100.0%	0.0%	0.53	0.51-0.55	3,369	674	100.0%	0.0%	0.40	0.39-0.42
Anaplastic astrocytoma	6,797	1,359	1.7%	53	0.41	0.40-0.42	3,712	742	100.0%	0.0%	0.46	0.45-0.48	3,085	617	100.0%	0.0%	0.36	0.34-0.37
Unique astrocytoma variants	1,161	232	0.3%	23	0.08	0.07-0.08	631	126	68.5%	31.5%	0.08	0.08-0.09	530	106	67.5%	32.5%	0.07	0.06-0.07
Malignant	*790*	*158*	--	*31*	*0.05*	*0.05-0.05*	*432*	*86*	--	--	*0.06*	*0.05-0.06*	*358*	*72*	--	--	*0.04*	*0.04-0.05*
Non-Malignant	*371*	*74*	--	*11*	*0.03*	*0.02-0.03*	*199*	*40*	--	--	*0.03*	*0.02-0.03*	*172*	*34*	--	--	*0.02*	*0.02-0.03*
Glioblastoma	57,805	11,561	14.7%	65	3.21	3.18-3.23	33,348	6,670	100.0%	0.0%	4.00	3.95-4.04	24,457	4,891	100.0%	0.0%	2.53	2.50-2.56
Oligodendroglioma	3,679	736	0.9%	43	0.23	0.23-0.24	2,048	410	100.0%	0.0%	0.26	0.25-0.28	1,631	326	100.0%	0.0%	0.20	0.19-0.21
Anaplastic oligodendroglioma	1,767	353	0.4%	50	0.11	0.10-0.11	978	196	100.0%	0.0%	0.12	0.11-0.13	789	158	100.0%	0.0%	0.10	0.09-0.10
Oligoastrocytic tumors	2,651	530	0.7%	42	0.17	0.16-0.17	1,512	302	100.0%	0.0%	0.19	0.18-0.21	1,139	228	100.0%	0.0%	0.14	0.13-0.15
Ependymal tumors	6,858	1,372	1.7%	44	0.43	0.42-0.44	3,877	775	56.3%	43.7%	0.49	0.47-0.51	2,981	596	62.5%	37.5%	0.37	0.36-0.38
Malignant	*4,045*	*809*	--	*42*	*0.25*	*0.25-0.26*	*2,183*	*437*	--	--	*0.28*	*0.27-0.29*	*1,862*	*372*	--	--	*0.23*	*0.22-0.25*
Non-Malignant	*2,813*	*563*	--	*47*	*0.17*	*0.17-0.18*	*1,694*	*339*	--	--	*0.21*	*0.20-0.22*	*1,119*	*224*	--	--	*0.14*	*0.13-0.14*
Glioma malignant, NOS	7,518	1,504	1.9%	36	0.48	0.47-0.49	3,824	765	100.0%	0.0%	0.50	0.49-0.52	3,694	739	100.0%	0.0%	0.46	0.44-0.47
Choroid plexus tumors	820	164	0.2%	20	0.05	0.05-0.06	411	82	16.5%	83.5%	0.05	0.05-0.06	409	82	14.9%	85.1%	0.05	0.05-0.06
Malignant	*129*	*26*	--	*2*	*0.01*	*0.01-0.01*	*68*	*14*	--	--	*0.01*	*0.01-0.01*	*61*	*12*	--	--	*0.01*	*0.01-0.01*
Non-Malignant	*691*	*138*	--	*24*	*0.04*	*0.04-0.05*	*343*	*69*	--	--	*0.04*	*0.04-0.05*	*348*	*70*	--	--	*0.05*	*0.04-0.05*
Other neuroepithelial tumors	100	20	0.0%	36	0.01	0.01-0.01	34	7	47.1%	52.9%	0.00	0.00-0.01	66	13	75.8%	24.2%	0.01	0.01-0.01
Malignant	*66*	*13*	--	*26*	*0.00*	*0.00-0.01*	*16*	*3*	--	--	*0.00*	*0.00-0.00*	*50*	*10*	--	--	*0.01*	*0.00-0.01*
Non-Malignant	*34*	*7*	--	*41*	*0.00*	*0.00-0.00*	*18*	*4*	--	--	*0.00*	*0.00-0.00*	*16*	*3*	--	--	*0.00*	*0.00-0.00*
Neuronal and mixed neuronal-glial tumors	4,640	928	1.2%	27	0.30	0.29-0.31	2,487	497	21.4%	78.6%	0.32	0.31-0.33	2,153	431	18.1%	81.9%	0.28	0.27-0.29
Malignant	*922*	*184*	--	*52*	*0.06*	*0.05-0.06*	*532*	*106*	--	--	*0.07*	*0.06-0.07*	*390*	*78*	--	--	*0.05*	*0.04-0.05*
Non-Malignant	*3,718*	*744*	--	*22*	*0.24*	*0.24-0.25*	*1,955*	*391*	--	--	*0.26*	*0.24-0.27*	*1,763*	*353*	--	--	*0.23*	*0.22-0.24*
Tumors of the pineal region	767	153	0.2%	35	0.05	0.05-0.05	307	61	68.1%	31.9%	0.04	0.04-0.04	460	92	46.3%	53.7%	0.06	0.05-0.06
Malignant	*422*	*84*	--	*27*	*0.03*	*0.03-0.03*	*209*	*42*	--	--	*0.03*	*0.02-0.03*	*213*	*43*	--	--	*0.03*	*0.02-0.03*
Non-Malignant	*345*	*69*	--	*41*	*0.02*	*0.02-0.02*	*98*	*20*	--	--	*0.01*	*0.01-0.02*	*247*	*49*	--	--	*0.03*	*0.03-0.03*
Embryonal tumors	3,524	705	0.9%	8	0.24	0.23-0.25	2,063	413	97.8%	2.2%	0.28	0.26-0.29	1,461	292	95.8%	4.2%	0.20	0.19-0.21

Table 3 *Continued*

Histology	Total						Male						Female					
	5-Year Total	Annual Average	% of All Tumors	Median Age	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI
Tumors of Cranial and Spinal Nerves	**33,771**	**6,754**	**8.6%**	**56**	**1.96**	**1.94-1.98**	**16,209**	**3,242**	**0.7%**	**99.3%**	**1.96**	**1.93-1.99**	**17,562**	**3,512**	**0.7%**	**99.3%**	**1.96**	**1.93-1.99**
Nerve sheath tumors	33,738	6,748	8.6%	56	1.96	1.94-1.98	16,187	3,237	0.7%	99.3%	1.96	1.93-1.99	17,551	3,510	0.7%	99.3%	1.96	1.93-1.99
Malignant	*225*	*45*	--	*56*	*0.01*	*0.01-0.02*	*107*	*21*	--	--	*0.01*	*0.01-0.02*	*118*	*24*	--	--	*0.01*	*0.01-0.02*
Non-Malignant	*33,513*	*6,703*	--	*52*	*1.94*	*1.92-1.96*	*16,080*	*3,216*	--	--	*1.94*	*1.91-1.98*	*17,433*	*3,487*	--	--	*1.95*	*1.92-1.98*
Other tumors of cranial and spinal nerves	33	7	0.0%	50	0.00	0.00-0.00	22	4	0.0%	100.0%	0.00	0.00-0.00	--	--	0.0%	0.0%	--	--
Tumors of Meninges	**150,390**	**30,078**	**38.3%**	**65**	**8.60**	**8.56-8.65**	**41,602**	**8,320**	**2.8%**	**97.2%**	**5.26**	**5.21-5.31**	**108,788**	**21,758**	**1.3%**	**98.7%**	**11.54**	**11.47-11.61**
Meningioma	145,916	29,183	37.1%	66	8.33	8.29-8.37	39,262	7,852	1.9%	98.1%	4.97	4.92-5.02	106,654	21,331	1.0%	99.0%	11.28	11.21-11.35
Malignant	*1,771*	*354*	--	*65*	*0.10*	*0.10-0.11*	*751*	*150*	--	--	*0.09*	*0.09-0.10*	*1,020*	*204*	--	--	*0.11*	*0.10-0.12*
Non-Malignant	*144,145*	*28,829*	--	*66*	*8.23*	*8.18-8.27*	*38,511*	*7,702*	--	--	*4.88*	*4.83-4.93*	*105,634*	*21,127*	--	--	*11.18*	*11.11-11.24*
Mesenchymal tumors	1,385	277	0.4%	49	0.09	0.08-0.09	683	137	35.7%	64.3%	0.09	0.08-0.09	702	140	28.1%	71.9%	0.08	0.08-0.09
Primary melanocytic lesions	123	25	0.0%	58	0.01	0.01-0.01	72	14	100.0%	0.0%	0.01	0.01-0.01	51	10	51.0%	49.0%	0.01	0.00-0.01
Other neoplasms related to the meninges	2,966	593	0.8%	49	0.18	0.17-0.19	1,585	317	8.4%	91.6%	0.20	0.19-0.21	1,381	276	9.0%	91.0%	0.16	0.16-0.17
Lymphomas and Hematopoietic Neoplasms	**7,818**	**1,564**	**2.0%**	**66**	**0.45**	**0.44-0.46**	**4032**	**806**	**100.0%**	**0.0%**	**0.50**	**0.48-0.51**	**3,786**	**757**	**100.0%**	**0.0%**	**0.40**	**0.39-0.41**
Lymphoma	7,585	1,517	1.9%	66	0.43	0.42-0.44	3,900	780	100.0%	0.0%	0.48	0.47-0.50	3,685	737	100.0%	0.0%	0.39	0.38-0.40
Other hematopoietic neoplasms	233	47	0.1%	50	0.01	0.01-0.02	132	26	100.0%	0.0%	0.02	0.01-0.02	101	20	100.0%	0.0%	0.01	0.01-0.01
Germ Cell Tumors and Cysts	**1,487**	**297**	**0.4%**	**16**	**0.10**	**0.09-0.10**	**1,017**	**203**	**77.2%**	**22.8%**	**0.13**	**0.13-0.14**	**470**	**94**	**46.6%**	**53.4%**	**0.06**	**0.06-0.07**
Germ cell tumors, cysts and heterotopias	1,487	297	0.4%	16	0.10	0.09-0.10	1,017	203	77.2%	22.8%	0.13	0.13-0.14	470	94	46.6%	53.4%	0.06	0.06-0.07
Malignant	*1,004*	*201*	--	*15*	*0.07*	*0.06-0.07*	*785*	*157*	--	--	*0.10*	*0.10-0.11*	*219*	*44*	--	--	*0.03*	*0.03-0.04*
Non-Malignant	*483*	*97*	--	*28*	*0.03*	*0.03-0.03*	*232*	*46*	--	--	*0.03*	*0.03-0.03*	*251*	*50*	--	--	*0.03*	*0.03-0.04*
Tumors of Sellar Region	**67,765**	**13,553**	**17.2%**	**51**	**4.12**	**4.09-4.16**	**30,749**	**6,150**	**0.4%**	**99.6%**	**3.81**	**3.77-3.86**	**37,016**	**7,403**	**0.2%**	**99.8%**	**4.51**	**4.47-4.56**
Tumors of the pituitary	64,749	12,950	16.5%	51	3.94	3.91-3.97	29,268	5,854	0.4%	99.6%	3.63	3.58-3.67	35,481	7,096	0.2%	99.8%	4.33	4.28-4.37
Malignant	*175*	*35*	--	*57*	*0.01*	*0.01-0.01*	*103*	*21*	--	--	*0.01*	*0.01-0.02*	*72*	*14*	--	--	*0.01*	*0.01-0.01*
Non-Malignant	*64,574*	*12,915*	--	*51*	*3.93*	*3.89-3.96*	*29,165*	*5,833*	--	--	*3.61*	*3.57-3.66*	*35,409*	*7,082*	--	--	*4.32*	*4.27-4.36*
Craniopharyngioma	3,016	603	0.8%	43.5	0.19	0.18-0.20	1,481	296	0.0%	100.0%	0.19	0.18-0.20	1,535	307	0.0%	100.0%	0.19	0.18-0.20
Unclassified Tumors	**20,890**	**4,178**	**5.3%**	**63**	**1.23**	**1.22-1.25**	**9,413**	**1,883**	**34.3%**	**65.7%**	**1.22**	**1.19-1.24**	**11,477**	**2,295**	**30.5%**	**69.5%**	**1.26**	**1.23-1.28**
Hemangioma	6,182	1,236	1.6%	50	0.38	0.37-0.39	2,646	529	0.0%	100.0%	0.33	0.32-0.34	3,536	707	0.0%	100.0%	0.42	0.41-0.43
Neoplasm, unspecified	14,588	2,918	3.7%	69	0.85	0.83-0.86	6,698	1,340	47.8%	52.2%	0.88	0.86-0.90	7,890	1,578	44.1%	55.9%	0.83	0.81-0.85

Table 3 *Continued*

Histology	Total						Male						Female					
	5-Year Total	Annual Average	% of All Tumors	Median Age	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI
Malignant	*6,679*	*1,336*	--	*76*	*0.38*	*0.37-0.39*	*3,201*	*640*	--	--	*0.42*	*0.41-0.44*	*3,478*	*696*	--	--	*0.35*	*0.33-0.36*
Non-Malignant	*7,909*	*1,582*	--	*63*	*0.47*	*0.46-0.48*	*3,497*	*699*	--	--	*0.45*	*0.44-0.47*	*4,412*	*882*	--	--	*0.48*	*0.47-0.50*
All other	120	24	0.0%	65	0.01	0.01-0.01	69	14	0.0%	100.0%	0.01	0.01-0.01	51	10	31.4%	68.6%	0.01	0.00-0.01
TOTAL[c]	**392,982**	**78,596**	**--**	**60**	**23.03**	**22.96-23.11**	**165,148**	**33,030**	**40.7%**	**59.3%**	**20.59**	**20.49-20.69**	**227,834**	**45,567**	**23.7%**	**76.3%**	**25.31**	**25.20-25.42**
Malignant	***121,277***	***24,255***	***30.9%***	***59***	***7.12***	***7.08-7.16***	***67,210***	***13,442***	**--**	**--**	***8.35***	***8.28-8.41***	***54,067***	***10,813***	**--**	**--**	***6.05***	***5.99-6.10***
Non-Malignant	***271,705***	***54,341***	***69.1%***	***60***	***15.91***	***15.85-15.97***	***97,938***	***19,588***	**--**	**--**	***12.25***	***12.17-12.32***	***173,767***	***34,753***	**--**	**--**	***19.26***	***19.17-19.36***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Refers to all brain tumors including histologies not presented in this table.
-- Counts are not presented when fewer than 16 cases were reported for the specific histology category.
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 4 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 Major Histology Grouping, Histology, and NCI Age Group, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	Age at Diagnosis											
	Children[c] (0-14)				AYA[d] (15-39)				Adults (40+)			
	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)
Tumors of Neuroepithelial Tissue	**12,573**	**2,515**	**4.11**	**4.04-4.18**	**18,249**	**3,650**	**3.48**	**3.43-3.53**	**80,039**	**16,008**	**10.35**	**10.27-10.42**
Pilocytic astrocytoma	3,096	619	1.01	0.98-1.05	1,521	304	0.28	0.27-0.30	595	119	0.08	0.08-0.09
Diffuse astrocytoma	723	145	0.24	0.22-0.25	2,272	454	0.43	0.41-0.45	4,567	913	0.61	0.59-0.62
Anaplastic astrocytoma	291	58	0.10	0.08-0.11	1,669	334	0.32	0.30-0.33	4,837	967	0.64	0.62-0.66
Unique astrocytoma variants	386	77	0.13	0.11-0.14	413	83	0.08	0.07-0.08	362	72	0.05	0.04-0.05
Malignant	*162*	*32*	*0.05*	*0.05-0.06*	*300*	*60*	*0.06*	*0.05-0.06*	*328*	*66*	*0.04*	*0.04-0.05*
Non-Malignant	*224*	*45*	*0.07*	*0.06-0.08*	*113*	*23*	*0.02*	*0.02-0.02*	*34*	*7*	*0.01*	*0.00-0.01*
Glioblastoma	507	101	0.17	0.15-0.18	2,662	532	0.53	0.51-0.55	54,636	10,927	6.93	6.87-6.99
Oligodendroglioma	100	20	0.03	0.03-0.04	1,425	285	0.28	0.26-0.29	2,154	431	0.30	0.29-0.31
Anaplastic oligodendroglioma	--	--	--	--	442	88	0.09	0.08-0.10	1,314	263	0.18	0.17-0.19
Oligoastrocytic tumors	52	10	0.02	0.01-0.02	1,138	228	0.22	0.21-0.23	1,461	292	0.20	0.19-0.21
Ependymal tumors	977	195	0.32	0.30-0.34	1,907	381	0.37	0.35-0.38	3,974	795	0.53	0.52-0.55
Malignant	*864*	*173*	*0.28*	*0.26-0.30*	*1,028*	*206*	*0.20*	*0.18-0.21*	*2,153*	*431*	*0.29*	*0.28-0.30*
Non-Malignant	*113*	*23*	*0.04*	*0.03-0.04*	*879*	*176*	*0.17*	*0.16-0.18*	*1,821*	*364*	*0.24*	*0.23-0.26*
Glioma malignant, NOS	2,390	478	0.78	0.75-0.81	1,565	313	0.30	0.28-0.31	3,563	713	0.47	0.46-0.49
Choroid plexus tumors	352	70	0.11	0.10-0.13	218	44	0.04	0.04-0.05	250	50	0.03	0.03-0.04
Malignant	*98*	*20*	*0.03*	*0.03-0.04*	*16*	*3*	*0.00*	*0.00-0.00*	--	--	--	--
Non-Malignant	*254*	*51*	*0.08*	*0.07-0.09*	*202*	*40*	*0.04*	*0.03-0.04*	*235*	*47*	*0.03*	*0.03-0.04*
Other neuroepithelial tumors	25	5	0.01	0.01-0.01	31	6	0.01	0.00-0.01	44	9	0.01	0.00-0.01
Malignant	*22*	*4*	*0.01*	*0.00-0.01*	*18*	*4*	*0.00*	*0.00-0.01*	*26*	*5*	*0.00*	*0.00-0.01*
Non-Malignant	--	--	--	--	--	--	--	--	*18*	*4*	*0.00*	*0.00-0.00*
Neuronal and mixed neuronal-glial tumors	1,204	241	0.39	0.37-0.42	1,861	372	0.35	0.33-0.36	1,575	315	0.21	0.20-0.23
Malignant	*60*	*12*	*0.02*	*0.01-0.03*	*197*	*39*	*0.04*	*0.03-0.04*	*665*	*133*	*0.09*	*0.08-0.10*
Non-Malignant	*1,144*	*229*	*0.37*	*0.35-0.40*	*1,664*	*333*	*0.31*	*0.29-0.32*	*910*	*182*	*0.13*	*0.12-0.13*
Tumors of the pineal region	154	31	0.05	0.04-0.06	283	57	0.05	0.05-0.06	330	66	0.05	0.04-0.05
Malignant	*134*	*27*	*0.04*	*0.04-0.05*	*144*	*29*	*0.03*	*0.02-0.03*	*144*	*29*	*0.02*	*0.02-0.02*
Non-Malignant	*20*	*4*	*0.01*	*0.00-0.01*	*139*	*28*	*0.03*	*0.02-0.03*	*186*	*37*	*0.03*	*0.02-0.03*
Embryonal tumors	2,305	461	0.75	0.72-0.78	842	168	0.16	0.14-0.17	377	75	0.05	0.05-0.06
Medulloblastoma[e]	*1,444*	*289*	*0.47*	*0.45-0.50*	*601*	*120*	*0.11*	*0.10-0.12*	*156*	*31*	*0.02*	*0.02-0.03*
Primitive neuroectodermal tumor[f]	*271*	*54*	*0.09*	*0.08-0.10*	*142*	*28*	*0.03*	*0.02-0.03*	*141*	*28*	*0.02*	*0.02-0.02*

Table 4 *Continued*

Histology	Age at Diagnosis											
	Children[c] (0-14)				AYA[d] (15-39)				Adults (40+)			
	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)
Atypical teratoid rhabdoid tumor[g]	*382*	*76*	*0.12*	*0.11-0.14*	*21*	*4*	*0.00*	*0.00-0.01*	--	--	--	--
Other embryonal histologies[h]	*208*	*42*	*0.07*	*0.06-0.08*	*78*	*16*	*0.01*	*0.01-0.02*	*68*	*14*	*0.01*	*0.01-0.01*
Tumors of Cranial and Spinal Nerves	**861**	**172**	**0.28**	**0.26-0.30**	**5,132**	**1,026**	**1.01**	**0.98-1.04**	**27,778**	**5,556**	**3.58**	**3.54-3.62**
Nerve sheath tumors	861	172	0.28	0.26-0.30	5,122	1,024	1.01	0.98-1.03	27,755	5,551	3.58	3.53-3.62
Malignant	*17*	*3*	*0.01*	*0.00-0.01*	*49*	*10*	*0.01*	*0.01-0.01*	*159*	*32*	*0.02*	*0.02-0.02*
Non-Malignant	*844*	*169*	*0.28*	*0.26-0.30*	*5,073*	*1,015*	*1.00*	*0.97-1.02*	*27,596*	*5,519*	*3.56*	*3.51-3.60*
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	23	5	0.00	0.00-0.00
Tumors of Meninges	**554**	**111**	**0.18**	**0.17-0.20**	**10,280**	**2,056**	**2.09**	**2.04-2.13**	**139,556**	**27,911**	**18.18**	**18.08-18.28**
Meningioma	295	59	0.10	0.09-0.11	9,003	1,801	1.84	1.80-1.88	136,618	27,324	17.79	17.69-17.88
Malignant	*19*	*4*	*0.01*	*0.00-0.01*	*131*	*26*	*0.03*	*0.02-0.03*	*1,621*	*324*	*0.21*	*0.20-0.22*
Non-Malignant	*276*	*55*	*0.09*	*0.08-0.10*	*8,872*	*1,774*	*1.81*	*1.78-1.85*	*134,997*	*26,999*	*17.58*	*17.48-17.68*
Mesenchymal tumors	185	37	0.06	0.05-0.07	325	65	0.06	0.06-0.07	875	175	0.12	0.11-0.12
Primary melanocytic lesions	--	--	--	--	--	--	--	--	101	20	0.01	0.01-0.02
Other neoplasms related to the meninges	67	13	0.02	0.02-0.03	937	187	0.18	0.17-0.19	1,962	392	0.26	0.25-0.27
Lymphomas and Hematopoietic Neoplasms	**75**	**15**	**0.02**	**0.02-0.03**	**555**	**111**	**0.11**	**0.10-0.12**	**7,188**	**1,438**	**0.94**	**0.91-0.96**
Lymphoma	24	5	0.01	0.01-0.01	509	102	0.10	0.09-0.11	7,052	1,410	0.92	0.90-0.94
Other hematopoietic neoplasms	51	10	0.02	0.01-0.02	46	9	0.01	0.01-0.01	136	27	0.02	0.01-0.02
Germ Cell Tumors and Cysts	**641**	**128**	**0.21**	**0.19-0.23**	**650**	**130**	**0.12**	**0.11-0.13**	**196**	**39**	**0.03**	**0.02-0.03**
Germ cell tumors, cysts and heterotopias	641	128	0.21	0.19-0.23	650	130	0.12	0.11-0.13	196	39	0.03	0.02-0.03
Malignant	*464*	*93*	*0.15*	*0.14-0.17*	*514*	*103*	*0.09*	*0.09-0.10*	*26*	*5*	*0.00*	*0.00-0.01*
Non-Malignant	*177*	*35*	*0.06*	*0.05-0.07*	*136*	*27*	*0.03*	*0.02-0.03*	*170*	*34*	*0.02*	*0.02-0.03*
Tumors of Sellar Region	**1,572**	**314**	**0.52**	**0.49-0.54**	**19,632**	**3,926**	**3.76**	**3.71-3.82**	**46,561**	**9,312**	**6.22**	**6.17-6.28**
Tumors of the pituitary	897	179	0.29	0.27-0.31	18,943	3,789	3.63	3.58-3.68	44,909	8,982	6.01	5.95-6.06
Malignant	--	--	--	--	*26*	*5*	*0.01*	*0.00-0.01*	*149*	*30*	*0.02*	*0.02-0.02*
Non-Malignant	*897*	*179*	*0.29*	*0.27-0.31*	*18,917*	*3,783*	*3.62*	*3.57-3.68*	*44,760*	*8,952*	*5.99*	*5.93-6.04*
Craniopharyngioma	675	135	0.22	0.21-0.24	689	138	0.13	0.12-0.14	1,652	330	0.22	0.21-0.23
Unclassified Tumors	**997**	**199**	**0.33**	**0.31-0.35**	**3,323**	**665**	**0.64**	**0.62-0.66**	**16,570**	**3,314**	**2.18**	**2.14-2.21**
Hemangioma	362	72	0.12	0.11-0.13	1,643	329	0.32	0.30-0.33	4,177	835	0.56	0.54-0.57
Neoplasm, unspecified	613	123	0.20	0.18-0.22	1,668	334	0.32	0.30-0.33	12,307	2,461	1.61	1.58-1.64

Table 4 *Continued*

Histology	Age at Diagnosis											
	Children[c] (0-14)				AYA[d] (15-39)				Adults (40+)			
	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)	5-Year Total	Annual Average	Rate	(95% CI)
Malignant	*164*	*33*	*0.05*	*0.05-0.06*	*371*	*74*	*0.07*	*0.06-0.08*	*6,144*	*1,229*	*0.80*	*0.78-0.82*
Non-Malignant	*449*	*90*	*0.15*	*0.13-0.16*	*1,297*	*259*	*0.25*	*0.23-0.26*	*6,163*	*1,233*	*0.81*	*0.79-0.83*
All other	22	4	0.01	0.00-0.01	--	--	--	--	86	17	0.01	0.01-0.01
TOTAL[i]	**17,273**	**3,455**	**5.65**	**5.56-5.73**	**57,821**	**11,564**	**11.20**	**171.11-11.29**	**317,888**	**63,578**	**41.47**	**41.32-41.62**
Malignant	***11,624***	***2,325***	***3.80***	***3.73-3.87***	***17,023***	***3,405***	***3.26***	***3.21-3.31***	***92,630***	***18,526***	***11.97***	***11.89-12.04***
Non-Malignant	***5,649***	***1,130***	***1.85***	***1.80-1.90***	***40,798***	***8,160***	***7.94***	***7.87-8.02***	***225,258***	***45,052***	***29.50***	***29.38-29.63***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and 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]ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3.
[f]ICD-O-3 histology and behavior code: 9473/3.
[g]ICD-O-3 histology and behavior code: 9508/3.
[h]ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.
[i]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology 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 5 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0-19 Years), Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, and Age at Diagnosis, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	Age At Diagnosis																			
	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
Tumors of Neuroepithelial Tissue	**15,742**	**3,148**	**3.82**	**3.77-3.88**	**4,939**	**988**	**4.95**	**4.81-5.09**	**4,044**	**809**	**3.94**	**3.82-4.07**	**3,590**	**718**	**3.47**	**3.36-3.59**	**3,169**	**634**	**2.98**	**2.88-3.09**
Pilocytic astrocytoma	3,746	749	0.91	0.88-0.94	1,103	221	1.10	1.04-1.17	1,072	214	1.04	0.98-1.11	921	184	0.89	0.83-0.95	650	130	0.61	0.57-0.66
Diffuse astrocytoma	998	200	0.24	0.23-0.26	272	54	0.27	0.24-0.31	211	42	0.21	0.18-0.24	240	48	0.23	0.20-0.26	275	55	0.26	0.23-0.29
Anaplastic astrocytoma	405	81	0.10	0.09-0.11	70	14	0.07	0.05-0.09	110	22	0.11	0.09-0.13	111	22	0.11	0.09-0.13	114	23	0.11	0.09-0.13
Unique astrocytoma variants	511	102	0.12	0.11-0.14	115	23	0.12	0.10-0.14	132	26	0.13	0.11-0.15	139	28	0.13	0.11-0.16	125	25	0.12	0.10-0.14
Malignant	*247*	*49*	*0.06*	*0.05-0.07*	*23*	*5*	*0.02*	*0.01-0.03*	*56*	*11*	*0.06*	*0.04-0.07*	*83*	*17*	*0.08*	*0.06-0.10*	*85*	*17*	*0.08*	*0.06-0.10*
Non-Malignant	*264*	*53*	*0.06*	*0.06-0.07*	*92*	*18*	*0.09*	*0.07-0.11*	*76*	*15*	*0.07*	*0.06-0.09*	*56*	*11*	*0.05*	*0.04-0.07*	*40*	*8*	*0.04*	*0.03-0.05*
Glioblastoma	759	152	0.18	0.17-0.20	120	24	0.12	0.10-0.14	178	36	0.17	0.15-0.20	209	42	0.20	0.18-0.23	252	50	0.24	0.21-0.27
Oligodendroglioma	191	38	0.05	0.04-0.05	18	4	0.02	0.01-0.03	36	7	0.04	0.02-0.05	46	9	0.04	0.03-0.06	91	18	0.09	0.07-0.11
Anaplastic oligodendroglioma	28	6	0.01	0.00-0.01	--	--	--	--	--	--	--	--	--	--	--	--	17	3	0.02	0.01-0.03
Oligoastrocytic tumors	105	21	0.03	0.02-0.03	--	--	--	--	17	3	0.02	0.01-0.03	20	4	0.02	0.01-0.03	53	11	0.05	0.04-0.07
Ependymal tumors	1,216	243	0.29	0.28-0.31	469	94	0.47	0.43-0.51	256	51	0.25	0.22-0.28	252	50	0.24	0.21-0.27	239	48	0.23	0.20-0.26
Malignant	*1,022*	*204*	*0.25*	*0.23-0.26*	*447*	*89*	*0.45*	*0.41-0.49*	*229*	*46*	*0.22*	*0.20-0.25*	*188*	*38*	*0.18*	*0.16-0.21*	*158*	*32*	*0.15*	*0.13-0.17*
Non-Malignant	*194*	*39*	*0.05*	*0.04-0.05*	*22*	*4*	*0.02*	*0.01-0.03*	*27*	*5*	*0.03*	*0.02-0.04*	*64*	*13*	*0.06*	*0.05-0.08*	*81*	*16*	*0.08*	*0.06-0.09*
Glioma malignant, NOS	2,799	560	0.68	0.66-0.71	933	187	0.93	0.88-1.00	862	172	0.84	0.78-0.90	595	119	0.58	0.53-0.63	409	82	0.39	0.35-0.42
Choroid plexus tumors	406	81	0.10	0.09-0.11	251	50	0.25	0.22-0.29	50	10	0.05	0.04-0.06	51	10	0.05	0.04-0.06	54	11	0.05	0.04-0.07
Malignant	*101*	*20*	*0.02*	*0.02-0.03*	*80*	*16*	*0.08*	*0.06-0.10*	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*305*	*61*	*0.07*	*0.07-0.08*	*171*	*34*	*0.17*	*0.15-0.20*	*40*	*8*	*0.04*	*0.03-0.05*	*43*	*9*	*0.04*	*0.03-0.06*	*51*	*10*	*0.05*	*0.04-0.06*
Other neuroepithelial tumors	32	6	0.01	0.01-0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Malignant	*27*	*5*	*0.01*	*0.00-0.01*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and mixed neuronal-glial tumors	1,787	357	0.43	0.41-0.45	301	60	0.30	0.27-0.34	352	70	0.34	0.31-0.38	551	110	0.53	0.49-0.58	583	117	0.55	0.51-0.60
Malignant	*89*	*18*	*0.02*	*0.02-0.03*	*21*	*4*	*0.02*	*0.01-0.03*	*17*	*3*	*0.02*	*0.01-0.03*	*22*	*4*	*0.02*	*0.01-0.03*	*29*	*6*	*0.03*	*0.02-0.04*
Non-Malignant	*1,698*	*340*	*0.41*	*0.39-0.43*	*280*	*56*	*0.28*	*0.25-0.32*	*335*	*67*	*0.33*	*0.29-0.37*	*529*	*106*	*0.51*	*0.47-0.56*	*554*	*111*	*0.52*	*0.48-0.57*

Table 5 *Continued*

Histology	Age At Diagnosis																			
	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
Tumors of the pineal region	212	42	0.05	0.04-0.06	67	13	0.07	0.05-0.09	41	8	0.04	0.03-0.05	46	9	0.04	0.03-0.06	58	12	0.05	0.04-0.07
Malignant	*174*	*35*	*0.04*	*0.04-0.05*	*58*	*12*	*0.06*	*0.04-0.08*	*36*	*7*	*0.04*	*0.02-0.05*	*40*	*8*	*0.04*	*0.03-0.05*	*40*	*8*	*0.04*	*0.03-0.05*
Non-Malignant	*38*	*8*	*0.01*	*0.01-0.01*	--	--	--	--	--	--	--	--	--	--	--	--	*18*	*4*	*0.02*	*0.01-0.03*
Embryonal tumors	2,547	509	0.62	0.60-0.64	1,195	239	1.20	1.13-1.27	714	143	0.70	0.65-0.75	396	79	0.38	0.35-0.42	242	48	0.23	0.20-0.26
Medulloblastoma[c]	*1,617*	*323*	*0.39*	*0.38-0.41*	*530*	*106*	*0.53*	*0.49-0.58*	*593*	*119*	*0.58*	*0.53-0.63*	*321*	*64*	*0.31*	*0.28-0.35*	*173*	*35*	*0.16*	*0.14-0.19*
Primitive neuroecto-dermal tumor[d]	*311*	*62*	*0.08*	*0.07-0.08*	*165*	*33*	*0.17*	*0.14-0.19*	*67*	*13*	*0.07*	*0.05-0.08*	*39*	*8*	*0.04*	*0.03-0.05*	*40*	*8*	*0.04*	*0.03-0.05*
Atypical teratoid rhab-doid tumor[e]	*388*	*78*	*0.09*	*0.08-0.10*	*337*	*67*	*0.34*	*0.30-0.38*	*30*	*6*	*0.03*	*0.02-0.04*	--	--	--	--	--	--	--	--
Other embryonal histologies[f]	*231*	*46*	*0.06*	*0.05-0.06*	*163*	*33*	*0.16*	*0.14-0.19*	*24*	*5*	*0.02*	*0.01-0.03*	*21*	*4*	*0.02*	*0.01-0.03*	*23*	*5*	*0.02*	*0.01-0.03*
Tumors of Cranial and Spinal Nerves	**1,286**	**257**	**0.31**	**0.29-0.33**	**279**	**56**	**0.28**	**0.25-0.31**	**261**	**52**	**0.25**	**0.22-0.29**	**321**	**64**	**0.31**	**0.28-0.35**	**425**	**85**	**0.40**	**0.36-0.44**
Nerve sheath tumors	1,283	257	0.31	0.29-0.33	279	56	0.28	0.25-0.31	261	52	0.25	0.22-0.29	321	64	0.31	0.28-0.35	422	84	0.40	0.36-0.44
Malignant	*23*	*5*	*0.01*	*0.00-0.01*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*1,260*	*252*	*0.31*	*0.29-0.32*	*274*	*55*	*0.27*	*0.24-0.31*	*255*	*51*	*0.25*	*0.22-0.28*	*315*	*63*	*0.30*	*0.27-0.34*	*416*	*83*	*0.39*	*0.35-0.43*
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges	**1,116**	**223**	**0.27**	**0.25-0.28**	**172**	**34**	**0.17**	**0.15-0.20**	**132**	**26**	**0.13**	**0.11-0.15**	**250**	**50**	**0.24**	**0.21-0.27**	**562**	**112**	**0.53**	**0.48-0.57**
Meningioma	668	134	0.16	0.15-0.17	70	14	0.07	0.05-0.09	74	15	0.07	0.06-0.09	151	30	0.15	0.12-0.17	373	75	0.35	0.32-0.39
Malignant	*33*	*7*	*0.01*	*0.01-0.01*	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*635*	*127*	*0.15*	*0.14-0.16*	*63*	*13*	*0.06*	*0.05-0.08*	*68*	*14*	*0.07*	*0.05-0.08*	*145*	*29*	*0.14*	*0.12-0.16*	*359*	*72*	*0.34*	*0.30-0.37*
Mesenchymal tumors	231	46	0.06	0.05-0.06	94	19	0.09	0.08-0.12	49	10	0.05	0.04-0.06	42	8	0.04	0.03-0.06	46	9	0.04	0.03-0.06
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other neoplasms related to the meninges	207	41	0.05	0.04-0.06	--	--	--	--	--	--	--	--	55	11	0.05	0.04-0.07	140	28	0.13	0.11-0.15
Lymphomas and Hematopoietic Neoplasms	**121**	**24**	**0.03**	**0.02-0.04**	**--**	**--**	**--**	**--**	**30**	**6**	**0.03**	**0.02-0.04**	**30**	**6**	**0.03**	**0.02-0.04**	**46**	**9**	**0.04**	**0.03-0.06**
Lymphoma	59	12	0.01	0.01-0.02	--	--	--	--	--	--	--	--	--	--	--	--	35	7	0.03	0.02-0.05
Other hematopoietic neoplasms	62	12	0.02	0.01-0.02	--	--	--	--	22	4	0.02	0.01-0.03	17	3	0.02	0.01-0.03	--	--	--	--

Table 5 *Continued*

Histology	Age At Diagnosis																			
	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
Germ Cell Tumors and Cysts	**910**	**182**	**0.22**	**0.21-0.24**	**169**	**34**	**0.17**	**0.15-0.20**	**155**	**31**	**0.15**	**0.13-0.18**	**317**	**63**	**0.31**	**0.27-0.34**	**269**	**54**	**0.25**	**0.22-0.29**
Germ cell tumors, cysts and heterotopias	910	182	0.22	0.21-0.24	169	34	0.17	0.15-0.20	155	31	0.15	0.13-0.18	317	63	0.31	0.27-0.34	269	54	0.25	0.22-0.29
Malignant	*708*	*142*	*0.17*	*0.16-0.19*	*67*	*13*	*0.07*	*0.05-0.09*	*113*	*23*	*0.11*	*0.09-0.13*	*284*	*57*	*0.27*	*0.24-0.31*	*244*	*49*	*0.23*	*0.20-0.26*
Non-Malignant	*202*	*40*	*0.05*	*0.04-0.06*	*102*	*20*	*0.10*	*0.08-0.12*	*42*	*8*	*0.04*	*0.03-0.06*	*33*	*7*	*0.03*	*0.02-0.04*	*25*	*5*	*0.02*	*0.02-0.03*
Tumors of Sellar Region	**3,850**	**770**	**0.92**	**0.89-0.95**	**176**	**35**	**0.18**	**0.15-0.20**	**552**	**110**	**0.54**	**0.50-0.59**	**844**	**169**	**0.81**	**0.76-0.87**	**2,278**	**456**	**2.14**	**2.05-2.23**
Tumors of the pituitary	3,002	600	0.72	0.69-0.74	38	8	0.04	0.03-0.05	239	48	0.23	0.21-0.27	620	124	0.59	0.55-0.64	2,105	421	1.98	1.89-2.06
Malignant	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Non-Malignant	*2,999*	*600*	*0.72*	*0.69-0.74*	*38*	*8*	*0.04*	*0.03-0.05*	*239*	*48*	*0.23*	*0.21-0.27*	*620*	*124*	*0.59*	*0.55-0.64*	*2,102*	*420*	*1.97*	*1.89-2.06*
Craniopharyngioma	848	170	0.21	0.19-0.22	138	28	0.14	0.12-0.16	313	63	0.31	0.27-0.34	224	45	0.22	0.19-0.25	173	35	0.16	0.14-0.19
Unclassified Tumors	**1,507**	**301**	**0.36**	**0.35-0.38**	**343**	**69**	**0.34**	**0.31-0.38**	**260**	**52**	**0.25**	**0.22-0.29**	**394**	**79**	**0.38**	**0.34-0.42**	**510**	**102**	**0.48**	**0.44-0.52**
Hemangioma	599	120	0.14	0.13-0.16	144	29	0.14	0.12-0.17	83	17	0.08	0.06-0.10	135	27	0.13	0.11-0.15	237	47	0.22	0.20-0.25
Neoplasm, unspecified	882	176	0.21	0.20-0.23	189	38	0.19	0.16-0.22	172	34	0.17	0.14-0.20	252	50	0.24	0.21-0.27	269	54	0.25	0.22-0.28
Malignant	*212*	*42*	*0.05*	*0.04-0.06*	*64*	*13*	*0.06*	*0.05-0.08*	*46*	*9*	*0.04*	*0.03-0.06*	*54*	*11*	*0.05*	*0.04-0.07*	*48*	*10*	*0.05*	*0.03-0.06*
Non-Malignant	*670*	*134*	*0.16*	*0.15-0.17*	*125*	*25*	*0.13*	*0.10-0.15*	*126*	*25*	*0.12*	*0.10-0.15*	*198*	*40*	*0.19*	*0.16-0.22*	*221*	*44*	*0.21*	*0.18-0.24*
All other	26	5	0.01	0.00-0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL[g]	**24,532**	**4,906**	**5.94**	**5.87-6.02**	**6,093**	**1,219**	**6.11**	**5.96-6.26**	**5,434**	**1,087**	**5.30**	**5.16-5.45**	**5,746**	**1,149**	**5.55**	**5.41-5.69**	**7,259**	**1,452**	**6.83**	**6.67-6.98**
Malignant	***14,422***	***2,884***	***3.51***	***3.45-3.56***	***4,554***	***911***	***4.56***	***4.43-4.70***	***3,777***	***755***	***3.68***	***3.57-3.80***	***3,293***	***659***	***3.19***	***3.08-3.30***	***2,798***	***560***	***2.63***	***2.54-2.73***
Non-Malignant	***10,110***	***2,022***	***2.44***	***2.39-2.49***	***1,539***	***308***	***1.54***	***1.47-1.62***	***1,657***	***331***	***1.62***	***1.54-1.70***	***2,453***	***491***	***2.36***	***2.27-2.46***	***4,461***	***892***	***4.19***	***4.07-4.32***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3.
[d]ICD-O-3 histology and behavior code: 9473/3.
[e]ICD-O-3 histology and behavior code: 9508/3.
[f]ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.
[g]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 6 Average Annual Age-Adjusted and Age-Specific Incidence Rates[a] with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, and Age at Diagnosis, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

	Age At Diagnosis													
	20-34 Years		35-44 Years		45-54 Years		55-64 Years		65-74 Years		75-84 Years		85+ Years	
Histology	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Tumors of Neuroepithelial Tissue	**3.36**	**3.30-3.42**	**4.46**	**4.36-4.55**	**6.72**	**6.61-6.83**	**11.40**	**11.25-11.55**	**16.90**	**16.67-17.14**	**19.24**	**18.91-19.58**	**12.20**	**11.81-12.61**
Pilocytic astrocytoma	0.22	0.21-0.24	0.12	0.10-0.13	0.10	0.09-0.11	0.07	0.06-0.09	0.07	0.05-0.08	0.07	0.05-0.09	-	-
Diffuse astrocytoma	0.46	0.44-0.48	0.48	0.45-0.51	0.49	0.47-0.53	0.62	0.59-0.66	0.81	0.76-0.86	0.92	0.85-0.99	0.52	0.44-0.61
Anaplastic astrocytoma	0.34	0.32-0.36	0.46	0.43-0.49	0.49	0.46-0.52	0.68	0.65-0.72	0.95	0.90-1.01	0.93	0.85-1.00	0.42	0.35-0.50
Unique astrocytoma variants	0.07	0.06-0.08	0.04	0.03-0.05	0.04	0.03-0.04	0.04	0.03-0.05	0.06	0.05-0.08	0.09	0.07-0.12	0.07	0.04-0.10
Malignant	*0.06*	*0.05-0.06*	*0.03*	*0.03-0.04*	*0.03*	*0.02-0.04*	*0.04*	*0.03-0.05*	*0.06*	*0.05-0.07*	*0.09*	*0.07-0.12*	*0.07*	*0.04-0.10*
Non-Malignant	*0.02*	*0.01-0.02*	*0.01*	*0.01-0.01*	*0.01*	*0.00-0.01*	-	-	-	-	-	-	-	-
Glioblastoma	0.46	0.43-0.48	1.25	1.20-1.30	3.55	3.47-3.63	8.05	7.92-8.17	12.99	12.79-13.20	15.13	14.84-15.43	9.07	8.73-9.42
Oligodendroglioma	0.29	0.27-0.31	0.41	0.38-0.44	0.37	0.34-0.39	0.28	0.25-0.30	0.19	0.16-0.21	0.15	0.13-0.19	0.10	0.06-0.14
Anaplastic oligodendroglioma	0.08	0.07-0.10	0.17	0.15-0.19	0.20	0.18-0.21	0.21	0.19-0.23	0.16	0.14-0.19	0.12	0.09-0.15	-	-
Oligoastrocytic tumors	0.24	0.23-0.26	0.29	0.26-0.31	0.23	0.21-0.25	0.19	0.17-0.21	0.17	0.15-0.20	0.12	0.09-0.15	-	-
Ependymal tumors	0.36	0.34-0.38	0.52	0.49-0.55	0.58	0.55-0.61	0.55	0.52-0.58	0.60	0.56-0.64	0.40	0.35-0.45	0.15	0.11-0.20
Malignant	*0.19*	*0.17-0.20*	*0.27*	*0.25-0.30*	*0.31*	*0.28-0.33*	*0.30*	*0.28-0.33*	*0.32*	*0.29-0.35*	*0.25*	*0.21-0.29*	*0.07*	*0.04-0.11*
Non-Malignant	*0.17*	*0.16-0.19*	*0.25*	*0.22-0.27*	*0.27*	*0.25-0.30*	*0.25*	*0.23-0.27*	*0.28*	*0.25-0.31*	*0.15*	*0.12-0.18*	*0.08*	*0.05-0.12*
Glioma malignant, NOS	0.27	0.25-0.29	0.26	0.24-0.29	0.31	0.28-0.33	0.36	0.33-0.39	0.58	0.53-0.62	1.04	0.97-1.12	1.69	1.55-1.84
Choroid plexus tumors	0.04	0.03-0.05	0.04	0.03-0.05	0.03	0.03-0.04	0.03	0.03-0.04	0.04	0.03-0.05	0.03	0.02-0.04	-	-
Malignant	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-Malignant	*0.03*	*0.03-0.04*	*0.04*	*0.03-0.05*	*0.03*	*0.02-0.04*	*0.03*	*0.03-0.04*	*0.04*	*0.03-0.05*	*0.02*	*0.01-0.04*	-	-
Other neuroepithelial tumors	-	-	0.01	0.01-0.01	-	-	-	-	-	-	-	-	-	-
Malignant	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-Malignant	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neuronal and mixed neuronal-glial tumors	0.31	0.29-0.33	0.25	0.23-0.27	0.23	0.21-0.26	0.21	0.19-0.23	0.20	0.17-0.22	0.17	0.14-0.21	0.07	0.04-0.11
Malignant	*0.04*	*0.03-0.04*	*0.07*	*0.05-0.08*	*0.08*	*0.07-0.09*	*0.10*	*0.08-0.11*	*0.11*	*0.09-0.13*	*0.11*	*0.09-0.14*	-	-
Non-Malignant	*0.28*	*0.26-0.30*	*0.18*	*0.16-0.20*	*0.16*	*0.14-0.17*	*0.12*	*0.10-0.13*	*0.09*	*0.07-0.11*	*0.06*	*0.05-0.09*	-	-
Tumors of the pineal region	0.05	0.04-0.06	0.06	0.05-0.07	0.05	0.04-0.06	0.05	0.04-0.06	0.05	0.03-0.06	0.03	0.02-0.05	-	-
Malignant	*0.02*	*0.02-0.03*	*0.02*	*0.02-0.03*	*0.02*	*0.02-0.03*	*0.02*	*0.01-0.03*	*0.02*	*0.01-0.03*	-	-	-	-
Non-Malignant	*0.03*	*0.02-0.03*	*0.03*	*0.03-0.04*	*0.02*	*0.02-0.03*	*0.02*	*0.02-0.03*	*0.03*	*0.02-0.04*	*0.02*	*0.01-0.04*	-	-
Embryonal tumors	0.15	0.13-0.16	0.09	0.08-0.11	0.06	0.05-0.07	0.05	0.04-0.06	0.03	0.02-0.05	0.04	0.02-0.06	-	-

Table 6 *Continued*

Histology	Age At Diagnosis													
	20-34 Years		35-44 Years		45-54 Years		55-64 Years		65-74 Years		75-84 Years		85+ Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Tumors of Cranial and Spinal Nerves	**0.93**	**0.89-0.96**	**2.02**	**1.96-2.08**	**3.18**	**3.11-3.26**	**4.44**	**4.34-4.53**	**5.13**	**5.01-5.26**	**3.84**	**3.69-3.99**	**1.70**	**1.56-1.86**
Nerve sheath tumors	0.93	0.89-0.96	2.02	1.95-2.08	3.18	3.11-3.26	4.43	4.34-4.53	5.13	5.00-5.26	3.84	3.69-3.99	1.70	1.56-1.86
Malignant	*0.01*	*0.01-0.01*	*0.01*	*0.01-0.02*	*0.02*	*0.01-0.02*	*0.02*	*0.01-0.02*	*0.03*	*0.02-0.04*	*0.03*	*0.02-0.05*	-	-
Non-Malignant	*0.92*	*0.88-0.95*	*2.00*	*1.94-2.06*	*3.16*	*3.09-3.24*	*4.42*	*4.32-4.51*	*5.10*	*4.97-5.23*	*3.80*	*3.66-3.96*	*1.67*	*1.53-1.83*
Other tumors of cranial and spinal nerves	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tumors of Meninges	**1.65**	**1.61-1.70**	**5.58**	**5.47-5.68**	**10.09**	**9.96-10.22**	**16.06**	**15.88-16.23**	**28.13**	**27.83-28.43**	**41.24**	**40.75-41.72**	**52.69**	**51.87-53.51**
Meningioma	1.41	1.37-1.46	5.24	5.14-5.34	9.71	9.58-9.84	15.64	15.47-15.82	27.66	27.36-27.96	40.78	40.30-41.27	52.53	51.72-53.36
Malignant	*0.02*	*0.02-0.03*	*0.06*	*0.05-0.07*	*0.11*	*0.09-0.12*	*0.20*	*0.18-0.22*	*0.37*	*0.33-0.40*	*0.45*	*0.40-0.50*	*0.61*	*0.52-0.70*
Non-Malignant	*1.39*	*1.35-1.44*	*5.19*	*5.09-5.29*	*9.61*	*9.48-9.74*	*15.45*	*15.27-15.62*	*27.29*	*27.00-27.59*	*40.33*	*39.85-40.81*	*51.93*	*51.12-52.75*
Mesenchymal tumors	0.06	0.05-0.07	0.08	0.07-0.10	0.12	0.10-0.13	0.12	0.11-0.14	0.15	0.13-0.17	0.15	0.12-0.18	0.06	0.04-0.09
Primary melanocytic lesions	-	-	-	-	0.01	0.00-0.01	0.02	0.01-0.03	-	-	0.03	0.02-0.04	-	-
Other neoplasms related to the meninges	0.17	0.16-0.19	0.24	0.22-0.26	0.26	0.23-0.28	0.27	0.25-0.30	0.31	0.28-0.34	0.28	0.24-0.33	0.08	0.05-0.12
Lymphomas and Hematopoietic Neoplasms	**0.10**	**0.09-0.12**	**0.23**	**0.21-0.25**	**0.41**	**0.38-0.44**	**0.89**	**0.85-0.93**	**1.81**	**1.74-1.89**	**2.43**	**2.32-2.56**	**1.20**	**1.07-1.33**
Lymphoma	0.10	0.09-0.11	0.22	0.20-0.24	0.40	0.37-0.43	0.87	0.83-0.91	1.78	1.70-1.85	2.42	2.30-2.54	1.18	1.06-1.31
Other hematopoietic neoplasms	0.01	0.01-0.01	0.01	0.01-0.02	0.01	0.01-0.02	0.02	0.01-0.03	0.03	0.02-0.05	-	-	-	-
Germ Cell Tumors and Cysts	**0.10**	**0.09-0.12**	**0.04**	**0.03-0.05**	**0.03**	**0.03-0.04**	**0.02**	**0.02-0.03**	**0.02**	**0.01-0.03**	**-**	**-**	**-**	**-**
Germ cell tumors, cysts and heterotopias	0.10	0.09-0.12	0.04	0.03-0.05	0.03	0.03-0.04	0.02	0.02-0.03	0.02	0.01-0.03	-	-	-	-
Malignant	*0.08*	*0.07-0.09*	*0.01*	*0.01-0.02*	-	-	-	-	-	-	-	-	-	-
Non-Malignant	*0.03*	*0.02-0.03*	*0.03*	*0.02-0.04*	*0.03*	*0.02-0.04*	*0.02*	*0.01-0.03*	*0.02*	*0.01-0.03*	-	-	-	-
Tumors of Sellar Region	**3.79**	**3.72-3.86**	**5.25**	**5.15-5.35**	**5.37**	**5.27-5.47**	**6.18**	**6.07-6.29**	**8.07**	**7.91-8.23**	**8.20**	**7.98-8.42**	**4.90**	**4.65-5.16**
Tumors of the pituitary	3.67	3.61-3.74	5.09	4.99-5.19	5.15	5.06-5.25	5.94	5.83-6.05	7.80	7.65-7.96	7.96	7.75-8.18	4.82	4.58-5.08
Malignant	-	-	*0.02*	*0.01-0.02*	*0.02*	*0.01-0.02*	*0.02*	*0.01-0.03*	*0.03*	*0.02-0.04*	*0.03*	*0.02-0.04*	-	-
Non-Malignant	*3.67*	*3.60-3.74*	*5.07*	*4.98-5.17*	*5.14*	*5.04-5.23*	*5.92*	*5.81-6.03*	*7.78*	*7.62-7.94*	*7.94*	*7.72-8.15*	*4.82*	*4.57-5.07*
Craniopharyngioma	0.12	0.10-0.13	0.16	0.14-0.18	0.21	0.19-0.23	0.24	0.22-0.27	0.27	0.24-0.30	0.23	0.20-0.27	0.08	0.05-0.11
Unclassified Tumors	**0.61**	**0.59-0.64**	**0.90**	**0.86-0.94**	**1.15**	**1.10-1.19**	**1.58**	**1.53-1.64**	**2.56**	**2.47-2.65**	**5.01**	**4.84-5.18**	**11.05**	**10.67-11.43**
Hemangioma	0.30	0.29-0.32	0.44	0.42-0.47	0.51	0.48-0.54	0.56	0.53-0.59	0.66	0.62-0.71	0.69	0.63-0.75	0.57	0.49-0.66

Table 6 *Continued*

Histology	Age At Diagnosis													
	20-34 Years		35-44 Years		45-54 Years		55-64 Years		65-74 Years		75-84 Years		85+Years	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Neoplasm, unspecified	0.31	0.29-0.33	0.45	0.42-0.48	0.63	0.60-0.67	1.02	0.98-1.07	1.87	1.79-1.95	4.29	4.14-4.45	10.43	10.07-10.81
Malignant	*0.07*	*0.06-0.08*	*0.12*	*0.10-0.13*	*0.21*	*0.19-0.23*	*0.45*	*0.43-0.49*	*0.91*	*0.85-0.96*	*2.46*	*2.34-2.58*	*6.14*	*5.86-6.42*
Non-Malignant	*0.24*	*0.22-0.26*	*0.33*	*0.31-0.36*	*0.43*	*0.40-0.45*	*0.57*	*0.53-0.60*	*0.96*	*0.91-1.02*	*1.83*	*1.73-1.94*	*4.30*	*4.07-4.54*
All other	-	-	-	-	-	-	-	-	0.02	0.01-0.03	0.03	0.02-0.05	-	-
TOTAL[c]	**10.55**	**10.44-10.66**	**18.47**	**18.28-18.66**	**26.95**	**26.74-27.17**	**40.56**	**40.28-40.85**	**62.62**	**62.18-63.07**	**79.98**	**79.30-80.66**	**83.75**	**82.72-84.80**
Malignant	***3.14***	***3.07-3.20***	***4.43***	***4.34-4.52***	***7.04***	***6.93-7.16***	***12.62***	***12.46-12.78***	***19.69***	***19.44-19.94***	***24.49***	***24.12-24.87***	***20.08***	***19.58-20.60***
Non-Malignant	***7.41***	***7.32-7.51***	***14.04***	***13.87-14.20***	***19.91***	***19.72-20.10***	***27.94***	***27.71-28.18***	***42.93***	***42.56-43.30***	***55.48***	***54.92-56.05***	***63.67***	***62.77-64.58***

[a]Rates are per 100,000 and age-adjusted to the 2000 US standard population.
[b]Adolescents and Young Adults AYA, as defined by the National Cancer Institute, see: http://www.cancer.gov/cancertopics/aya.
[c]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology 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 7 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 Site[c] and Sex, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Site (ICD-O-3 Code)	Total					Male						Female					
	5-Year Total	Annual Average	% of All Tumors	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI	5-Year Total	Annual Average	% Malignant	% Non-Malignant	Rate	95% CI
Frontal, temporal, parietal, and occipital lobes of the brain (C71.1-C71.4)	73,581	14,716	18.7%	4.27	4.24-4.30	40,956	8,191	91.4%	8.6%	5.04	4.99-5.09	32,625	6,525	87.9%	12.1%	3.60	3.56-3.64
Frontal lobe (C71.1)	*32,053*	*6,411*	*8.2%*	*1.88*	*1.86-1.90*	*17,064*	*3,413*	*92.0%*	*8.0%*	*2.11*	*2.08-2.15*	*14,989*	*2,998*	*88.8%*	*11.2%*	*1.67*	*1.65-1.70*
Temporal lobe (C71.2)	*23,775*	*4,755*	*6.0%*	*1.37*	*1.35-1.39*	*14,155*	*2,831*	*90.8%*	*9.2%*	*1.73*	*1.70-1.76*	*9,620*	*1,924*	*87.0%*	*13.0%*	*1.06*	*1.04-1.08*
Parietal lobe (C71.3)	*13,947*	*2,789*	*3.5%*	*0.80*	*0.78-0.81*	*7,603*	*1,521*	*92.5%*	*7.5%*	*0.93*	*0.91-0.95*	*6,344*	*1,269*	*88.7%*	*11.3%*	*0.68*	*0.67-0.70*
Occipital lobe (C71.4)	*3,806*	*761*	*1.0%*	*0.22*	*0.21-0.23*	*2,134*	*427*	*87.0%*	*13.0%*	*0.26*	*0.25-0.28*	*1,672*	*334*	*81.7%*	*18.3%*	*0.18*	*0.17-0.19*
Cerebrum (C71.0)	6,839	1,368	1.7%	0.41	0.40-0.42	3,707	741	83.7%	16.3%	0.46	0.45-0.48	3,132	626	79.9%	20.1%	0.36	0.35-0.38
Ventricle (C71.5)	4,106	821	1.0%	0.26	0.25-0.27	2,196	439	43.9%	56.1%	0.28	0.27-0.29	1,910	382	40.7%	59.3%	0.24	0.23-0.25
Cerebellum (C71.6)	8,710	1,742	2.2%	0.55	0.54-0.57	4,589	918	62.5%	37.5%	0.60	0.58-0.61	4,121	824	55.8%	44.2%	0.52	0.50-0.53
Brain stem (C71.7)	6,012	1,202	1.5%	0.39	0.38-0.40	3,241	648	75.8%	24.2%	0.42	0.41-0.44	2,771	554	78.1%	21.9%	0.36	0.35-0.37
Other brain (C71.8-C71.9)	33,817	6,763	8.6%	1.96	1.94-1.99	17,676	3,535	83.1%	16.9%	2.21	2.18-2.25	16,141	3,228	77.9%	22.1%	1.75	1.73-1.78
Spinal cord and cauda equina (C72.0-C72.1)	12,333	2,467	3.1%	0.75	0.73-0.86	6,390	1,278	29.2%	70.8%	0.80	0.78-0.82	5,943	1,189	27.6%	72.4%	0.70	0.68-0.72
Cranial nerves (C72.2-C72.5)	27,656	5,531	7.0%	1.60	1.58-1.62	13,028	2,606	5.9%	94.1%	1.57	1.55-1.60	14,628	2,926	5.4%	94.6%	1.64	1.61-1.67
Other nervous system (C72.8-C72.9)	2,455	491	0.6%	0.15	0.14-0.15	1,261	252	56.7%	43.3%	0.16	0.15-0.17	1,194	239	50.8%	49.2%	0.14	0.13-0.14
Meninges (cerebral and spinal) (C70.0-C70.9)	146,157	29,231	37.2%	8.35	8.30-8.39	39,533	7,907	2.4%	97.6%	5.00	4.95-5.05	106,624	21,325	1.1%	98.9%	11.28	11.21-11.35
Pituitary and craniopharyngeal duct (C75.1-C75.2)	68,838	13,768	17.5%	4.19	4.16-4.22	31,177	6,235	0.9%	99.1%	3.87	3.83-3.91	37,661	7,532	0.6%	99.4%	4.59	4.54-4.64
Pineal (C75.3)	1,750	350	0.4%	0.11	0.11-0.12	973	195	73.7%	26.3%	0.13	0.12-0.13	777	155	41.2%	58.8%	0.10	0.09-0.11
Olfactory tumors of the nasal cavity (C30.0[c])	728	146	0.2%	0.04	0.04-0.05	421	84	-	-	0.05	0.05-0.06	307	61	-	-	0.04	0.03-0.04
TOTAL	**392,982**	**78,596**	**100.0%**	**23.03**	**22.96-23.11**	**165,148**	**33,030**	**40.7%**	**59.3%**	**20.59**	**20.49-20.69**	**227,834**	**45,567**	**23.7%**	**76.3%**	**24.31**	**25.20-25.42**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER site/histology validation list.
[d]ICD-O-3 histology codes 9522-9523 only.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval

Table 8 Characteristics of All Brain and Other Central Nervous System Tumors by Central Cancer Registry and Behavior, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

State	Total				Malignant				Non-Malignant				Average Annual 2011-2015 Population[a]
	5-Year Total	Annual Average	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	5-Year Total	% Malignant	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	5-Year Total	% Non-Malignant	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	
Alabama	4,632	926	68.0%	27.3%	1,854	40.0%	84.0%	6.2%	2,778	60.0%	57.3%	41.4%	24,142,446
Alaska	809	162	49.8%	47.2%	227	28.1%	81.5%	12.8%	582	71.9%	37.5%	60.7%	3,665,095
Arizona	7,584	1,517	61.0%	33.4%	2,475	32.6%	82.4%	8.2%	5,109	67.4%	50.7%	45.7%	33,178,972
Arkansas	3,275	655	58.0%	37.2%	1,214	37.1%	79.4%	12.4%	2,061	62.9%	45.4%	51.8%	14,793,606
California	42,410	8,482	61.0%	34.7%	13,007	30.7%	86.3%	8.8%	29,403	69.3%	49.8%	46.2%	191,697,888
Colorado	7,280	1,456	49.5%	47.6%	1,912	26.3%	82.0%	12.3%	5,368	73.7%	38.0%	60.2%	26,374,297
Connecticut	4,430	886	68.3%	29.8%	1,513	34.2%	88.9%	8.9%	2,917	65.9%	57.6%	40.6%	17,956,294
Delaware	1,010	202	68.5%	28.5%	357	35.4%	84.3%	10.6%	653	64.7%	59.9%	38.3%	4,629,336
District of Columbia	717	143	61.6%	35.4%	192	26.8%	89.1%	5.7%	525	73.2%	51.6%	46.3%	3,234,351
Florida	28,326	5,665	54.5%	42.3%	8,164	28.8%	85.8%	9.9%	20,162	71.2%	41.7%	55.4%	98,156,785
Georgia	12,381	2,476	52.8%	43.2%	3,377	27.3%	85.3%	11.0%	9,004	72.7%	40.7%	55.2%	49,997,845
Hawaii	1,398	280	55.4%	36.6%	358	25.6%	86.0%	7.5%	1,040	74.4%	44.9%	46.6%	7,017,671
Idaho	1,813	363	64.8%	31.8%	658	36.3%	84.2%	11.7%	1,155	63.7%	53.8%	43.2%	8,078,425
Illinois	16,388	3,278	58.2%	39.8%	4,821	29.4%	88.1%	8.6%	11,567	70.6%	45.7%	52.7%	64,316,906
Indiana	7,836	1,567	53.9%	42.9%	2,536	32.4%	84.6%	11.9%	5,300	67.6%	39.2%	57.7%	32,831,326
Iowa	4,342	868	57.5%	40.2%	1,379	31.8%	85.8%	11.2%	2,963	68.2%	44.3%	53.6%	15,463,490
Kansas	3,459	692	56.8%	39.9%	1,180	34.1%	85.8%	10.0%	2,279	65.9%	41.8%	55.4%	14,453,667
Kentucky	6,816	1,363	48.6%	47.0%	1,956	28.7%	80.3%	13.1%	4,860	71.3%	35.8%	60.7%	21,992,298
Louisiana	5,554	1,111	59.5%	36.0%	1,605	28.9%	85.8%	10.0%	3,949	71.1%	48.8%	46.6%	23,122,075
Maine	1,528	306	65.1%	32.1%	642	42.0%	84.9%	11.1%	886	58.0%	50.8%	47.3%	6,646,374
Maryland	6,452	1,290	66.1%	29.8%	2,122	32.9%	87.1%	6.7%	4,330	67.1%	55.8%	41.2%	29,626,661
Massachusetts	7,280	1,456	71.1%	26.3%	2,767	38.0%	88.4%	7.9%	4,513	62.0%	60.5%	37.5%	33,510,868
Michigan	11,590	2,318	60.4%	35.8%	3,897	33.6%	85.0%	9.0%	7,693	66.4%	47.9%	49.4%	49,495,915
Minnesota	5,916	1,183	76.0%	19.8%	2,289	38.7%	90.2%	5.8%	3,627	61.3%	67.1%	28.7%	27,082,912
Mississippi	3,349	670	61.1%	35.5%	1,063	31.7%	85.0%	11.1%	2,286	68.3%	49.9%	46.8%	14,935,379
Missouri	7,750	1,550	55.3%	41.0%	2,407	31.1%	87.5%	7.9%	5,343	68.9%	40.8%	55.9%	30,215,977
Montana	1,283	257	56.0%	40.5%	460	35.9%	84.1%	12.0%	823	64.2%	40.2%	56.5%	5,072,271
Nebraska	2,025	405	60.3%	36.4%	768	37.9%	84.8%	9.8%	1,257	62.1%	45.3%	52.7%	9,341,477
Nevada	2,414	483	62.4%	31.9%	948	39.3%	83.3%	6.5%	1,466	60.7%	48.8%	48.3%	11,255,800
New Hampshire	1,612	322	67.9%	30.4%	596	37.0%	90.9%	6.5%	1,016	63.0%	54.4%	44.4%	6,621,196

Table 8 *Continued*

State	Total				Malignant				Non-Malignant				Average Annual 2011-2015 Population[a]
	5-Year Total	Annual Average	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	5-Year Total	% Malignant	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	5-Year Total	% Non-Malignant	Histologically Confirmed (%)	Radio-graphically Confirmed (%)	
New Jersey	11,915	2,383	58.5%	36.8%	3,673	30.8%	87.6%	9.3%	8,242	69.2%	45.5%	49.0%	44,474,038
New Mexico	2,171	434	63.8%	30.1%	665	30.6%	86.9%	7.4%	1,506	69.4%	53.6%	40.1%	10,410,085
New York	28,549	5,710	53.7%	43.7%	7,735	27.1%	86.2%	11.6%	20,814	72.9%	41.7%	55.7%	98,261,542
North Carolina	12,533	2,507	57.8%	38.8%	3,711	29.6%	85.0%	10.4%	8,822	70.4%	46.4%	50.7%	49,208,313
North Dakota	733	147	55.7%	41.6%	268	36.6%	85.8%	10.8%	465	63.4%	38.3%	59.4%	3,608,321
Ohio	13,251	2,650	64.8%	31.1%	4,726	35.7%	84.6%	8.4%	8,525	64.3%	53.9%	43.7%	57,865,183
Oklahoma	4,510	902	51.9%	44.5%	1,464	32.5%	80.2%	11.9%	3,046	67.5%	38.3%	60.1%	19,240,656
Oregon	4,498	900	68.3%	27.8%	1,747	38.8%	85.1%	7.2%	2,751	61.2%	57.7%	40.9%	19,685,903
Pennsylvania	19,135	3,827	53.3%	43.1%	5,721	29.9%	83.3%	10.6%	13,414	70.1%	40.5%	56.9%	63,879,954
Rhode Island	1,133	227	68.1%	29.6%	422	37.3%	90.0%	6.6%	711	62.8%	55.1%	43.2%	5,268,472
South Carolina	6,107	1,221	53.6%	40.5%	1,849	30.3%	84.5%	9.2%	4,258	69.7%	40.1%	54.1%	23,884,555
South Dakota	1,013	203	54.0%	42.8%	354	35.0%	83.6%	12.4%	659	65.1%	38.1%	59.2%	4,214,241
Tennessee	8,709	1,742	54.4%	43.4%	2,473	28.4%	86.9%	9.9%	6,236	71.6%	41.5%	56.7%	32,486,480
Texas	31,394	6,279	51.6%	42.0%	9,112	29.0%	80.9%	13.2%	22,282	71.0%	39.7%	53.8%	132,565,959
Utah	4,175	835	54.8%	44.1%	994	23.8%	85.7%	12.7%	3,181	76.2%	45.1%	53.9%	14,507,037
Vermont	877	175	57.6%	40.9%	260	29.7%	93.5%	6.2%	617	70.4%	42.5%	55.6%	3,133,386
Virginia	8,350	1,670	65.7%	30.5%	2,872	34.4%	85.9%	6.8%	5,478	65.6%	55.1%	42.8%	41,249,734
Washington	11,170	2,234	50.1%	46.9%	2,987	26.7%	85.2%	11.2%	8,183	73.3%	37.3%	59.9%	34,900,238
West Virginia	2,226	445	60.0%	37.2%	790	35.5%	88.6%	8.2%	1,436	64.5%	44.2%	53.2%	9,254,330
Wisconsin	8,222	1,644	53.4%	43.6%	2,482	30.2%	85.3%	11.0%	5,740	69.8%	39.6%	57.6%	28,704,939
Wyoming	652	130	66.1%	33.1%	228	35.0%	86.8%	11.8%	424	65.0%	55.0%	44.6%	2,897,371
TOTAL	**392,982**	**78,596**	**57.6%**	**38.6%**	**121,277**	**30.9%**	**85.3%**	**9.8%**	**271,705**	**69.1%**	**45.3%**	**51.4%**	**1,578,608,340**

[a]Population estimates were obtained from the United States Bureau of the Census available on the SEER program website.

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

Table 9 Average Annual Age-Adjusted Incidence Rates[a] with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Age, Behavior, and Central Cancer Registry, CBTRUS Statistical Report: NPCR and SEER, 2011–2015

State	0–19 Years						20+ Years						All Ages					
	Malignant		Non-Malignant		All Tumors		Malignant		Non-Malignant		All Tumors		Malignant		Non-Malignant		All Tumors	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Alabama	3.31	2.88–3.80	1.27	1.00–1.58	4.58	4.06–5.15	8.40	7.99–8.83	13.95	13.41–14.50	22.35	21.67–23.04	6.94	6.62–7.27	10.31	9.92–10.71	17.25	16.75–17.77
Alaska	2.35	1.52–3.48	3.73	2.64–5.12	6.08	4.67–7.79	8.31	7.12–9.64	22.47	20.48–24.60	30.78	28.44–33.25	6.60	5.71–7.58	17.09	15.63–18.65	23.69	21.97–25.51
Arizona	3.13	2.78–3.52	2.47	2.16–2.82	5.61	5.13–6.12	8.27	7.92–8.63	18.87	18.33–19.42	27.14	26.49–27.79	6.79	6.52–7.07	14.17	13.77–14.57	20.96	20.48–21.45
Arkansas	3.59	3.03–4.23	2.34	1.88–2.87	5.93	5.19–6.74	8.93	8.39–9.49	16.85	16.09–17.63	25.78	24.84–26.73	7.40	6.98–7.84	12.69	12.13–13.26	20.08	19.38–20.80
California	3.03	2.88–3.19	2.10	1.98–2.23	5.13	4.94–5.33	8.05	7.90–8.21	20.16	19.92–20.40	28.21	27.93–28.50	6.61	6.50–6.73	14.98	14.81–15.15	21.59	21.38–21.80
Colorado	3.39	2.97–3.85	2.07	1.74–2.44	5.46	4.92–6.04	8.56	8.14–8.99	27.17	26.42–27.94	35.73	34.87–36.60	7.08	6.76–7.41	19.97	19.43–20.52	27.05	26.41–27.69
Connecticut	3.49	2.96–4.10	2.59	2.15–3.10	6.08	5.38–6.85	9.15	8.65–9.66	19.38	18.65–20.14	28.53	27.64–29.44	7.53	7.14–7.93	14.57	14.02–15.12	22.09	21.42–22.77
Delaware	4.10	3.01–5.45	2.79	1.91–3.94	6.88	5.45–8.58	7.99	7.10–8.96	16.52	15.21–17.92	24.51	22.92–26.20	6.87	6.16–7.65	12.58	11.61–13.62	19.46	18.24–20.74
District of Columbia	3.91	2.52–5.79	3.25	1.91–5.13	7.16	5.16–9.67	7.03	5.97–8.22	22.43	20.46–24.52	29.45	27.21–31.83	6.13	5.27–7.10	16.93	15.46–18.49	23.06	21.35–24.88
Florida	3.46	3.22–3.71	2.90	2.69–3.13	6.36	6.04–6.70	8.43	8.24–8.64	22.51	22.19–22.84	30.95	30.56–31.33	7.01	6.85–7.17	16.89	16.65–17.13	23.89	23.61–24.19
Georgia	3.47	3.16–3.79	2.44	2.19–2.72	5.91	5.51–6.33	8.02	7.72–8.32	24.24	23.72–24.77	32.26	31.67–32.87	6.71	6.49–6.95	17.99	17.61–18.37	24.70	24.26–25.15
Hawaii	1.99	1.37–2.78	1.56	1.02–2.28	3.54	2.70–4.56	5.56	4.95–6.22	17.71	16.60–18.87	23.27	21.99–24.59	4.53	4.06–5.05	13.08	12.27–13.93	17.61	16.67–18.59
Idaho	3.52	2.81–4.36	1.50	1.04–2.08	5.02	4.16–6.01	9.40	8.62–10.22	18.69	17.59–19.85	28.09	26.74–29.50	7.71	7.12–8.34	13.76	12.96–14.60	21.47	20.47–22.51
Illinois	3.31	3.04–3.60	2.52	2.28–2.77	5.83	5.47–6.20	8.58	8.32–8.85	22.72	22.30–23.16	31.31	30.80–31.81	7.07	6.87–7.28	16.93	16.61–17.24	24.00	23.62–24.37
Indiana	3.56	3.17–3.97	2.46	2.15–2.81	6.02	5.52–6.55	8.74	8.38–9.12	20.20	19.63–20.77	28.94	28.26–29.63	7.25	6.97–7.55	15.11	14.70–15.53	22.36	21.86–22.88
Iowa	3.91	3.33–4.56	3.52	2.97–4.14	7.43	6.62–8.31	9.61	9.06–10.18	22.71	21.85–23.60	32.32	31.29–33.36	7.97	7.54–8.42	17.20	16.57–17.86	25.18	24.41–25.96
Kansas	3.69	3.12–4.33	2.47	2.01–3.01	6.16	5.42–6.98	9.18	8.61–9.77	19.96	19.11–20.84	29.14	28.12–30.19	7.60	7.16–8.06	14.95	14.32–15.59	22.55	21.79–23.33
Kentucky	4.24	3.72–4.81	3.27	2.82–3.78	7.51	6.82–8.26	9.77	9.30–10.25	27.11	26.32–27.92	36.88	35.96–37.82	8.18	7.82–8.56	20.27	19.69–20.86	28.45	27.77–29.15
Louisiana	3.79	3.33–4.31	2.46	2.08–2.88	6.25	5.65–6.91	7.72	7.31–8.15	21.81	21.11–22.54	29.54	28.72–30.37	6.60	6.27–6.93	16.26	15.75–16.79	22.86	22.25–23.48
Maine	3.76	2.84–4.88	1.48	0.94–2.23	5.24	4.14–6.53	9.77	8.95–10.64	14.87	13.84–15.95	24.64	23.32–26.01	8.04	7.40–8.73	11.03	10.27–11.82	19.07	18.08–20.11
Maryland	3.40	3.00–3.84	1.41	1.16–1.71	4.81	4.33–5.33	8.08	7.71–8.47	18.35	17.79–18.92	26.43	25.75–27.12	6.74	6.45–7.04	13.49	13.08–13.91	20.23	19.73–20.74
Massachusetts	3.71	3.29–4.16	2.22	1.91–2.57	5.92	5.40–6.48	9.01	8.65–9.39	15.82	15.34–16.31	24.83	24.23–25.44	7.49	7.21–7.78	11.92	11.56–12.28	19.41	18.95–19.87
Michigan	3.44	3.12–3.78	1.86	1.63–2.11	5.30	4.91–5.72	8.52	8.23–8.82	18.69	18.26–19.14	27.22	26.69–27.75	7.06	6.84–7.30	13.86	13.55–14.19	20.93	20.54–21.33
Minnesota	3.99	3.54–4.48	2.04	1.73–2.40	6.04	5.48–6.63	9.51	9.09–9.95	16.43	15.87–17.00	25.94	25.24–26.65	7.93	7.60–8.27	12.30	11.90–12.72	20.23	19.70–20.76
Mississippi	3.03	2.52–3.61	2.45	1.99–2.98	5.48	4.79–6.24	8.16	7.63–8.71	19.27	18.45–20.12	27.43	26.45–28.43	6.69	6.28–7.11	14.45	13.85–15.06	21.13	20.41–21.88
Missouri	3.85	3.43–4.31	2.09	1.79–2.44	5.95	5.42–6.51	8.56	8.19–8.95	21.60	21.00–22.21	30.17	29.46–30.88	7.21	6.92–7.51	16.01	15.57–16.45	23.22	22.69–23.75
Montana	2.30	1.54–3.31	1.49	0.90–2.33	3.79	2.80–5.03	9.96	9.00–10.99	19.29	17.92–20.74	29.25	27.57–31.00	7.76	7.04–8.54	14.19	13.19–15.24	21.95	20.71–23.24
Nebraska	4.11	3.36–4.96	3.31	2.65–4.09	7.41	6.40–8.54	9.13	8.43–9.87	16.47	15.52–17.47	25.60	24.41–26.84	7.69	7.14–8.27	12.70	11.99–13.44	20.39	19.49–21.32
Nevada[b]	2.71	2.20–3.30	1.40	1.03–1.85	4.11	3.47–4.82	7.78	7.26–8.34	13.29	12.59–14.02	21.07	20.19–21.98	6.33	5.92–6.75	9.88	9.37–10.41	16.21	15.55–16.88
New Hampshire	4.76	3.72–6.00	2.36	1.68–3.24	7.12	5.85–8.59	9.20	8.41–10.06	17.80	16.66–19.00	27.01	25.61–28.47	7.93	7.28–8.62	13.37	12.53–14.26	21.30	20.24–22.41
New Jersey	3.62	3.27–3.99	2.85	2.55–3.18	6.47	6.01–6.96	9.17	8.85–9.49	22.41	21.90–22.92	31.57	30.98–32.18	7.57	7.33–7.83	16.80	16.43–17.17	24.37	23.93–24.82
New Mexico	2.60	2.03–3.26	1.60	1.17–2.14	4.20	3.47–5.03	7.05	6.48–7.66	18.05	17.11–19.03	25.10	24.00–26.25	5.77	5.33–6.24	13.33	12.65–14.05	19.11	18.29–19.95

Table 9 Continued

State	0–19 Years						20+ Years						All Ages					
	Malignant		Non-Malignant		All Tumors		Malignant		Non-Malignant		All Tumors		Malignant		Non-Malignant		All Tumors	
	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
New York	3.96	3.71–4.22	3.67	3.44–3.92	7.64	7.29–8.00	8.63	8.42–8.84	25.66	25.30–26.03	34.29	33.87–34.71	7.29	7.12–7.46	19.35	19.08–19.62	26.64	26.33–26.96
North Carolina	3.36	3.05–3.70	2.23	1.98–2.51	5.59	5.19–6.02	8.42	8.13–8.72	22.27	21.79–22.75	30.69	30.12–31.26	6.97	6.74–7.20	16.52	16.17–16.88	23.49	23.07–23.91
North Dakota	2.55	1.65–3.78	2.53	1.61–3.77	5.08	3.75–6.73	8.52	7.45–9.70	16.23	14.70–17.88	24.75	22.87–26.75	6.81	6.00–7.70	12.30	11.17–13.51	19.11	17.70–20.59
Ohio	3.91	3.60–4.24	2.55	2.30–2.82	6.46	6.06–6.89	8.74	8.46–9.01	17.52	17.13–17.92	26.26	25.78–26.74	7.35	7.14–7.57	13.23	12.94–13.52	20.58	20.22–20.94
Oklahoma	3.37	2.90–3.91	2.12	1.74–2.55	5.49	4.88–6.16	8.52	8.05–9.01	19.96	19.23–20.72	28.48	27.61–29.37	7.04	6.68–7.42	14.84	14.31–15.39	21.89	21.24–22.55
Oregon	3.94	3.39–4.54	2.73	2.29–3.24	6.67	5.96–7.44	9.53	9.05–10.03	16.48	15.83–17.14	26.01	25.20–26.84	7.93	7.55–8.32	12.53	12.06–13.03	20.46	19.85–21.09
Pennsylvania	4.11	3.80–4.45	2.39	2.16–2.65	6.51	6.11–6.92	9.29	9.02–9.55	24.30	23.87–24.74	33.59	33.09–34.10	7.80	7.59–8.01	18.02	17.70–18.34	25.82	25.44–26.20
Rhode Island	2.78	1.92–3.91	1.70	1.07–2.58	4.49	3.38–5.84	8.83	7.94–9.78	15.84	14.65–17.12	24.67	23.17–26.24	7.09	6.41–7.83	11.79	10.91–12.72	18.88	17.76–20.06
South Carolina	3.18	2.75–3.66	2.20	1.84–2.60	5.38	4.81–5.99	8.44	8.03–8.87	21.52	20.84–22.20	29.95	29.16–30.76	6.93	6.61–7.26	15.97	15.48–16.48	22.90	22.32–23.50
South Dakota	3.30	2.35–4.52	1.53	0.90–2.42	4.83	3.65–6.26	9.31	8.27–10.44	19.71	18.16–21.36	29.02	27.14–30.99	7.58	6.79–8.45	14.49	13.37–15.69	22.08	20.69–23.53
Tennessee	3.64	3.24–4.07	2.74	2.40–3.12	6.38	5.85–6.95	8.28	7.92–8.64	23.48	22.88–24.09	31.76	31.06–32.47	6.95	6.67–7.23	17.53	17.09–17.98	24.48	23.95–25.01
Texas	3.63	3.45–3.83	2.49	2.33–2.65	6.12	5.88–6.37	8.36	8.17–8.55	23.58	23.26–23.91	31.94	31.57–32.32	7.00	6.86–7.15	17.53	17.30–17.77	24.53	24.26–24.81
Utah	3.00	2.53–3.52	2.86	2.40–3.39	5.86	5.19–6.58	9.50	8.85–10.17	34.26	33.03–35.53	43.76	42.37–45.18	7.63	7.15–8.13	25.25	24.37–26.17	32.88	31.87–33.92
Vermont	--	--	3.33	2.14–4.93	5.51	3.92–7.52	9.05	7.90–10.32	22.80	20.92–24.81	31.85	29.63–34.20	7.08	6.21–8.05	17.21	15.82–18.70	24.29	22.64–26.04
Virginia	3.03	2.71–3.38	1.74	1.50–2.01	4.77	4.36–5.21	7.99	7.68–8.31	16.62	16.16–17.08	24.61	24.06–25.17	6.57	6.33–6.82	12.35	12.02–12.69	18.92	18.51–19.34
Washington	4.17	3.76–4.62	3.37	3.00–3.78	7.54	6.98–8.14	9.55	9.18–9.93	29.41	28.75–30.08	38.96	38.20–39.73	8.01	7.72–8.31	21.94	21.46–22.43	29.95	29.38–30.52
West Virginia	3.59	2.84–4.49	2.11	1.54–2.82	5.70	4.74–6.81	8.73	8.07–9.42	17.55	16.60–18.54	26.27	25.12–27.47	7.25	6.73–7.80	13.12	12.42–13.85	20.37	19.50–21.28
Wisconsin	3.69	3.26–4.16	2.52	2.17–2.91	6.21	5.65–6.80	9.46	9.06–9.88	24.26	23.61–24.92	33.72	32.95–34.50	7.81	7.49–8.13	18.02	17.55–18.51	25.83	25.26–26.41
Wyoming	2.07	1.18–3.37	--	--	3.29	2.13–4.85	9.49	8.21–10.91	18.95	17.11–20.93	28.44	26.18–30.84	7.36	6.40–8.42	13.86	12.53–15.30	21.22	19.57–22.98
TOTAL	**3.51**	**3.45–3.56**	**2.44**	**2.39–2.49**	**5.94**	**5.87–6.02**	**8.57**	**8.52–8.63**	**21.33**	**21.25–21.42**	**29.91**	**29.81–30.01**	**7.12**	**7.08–7.16**	**15.91**	**15.85–15.97**	**23.03**	**22.96–23.11**

[a]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[b]For Nevada only, data was not available from 2011.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results program; CI, confidence interval

Table 10 Distribution of Histologically-Confirmed Brain and Other Central Nervous System Tumors by WHO Grade, Treatment Information Completeness, and Major Histology Grouping, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	Number of Newly Diagnosed Tumors (2011-2015)	Histologically Confirmed (%)	WHO Grade Completeness (%)			Assigned WHO Grade				Radiation Information Completeness[b] (%)	Surgical Extent of Resection Information Completeness[c] (%)
			Complete[a]	Incomplete	Not Applicable	Grade I	Grade II	Grade III	Grade IV		
Tumors of Neuroepithelial Tissue	**110,861**	**89.3%**	**84.1%**	**14.4%**	**1.5%**	**10.7%**	**14.4%**	**13.7%**	**61.1%**	**49.1%**	**98.1%**
Pilocytic astrocytoma	5,212	91.9%	85.8%	13.9%	0.4%	92.8%	6.0%	0.8%	0.4%	6.0%	99.1%
Diffuse astrocytoma	7,562	92.3%	84.7%	15.2%	0.1%	3.7%	61.5%	21.0%	13.8%	44.5%	98.0%
Anaplastic astrocytoma	6,797	99.3%	94.2%	5.7%	0.1%	0.1%	1.2%	90.1%	8.6%	70.1%	99.3%
Unique astrocytoma variants	1,161	76.3%	74.9%	24.8%	0.2%	22.9%	55.1%	16.9%	5.1%	18.2%	98.1%
Malignant	*790*	*87.2%*	*77.1%*	*22.8%*	*0.1%*	*4.0%*	*68.5%*	*21.1%*	*6.4%*	*26.3%*	*98.0%*
Non-Malignant	*371*	*53.1%*	*67.5%*	*32.0%*	*0.5%*	*98.5%*	*1.5%*	*0.0%*	*0.0%*	*0.8%*	*98.4%*
Glioblastoma	57,805	93.1%	86.8%	13.2%	0.0%	0.2%	0.2%	0.8%	98.8%	62.2%	97.9%
Oligodendroglioma	3,679	96.4%	92.6%	7.4%	0.1%	1.5%	86.0%	6.8%	5.7%	25.7%	98.5%
Anaplastic oligodendroglioma	1,767	99.2%	95.1%	4.9%	0.0%	0.1%	2.8%	88.4%	8.6%	62.8%	98.7%
Oligoastrocytic tumors	2,651	99.5%	95.1%	4.9%	0.0%	0.8%	51.1%	39.9%	8.1%	49.6%	99.5%
Ependymal tumors	6,858	90.1%	84.2%	15.8%	0.0%	35.3%	49.8%	14.1%	0.7%	23.7%	98.5%
Malignant	*4,045*	*94.0%*	*87.7%*	*12.3%*	*0.1%*	*2.7%*	*74.3%*	*22.0%*	*1.1%*	*34.3%*	*98.4%*
Non-Malignant	*2,813*	*84.4%*	*78.5%*	*21.5%*	*0.0%*	*93.8%*	*6.0%*	*0.1%*	*0.1%*	*8.4%*	*98.6%*
Glioma malignant, NOS	7,518	32.6%	44.4%	54.7%	0.9%	20.7%	28.6%	24.2%	26.6%	23.8%	97.8%
Choroid plexus tumors	820	88.3%	73.6%	26.4%	0.0%	66.0%	17.1%	16.3%	0.6%	4.9%	98.1%
Malignant	*129*	*97.7%*	*81.0%*	*19.0%*	*0.0%*	*7.8%*	*3.9%*	*85.3%*	*2.9%*	*18.6%*	*100.0%*
Non-Malignant	*691*	*86.5%*	*72.1%*	*27.9%*	*0.0%*	*79.8%*	*20.2%*	*0.0%*	*0.0%*	*2.3%*	*97.8%*
Other neuroepithelial tumors	100	96.0%	46.9%	52.1%	1.0%	6.7%	53.3%	24.4%	15.6%	36.0%	100.0%
Malignant	*66*	*100.0%*	*36.4%*	*62.1%*	*1.5%*	*4.2%*	*20.8%*	*45.8%*	*29.2%*	*47.0%*	*100.0%*
Non-Malignant	*34*	*88.2%*	*70.0%*	*30.0%*	*0.0%*	*9.5%*	*90.5%*	*0.0%*	*0.0%*	*14.7%*	*100.0%*
Neuronal and mixed neuronal-glial tumors	4,640	93.4%	61.7%	21.1%	17.2%	79.9%	15.6%	3.8%	0.8%	14.1%	98.6%
Malignant	*922*	*98.6%*	*15.1%*	*5.6%*	*79.3%*	*19.7%*	*6.6%*	*62.8%*	*10.9%*	*54.2%*	*97.7%*
Non-Malignant	*3,718*	*92.1%*	*74.1%*	*25.2%*	*0.7%*	*83.1%*	*16.0%*	*0.6%*	*0.2%*	*4.1%*	*98.8%*
Tumors of the pineal region	767	75.7%	0.0%	0.0%	100.0%	--	--	--	--	35.9%	97.5%
Malignant	*422*	*95.0%*	*0.0%*	*0.0%*	*100.0%*	--	--	--	--	*56.4%*	*99.1%*
Non-Malignant	*345*	*52.2%*	*0.0%*	*0.0%*	*100.0%*	--	--	--	--	*10.7%*	*96.3%*
Embryonal tumors	3,524	98.1%	73.2%	25.9%	0.9%	1.2%	0.2%	1.5%	97.1%	56.7%	97.5%
Tumors of Cranial and Spinal Nerves	**33,771**	**51.2%**	**31.0%**	**69.0%**	**0.0%**	**99.0%**	**0.5%**	**0.3%**	**0.2%**	**17.1%**	**98.3%**
Nerve sheath tumors	33,738	51.2%	31.0%	69.0%	0.0%	99.0%	0.5%	0.3%	0.2%	17.1%	98.3%
Malignant	*225*	*82.7%*	*18.8%*	*81.2%*	*0.0%*	*48.6%*	*11.4%*	*28.6%*	*11.4%*	*32.4%*	*81.7%*
Non-Malignant	*33,513*	*51.0%*	*31.2%*	*68.8%*	*0.0%*	*99.3%*	*0.4%*	*0.1%*	*0.1%*	*17.0%*	*98.4%*
Other tumors of cranial and spinal nerves	33	39.4%	30.8%	69.2%	0.0%	100.0%	0.0%	0.0%	0.0%	3.0%	100.0%

Table 10 *Continued*

Histology	Number of Newly Diagnosed Tumors (2011-2015)	Histologically Confirmed (%)	WHO Grade Completeness (%)			Assigned WHO Grade				Radiation Information Completeness[b] (%)	Surgical Extent of Resection Information Completeness[c] (%)
			Complete[a]	Incomplete	Not Applicable	Grade I	Grade II	Grade III	Grade IV		
Tumors of Meninges	**150,390**	**42.5%**	**75.5%**	**24.4%**	**0.1%**	**80.4%**	**17.4%**	**2.1%**	**0.1%**	**6.8%**	**97.9%**
Meningioma	145,916	41.2%	77.1%	22.9%	0.0%	80.6%	17.6%	1.7%	0.1%	6.5%	97.9%
Malignant	*1,771*	*79.2%*	*82.9%*	*17.1%*	*0.0%*	*23.0%*	*16.1%*	*59.7%*	*1.2%*	*30.3%*	*85.1%*
Non-Malignant	*144,145*	*40.8%*	*77.0%*	*23.0%*	*0.0%*	*82.1%*	*17.6%*	*0.2%*	*0.1%*	*6.3%*	*98.0%*
Mesenchymal tumors	1,385	71.8%	49.9%	48.9%	1.1%	6.4%	50.7%	38.4%	4.4%	27.1%	98.4%
Primary melanocytic lesions	123	91.1%	10.7%	86.6%	2.7%	66.7%	16.7%	8.3%	8.3%	36.6%	94.2%
Other neoplasms related to the meninges	2,966	91.7%	51.9%	46.7%	1.4%	99.2%	0.6%	0.1%	0.2%	6.8%	98.7%
Lymphomas and Hematopoietic Neoplasms	**7,818**	**94.0%**	**10.6%**	**87.7%**	**1.7%**	**100.0%**	**0.0%**	**0.0%**	**0.0%**	**21.4%**	**99.1%**
Lymphoma	7,585	94.1%	11.1%	88.0%	0.9%	100.0%	0.0%	0.0%	0.0%	21.1%	99.1%
Other hematopoietic neoplasms	233	90.6%	0.7%	82.1%	17.2%	100.0%	0.0%	0.0%	0.0%	31.8%	99.2%
Germ Cell Tumors and Cysts	**1,487**	**81.9%**	**1.8%**	**55.6%**	**42.6%**	**18.2%**	**9.1%**	**4.5%**	**68.2%**	**43.1%**	**99.0%**
Germ cell tumors, cysts and heterotopias	1,487	81.9%	1.8%	55.6%	42.6%	18.2%	9.1%	4.5%	68.2%	43.1%	99.0%
Malignant	*1,004*	*88.7%*	*2.1%*	*43.1%*	*54.7%*	*5.3%*	*10.5%*	*5.3%*	*78.9%*	*62.8%*	*99.1%*
Non-Malignant	*483*	*67.7%*	*0.9%*	*89.6%*	*9.5%*	*100.0%*	*0.0%*	*0.0%*	*0.0%*	*2.1%*	*98.9%*
Tumors of Sellar Region	**67,765**	**50.0%**	**0.5%**	**0.6%**	**98.9%**	**99.4%**	**0.0%**	**0.6%**	**0.0%**	**3.1%**	**98.0%**
Tumors of the pituitary	64,749	48.4%	0.0%	0.0%	100.0%	--	--	--	--	2.3%	98.0%
Malignant	*175*	*66.3%*	*0.0%*	*0.0%*	*100.0%*	--	--	--	--	*16.6%*	*88.2%*
Non-Malignant	*64,574*	*48.4%*	*0.0%*	*0.0%*	*100.0%*	--	--	--	--	*2.3%*	*98.0%*
Craniopharyngioma	3,016	83.9%	6.1%	8.6%	85.3%	99.4%	0.0%	0.6%	0.0%	20.2%	98.1%
Unclassified Tumors	**20,890**	**17.5%**	**4.3%**	**87.1%**	**8.6%**	**64.1%**	**7.7%**	**11.5%**	**16.7%**	**2.7%**	**71.1%**
Hemangioma	6,182	29.0%	2.5%	97.1%	0.4%	93.3%	2.2%	2.2%	2.2%	1.8%	98.1%
Neoplasm, unspecified	14,588	12.5%	5.8%	78.0%	16.2%	52.8%	10.4%	14.2%	22.6%	2.9%	61.1%
Malignant	*6,679*	*8.7%*	*8.1%*	*84.8%*	*7.1%*	*14.9%*	*10.6%*	*27.7%*	*46.8%*	*4.0%*	*43.7%*
Non-Malignant	*7,909*	*15.7%*	*4.8%*	*74.8%*	*20.5%*	*83.1%*	*10.2%*	*3.4%*	*3.4%*	*2.0%*	*76.2%*
All other	120	40.0%	10.4%	62.5%	27.1%	40.0%	0.0%	40.0%	20.0%	10.8%	91.7%
TOTAL[c]	**392,982**	**57.6%**	**62.0%**	**21.8%**	**16.2%**	**39.0%**	**14.9%**	**9.1%**	**37.1%**	**19.2%**	**96.1%**
Malignant	***121,277***	***85.3%***	***81.0%***	***17.0%***	***2.0%***	***6.5%***	***14.5%***	***15.3%***	***63.7%***	***47.4%***	***92.7%***
Non-Malignant	***271,705***	***45.3%***	***46.8%***	***25.6%***	***27.6%***	***84.3%***	***15.3%***	***0.3%***	***0.1%***	***6.6%***	***97.2%***

[a]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.
[b]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."
[c]Surgery is defined using a recoded variable based on NAACCR Item #1290 (http://datadictionary.naaccr.org/default.aspx?c=10#1290). Please see the SEER site-specific surgery codes for more information on coding for this variable (https://seer.cancer.gov/archive/tools/SEER2003.surg.prim.site.codes.pdf). Completeness is defined as having a value other than "unknown."
- Percentages are not presented when category is not applicable.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; CNS, central nervous system; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; WHO, World Health Organization

Table 11 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 Major Histology Grouping, Histology, and Race[c], CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	White				Black				American Indian/Alaskan 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
Tumors of Neuroepithelial Tissue	**97,396**	**19,479**	**7.10**	**7.05-7.14**	**8,321**	**1,664**	**3.98**	**3.89-4.07**	**625**	**125**	**3.20**	**2.93-3.48**	**3,664**	**733**	**4.07**	**3.93-4.20**
Pilocytic astrocytoma	4,260	852	0.38	0.37-0.39	603	121	0.26	0.24-0.28	40	8	0.15	0.11-0.21	257	51	0.29	0.26-0.33
Diffuse astrocytoma	6,612	1,322	0.51	0.50-0.52	578	116	0.27	0.25-0.30	53	11	0.26	0.19-0.34	261	52	0.28	0.25-0.32
Anaplastic astrocytoma	6,028	1,206	0.45	0.44-0.46	446	89	0.22	0.20-0.24	44	9	0.21	0.15-0.29	218	44	0.24	0.21-0.27
Unique astrocytoma variants	915	183	0.08	0.07-0.08	152	30	0.07	0.06-0.08	-	-	-	-	68	14	0.08	0.06-0.10
Malignant	*646*	*129*	*0.05*	*0.05-0.06*	*81*	*16*	*0.04*	*0.03-0.05*	-	-	-	-	*44*	*9*	*0.05*	*0.04-0.07*
Non-Malignant	*269*	*54*	*0.02*	*0.02-0.03*	*71*	*14*	*0.03*	*0.02-0.04*	-	-	-	-	*24*	*5*	*0.03*	*0.02-0.04*
Glioblastoma	52,306	10,461	3.47	3.44-3.50	3,552	710	1.80	1.73-1.86	227	45	1.43	1.24-1.65	1,365	273	1.57	1.48-1.66
Oligodendroglioma	3,230	646	0.26	0.25-0.27	237	47	0.11	0.10-0.13	26	5	0.11	0.07-0.17	147	29	0.15	0.13-0.18
Anaplastic oligodendroglioma	1,546	309	0.12	0.11-0.12	103	21	0.05	0.04-0.06	-	-	-	-	94	19	0.10	0.08-0.12
Oligoastrocytic tumors	2,349	470	0.19	0.18-0.20	149	30	0.07	0.06-0.08	17	3	0.08	0.04-0.13	108	22	0.11	0.09-0.13
Ependymal tumors	5,908	1,182	0.47	0.45-0.48	540	108	0.25	0.23-0.27	59	12	0.27	0.20-0.35	297	59	0.31	0.28-0.35
Malignant	*3,419*	*684*	*0.27*	*0.26-0.28*	*367*	*73*	*0.17*	*0.15-0.19*	*33*	*7*	*0.14*	*0.10-0.21*	*192*	*38*	*0.21*	*0.18-0.24*
Non-Malignant	*2,489*	*498*	*0.19*	*0.19-0.20*	*173*	*35*	*0.08*	*0.07-0.10*	*26*	*5*	*0.13*	*0.08-0.19*	*105*	*21*	*0.11*	*0.09-0.13*
Glioma malignant, NOS	6,234	1,247	0.50	0.48-0.51	838	168	0.40	0.37-0.42	53	11	0.24	0.18-0.32	327	65	0.37	0.33-0.41
Choroid plexus tumors	680	136	0.06	0.05-0.06	87	17	0.04	0.03-0.05	-	-	-	-	37	7	0.04	0.03-0.06
Malignant	*99*	*20*	*0.01*	*0.01-0.01*	*16*	*3*	*0.01*	*0.00-0.01*	-	-	-	-	-	-	-	-
Non-Malignant	*581*	*116*	*0.05*	*0.04-0.05*	*71*	*14*	*0.03*	*0.02-0.04*	-	-	-	-	*27*	*5*	*0.03*	*0.02-0.04*
Other neuroepithelial tumors	84	17	0.01	0.01-0.01	-	-	-	-	-	-	-	-	-	-	-	-
Malignant	*54*	*11*	*0.00*	*0.00-0.01*	-	-	-	-	-	-	-	-	-	-	-	-
Non-Malignant	*30*	*6*	*0.00*	*0.00-0.00*	-	-	-	-	-	-	-	-	-	-	-	-
Neuronal and mixed neuronal-glial tumors	3,814	763	0.32	0.31-0.33	498	100	0.22	0.20-0.24	38	8	0.17	0.12-0.23	244	49	0.26	0.23-0.30
Malignant	*768*	*154*	*0.06*	*0.05-0.06*	*75*	*15*	*0.04*	*0.03-0.05*	-	-	-	-	*56*	*11*	*0.06*	*0.05-0.08*
Non-Malignant	*3,046*	*609*	*0.26*	*0.25-0.27*	*423*	*85*	*0.18*	*0.17-0.20*	*27*	*5*	*0.11*	*0.07-0.17*	*188*	*38*	*0.20*	*0.17-0.23*
Tumors of the pineal region	603	121	0.05	0.05-0.05	119	24	0.05	0.04-0.06	-	-	-	-	35	7	0.04	0.03-0.05
Malignant	*308*	*62*	*0.03*	*0.02-0.03*	*81*	*16*	*0.04*	*0.03-0.04*	-	-	-	-	*24*	*5*	*0.03*	*0.02-0.04*
Non-Malignant	*295*	*59*	*0.02*	*0.02-0.03*	*38*	*8*	*0.02*	*0.01-0.02*	-	-	-	-	-	-	-	-
Embryonal tumors	2,827	565	0.25	0.24-0.26	411	82	0.17	0.16-0.19	36	7	0.14	0.10-0.20	201	40	0.23	0.20-0.26

Table 11 *Continued*

Histology	White				Black				American Indian/Alaskan 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
Tumors of Cranial and Spinal Nerves	**28,908**	**5,782**	**2.06**	**2.04-2.09**	**2,053**	**411**	**0.99**	**0.95-1.04**	**212**	**42**	**1.09**	**0.94-1.25**	**2,233**	**447**	**2.36**	**2.26-2.46**
Nerve sheath tumors	28,881	5,776	2.06	2.04-2.08	2,051	410	0.99	0.95-1.03	211	42	1.08	0.93-1.25	2,230	446	2.36	2.26-2.46
Malignant	*174*	*35*	*0.01*	*0.01-0.02*	*2,025*	*405*	*0.98*	*0.93-1.02*	*209*	*42*	*1.07*	*0.92-1.24*	*2,212*	*442*	*2.34*	*2.24-2.44*
Non-Malignant	*28,707*	*5,741*	*2.05*	*2.02-2.07*	*26*	*5*	*0.01*	*0.01-0.02*	-	-	-	-	*18*	*4*	*0.02*	*0.01-0.03*
Other tumors of cranial and spinal nerves	27	5	0.00	0.00-0.00	-	-	-	-	-	-	-	-	-	-	-	-
Tumors of Meninges	**122,895**	**24,579**	**8.42**	**8.37-8.47**	**18,567**	**3,713**	**9.91**	**9.77-10.06**	**875**	**175**	**5.44**	**5.06-5.84**	**7,110**	**1,422**	**8.39**	**8.19-8.59**
Meningioma	119,167	23,833	8.14	8.09-8.18	18,135	3,627	9.71	9.56-9.86	844	169	5.30	4.92-5.69	6,859	1,372	8.13	7.93-8.33
Malignant	*1,405*	*281*	*0.10*	*0.09-0.10*	*268*	*54*	*0.15*	*0.13-0.16*	-	-	-	-	*83*	*17*	*0.10*	*0.08-0.12*
Non-Malignant	*117,762*	*23,552*	*8.04*	*7.99-8.09*	*17,867*	*3,573*	*9.56*	*9.42-9.71*	*836*	*167*	*5.24*	*4.87-5.64*	*6,776*	*1,355*	*8.02*	*7.83-8.22*
Mesenchymal tumors	1,167	233	0.09	0.08-0.10	123	25	0.06	0.05-0.07	-	-	-	-	80	16	0.09	0.07-0.11
Primary melanocytic lesions	112	22	0.01	0.01-0.01	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	2,449	490	0.19	0.18-0.19	304	61	0.14	0.13-0.16	23	5	0.11	0.07-0.16	166	33	0.17	0.15-0.20
Lymphomas and Hematopoietic Neoplasms	**6,618**	**1,324**	**0.45**	**0.44-0.46**	**645**	**129**	**0.32**	**0.30-0.35**	**49**	**10**	**0.27**	**0.20-0.37**	**437**	**87**	**0.51**	**0.46-0.56**
Lymphoma	6,422	1,284	0.44	0.42-0.45	622	124	0.31	0.29-0.34	47	9	0.27	0.19-0.36	427	85	0.50	0.45-0.55
Other hematopoietic neoplasms	196	39	0.01	0.01-0.02	23	5	0.01	0.01-0.02	-	-	-	-	-	-	-	-
Germ Cell Tumors and Cysts	**1,179**	**236**	**0.10**	**0.10-0.11**	**146**	**29**	**0.06**	**0.05-0.07**	**-**	**-**	**-**	**-**	**141**	**28**	**0.16**	**0.13-0.19**
Germ cell tumors, cysts and heterotopias	1,179	236	0.10	0.10-0.11	146	29	0.06	0.05-0.07	-	-	-	-	141	28	0.16	0.13-0.19
Malignant	*783*	*157*	*0.07*	*0.06-0.07*	*96*	*19*	*0.04*	*0.03-0.05*	-	-	-	-	*107*	*21*	*0.12*	*0.10-0.15*
Non-Malignant	*396*	*79*	*0.03*	*0.03-0.04*	*50*	*10*	*0.02*	*0.02-0.03*	-	-	-	-	*34*	*7*	*0.04*	*0.03-0.05*
Tumors of Sellar Region	**49,486**	**9,897**	**3.76**	**3.73-3.80**	**13,009**	**2,602**	**6.48**	**6.37-6.60**	**602**	**120**	**3.13**	**2.87-3.40**	**4,119**	**824**	**4.39**	**4.26-4.53**
Tumors of the pituitary	47,305	9,461	3.59	3.56-3.62	12,392	2,478	6.19	6.08-6.31	584	117	3.03	2.78-3.31	3,948	790	4.21	4.07-4.34
Malignant	*128*	*26*	*0.01*	*0.01-0.01*	*35*	*7*	*0.02*	*0.01-0.03*	-	-	-	-	-	-	-	-
Non-Malignant	*47,177*	*9,435*	*3.58*	*3.55-3.61*	*12,357*	*2,471*	*6.17*	*6.06-6.29*	*581*	*116*	*3.02*	*2.77-3.29*	*3,939*	*788*	*4.20*	*4.06-4.33*
Craniopharyngioma	2,181	436	0.17	0.16-0.18	617	123	0.29	0.27-0.31	18	4	0.09	0.05-0.15	171	34	0.18	0.16-0.22
Unclassified Tumors	**17,563**	**3,513**	**1.26**	**1.24-1.27**	**2,174**	**435**	**1.14**	**1.09-1.19**	**188**	**38**	**1.10**	**0.94-1.28**	**873**	**175**	**1.02**	**0.95-1.09**
Hemangioma	5,183	1,037	0.39	0.38-0.41	569	114	0.27	0.25-0.30	75	15	0.38	0.30-0.48	325	65	0.35	0.31-0.39
Neoplasm, unspecified	12,296	2,459	0.85	0.84-0.87	1,579	316	0.85	0.81-0.90	111	22	0.70	0.57-0.86	541	108	0.67	0.61-0.73

Table 11 *Continued*

Histology	White				Black				American Indian/Alaskan Native				Asian/Pacific Islander			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
Malignant	*5,814*	*1,163*	*0.39*	*0.38-0.40*	*570*	*114*	*0.32*	*0.30-0.35*	*50*	*10*	*0.32*	*0.23-0.42*	*221*	*44*	*0.28*	*0.25-0.32*
Non-Malignant	*6,482*	*1,296*	*0.47*	*0.45-0.48*	*1,009*	*202*	*0.53*	*0.50-0.56*	*61*	*12*	*0.39*	*0.29-0.51*	*320*	*64*	*0.38*	*0.34-0.43*
All other	84	17	0.01	0.00-0.01	26	5	0.01	0.01-0.02	-	-	-	-	-	-	-	-
TOTAL[c]	**324,045**	**64,809**	**23.15**	**23.07-23.23**	**44,915**	**8,983**	**22.89**	**22.67-23.11**	**2,561**	**512**	**14.27**	**13.68-14.87**	**18,577**	**3,715**	**20.90**	**20.59-21.21**
Malignant	***106,225***	***21,245***	***7.62***	***7.57-7.67***	***9,237***	***1,847***	***4.52***	***4.42-4.61***	***682***	***136***	***3.62***	***3.33-3.92***	***4,225***	***845***	***4.78***	***4.63-4.93***
Non-Malignant	***217,820***	***43,564***	***15.53***	***15.47-15.60***	***35,678***	***7,136***	***18.37***	***18.17-18.57***	***1,879***	***376***	***10.65***	***10.14-11.18***	***14,352***	***2,870***	***16.12***	***15.85-16.39***

[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 = 2,884).
[d]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology 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 12 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 Major Histology Grouping, Histology, and Hispanic Ethnicity[c], CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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 Neuroepithelial Tissue	**11,101**	**2,220**	**4.97**	**4.87-5.07**	**10,244**	**2,049**	**5.07**	**4.96-5.18**	**269**	**54**	**2.49**	**2.16-2.85**	**99,760**	**19,952**	**6.85**	**6.81-6.90**
Pilocytic astrocytoma	817	163	0.25	0.23-0.27	736	147	0.25	0.23-0.27	29	6	0.15	0.10-0.23	4,395	879	0.38	0.37-0.39
Diffuse astrocytoma	811	162	0.35	0.32-0.37	742	148	0.35	0.32-0.38	18	4	0.13	0.08-0.22	6,751	1,350	0.49	0.48-0.50
Anaplastic astrocytoma	648	130	0.29	0.27-0.32	605	121	0.30	0.27-0.33	--	--	--	--	6,149	1,230	0.43	0.42-0.44
Unique astrocytoma variants	176	35	0.06	0.05-0.07	165	33	0.06	0.05-0.07	--	--	--	--	985	197	0.08	0.07-0.08
Malignant	*111*	*22*	*0.04*	*0.03-0.05*	*108*	*22*	*0.04*	*0.04-0.05*	--	--	--	--	*679*	*136*	*0.05*	*0.05-0.06*
Non-Malignant	*65*	*13*	*0.02*	*0.02-0.03*	*57*	*11*	*0.02*	*0.01-0.03*	--	--	--	--	*306*	*61*	*0.03*	*0.02-0.03*
Glioblastoma	4,269	854	2.40	2.32-2.47	4,016	803	2.46	2.38-2.54	102	20	1.29	1.03-1.59	53,536	10,707	3.30	3.27-3.33
Oligodendroglioma	409	82	0.16	0.15-0.18	368	74	0.16	0.15-0.18	--	--	--	--	3,270	654	0.25	0.24-0.26
Anaplastic oligodendroglioma	196	39	0.09	0.07-0.10	181	36	0.09	0.08-0.10	--	--	--	--	1,571	314	0.11	0.11-0.12
Oligoastrocytic tumors	265	53	0.11	0.10-0.12	242	48	0.11	0.10-0.13	--	--	--	--	2,386	477	0.18	0.17-0.19
Ependymal tumors	943	189	0.37	0.34-0.39	854	171	0.37	0.34-0.39	19	4	0.18	0.10-0.29	5,915	1,183	0.44	0.43-0.45
Malignant	*620*	*124*	*0.23*	*0.21-0.25*	*568*	*114*	*0.23*	*0.21-0.26*	--	--	--	--	*3,425*	*685*	*0.26*	*0.25-0.27*
Non-Malignant	*323*	*65*	*0.14*	*0.12-0.15*	*286*	*57*	*0.13*	*0.12-0.15*	--	--	--	--	*2,490*	*498*	*0.18*	*0.17-0.19*
Glioma malignant, NOS	927	185	0.36	0.34-0.39	848	170	0.37	0.34-0.40	26	5	0.19	0.11-0.30	6,591	1,318	0.51	0.49-0.52
Choroid plexus tumors	163	33	0.05	0.05-0.06	150	30	0.06	0.05-0.07	--	--	--	--	657	131	0.05	0.05-0.06
Malignant	*31*	*6*	*0.01*	*0.01-0.01*	*28*	*6*	*0.01*	*0.01-0.01*	--	--	--	--	*98*	*20*	*0.01*	*0.01-0.01*
Non-Malignant	*132*	*26*	*0.04*	*0.04-0.05*	*122*	*24*	*0.05*	*0.04-0.06*	--	--	--	--	*559*	*112*	*0.05*	*0.04-0.05*
Other neuroepithelial tumors	17	3	0.01	0.00-0.01	17	3	0.01	0.00-0.01	--	--	--	--	83	17	0.01	0.01-0.01
Malignant	--	--	--	--	--	--	--	--	--	--	--	--	*55*	*11*	*0.00*	*0.00-0.01*
Non-Malignant	--	--	--	--	--	--	--	--	--	--	--	--	*28*	*6*	*0.00*	*0.00-0.00*
Neuronal and mixed neuronal-glial tumors	591	118	0.21	0.19-0.22	522	104	0.20	0.18-0.22	--	--	--	--	4,049	810	0.32	0.31-0.33
Malignant	*108*	*22*	*0.05*	*0.04-0.06*	*96*	*19*	*0.05*	*0.04-0.06*	--	--	--	--	*814*	*163*	*0.06*	*0.05-0.06*
Non-Malignant	*483*	*97*	*0.16*	*0.14-0.17*	*426*	*85*	*0.16*	*0.14-0.17*	--	--	--	--	*3,235*	*647*	*0.27*	*0.26-0.28*
Tumors of the pineal region	99	20	0.04	0.03-0.05	93	19	0.04	0.03-0.05	--	--	--	--	668	134	0.05	0.05-0.06
Malignant	*66*	*13*	*0.02*	*0.02-0.03*	*61*	*12*	*0.02*	*0.02-0.03*	--	--	--	--	*356*	*71*	*0.03*	*0.03-0.03*
Non-Malignant	*33*	*7*	*0.01*	*0.01-0.02*	*32*	*6*	*0.01*	*0.01-0.02*	--	--	--	--	*312*	*62*	*0.02*	*0.02-0.03*
Embryonal tumors	770	154	0.23	0.22-0.25	705	141	0.24	0.22-0.26	19	4	0.09	0.05-0.16	2,754	551	0.24	0.23-0.25

Table 12 *Continued*

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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 Cranial and Spinal Nerves	**2,955**	**591**	**1.39**	**1.33-1.44**	**2,664**	**533**	**1.38**	**1.32-1.43**	**72**	**14**	**0.74**	**0.56-0.96**	**30,816**	**6,163**	**2.05**	**2.03-2.08**
Nerve sheath tumors	2,949	590	1.38	1.33-1.44	2,658	532	1.37	1.32-1.43	72	14	0.74	0.56-0.96	30,789	6,158	2.05	2.03-2.08
Malignant	*30*	*6*	*0.01*	*0.01-0.02*	*27*	*5*	*0.01*	*0.01-0.02*	--	--	--	--	*195*	*39*	*0.01*	*0.01-0.02*
Non-Malignant	*2,919*	*584*	*1.37*	*1.32-1.42*	*2,631*	*526*	*1.36*	*1.31-1.42*	*72*	*14*	*0.74*	*0.56-0.96*	*30,594*	*6,119*	*2.04*	*2.01-2.06*
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	27	5	0.00	0.00-0.00
Tumors of Meninges	**14,299**	**2,860**	**8.20**	**8.06-8.34**	**13,082**	**2,616**	**8.19**	**8.04-8.34**	**417**	**83**	**5.53**	**4.96-6.13**	**136,091**	**27,218**	**8.69**	**8.64-8.74**
Meningioma	13,693	2,739	7.94	7.80-8.09	12,528	2,506	7.93	7.78-8.08	404	81	5.43	4.87-6.03	132,223	26,445	8.41	8.37-8.46
Malignant	*173*	*35*	*0.09*	*0.08-0.11*	*162*	*32*	*0.10*	*0.08-0.11*	--	--	--	--	*1,598*	*320*	*0.10*	*0.10-0.11*
Non-Malignant	*13,520*	*2,704*	*7.85*	*7.71-7.99*	*12,366*	*2,473*	*7.83*	*7.69-7.98*	*401*	*80*	*5.38*	*4.82-5.98*	*130,625*	*26,125*	*8.31*	*8.27-8.36*
Mesenchymal tumors	204	41	0.09	0.07-0.10	187	37	0.09	0.07-0.10	--	--	--	--	1,181	236	0.09	0.08-0.09
Primary melanocytic lesions	--	--	--	--	-	-	--	--	--	--	--	--	113	23	0.01	0.01-0.01
Other neoplasms related to the meninges	392	78	0.16	0.15-0.18	359	72	0.17	0.15-0.19	--	--	--	--	2,574	515	0.18	0.18-0.19
Lymphomas and Hematopoietic Neoplasms	**865**	**173**	**0.47**	**0.44-0.51**	**809**	**162**	**0.49**	**0.45-0.52**	**19**	**4**	**0.17**	**0.10-0.27**	**6,953**	**1,391**	**0.44**	**0.43-0.45**
Lymphoma	825	165	0.46	0.42-0.49	773	155	0.47	0.44-0.51	18	4	0.16	0.10-0.27	6,760	1,352	0.43	0.42-0.44
Other hematopoietic neoplasms	40	8	0.02	0.01-0.02	36	7	0.02	0.01-0.02	--	--	--	--	193	39	0.01	0.01-0.02
Germ Cell Tumors and Cysts	**314**	**63**	**0.10**	**0.09-0.11**	**287**	**57**	**0.10**	**0.09-0.11**	--	--	--	--	**1,173**	**235**	**0.10**	**0.09-0.11**
Germ cell tumors, cysts and heterotopias	314	63	0.10	0.09-0.11	287	57	0.10	0.09-0.11	--	--	--	--	1,173	235	0.10	0.09-0.11
Malignant	*227*	*45*	*0.07*	*0.06-0.08*	*208*	*42*	*0.07*	*0.06-0.08*	--	--	--	--	*777*	*155*	*0.07*	*0.06-0.07*
Non-Malignant	*87*	*17*	*0.03*	*0.02-0.04*	*79*	*16*	*0.03*	*0.02-0.04*	--	--	--	--	*396*	*79*	*0.03*	*0.03-0.04*
Tumors of Sellar Region	**10,503**	**2,101**	**4.64**	**4.55-4.74**	**9,450**	**1,890**	**4.61**	**4.52-4.71**	**323**	**65**	**3.15**	**2.78-3.56**	**57,262**	**11,452**	**4.06**	**4.02-4.09**
Tumors of the pituitary	10,045	2,009	4.47	4.38-4.56	9,031	1,806	4.44	4.34-4.53	308	62	3.06	2.69-3.46	54,704	10,941	3.87	3.83-3.90
Malignant	*29*	*6*	*0.01*	*0.01-0.02*	*25*	*5*	*0.01*	*0.01-0.02*	--	--	--	--	*146*	*29*	*0.01*	*0.01-0.01*
Non-Malignant	*10,016*	*2,003*	*4.45*	*4.36-4.55*	*9,006*	*1,801*	*4.42*	*4.33-4.52*	*307*	*61*	*3.05*	*2.68-3.45*	*54,558*	*10,912*	*3.86*	*3.82-3.89*
Craniopharyngioma	458	92	0.18	0.16-0.19	419	84	0.18	0.16-0.20	--	--	--	--	2,558	512	0.19	0.18-0.20
classified Tumors	**2,405**	**481**	**1.25**	**1.20-1.30**	**2,226**	**445**	**1.28**	**1.22-1.34**	**58**	**12**	**0.59**	**0.43-0.79**	**18,485**	**3,697**	**1.24**	**1.22-1.26**
Hemangioma	815	163	0.37	0.34-0.39	746	149	0.37	0.34-0.40	21	4	0.19	0.11-0.31	5,367	1,073	0.38	0.37-0.39
Neoplasm, unspecified	1,572	314	0.87	0.83-0.92	1,463	293	0.89	0.85-0.94	37	7	0.40	0.26-0.57	13,016	2,603	0.85	0.83-0.86
Malignant	*583*	*117*	*0.36*	*0.33-0.40*	*541*	*108*	*0.37*	*0.34-0.40*	--	--	--	--	*6,096*	*1,219*	*0.38*	*0.37-0.39*
Non-Malignant	*989*	*198*	*0.51*	*0.48-0.54*	*922*	*184*	*0.52*	*0.49-0.56*	--	--	--	--	*6,920*	*1,384*	*0.47*	*0.46-0.48*
All other	18	4	0.01	0.01-0.02	17	3	0.01	0.01-0.02	--	--	--	--	102	20	0.01	0.01-0.01

Table 12 *Continued*

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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
TOTAL[c]	**42,442**	**8,488**	**21.02**	**20.80-21.23**	**38,762**	**7,752**	**21.11**	**20.89-21.34**	**1,168**	**234**	**12.73**	**11.92-13.57**	**350,540**	**70,108**	**23.44**	**23.36-23.52**
Malignant	***12,079***	***2,416***	***5.67***	***5.56-5.78***	***11,192***	***2,238***	***5.79***	***5.68-5.91***	***286***	***57***	***2.68***	***2.34-3.06***	***109,198***	***21,840***	***7.36***	***7.32-7.41***
Non-Malignant	***30,363***	***6,073***	***15.35***	***15.17-15.54***	***27,570***	***5,514***	***15.32***	***15.13-15.51***	***882***	***176***	***10.05***	***9.32-10.81***	***241,342***	***48,268***	***16.07***	***16.01-16.14***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and age-adjusted to the 2000 US standard population.
[c]Hispanic ethnicity is not mutually exclusive of race; Classified using the North American Association of Central Cancer Registries Hispanic Identification Algorithm, version 2 (NHIA v2).
[d]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology 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 13 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0-19 Years), Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, and Sex, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	Total				Male				Female			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
Tumors of Neuroepithelial Tissue	**15,742**	**3,148**	**3.82**	**3.77-3.88**	**8,488**	**1,698**	**4.04**	**3.95-4.12**	**7,254**	**1,451**	**3.60**	**3.52-3.69**
Pilocytic astrocytoma	3,746	749	0.91	0.88-0.94	1,954	391	0.93	0.89-0.97	1,792	358	0.89	0.85-0.93
Diffuse astrocytoma	998	200	0.24	0.23-0.26	534	107	0.25	0.23-0.28	464	93	0.23	0.21-0.25
Anaplastic astrocytoma	405	81	0.10	0.09-0.11	220	44	0.10	0.09-0.12	185	37	0.09	0.08-0.11
Unique astrocytoma variants	511	102	0.12	0.11-0.14	290	58	0.14	0.12-0.15	221	44	0.11	0.10-0.13
Malignant	*247*	*49*	*0.06*	*0.05-0.07*	*141*	*28*	*0.07*	*0.06-0.08*	*106*	*21*	*0.05*	*0.04-0.06*
Non-Malignant	*264*	*53*	*0.06*	*0.06-0.07*	*149*	*30*	*0.07*	*0.06-0.08*	*115*	*23*	*0.06*	*0.05-0.07*
Glioblastoma	759	152	0.18	0.17-0.20	408	82	0.19	0.18-0.21	351	70	0.17	0.16-0.19
Oligodendroglioma	191	38	0.05	0.04-0.05	99	20	0.05	0.04-0.06	92	18	0.05	0.04-0.06
Anaplastic oligodendroglioma	28	6	0.01	0.00-0.01	-	-	-	-	-	-	-	-
Oligoastrocytic tumors	105	21	0.03	0.02-0.03	50	10	0.02	0.02-0.03	55	11	0.03	0.02-0.04
Ependymal tumors	1,216	243	0.29	0.28-0.31	670	134	0.32	0.29-0.34	546	109	0.27	0.25-0.29
Malignant	*1,022*	*204*	*0.25*	*0.23-0.26*	*567*	*113*	*0.27*	*0.25-0.29*	*455*	*91*	*0.23*	*0.21-0.25*
Non-Malignant	*194*	*39*	*0.05*	*0.04-0.05*	*103*	*21*	*0.05*	*0.04-0.06*	*91*	*18*	*0.04*	*0.04-0.05*
Glioma malignant, NOS	2,799	560	0.68	0.66-0.71	1,412	282	0.67	0.64-0.71	1,387	277	0.69	0.65-0.73
Choroid plexus tumors	406	81	0.10	0.09-0.11	230	46	0.11	0.10-0.12	176	35	0.09	0.07-0.10
Malignant	*101*	*20*	*0.02*	*0.02-0.03*	*54*	*11*	*0.03*	*0.02-0.03*	*47*	*9*	*0.02*	*0.02-0.03*
Non-Malignant	*305*	*61*	*0.07*	*0.07-0.08*	*176*	*35*	*0.08*	*0.07-0.10*	*129*	*26*	*0.06*	*0.05-0.08*
Other neuroepithelial tumors	32	6	0.01	0.01-0.01	-	-	-	-	27	5	0.01	0.01-0.02
Malignant	*27*	*5*	*0.01*	*0.00-0.01*	-	-	-	-	*24*	*5*	*0.01*	*0.01-0.02*
Non-Malignant	-	-	-	-	-	-	-	-	-	-	-	-
Neuronal and mixed neuronal-glial tumors	1,787	357	0.43	0.41-0.45	987	197	0.47	0.44-0.50	800	160	0.40	0.37-0.43
Malignant	*89*	*18*	*0.02*	*0.02-0.03*	*54*	*11*	*0.03*	*0.02-0.03*	*35*	*7*	*0.02*	*0.01-0.02*
Non-Malignant	*1,698*	*340*	*0.41*	*0.39-0.43*	*933*	*187*	*0.44*	*0.41-0.47*	*765*	*153*	*0.38*	*0.35-0.41*
Tumors of the pineal region	212	42	0.05	0.04-0.06	104	21	0.05	0.04-0.06	108	22	0.05	0.04-0.06
Malignant	*174*	*35*	*0.04*	*0.04-0.05*	*92*	*18*	*0.04*	*0.04-0.05*	*82*	*16*	*0.04*	*0.03-0.05*
Non-Malignant	*38*	*8*	*0.01*	*0.01-0.01*	-	-	-	-	*26*	*5*	*0.01*	*0.01-0.02*
Embryonal tumors	2,547	509	0.62	0.60-0.64	1,510	302	0.72	0.68-0.76	1,037	207	0.52	0.48-0.55
Medulloblastoma[c]	*1,617*	*323*	*0.39*	*0.38-0.41*	*1,027*	*205*	*0.49*	*0.46-0.52*	*590*	*118*	*0.29*	*0.27-0.32*

Table 13 *Continued*

Histology	Total				Male				Female			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
Primitive neuroectodermal tumor[d]	*311*	*62*	*0.08*	*0.07-0.08*	*162*	*32*	*0.08*	*0.07-0.09*	*149*	*30*	*0.07*	*0.06-0.09*
Atypical teratoid rhabdoid tumor[e]	*388*	*78*	*0.09*	*0.08-0.10*	*201*	*40*	*0.10*	*0.08-0.11*	*187*	*37*	*0.09*	*0.08-0.11*
Other embryonal histologies[f]	*231*	*46*	*0.06*	*0.05-0.06*	*120*	*24*	*0.06*	*0.05-0.07*	*111*	*22*	*0.05*	*0.05-0.07*
Tumors of Cranial and Spinal Nerves	**1,286**	**257**	**0.31**	**0.29-0.33**	**672**	**134**	**0.32**	**0.29-0.34**	**614**	**123**	**0.30**	**0.28-0.33**
Nerve sheath tumors	1,283	257	0.31	0.29-0.33	669	134	0.32	0.29-0.34	614	123	0.30	0.28-0.33
Malignant	*23*	*5*	*0.01*	*0.00-0.01*	-	-	-	-	-	-	-	-
Non-Malignant	*1,260*	*252*	*0.31*	*0.29-0.32*	*659*	*132*	*0.31*	*0.29-0.34*	*601*	*120*	*0.30*	*0.27-0.32*
Other tumors of cranial and spinal nerves	-	-	-	-	-	-	-	-	-	-	-	-
Tumors of Meninges	**1,116**	**223**	**0.27**	**0.25-0.28**	**551**	**110**	**0.26**	**0.24-0.28**	**565**	**113**	**0.28**	**0.26-0.30**
Meningioma	668	134	0.16	0.15-0.17	318	64	0.15	0.13-0.17	350	70	0.17	0.15-0.19
Malignant	*33*	*7*	*0.01*	*0.01-0.01*	-	-	-	-	*21*	*4*	*0.01*	*0.01-0.02*
Non-Malignant	*635*	*127*	*0.15*	*0.14-0.16*	*306*	*61*	*0.14*	*0.13-0.16*	*329*	*66*	*0.16*	*0.14-0.18*
Mesenchymal tumors	231	46	0.06	0.05-0.06	123	25	0.06	0.05-0.07	108	22	0.05	0.04-0.06
Primary melanocytic lesions	-	-	-	-	-	-	-	-	-	-	-	-
Other neoplasms related to the meninges	207	41	0.05	0.04-0.06	103	21	0.05	0.04-0.06	104	21	0.05	0.04-0.06
Lymphomas and Hematopoietic Neoplasms	**121**	**24**	**0.03**	**0.02-0.04**	**79**	**16**	**0.04**	**0.03-0.05**	**42**	**8**	**0.02**	**0.01-0.03**
Lymphoma	59	12	0.01	0.01-0.02	40	8	0.02	0.01-0.03	19	4	0.01	0.01-0.01
Other hematopoietic neoplasms	62	12	0.02	0.01-0.02	39	8	0.02	0.01-0.03	23	5	0.01	0.01-0.02
Germ Cell Tumors and Cysts	**910**	**182**	**0.22**	**0.21-0.24**	**630**	**126**	**0.30**	**0.28-0.32**	**280**	**56**	**0.14**	**0.12-0.16**
Germ cell tumors, cysts and heterotopias	910	182	0.22	0.21-0.24	630	126	0.30	0.28-0.32	280	56	0.14	0.12-0.16
Malignant	*708*	*142*	*0.17*	*0.16-0.19*	*525*	*105*	*0.25*	*0.23-0.27*	*183*	*37*	*0.09*	*0.08-0.11*
Non-Malignant	*202*	*40*	*0.05*	*0.04-0.06*	*105*	*21*	*0.05*	*0.04-0.06*	*97*	*19*	*0.05*	*0.04-0.06*
Tumors of Sellar Region	**3,850**	**770**	**0.92**	**0.89-0.95**	**1,231**	**246**	**0.58**	**0.55-0.61**	**2,619**	**524**	**1.28**	**1.24-1.33**
Tumors of the pituitary	3,002	600	0.72	0.69-0.74	798	160	0.37	0.35-0.40	2,204	441	1.08	1.03-1.12
Malignant	-	-	-	-	-	-	-	-	-	-	-	-
Non-Malignant	*2,999*	*600*	*0.72*	*0.69-0.74*	*797*	*159*	*0.37*	*0.35-0.40*	*2,202*	*440*	*1.08*	*1.03-1.12*
Craniopharyngioma	848	170	0.21	0.19-0.22	433	87	0.21	0.19-0.23	415	83	0.21	0.19-0.23
Unclassified Tumors	**1,507**	**301**	**0.36**	**0.35-0.38**	**719**	**144**	**0.34**	**0.32-0.37**	**788**	**158**	**0.39**	**0.36-0.42**
Hemangioma	599	120	0.14	0.13-0.16	284	57	0.13	0.12-0.15	315	63	0.16	0.14-0.17
Neoplasm, unspecified	882	176	0.21	0.20-0.23	423	85	0.20	0.18-0.22	459	92	0.23	0.21-0.25
Malignant	*212*	*42*	*0.05*	*0.04-0.06*	*109*	*22*	*0.05*	*0.04-0.06*	*103*	*21*	*0.05*	*0.04-0.06*
Non-Malignant	*670*	*134*	*0.16*	*0.15-0.17*	*314*	*63*	*0.15*	*0.13-0.17*	*356*	*71*	*0.18*	*0.16-0.20*

Table 13 *Continued*

Histology	Total				Male				Female			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
All other	26	5	0.01	0.00-0.01	-	-	-	-	-	-	-	-
TOTAL[g]	**24,532**	**4,906**	**5.94**	**5.87-6.02**	**12,370**	**2,474**	**5.87**	**5.77-5.98**	**12,162**	**2,432**	**6.02**	**5.91-6.13**
Malignant	***14,422***	***2,884***	***3.51***	***3.45-3.56***	***7,902***	***1,580***	***3.76***	***3.68-3.84***	***6,520***	***1,304***	***3.24***	***3.16-3.32***
Non-Malignant	***10,110***	***2,022***	***2.44***	***2.39-2.49***	***4,468***	***894***	***2.11***	***2.05-2.18***	***5,642***	***1,128***	***2.78***	***2.71-2.85***

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3.
[d]ICD-O-3 histology and behavior code: 9473/3.
[e]ICD-O-3 histology and behavior code: 9508/3.
[f]ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.
[g]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology category. Suppressed cases are included in the total counts and rates.
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 14 Five-Year Total, Annual Average Total[a], and Average Annual Age-Adjusted Incidence Rates[b] with 95% Confidence Intervals for Children and Adolescents (Age 0-19 Years), Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, and Race[c], CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	White				Black				American Indian/Alaskan 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
Tumors of Neuroepithelial Tissue	**12,521**	**2,504**	**4.03**	**(3.96-4.10)**	**2,016**	**403**	**2.94**	**(2.81-3.07)**	**143**	**29**	**1.86**	**(1.57-2.19)**	**878**	**175**	**3.56**	**(3.33-3.81)**
Pilocytic astrocytoma	3,017	603	0.97	(0.94-1.01)	460	92	0.67	(0.61-0.74)	31	6	0.40	(0.27-0.57)	193	39	0.79	(0.68-0.90)
Diffuse astrocytoma	810	162	0.26	(0.24-0.28)	117	23	0.17	(0.14-0.20)	---	---	---	---	52	10	0.21	(0.16-0.28)
Anaplastic astrocytoma	325	65	0.10	(0.09-0.12)	50	10	0.07	(0.05-0.10)	---	---	---	---	24	5	0.10	(0.06-0.15)
Unique astrocytoma variants	380	76	0.12	(0.11-0.14)	88	18	0.13	(0.10-0.16)	---	---	---	---	31	6	0.13	(0.09-0.18)
Malignant	*194*	*39*	*0.06*	*(0.05-0.07)*	*32*	*6*	*0.05*	*(0.03-0.07)*	---	---	---	---	---	---	---	---
Non-Malignant	*186*	*37*	*0.06*	*(0.05-0.07)*	*56*	*11*	*0.08*	*(0.06-0.11)*	---	---	---	---	*18*	*4*	*0.07*	*(0.04-0.12)*
Glioblastoma	592	118	0.19	(0.17-0.21)	94	19	0.14	(0.11-0.17)	---	---	---	---	50	10	0.21	(0.15-0.27)
Oligodendroglioma	155	31	0.05	(0.04-0.06)	20	4	0.03	(0.02-0.05)	---	---	---	---	---	---	---	---
Anaplastic oligodendroglioma	20	4	0.01	(0.00-0.01)	---	---	---	---	---	---	---	---	---	---	---	---
Oligoastrocytic tumors	83	17	0.03	(0.02-0.03)	---	---	---	---	---	---	---	---	---	---	---	---
Ependymal tumors	989	198	0.32	(0.30-0.34)	137	27	0.20	(0.17-0.23)	18	4	0.23	(0.14-0.37)	60	12	0.24	(0.19-0.31)
Malignant	*817*	*163*	*0.26*	*(0.25-0.28)*	*128*	*26*	*0.18*	*(0.15-0.22)*	---	---	---	---	*52*	*10*	*0.21*	*(0.16-0.28)*
Non-Malignant	*172*	*34*	*0.05*	*(0.05-0.06)*	---	---	---	---	---	---	---	---	---	---	---	---
Glioma malignant, NOS	2,221	444	0.72	(0.69-0.75)	381	76	0.56	(0.50-0.62)	22	4	0.28	(0.18-0.43)	149	30	0.60	(0.51-0.71)
Choroid plexus tumors	314	63	0.10	(0.09-0.11)	59	12	0.08	(0.06-0.11)	---	---	---	---	26	5	0.11	(0.07-0.15)
Malignant	*75*	*15*	*0.02*	*(0.02-0.03)*	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	*239*	*48*	*0.08*	*(0.07-0.09)*	*45*	*9*	*0.06*	*(0.05-0.09)*	---	---	---	---	*17*	*3*	*0.07*	*(0.04-0.11)*
Other neuroepithelial tumors	24	5	0.01	(0.00-0.01)	---	---	---	---	---	---	---	---	---	---	---	---
Malignant	*20*	*4*	*0.01*	*(0.00-0.01)*	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Neuronal and mixed neuronal-glial tumors	1,437	287	0.46	(0.44-0.48)	227	45	0.33	(0.29-0.38)	---	---	---	---	96	19	0.40	(0.32-0.48)
Malignant	*65*	*13*	*0.02*	*(0.02-0.03)*	*18*	*4*	*0.03*	*(0.02-0.04)*	---	---	---	---	---	---	---	---
Non-Malignant	*1,372*	*274*	*0.44*	*(0.42-0.46)*	*209*	*42*	*0.31*	*(0.27-0.35)*	---	---	---	---	*92*	*18*	*0.38*	*(0.31-0.46)*
Tumors of the pineal region	146	29	0.05	(0.04-0.06)	48	10	0.07	(0.05-0.09)	---	---	---	---	---	---	---	---
Malignant	*115*	*23*	*0.04*	*(0.03-0.04)*	*42*	*8*	*0.06*	*(0.04-0.08)*	---	---	---	---	---	---	---	---
Non-Malignant	*31*	*6*	*0.01*	*(0.01-0.01)*	---	---	---	---	---	---	---	---	---	---	---	---

Table 14 *Continued*

Histology	White				Black				American Indian/Alaskan 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
Embryonal tumors	2,008	402	0.65	(0.62-0.68)	312	62	0.45	(0.40-0.51)	28	6	0.36	(0.24-0.52)	158	32	0.64	(0.54-0.75)
Medulloblastoma[c]	*1,297*	*259*	*0.42*	*(0.40-0.44)*	*175*	*35*	*0.26*	*(0.22-0.30)*	*20*	*4*	*0.26*	*(0.16-0.40)*	*101*	*20*	*0.41*	*(0.33-0.50)*
Primitive neuroectodermal tumor[d]	*242*	*48*	*0.08*	*(0.07-0.09)*	*48*	*10*	*0.07*	*(0.05-0.09)*	---	---	---	---	---	---	---	---
Atypical teratoid rhabdoid tumor[e]	*293*	*59*	*0.09*	*(0.08-0.11)*	*59*	*12*	*0.08*	*(0.06-0.11)*	---	---	---	---	*30*	*6*	*0.12*	*(0.08-0.17)*
Other embryonal histologies[f]	*176*	*35*	*0.06*	*(0.05-0.07)*	*30*	*6*	*0.04*	*(0.03-0.06)*	---	---	---	---	*16*	*3*	*0.07*	*(0.04-0.11)*
Tumors of Cranial and Spinal Nerves	**976**	**195**	**0.31**	**(0.29-0.33)**	**175**	**35**	**0.26**	**(0.22-0.30)**	**19**	**4**	**0.25**	**(0.15-0.39)**	**100**	**20**	**0.41**	**(0.33-0.50)**
Nerve sheath tumors	973	195	0.31	(0.29-0.33)	175	35	0.26	(0.22-0.30)	19	4	0.25	(0.15-0.39)	100	20	0.41	(0.33-0.50)
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	*958*	*192*	*0.31*	*(0.29-0.33)*	*170*	*34*	*0.25*	*(0.21-0.29)*	*19*	*4*	*0.25*	*(0.15-0.39)*	*99*	*20*	*0.41*	*(0.33-0.49)*
Other tumors of cranial and spinal nerves	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tumors of Meninges	**883**	**177**	**0.28**	**(0.26-0.30)**	**145**	**29**	**0.21**	**(0.18-0.25)**	**---**	---	---	---	**71**	**14**	**0.29**	**(0.23-0.37)**
Meningioma	519	104	0.16	(0.15-0.18)	102	20	0.15	(0.12-0.18)	---	---	---	---	37	7	0.15	(0.11-0.21)
Malignant	*25*	*5*	*0.01*	*(0.01-0.01)*	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	*494*	*99*	*0.16*	*(0.14-0.17)*	*97*	*19*	*0.14*	*(0.11-0.17)*	---	---	---	---	*34*	*7*	*0.14*	*(0.10-0.20)*
Mesenchymal tumors	188	38	0.06	(0.05-0.07)	20	4	0.03	(0.02-0.05)	---	---	---	---	18	4	0.07	(0.04-0.11)
Primary melanocytic lesions	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Other neoplasms related to the meninges	166	33	0.05	(0.04-0.06)	23	5	0.03	(0.02-0.05)	---	---	---	---	16	3	0.07	(0.04-0.11)
Lymphomas and Hematopoietic Neoplasms	**90**	**18**	**0.03**	**(0.02-0.04)**	**---**	**---**	**---**	**---**	**---**	---	---	---	---	---	---	---
Lymphoma	38	8	0.01	(0.01-0.02)	---	---	---	---	---	---	---	---	---	---	---	---
Other hematopoietic neoplasms	52	10	0.02	(0.01-0.02)	---	---	---	---	---	---	---	---	---	---	---	---
Germ Cell Tumors and Cysts	**703**	**141**	**0.23**	**(0.21-0.24)**	**89**	**18**	**0.13**	**(0.10-0.16)**	**---**	---	---	---	**104**	**21**	**0.43**	(0.35-0.52)
Germ cell tumors, cysts and heterotopias	703	141	0.23	(0.21-0.24)	89	18	0.13	(0.10-0.16)	---	---	---	---	104	21	0.43	(0.35-0.52)
Malignant	*545*	*109*	*0.18*	*(0.16-0.19)*	*69*	*14*	*0.10*	*(0.08-0.13)*	---	---	---	---	*81*	*16*	*0.34*	*(0.27-0.42)*
Non-Malignant	*158*	*32*	*0.05*	*(0.04-0.06)*	*20*	*4*	*0.03*	*(0.02-0.04)*	---	---	---	---	*23*	*5*	*0.09*	*(0.06-0.14)*

Table 14 *Continued*

Histology	White				Black				American Indian/Alaskan 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
Tumors of Sellar Region	**2,893**	**579**	**0.92**	**(0.88-0.95)**	**564**	**113**	**0.82**	**(0.75-0.89)**	**56**	**11**	**0.75**	**(0.56-0.97)**	**294**	**59**	**1.22**	**(1.08-1.37)**
Tumors of the pituitary	2,274	455	0.72	(0.69-0.75)	410	82	0.59	(0.53-0.65)	50	10	0.67	(0.49-0.88)	236	47	0.98	(0.86-1.11)
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	*2,273*	*455*	*0.72*	*(0.69-0.75)*	*410*	*82*	*0.59*	*(0.53-0.65)*	*49*	*10*	*0.65*	*(0.48-0.86)*	*235*	*47*	*0.97*	*(0.85-1.11)*
Craniopharyngioma	619	124	0.20	(0.18-0.22)	154	31	0.23	(0.19-0.27)	---	---	---	---	58	12	0.24	(0.18-0.31)
Unclassified Tumors	**1,182**	**236**	**0.38**	**(0.36-0.40)**	**181**	**36**	**0.26**	**(0.23-0.30)**	**26**	**5**	**0.34**	**(0.22-0.50)**	**111**	**22**	**0.46**	**(0.37-0.55)**
Hemangioma	483	97	0.15	(0.14-0.17)	56	11	0.08	(0.06-0.11)	---	---	---	---	49	10	0.20	(0.15-0.26)
Neoplasm, unspecified	679	136	0.22	(0.20-0.23)	123	25	0.18	(0.15-0.21)	17	3	0.23	(0.13-0.36)	59	12	0.24	(0.18-0.31)
Malignant	*152*	*30*	*0.05*	*(0.04-0.06)*	*34*	*7*	*0.05*	*(0.03-0.07)*	---	---	---	---	*20*	*4*	*0.08*	*(0.05-0.13)*
Non-Malignant	*527*	*105*	*0.17*	*(0.15-0.18)*	*89*	*18*	*0.13*	*(0.10-0.16)*	---	---	---	---	*39*	*8*	*0.16*	*(0.11-0.22)*
All other	20	4	0.01	(0.00-0.01)	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL[g]	**19,248**	**3,850**	**6.17**	**(6.08-6.26)**	**3,182**	**636**	**4.63**	**(4.47-4.79)**	**263**	**53**	**3.45**	**(3.04-3.89)**	**1,568**	**314**	**6.43**	*(6.11-6.75)*
Malignant	***11,421***	***2,284***	***3.68***	***(3.61-3.74)***	***1,821***	***364***	***2.66***	***(2.53-2.78)***	***147***	***29***	***1.91***	***(1.62-2.25)***	***862***	***172***	***3.52***	***(3.29-3.76)***
Non-Malignant	***7,827***	***1,565***	***2.49***	***(2.44-2.55)***	***1,361***	***272***	***1.97***	***(1.87-2.08)***	***116***	***23***	***1.53***	***(1.27-1.84)***	***706***	***141***	***2.91***	***(2.70-3.13)***

[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 = 271).*
[d]*ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3.*
[e]*ICD-O-3 histology and behavior code: 9473/3.*
[f]*ICD-O-3 histology and behavior code: 9508/3.*
[g]*ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.*
[h]*Refers to all brain tumors including histologies not presented in this table.*
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology category. Suppressed cases are included in the total counts and rates.
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 Children and Adolescents (Age 0-19 Years), Brain and Other Central Nervous System Tumors by Major Histology Grouping, Histology, Hispanic Ethnicity[c], and Race, CBTRUS Statistical Report: NPCR and SEER, 2011-2015

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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 Neuroepithelial Tissue	**2,920**	**584**	**2.93**	**(2.82-3.04)**	**2,669**	**534**	**3.03**	**(2.92-3.15)**	**86**	**17**	**1.44**	**(1.15-1.78)**	**12,822**	**2,564**	**4.11**	**(4.03-4.18)**
Pilocytic astrocytoma	648	130	0.65	(0.60-0.70)	582	116	0.66	(0.61-0.72)	26	5	0.45	(0.29-0.66)	3,098	620	0.99	(0.96-1.03)
Diffuse astrocytoma	127	25	0.13	(0.11-0.15)	118	24	0.14	(0.11-0.16)	---	---	---	---	871	174	0.28	(0.26-0.30)
Anaplastic astrocytoma	87	17	0.09	(0.07-0.11)	80	16	0.09	(0.07-0.12)	---	---	---	---	318	64	0.10	(0.09-0.11)
Unique astrocytoma variants	108	22	0.11	(0.09-0.13)	102	20	0.12	(0.10-0.14)	---	---	---	---	403	81	0.13	(0.12-0.14)
Malignant	*55*	*11*	*0.06*	*(0.04-0.07)*	*55*	*11*	*0.06*	*(0.05-0.08)*	---	---	---	---	*192*	*38*	*0.06*	*(0.05-0.07)*
Non-Malignant	*53*	*11*	*0.05*	*(0.04-0.07)*	*47*	*9*	*0.05*	*(0.04-0.07)*	---	---	---	---	*211*	*42*	*0.07*	*(0.06-0.08)*
Glioblastoma	169	34	0.17	(0.15-0.20)	160	32	0.19	(0.16-0.22)	---	---	---	---	590	118	0.19	(0.17-0.20)
Oligodendroglioma	25	5	0.03	(0.02-0.04)	24	5	0.03	(0.02-0.04)	---	---	---	---	166	33	0.05	(0.04-0.06)
Anaplastic oligodendroglioma	---	---	---	---	---	---	---	---	---	---	---	---	24	5	0.01	(0.00-0.01)
Oligoastrocytic tumors	---	---	---	---	---	---	---	---	---	---	---	---	90	18	0.03	(0.02-0.03)
Ependymal tumors	282	56	0.28	(0.25-0.32)	262	52	0.30	(0.26-0.34)	---	---	---	---	934	187	0.30	(0.28-0.32)
Malignant	*249*	*50*	*0.25*	*(0.22-0.28)*	*233*	*47*	*0.26*	*(0.23-0.30)*	---	---	---	---	*773*	*155*	*0.25*	*(0.23-0.27)*
Non-Malignant	*33*	*7*	*0.03*	*(0.02-0.05)*	*29*	*6*	*0.03*	*(0.02-0.05)*	---	---	---	---	*161*	*32*	*0.05*	*(0.04-0.06)*
Glioma malignant, NOS	476	95	0.47	(0.43-0.52)	429	86	0.48	(0.44-0.53)	17	3	0.28	(0.16-0.45)	2,323	465	0.75	(0.72-0.78)
Choroid plexus tumors	98	20	0.10	(0.08-0.12)	88	18	0.10	(0.08-0.12)	---	---	---	---	308	62	0.10	(0.09-0.11)
Malignant	*26*	*5*	*0.02*	*(0.02-0.04)*	*24*	*5*	*0.03*	*(0.02-0.04)*	---	---	---	---	*75*	*15*	*0.02*	*(0.02-0.03)*
Non-Malignant	*72*	*14*	*0.07*	*(0.06-0.09)*	*64*	*13*	*0.07*	*(0.06-0.09)*	---	---	---	---	*233*	*47*	*0.07*	*(0.07-0.09)*
Other neuroepithelial tumors	---	---	---	---	---	---	---	---	---	---	---	---	25	5	0.01	(0.01-0.01)
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	*21*	*4*	*0.01*	*(0.00-0.01)*
Non-Malignant	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Neuronal and mixed neuronal-glial tumors	277	55	0.28	(0.25-0.32)	251	50	0.29	(0.26-0.33)	---	---	---	---	1,150	302	0.48	(0.45-0.50)
Malignant	*17*	*3*	*0.02*	*(0.01-0.03)*	*16*	*3*	*0.02*	*(0.01-0.03)*	---	---	---	---	*72*	*14*	*0.02*	*(0.02-0.03)*
Non-Malignant	*260*	*52*	*0.27*	*(0.24-0.30)*	*235*	*47*	*0.27*	*(0.24-0.31)*	---	---	---	---	*1,438*	*288*	*0.46*	*(0.43-0.48)*

Table 15 *Continued*

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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	39	8	0.04	(0.03-0.05)	35	7	0.04	(0.03-0.06)	---	---	---	---	173	35	0.06	(0.05-0.06)
Malignant	*34*	*7*	*0.03*	*(0.02-0.05)*	*30*	*6*	*0.03*	*(0.02-0.05)*	---	---	---	---	*140*	*28*	*0.04*	*(0.04-0.05)*
Non-Malignant	---	---	---	---	---	---	---	---	---	---	---	---	*33*	*7*	*0.01*	*(0.01-0.01)*
Embryonal tumors	558	112	0.55	(0.50-0.59)	512	102	0.57	(0.52-0.62)	16	3	0.25	(0.14-0.41)	1,989	398	0.64	(0.62-0.67)
Medulloblastoma[c]	*332*	*66*	*0.33*	*(0.30-0.37)*	*308*	*62*	*0.35*	*(0.31-0.39)*	---	---	---	---	*1,285*	*257*	*0.42*	*(0.39-0.44)*
Primitive neuroectodermal tumor[d]	*66*	*13*	*0.06*	*(0.05-0.08)*	*57*	*11*	*0.06*	*(0.05-0.08)*	---	---	---	---	*245*	*49*	*0.08*	*(0.07-0.09)*
Atypical teratoid rhabdoid tumor[e]	*113*	*23*	*0.11*	*(0.09-0.13)*	*105*	*21*	*0.11*	*(0.09-0.14)*	---	---	---	---	*275*	*55*	*0.09*	*(0.08-0.10)*
Other embryonal histologies[f]	*47*	*9*	*0.05*	*(0.03-0.06)*	*42*	*8*	*0.05*	*(0.03-0.06)*	---	---	---	---	*184*	*37*	*0.06*	*(0.05-0.07)*
Tumors of Cranial and Spinal Nerves	**228**	**46**	**0.23**	**(0.20-0.27)**	**198**	**40**	**0.23**	**(0.20-0.26)**	---	---	---	---	**1,058**	**212**	**0.33**	**(0.32-0.36)**
Nerve sheath tumors	227	45	0.23	(0.20-0.27)	197	39	0.23	(0.20-0.26)	---	---	---	---	1,056	211	0.33	(0.31-0.36)
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	*18*	*4*	*0.01*	*(0.00-0.01)*
Non-Malignant	*222*	*44*	*0.23*	*(0.20-0.26)*	*192*	*38*	*0.22*	*(0.19-0.26)*	---	---	---	---	*1,038*	*208*	*0.33*	*(0.31-0.35)*
Other tumors of cranial and spinal nerves	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tumors of Meninges	**227**	**45**	**0.24**	**(0.21-0.27)**	**205**	**41**	**0.24**	**(0.21-0.28)**	---	---	---	---	**889**	**178**	**0.28**	**(0.26-0.30)**
Meningioma	122	24	0.13	(0.11-0.15)	113	23	0.14	(0.11-0.16)	---	---	---	---	546	109	0.17	(0.16-0.18)
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	*25*	*5*	*0.01*	*(0.01-0.01)*
Non-Malignant	*114*	*23*	*0.12*	*(0.10-0.15)*	*105*	*21*	*0.13*	*(0.10-0.15)*	---	---	---	---	*521*	*104*	*0.16*	*(0.15-0.18)*
Mesenchymal tumors	51	10	0.05	(0.04-0.07)	45	9	0.05	(0.04-0.07)	---	---	---	---	180	36	0.06	(0.05-0.07)
Primary melanocytic lesions	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Other neoplasms related to the meninges	52	10	0.06	(0.04-0.07)	45	9	0.05	(0.04-0.07)	---	---	---	---	155	31	0.05	(0.04-0.06)
Lymphomas and Hematopoietic Neoplasms	**29**	**6**	**0.03**	**(0.02-0.04)**	**24**	**5**	**0.03**	**(0.02-0.04)**	---	---	---	---	**92**	**18**	**0.03**	**(0.02-0.04)**
Lymphoma	---	---	---	---	---	---	---	---	---	---	---	---	45	9	0.01	(0.01-0.02)
Other hematopoietic neoplasms	---	---	---	---	---	---	---	---	---	---	---	---	47	9	0.02	(0.01-0.02)
Germ Cell Tumors and Cysts	**219**	**44**	**0.23**	**(0.20-0.26)**	**203**	**41**	**0.24**	**(0.21-0.27)**	---	---	---	---	**691**	**138**	**0.22**	**(0.20-0.24)**

Table 15 *Continued*

Histology	All Hispanic				White Hispanic				Black Hispanic				All Non-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
Germ cell tumors, cysts and heterotopias	219	44	0.23	(0.20-0.26)	203	41	0.24	(0.21-0.27)	---	---	---	---	691	138	0.22	(0.20-0.24)
Malignant	*179*	*36*	*0.19*	*(0.16-0.22)*	*165*	*33*	*0.20*	*(0.17-0.23)*	---	---	---	---	*529*	*106*	*0.17*	*(0.15-0.18)*
Non-Malignant	*40*	*8*	*0.04*	*(0.03-0.05)*	*38*	*8*	*0.04*	*(0.03-0.06)*	---	---	---	---	*162*	*32*	*0.05*	*(0.04-0.06)*
Tumors of Sellar Region	*1,008*	**202**	*1.08*	*(1.01-1.14)*	*888*	**178**	**1.07**	**(1.00-1.14)**	*31*	**6**	**0.56**	**(0.38-0.79)**	*2,842*	**568**	**0.88**	**(0.85-0.91)**
Tumors of the pituitary	*814*	163	*0.88*	*(0.82-0.94)*	*708*	142	*0.86*	*(0.80-0.92)*	*24*	5	*0.44*	(0.28-0.66)	*2,188*	438	*0.67*	*(0.64-0.70)*
Malignant	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Non-Malignant	*812*	*162*	*0.87*	*(0.82-0.94)*	*707*	*141*	*0.86*	*(0.79-0.92)*	*24*	*5*	*0.44*	*(0.28-0.66)*	*2,187*	*437*	*0.67*	*(0.64-0.70)*
Craniopharyngioma	194	39	0.20	(0.17-0.23)	180	36	*0.21*	*(0.18-0.24)*	---	---	---	---	654	131	*0.21*	*(0.19-0.23)*
Unclassified Tumors	**305**	**61**	**0.31**	**(0.28-0.35)**	**268**	**54**	**0.31**	**(0.28-0.35)**	---	---	---	---	**1,202**	**240**	**0.38**	**(0.36-0.40)**
Hemangioma	122	24	0.13	(0.10-0.15)	109	22	0.13	(0.10-0.15)	---	---	---	---	477	95	0.15	(0.14-0.16)
Neoplasm, unspecified	178	36	0.18	(0.16-0.21)	154	31	0.18	(0.15-0.21)	---	---	---	---	704	141	0.22	(0.21-0.24)
Malignant	*44*	*9*	*0.04*	*(0.03-0.06)*	*38*	*8*	*0.04*	*(0.03-0.06)*	---	---	---	---	*168*	*34*	*0.05*	*(0.05-0.06)*
Non-Malignant	*134*	*27*	*0.14*	*(0.12-0.16)*	*116*	*23*	*0.14*	*(0.11-0.16)*	---	---	---	---	*536*	*107*	*0.17*	*(0.16-0.18)*
All other	---	---	---	---	---	---	---	---	---	---	---	---	21	4	0.01	(0.00-0.01)
TOTAL[h]	**4,936**	**987**	**5.05**	**(4.91-5.19)**	**4,455**	**891**	**5.15**	**(5.00-5.30)**	**149**	30	**2.56**	**(2.16-3.01)**	**19,596**	**3,919**	**6.23**	**(6.14-6.31)**
Malignant	***2,790***	***558***	***2.81***	***(2.70-2.91)***	***2,554***	***511***	***2.91***	***(2.79-3.02)***	***85***	***17***	***1.44***	***(1.14-1.78)***	***11,632***	***2,326***	***3.73***	***(3.66-3.80)***
Non-Malignant	***2,146***	***429***	***2.24***	***(2.15-2.34)***	***1,901***	***380***	***2.24***	***(2.14-2.35)***	***64***	***13***	***1.12***	***(0.86-1.44)***	***7,964***	***1,593***	***2.50***	***(2.44-2.55)***

[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]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]ICD-O-3 histology and behavior codes: 9470/3, 9471/3, 9472/3, and 9474/3.
[e]ICD-O-3 histology and behavior code: 9473/3.
[f]ICD-O-3 histology and behavior code: 9508/3.
[g]ICD-O-3 histology and behavior codes: 8963/3, 9364/3, 9480/3, 9490/0, 9490/3, 9500/3, 9501/3, and 9502/3.
[h]Refers to all brain tumors including histologies not presented in this table.
- Counts and rates are not presented when fewer than 16 cases were reported for the specific histology category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; CI, confidence interval; NOS, not otherwise specified

Table 16 Estimated Number of Cases[a,b] of Brain and Other Central Nervous System Tumors Overall and by Behavior by State, 2018, 2019

State	2018 Estimated New Cases			2019 Estimated New Cases		
	All	Malignant	Non-Malignant	All	Malignant	Non-Malignant
Alabama	1,010	400	610	1,030	400	630
Alaska	190	60	130	190	60	130
Arizona	1,570	510	1,060	1,580	510	1,070
Arkansas	720	290	430	730	290	440
California	9,540	2,830	6,710	9,710	2,830	6,890
Colorado	1,630	440	1,190	1,660	440	1,220
Connecticut	990	310	680	1,010	310	700
Delaware	160	80	80	150	80	70
District of Columbia	140	--	100	140	--	100
Florida	6,170	1,740	4,430	6,250	1,740	4,510
Georgia	3,060	730	2,330	3,190	730	2,460
Hawaii	300	80	220	300	80	220
Idaho	440	150	290	450	150	300
Illinois	3,610	1,030	2,590	3,670	1,030	2,640
Indiana	1,660	480	1,180	1,690	480	1,210
Iowa	750	280	460	720	280	440
Kansas	770	240	530	790	240	550
Kentucky	1,510	460	1,060	1,530	460	1,080
Louisiana	1,290	340	950	1,320	340	980
Maine	320	140	190	330	140	190
Maryland	1,510	450	1,060	1,550	450	1,100
Massachusetts	1,570	560	1,010	1,590	560	1,030
Michigan	2,370	790	1,580	2,380	790	1,590
Minnesota	1,520	510	1,010	1,590	510	1,080
Mississippi	750	220	530	770	220	540
Missouri	1,700	520	1,180	1,720	520	1,200
Montana	270	100	170	270	100	170
Nebraska	440	170	270	440	170	280
Nevada	540	210	330	550	210	340
New Hampshire	350	130	220	360	130	220
New Jersey	2,850	760	2,090	2,950	760	2,190
New Mexico	500	150	350	510	150	360

Table 16 *Continued*

State	2018 Estimated New Cases			2019 Estimated New Cases		
	All	Malignant	Non-Malignant	All	Malignant	Non-Malignant
New York	6,320	1,540	4,770	6,440	1,540	4,900
North Carolina	2,930	860	2,070	3,000	860	2,140
North Dakota	170	60	120	180	60	120
Ohio	3,020	1,010	2,010	3,090	1,010	2,080
Oklahoma	1,140	310	830	1,200	310	890
Oregon	950	380	570	950	380	570
Pennsylvania	4,190	1,220	2,970	4,250	1,220	3,030
Rhode Island	210	80	130	210	80	130
South Carolina	1,520	430	1,090	1,570	430	1,140
South Dakota	230	70	160	240	70	170
Tennessee	1,910	460	1,460	1,950	460	1,500
Texas	6,590	1,990	4,600	6,620	1,990	4,630
Utah	1,180	230	950	1,260	230	1,030
Vermont	160	--	130	160	--	130
Virginia	1,820	670	1,150	1,830	670	1,160
Washington	2,500	680	1,820	2,550	680	1,860
West Virginia	490	180	310	490	180	310
Wisconsin	1,860	450	1,410	1,920	450	1,470
Wyoming	160	60	100	170	60	110
United States[c]	**85,440**	**25,800**	**59,640**	**86,970**	**26,170**	**60,800**

[a]Source: Estimation based on CBTRUS NPCR and SEER 2000-2015 data for malignant tumors, and NPCR and SEER 2006-2015 data for non-malignant tumors.
[b]Rounded to the nearest 10. Numbers may not add up due to rounding.
[c]Total estimate is based on overall estimate. Histology-specific estimates may not add up to total.
– Estimated number is less than 50. These cases are included in overall rates.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program

Table 17 Estimated Number of Cases[a,b] of Brain and Other Central Nervous System Tumors Overall and by Behavior, by Age, Major Histology Grouping, and Histology, 2018, 2019

Histology	2018 Estimated New Cases								2019 Estimated New Cases							
	All						Malignant	Non-Malignant	All						Malignant	Non-Malignant
	All Ages	0-14	0-19	15-39	40-64	65+	All Ages	All Ages	All Ages	0-14	0-19	15-39	40-64	65+	All Ages	All Ages
Tumors of Neuroepithelial Tissue[c]	**23,650**	**2,600**	**3,220**	**3,580**	**8,620**	**8,570**	**21,880**	**1,770**	**24,010**	**2,620**	**3,240**	**3,600**	**8,680**	**8,970**	**22,220**	**1,800**
Pilocytic astrocytoma	1,110	670	790	290	90	--	1,100	--	1,120	680	800	290	90	--	1,120	--
Diffuse astrocytoma	1,280	130	180	420	460	320	1,280	--	1,240	130	180	410	440	310	1,240	--
Anaplastic astrocytoma	1,630	70	90	420	660	440	1,630	--	1,690	70	100	440	680	450	1,690	--
Unique astrocytoma variants	260	80	100	80	--	50	190	70	270	80	100	80	--	50	200	70
Glioblastoma	13,010	110	170	590	5,490	6,610	13,010	--	13,310	120	180	610	5,560	6,780	13,310	--
Oligodendroglioma	670	--	--	260	310	70	670	--	650	--	--	250	310	70	650	--
Anaplastic oligodendroglioma	360	--	--	80	210	60	360	--	360	--	--	80	210	60	360	--
Oligoastrocytic tumors	90	--	--	--	50	50	90	--	60	--	--	--	--	50	60	--
Ependymal tumors	1,420	210	240	370	590	260	800	620	1,430	210	240	370	590	270	790	630
Glioma malignant, NOS	1,700	480	590	360	330	410	1,690	--	1,730	490	590	370	330	410	1,730	--
Choroid plexus tumors	170	70	80	--	--	--	--	140	170	70	80	--	--	--	--	140
Other neuroepithelial tumors	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neuronal and mixed neuronal-glial tumors	1,040	270	400	400	250	90	210	820	1,060	280	410	410	250	90	220	840
Tumors of the pineal region	180	--	50	70	60	--	100	80	190	--	50	70	60	--	110	80
Embryonal tumors	720	440	480	150	--	--	700	--	720	430	470	150	--	--	700	--
Tumors of Cranial and Spinal Nerves[c]	**7,510**	**150**	**240**	**1,100**	**3,970**	**2,320**	--	**7,480**	**7,690**	**150**	**230**	**1,120**	**4,040**	**2,420**	--	**7,650**
Nerve sheath tumors	7,500	150	240	1,100	3,960	2,320	--	7,460	7,670	150	230	1,110	4,040	2,410	--	7,630
Other tumors of cranial and spinal nerves	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tumors of Meninges[c]	**32,440**	**130**	**260**	**2,160**	**12,800**	**18,400**	**470**	**31,960**	**32,930**	**140**	**270**	**2,180**	**12,920**	**18,980**	**470**	**32,460**
Meningioma	31,500	70	160	1,900	12,410	18,190	300	31,200	31,990	70	160	1,920	12,520	18,770	300	31,690
Mesenchymal tumors	300	50	60	60	120	70	100	200	300	50	60	60	120	70	100	200
Primary melanocytic lesions	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other neoplasms related to the meninges	600	--	50	190	260	130	50	550	600	--	50	190	260	130	50	550

Table 17 *Continued*

Histology	2018 Estimated New Cases								2019 Estimated New Cases							
	All						Malignant	Non-Malignant	All						Malignant	Non-Malignant
	All Ages	0-14	0-19	15-39	40-64	65+	All Ages	All Ages	All Ages	0-14	0-19	15-39	40-64	65+	All Ages	All Ages
Lymphomas and Hematopoietic Neoplasms[c]	**1,720**	**--**	--	**100**	**610**	**970**	**1,710**	--	**1,750**	**--**	--	**100**	**610**	**990**	**1,740**	--
Lymphoma	1,660	--	--	90	590	950	1,660	--	1,680	--	--	90	590	980	1,680	--
Other hematopoietic neoplasms	60	--	--	--	--	--	60	--	60	--	--	--	--	--	60	--
Germ Cell Tumors and Cysts[c]	**300**	**140**	**190**	**120**	**--**	**--**	**210**	**90**	**300**	**150**	**200**	**120**	**--**	**--**	**210**	**90**
Germ cell tumors, cysts and heterotopias	300	140	190	120	--	--	210	90	300	150	200	120	--	--	210	90
Tumors of Sellar Region[c]	**15,830**	**380**	**890**	**4,500**	**5,990**	**4,180**	**--**	**15,800**	**16,340**	**390**	**920**	**4,620**	**6,010**	**4,350**	--	**16,300**
Tumors of the pituitary	15,190	230	710	4,360	5,760	4,050	--	15,160	15,690	240	740	4,490	5,780	4,220	--	15,660
Craniopharyngioma	640	150	180	140	230	130	--	640	640	150	180	140	230	130	--	640
Unclassified Tumors[c]	**3,990**	**240**	**360**	**580**	**1,140**	**1,980**	**1,440**	**2,550**	**3,960**	**260**	**370**	**560**	**1,110**	**1,970**	**1,460**	**2,500**
Hemangioma	930	100	150	260	350	230	--	920	880	100	160	250	320	220	--	870
Neoplasm, unspecified	3,040	140	190	310	790	1,720	1,430	1,610	3,060	140	200	310	790	1,730	1,450	1,610
All other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL[c]	**85,440**	**3,670**	**5,200**	**12,130**	**33,150**	**36,410**	**25,800**	**59,640**	**86,970**	**3,720**	**5,270**	**12,290**	**33,390**	**37,700**	**26,170**	**60,800**

[a]Source: Estimation based on CBTRUS NPCR and SEER 2000-2015 data for malignant tumors, and NPCR and SEER 2006-2015 data for non-malignant tumors.
[b]Rounded to the nearest 10. Numbers may not add up due to rounding.
[c]Major histology grouping estimates are calculated by summing estimates for all included histologies.
[d]Total estimate is based on overall estimate. Histology-specific estimates may not add up to total.
– Estimated number is less than 50. These cases are included in overall rates.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results Program; NOS, not otherwise specified

Table 18 Five-Year Total, Average Annual Total[a], and Average Annual Age-Adjusted Mortality Rates[b] with 95% Confidence Intervals for Malignant Brain and Other Central Nervous System Cancer Overall and by State and Sex, United States, 2011-2015[c]

State	TOTAL				Males				Females			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
Alabama	1,422	284	5.05	4.78-5.32	790	158	6.21	5.77-6.67	632	126	4.12	3.80-4.46
Alaska	141	28	4.22	3.50-5.04	83	17	5.02	3.88-6.38	58	12	3.43	2.56-4.49
Arizona	1,639	328	4.35	4.14-4.57	912	182	5.13	4.79-5.47	727	145	3.66	3.39-3.94
Arkansas	865	173	5.02	4.69-5.38	483	97	6.15	5.61-6.74	382	76	4.12	3.71-4.57
California	8,620	1,724	4.33	4.24-4.43	4,889	978	5.34	5.19-5.49	3,731	746	3.48	3.37-3.59
Colorado	1,194	239	4.37	4.12-4.64	649	130	5.07	4.67-5.49	545	109	3.78	3.46-4.12
Connecticut	895	179	4.20	3.92-4.49	495	99	5.16	4.70-5.65	400	80	3.34	3.01-3.70
Delaware	226	45	4.10	3.57-4.69	114	23	4.63	3.80-5.60	112	22	3.73	3.05-4.53
District of Columbia	82	16	2.65	2.10-3.31	49	10	3.64	2.67-4.84	33	7	1.92	1.31-2.73
Florida	5,408	1,082	4.22	4.11-4.34	3,053	611	5.19	5.01-5.39	2,355	471	3.37	3.23-3.51
Georgia	2,146	429	4.24	4.06-4.43	1,205	241	5.20	4.90-5.52	941	188	3.44	3.22-3.67
Hawaii	219	44	2.57	2.23-2.94	120	24	2.91	2.40-3.50	99	20	2.23	1.80-2.74
Idaho	446	89	5.07	4.60-5.58	285	57	6.85	6.06-7.72	161	32	3.46	2.94-4.05
Illinois	2,944	589	4.15	4.00-4.31	1,658	332	5.12	4.87-5.38	1,286	257	3.34	3.15-3.53
Indiana	1,695	339	4.66	4.44-4.89	962	192	5.71	5.34-6.09	733	147	3.78	3.51-4.08
Iowa	898	180	4.95	4.62-5.29	516	103	6.14	5.61-6.71	382	76	3.85	3.46-4.28
Kansas	845	169	5.20	4.85-5.57	490	98	6.51	5.94-7.13	355	71	4.11	3.68-4.57
Kentucky	1,184	237	4.73	4.45-5.01	666	133	5.72	5.28-6.18	518	104	3.84	3.51-4.20
Louisiana	1,085	217	4.34	4.08-4.61	604	121	5.35	4.92-5.81	481	96	3.53	3.21-3.86
Maine	439	88	4.98	4.51-5.49	264	53	6.42	5.64-7.28	175	35	3.70	3.14-4.34
Maryland	1,335	267	4.09	3.87-4.32	747	149	5.06	4.69-5.45	588	118	3.28	3.02-3.57
Massachusetts	1,708	342	4.38	4.17-4.60	949	190	5.38	5.03-5.74	759	152	3.57	3.31-3.84
Michigan	2,694	539	4.62	4.44-4.80	1,516	303	5.62	5.33-5.92	1,178	236	3.76	3.55-3.99
Minnesota	1,398	280	4.64	4.40-4.90	832	166	5.83	5.43-6.25	566	113	3.58	3.28-3.90
Mississippi	864	173	5.27	4.92-5.64	461	92	6.31	5.73-6.94	403	81	4.46	4.02-4.92
Missouri	1,515	303	4.29	4.07-4.52	846	169	5.26	4.90-5.63	669	134	3.47	3.21-3.75
Montana	310	62	4.93	4.38-5.54	175	35	5.89	5.02-6.87	135	27	4.01	3.34-4.78
Nebraska	536	107	5.19	4.75-5.67	300	60	6.27	5.57-7.04	236	47	4.25	3.71-4.85
Nevada	649	130	4.30	3.96-4.65	375	75	5.04	4.52-5.59	274	55	3.57	3.15-4.03
New Hampshire	378	76	4.65	4.18-5.17	221	44	5.81	5.04-6.67	157	31	3.70	3.12-4.36

Table 18 *Continued*

State	TOTAL				Males				Females			
	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI	5-Year Total	Annual Average	Rate	95% CI
New Jersey	2,007	401	3.94	3.77-4.12	1,129	226	4.91	4.62-5.21	878	176	3.15	2.94-3.37
New Mexico	433	87	3.65	3.31-4.02	243	49	4.35	3.81-4.95	190	38	3.02	2.60-3.50
New York	4,242	848	3.79	3.68-3.91	2,268	454	4.52	4.33-4.71	1,974	395	3.20	3.06-3.35
North Carolina	2,436	487	4.43	4.25-4.61	1,352	270	5.48	5.19-5.79	1,084	217	3.56	3.35-3.78
North Dakota	181	36	4.45	3.81-5.17	105	21	5.45	4.44-6.63	76	15	3.63	2.84-4.59
Ohio	3,042	608	4.47	4.31-4.64	1,738	348	5.56	5.30-5.84	1,304	261	3.54	3.35-3.75
Oklahoma	1,006	201	4.72	4.43-5.03	571	114	5.76	5.28-6.26	435	87	3.80	3.44-4.18
Oregon	1,207	241	5.18	4.89-5.49	696	139	6.31	5.84-6.82	511	102	4.16	3.79-4.55
Pennsylvania	3,369	674	4.28	4.13-4.43	1,869	374	5.21	4.97-5.45	1,500	300	3.51	3.32-3.70
Rhode Island	271	54	4.33	3.81-4.89	153	31	5.35	4.51-6.30	118	24	3.45	2.84-4.16
South Carolina	1,231	246	4.41	4.16-4.67	710	142	5.62	5.20-6.06	521	104	3.39	3.10-3.70
South Dakota	264	53	5.33	4.69-6.04	154	31	6.55	5.53-7.70	110	22	4.33	3.52-5.26
Tennessee	1,742	348	4.72	4.50-4.95	972	194	5.80	5.43-6.19	770	154	3.80	3.53-4.09
Texas	5,283	1,057	4.12	4.01-4.24	2,920	584	4.89	4.71-5.08	2,363	473	3.45	3.31-3.60
Utah	585	117	4.67	4.29-5.07	346	69	5.86	5.25-6.53	239	48	3.61	3.16-4.10
Vermont	220	44	5.59	4.85-6.42	126	25	6.72	5.56-8.06	94	19	4.60	3.68-5.69
Virginia	1,822	364	4.02	3.84-4.21	958	192	4.63	4.33-4.94	864	173	3.54	3.30-3.79
Washington	1,917	383	4.95	4.72-5.18	1,092	218	5.95	5.59-6.32	825	165	4.05	3.77-4.35
West Virginia	528	106	4.42	4.04-4.83	311	62	5.54	4.92-6.22	217	43	3.43	2.98-3.95
Wisconsin	1,656	331	4.98	4.73-5.23	918	184	5.85	5.47-6.26	738	148	4.21	3.90-4.53
Wyoming	153	31	4.73	3.99-5.57	83	17	5.35	4.22-6.68	70	14	4.21	3.26-5.37
United States	**77,375**	**15,475**	**4.37**	**4.34-4.40**	**43,423**	**8,685**	**5.33**	**5.28-5.38**	**33,952**	**6,790**	**3.55**	**3.51-3.59**

[a]Annual average deaths are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Mortality - All COD, Aggregated With State, Total U.S. (1990-2015) <Katrina/Rita Population Adjustment>, National Cancer Institute, DCCPS, Surveillance Research Program, released December 2017. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).
- Counts and rates are not presented when fewer than 20 cases were reported for the specific category. The suppressed cases are included in the counts and rates for totals.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NCHS, National Center for Health Statistics; CI, confidence interval

Table 19 One-, Two-, Five-, and Ten-Year Relative Survival Rates[a,b] with 95% Confidence Intervals for Brain and Other Central Nervous System Tumors by Behavior and Site[c], SEER 18 Registries, 2000-2015 (varying)[d]

ICD-O-3 Site Code	Site[c]	Malignant (2000-2014)								Non-Malignant (2004-2015)						
			1-Year		5-Year		10-Year			1-Year		5-Year		10-Year		
		N[e]	%	95% CI	%	95% CI	%	95% CI	N[e]	%	95% CI	%	95% CI	%	95% CI	
C71.0	Cerebrum	3,938	52.1	50.4-53.7	28.6	27.1-30.2	24.2	22.5-25.8	625	85.7	82.5-88.4	80.4	76.4-83.9	78.4	72.8-82.9	
C71.1	Frontal lobe of the brain	19,445	61.4	60.7-62.1	34.2	33.4-34.9	25.6	24.8-26.4	1,818	87.0	85.2-88.6	81.3	78.8-83.5	76.6	72.6-80.1	
C71.2	Temporal lobe of the brain	13,933	58.2	57.3-59.0	23.1	22.3-23.9	17.4	16.6-18.2	1,634	93.2	91.7-94.4	90.3	88.3-92.0	87.8	84.8-90.2	
C71.3	Parietal lobe of the brain	8,891	51.4	50.3-52.5	20.2	19.2-21.1	15.1	14.1-16.1	814	84.7	81.8-87.1	79.2	75.5-82.5	76.2	71.0-80.7	
C71.4	Occipital lobe of the brain	2,244	53.4	51.3-55.6	21.4	19.5-23.3	17.5	15.6-19.4	335	91.6	87.6-94.3	88.1	82.8-91.8	83.4	74.1-89.5	
C71.5	Ventricle	1,480	75.8	73.4-77.9	62.6	59.8-65.2	58.4	55.3-61.3	1,497	93.3	91.8-94.6	89.8	87.6-91.5	84.6	80.8-87.8	
C71.6	Cerebellum	4,518	85.1	84.0-86.2	71.5	70.0-73.0	67.0	65.3-68.6	2,179	93.1	91.8-94.2	89.5	87.6-91.1	86.0	82.8-88.6	
C71.7	Brain stem	3,701	70.9	69.4-72.4	50.0	48.2-51.7	45.3	43.3-47.2	885	90.5	88.1-92.4	86.0	82.8-88.7	80.8	75.2-85.2	
C71.8-C71.9	Other brain	17,413	44.7	43.9-45.5	22.8	22.1-23.5	18.5	17.8-19.2	3,200	79.5	77.9-81.0	73.1	71.2-75.0	67.8	64.9-70.5	
C72.0-C72.1	Spinal cord and cauda equina	2,774	89.8	88.5-90.9	81.5	79.7-83.1	76.9	74.6-79.0	4,622	98.8	98.3-99.2	98.2	97.2-98.9	97.3	94.6-98.7	
C72.2-C72.5	Cranial nerves	1,000	96.9	95.5-97.8	93.7	91.7-95.2	92.2	89.6-94.1	16,792	99.5	99.3-99.7	99.5	99.3-99.7	99.5	99.3-99.7	
C72.8-C72.9	Other nervous system	731	62.9	59.1-66.4	46.5	42.3-50.6	44.0	39.2-48.7	436	97.4	94.9-98.7	93.2	88.5-96.0	84.3	74.0-90.8	
C70.0-C70.9	Meninges (cerebral and spinal)	1,409	81.9	79.7-84.0	64.3	61.1-67.2	57.2	53.3-60.8	84,459	92.6	92.4-92.8	86.8	86.4-87.2	81.5	80.8-82.2	
C75.1-C75.2	Pituitary and cranio-pharyngeal duct	327	86.8	82.3-90.2	75.0	68.8-80.1	70.9	63.6-77.0	43,739	97.8	97.6-97.9	96.0	95.6-96.3	93.8	93.0-94.4	
C75.3	Pineal	876	88.6	86.2-90.6	77.2	74.0-80.1	72.6	68.7-76.1	405	91.9	88.5-94.3	86.2	81.2-89.9	81.3	73.7-86.9	
C30.0[g]	Olfactory tumors of the nasal cavity	480	91.4	88.2-93.7	79.4	74.5-83.4	65.7	58.6-71.9	--	--	--	--	--	--	--	
All Codes	**All Sites**	**83,160**	**59.9**	**59.6-60.3**	**35.0**	**34.6-35.3**	**29.3**	**28.9-29.7**	**163,440**	**94.5**	**94.4-94.7**	**90.7**	**90.5-91.0**	**87.2**	**86.8-87.7**	

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER Site/Histology Validation List.
[d]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2017 Sub (2000-2015) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018, based on the November 2017 submission.
[e]Total number of case that occurred within the SEER registries between 2000 and 2015.
[f]ICD-O-3 histology codes 9522-9523 only.
-- Counts and rates are not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category. The suppressed cases are included in the counts and rates for totals.
Abbreviation: CBTRUS, Central Brain Tumor Registry of the United States; SEER, Survival, Epidemiology, and End Results; CI, confidence interval

Table 20 One-, Two-, Five-, and Ten-Year Relative Survival Rates[a,b] with 95% Confidence Intervals for Selected Malignant Brain and Other Central Nervous System Tumors Overall and by NCI Age Group, SEER 18 Registries, 2000-2015[c]

Histology	Age Group (years)		1-Year		2-Year		5-Year		10-Year	
		N[d]	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Pilocytic astrocytoma	Children[e] (0-14)	2,507	98.7	98.2-99.1	98.3	97.6-98.7	96.9	96.0-97.6	95.8	94.7-96.7
	AYA[f] (15-39)	1,257	97.5	96.4-98.3	95.9	94.6-97.0	93.2	91.4-94.6	90.2	87.8-92.1
	Adults (40+)	417	93.9	90.9-96.0	87.0	83.0-90.1	79.7	74.6-83.9	76.3	69.6-81.7
	All Ages	4,181	97.9	97.4-98.3	96.4	95.8-97.0	94.1	93.2-94.8	92.2	91.0-93.2
Diffuse astrocytoma	Children[d] (0-14)	740	92.2	90.0-94.0	86.9	84.2-89.2	82.8	79.7-85.5	81.1	77.7-84.0
	AYA[e] (15-39)	2,088	94.5	93.4-95.4	88.2	86.7-89.6	72.2	70.0-74.3	53.3	50.5-56.1
	Adults (40+)	3,665	60.3	58.6-61.9	45.8	44.1-47.5	31.2	29.5-32.9	22.0	20.3-23.8
	All Ages	6,493	74.9	73.8-76.0	64.2	62.9-65.4	50.4	49.0-51.7	39.3	37.8-40.8
Anaplastic astrocytoma	Children[d] (0-14)	248	62.7	56.3-68.5	33.5	27.4-39.6	21.9	16.6-27.7	16.1	11.1-21.9
	AYA[e] (15-39)	1,266	90.5	88.7-92.0	76.5	73.9-78.9	55.7	52.4-58.8	40.3	36.6-44.0
	Adults (40+)	3,022	55.0	53.1-56.8	35.2	33.4-37.0	19.8	18.2-21.5	13.1	11.5-14.8
	All Ages	4,536	65.3	63.9-66.8	46.6	45.1-48.2	30.0	28.4-31.5	20.9	19.3-22.6
Glioblastoma	Children[d] (0-14)	348	52.9	47.4-58.0	28.8	23.9-33.9	19.6	15.3-24.4	14.8	10.6-19.7
	AYA[e] (15-39)	1,998	74.3	72.2-76.2	48.0	45.6-50.2	22.7	20.7-24.8	13.7	11.8-15.7
	Adults (40+)	34,270	38.1	37.5-38.6	15.5	15.1-15.9	4.3	4.1-4.6	1.9	1.7-2.2
	All Ages	36,616	40.2	39.7-40.7	17.4	17.0-17.8	5.6	5.3-5.8	2.8	2.6-3.1
Oligodendroglioma	Children[d] (0-14)	129	95.2	89.6-97.8	94.4	88.5-97.3	89.7	82.4-94.0	88.6	80.9-93.3
	AYA[e] (15-39)	1,388	99.1	98.3-99.5	97.3	96.2-98.1	89.9	87.9-91.6	74.4	71.3-77.3
	Adults (40+)	1,925	91.4	90.0-92.7	85.4	83.6-87.1	75.0	72.7-77.2	58.5	55.4-61.5
	All Ages	3,442	94.7	93.8-95.4	90.6	89.5-91.6	81.6	80.1-83.1	66.3	64.1-68.4
Anaplastic oligodendroglioma	Children[d] (0-14)	--	--	--	--	--	--	--	--	--
	AYA[e] (15-39)	401	93.6	90.7-95.7	85.2	81.1-88.5	72.3	67.1-76.8	56.4	49.9-62.5
	Adults (40+)	1,086	80.9	78.3-83.2	67.7	64.6-70.6	52.3	48.9-55.7	39.4	35.5-43.2
	All Ages	1,499	84.4	82.4-86.2	72.4	69.9-74.8	57.6	54.7-60.4	44.1	40.7-47.4
Ependymal tumors	Children[d] (0-14)	733	95.1	93.1-96.4	87.7	84.9-90.0	74.9	71.2-78.3	65.8	61.3-69.8
	AYA[e] (15-39)	890	96.9	95.5-97.9	94.6	92.7-95.9	90.6	88.1-92.5	86.8	83.5-89.4
	Adults (40+)	1,532	92.6	91.0-93.9	89.6	87.7-91.2	86.2	83.8-88.2	81.9	78.6-84.8
	All Ages	3,155	94.4	93.5-95.2	90.5	89.3-91.6	84.8	83.2-86.2	79.5	77.4-81.4
Oligoastrocytic tumors	Children[d] (0-14)	76	94.7	86.2-98.0	88.9	78.9-94.3	82.5	71.0-89.8	80.6	68.6-88.4

Table 20 *Continued*

Histology	Age Group (years)		1-Year		2-Year		5-Year		10-Year	
		N[d]	%	95% CI	%	95% CI	%	95% CI	%	95% CI
	AYA[e] (15-39)	968	97.2	95.9-98.1	91.7	89.6-93.3	75.6	72.4-78.5	56.2	51.9-60.3
	Adults (40+)	1,191	81.4	79.0-83.6	68.5	65.6-71.2	52.6	49.4-55.7	39.7	35.9-43.4
	All Ages	2,235	88.7	87.3-90.0	79.2	77.4-80.9	63.7	61.4-65.8	48.3	45.5-51.0
Glioma malignant, NOS	Children[d] (0-14)	1,756	77.1	75.0-79.1	66.0	63.6-68.2	63.4	61.0-65.7	61.8	59.2-64.2
	AYA[e] (15-39)	1,029	89.7	87.6-91.5	82.8	80.2-85.1	72.8	69.6-75.8	62.5	58.3-66.4
	Adults (40+)	2,420	49.0	46.9-51.0	38.3	36.2-40.4	30.3	28.2-32.5	24.9	22.6-27.3
	All Ages	5,205	66.6	65.3-67.9	56.6	55.1-58.0	50.1	48.6-51.6	45.2	43.6-46.9
Neuronal and mixed neuronal-glial tumors	Children[d] (0-14)	--	--	--	--	--	--	--	--	--
	AYA[e] (15-39)	150	95.2	90.1-97.7	89.3	82.7-93.5	78.5	70.0-84.8	70.5	60.1-78.7
	Adults (40+)	416	90.1	86.5-92.8	84.0	79.6-87.5	76.0	70.4-80.7	59.0	50.9-66.3
	All Ages	611	91.6	88.9-93.7	85.8	82.5-88.6	77.6	73.3-81.3	64.8	58.9-70.2
Embryonal tumors	Children[d] (0-14)	2,083	80.6	78.8-82.3	71.0	68.9-73.0	62.6	60.3-64.8	56.4	53.9-58.9
	AYA[e] (15-39)	793	88.2	85.7-90.3	80.4	77.3-83.1	65.8	62.0-69.4	58.9	54.7-62.9
	Adults (40+)	248	72.9	66.7-78.1	58.5	51.8-64.6	45.7	38.7-52.4	31.5	24.1-39.2
	All Ages	3,124	81.9	80.5-83.2	72.4	70.7-74.0	62.1	60.2-63.9	55.1	53.0-57.2
Medulloblastoma	Children[d] (0-14)	1,194	88.5	86.5-90.2	81.6	79.1-83.7	72.8	69.9-75.4	65.4	62.0-68.5
	AYA[e] (15-39)	576	91.5	88.8-93.6	86.9	83.7-89.6	75.1	70.8-78.8	67.6	62.6-72.1
	Adults (40+)	124	86.4	78.7-91.4	79.6	70.9-85.9	69.0	58.8-77.1	47.5	35.0-59.1
	All Ages	1,894	89.3	87.7-90.6	83.0	81.2-84.7	73.2	71.0-75.3	64.9	62.2-67.5
PNET	Children[d] (0-14)	399	77.9	73.4-81.7	62.1	57.0-66.8	54.7	49.5-59.7	49.0	43.6-54.3
	AYA[e] (15-39)	148	80.8	73.3-86.3	61.8	53.2-69.3	39.4	30.8-47.8	34.4	25.9-43.0
	Adults (40+)	96	55.8	45.0-65.3	35.6	25.8-45.6	20.6	12.5-30.2	--	--
	All Ages	643	75.3	71.7-78.5	58.1	54.1-62.0	46.4	42.2-50.4	40.8	36.6-45.0
ATRT	Children[d] (0-14)	283	51.6	45.5-57.4	38.7	32.6-44.6	32.2	26.2-38.3	28.7	22.6-35.1
	AYA[e] (15-39)	--	--	--	--	--	--	--	--	--
	Adults (40+)	--	--	--	--	--	--	--	--	--
	All Ages	293	52.6	46.6-58.3	39.8	33.9-45.7	32.0	26.1-38.0	28.6	22.5-34.9
Meningioma	Children[d] (0-14)	--	--	--	--	--	--	--	--	--
	AYA[e] (15-39)	98	97.0	90.5-99.1	97.0	90.5-99.1	89.0	79.7-94.1	83.2	72.0-90.2
	Adults (40+)	1,119	80.8	78.2-83.2	72.9	69.9-75.7	61.5	57.9-64.9	53.5	49.2-57.5
	All Ages	1,229	82.1	79.6-84.3	74.9	72.1-77.5	63.8	60.5-67.0	56.1	52.1-59.9

Table 20 *Continued*

Histology	Age Group (years)		1-Year		2-Year		5-Year		10-Year	
		N[d]	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Lymphoma	Children[d] (0-14)	--	--	--	--	--	--	--	--	--
	AYA[e] (15-39)	573	59.1	54.8-63.1	54.2	49.8-58.3	48.9	44.5-53.2	45.2	40.5-49.7
	Adults (40+)	4,591	52.6	51.1-54.1	43.8	42.2-45.3	32.2	30.6-33.8	23.5	21.7-25.3
	All Ages	5,203	53.6	52.2-55.0	45.2	43.8-46.6	34.5	33.0-36.0	26.6	24.9-28.3
TOTAL	**Children[d] (0-14)**	**9,699**	**86.2**	**85.4-86.9**	**78.7**	**77.9-79.6**	**73.3**	**72.4-74.3**	**69.9**	**68.8-70.9**
	AYA[e] (15-39)	**14,189**	**89.7**	**89.2-90.2**	**81.3**	**80.6-81.9**	**68.3**	**67.5-69.2**	**57.2**	**56.1-58.2**
	Adults (40+)	**59,272**	**48.4**	**48.0-48.8**	**31.1**	**30.7-31.5**	**20.3**	**19.9-20.6**	**15.4**	**15.0-15.8**
	All Ages	**83,160**	**59.9**	**59.6-60.3**	**45.4**	**45.0-45.8**	**35.0**	**34.6-35.3**	**29.3**	**28.9-29.7**

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2017 Sub (2000-2015) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018, based on the November 2017 submission.
[d]Total number of case that occurred within the SEER registries between 2000 and 2015.
[e]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[f]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/adolescent-young-adult.
[g]Total includes histologies not listed in this table.
-- Counts and rates are not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category. The suppressed cases are included in the counts and rates for totals.
Abbreviation: CBTRUS, Central Brain Tumor Registry of the United States; SEER, Survival, Epidemiology, and End Results; CI, confidence interval; NOS, not otherwise specified

Table 21 One-, Two-, Five-, and Ten-Year Relative Survival Rates[a,b] with 95% Confidence Intervals for Selected Malignant Brain and Other Central Nervous System Tumors by Age Group, SEER 18 Registries, 2000-2015[c]

Histology	Age Group (years)	N[d]	1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
Pilocytic astrocytoma	0-19	3,039	98.7	98.2-99.1	98.2	97.6-98.6	96.6	95.8-97.2	95.7	94.7-96.5
	20-44	826	96.7	95.2-97.8	94.5	92.6-95.9	91.5	89.1-93.4	86.1	82.7-88.9
	45-54	154	94.4	89.0-97.2	86.1	79.1-90.9	78.8	70.3-85.1	76.0	65.8-83.5
	55-64	95	95.2	87.2-98.3	89.9	80.4-95.0	83.0	72.1-89.9	78.7	64.5-87.7
	65-74	--	--	--	--	--	--	--	--	--
	75+	--	--	--	--	--	--	--	--	--
Diffuse astrocytoma	0-19	977	93.1	91.2-94.5	87.6	85.3-89.6	83.5	80.8-85.8	81.2	78.2-83.8
	20-44	2,330	93.5	92.4-94.5	87.4	85.9-88.8	69.2	67.1-71.2	49.6	46.9-52.2
	45-54	1,039	77.4	74.7-79.9	63.0	59.8-65.9	44.9	41.5-48.2	32.8	29.1-36.5
	55-64	909	58.0	54.6-61.2	38.3	35.0-41.6	23.0	20.0-26.2	14.6	11.5-18.1
	65-74	681	43.2	39.4-47.0	26.5	23.0-30.1	15.4	12.4-18.7	11.6	8.3-15.6
	75+	557	25.1	21.4-28.9	13.0	10.1-16.2	6.4	4.1-9.5	1.2	0.1-5.1
Anaplastic astrocytoma	0-19	341	68.9	63.6-73.6	39.3	33.8-44.6	27.0	22.0-32.2	19.5	14.6-24.9
	20-44	1,535	89.5	87.8-90.9	75.9	73.5-78.1	55.2	52.2-58.0	39.3	35.9-42.6
	45-54	789	74.7	71.4-77.7	51.7	47.9-55.3	31.5	27.8-35.3	22.9	19.0-27.0
	55-64	810	55.4	51.7-58.8	30.8	27.4-34.2	13.3	10.6-16.2	6.1	3.8-9.2
	65-74	628	37.1	33.2-41.0	18.0	14.9-21.4	7.9	5.6-10.8	5.0	3.0-7.9
	75+	433	18.0	14.4-22.0	8.8	6.1-12.1	1.1	0.3-3.2	0.6	0.1-2.8
Glioblastoma	0-19	516	59.1	54.7-63.3	33.4	29.2-37.7	16.6	13.2-20.4	12.1	8.8-15.9
	20-44	3,253	70.4	68.8-72.0	41.6	39.8-43.3	19.1	17.6-20.7	10.9	9.6-12.4
	45-54	6,360	57.9	56.7-59.2	25.9	24.7-27.0	7.7	7.0-8.5	3.8	3.2-4.6
	55-64	10,027	46.6	45.6-47.6	18.3	17.5-19.1	4.7	4.2-5.2	1.8	1.4-2.3
	65-74	9,093	30.0	29.0-31.0	11.1	10.4-11.8	2.6	2.2-3.0	1.0	0.7-1.5
	75+	7,367	12.7	12.0-13.6	3.8	3.3-4.4	1.0	0.7-1.3	0.3	0.1-0.8
Oligodendroglioma	0-19	240	96.6	93.3-98.3	94.8	90.9-97.0	90.9	86.0-94.1	88.6	83.1-92.3
	20-44	1,720	98.7	98.0-99.2	96.5	95.5-97.4	88.3	86.4-89.9	71.8	68.9-74.5
	45-54	778	94.8	92.8-96.2	90.3	87.8-92.3	81.0	77.6-83.9	64.5	59.7-68.9
	55-64	427	89.3	85.8-92.0	80.0	75.5-83.7	69.7	64.2-74.5	53.3	45.9-60.2
	65-74	181	81.2	74.2-86.5	73.0	64.9-79.4	54.4	45.0-62.8	38.1	27.0-49.1
	75+	96	63.0	51.3-72.5	51.0	38.9-61.9	39.1	25.9-52.1	--	--

Table 21 *Continued*

Histology	Age Group (years) N[d]		1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
Anaplastic oligodendroglioma	0-19	--	--	--	--	--	--	--	--	--
	20-44	575	94.6	92.3-96.2	85.5	82.1-88.3	72.1	67.8-75.9	56.3	51.0-61.4
	45-54	385	89.7	86.0-92.4	78.8	74.0-82.8	63.7	57.8-68.9	46.9	40.0-53.5
	55-64	311	78.3	73.0-82.6	63.4	57.3-68.8	46.1	39.6-52.3	33.5	26.3-40.8
	65-74	139	57.1	48.1-65.1	38.4	29.7-47.0	22.1	14.3-31.0	16.1	8.4-26.1
	75+	57	40.5	26.8-53.7	--	--	--	--	--	--
Ependymal tumors	0-19	880	95.3	93.6-96.5	88.5	86.1-90.6	77.0	73.6-79.9	68.4	64.4-72.0
	20-44	987	97.4	96.1-98.2	95.5	93.9-96.7	91.8	89.6-93.6	88.3	85.3-90.7
	45-54	570	95.8	93.6-97.2	93.2	90.5-95.1	89.5	86.1-92.1	87.3	83.0-90.6
	55-64	413	92.2	89.0-94.6	89.2	85.3-92.1	86.7	81.9-90.2	84.6	77.7-89.5
	65-74	208	88.5	82.6-92.5	82.7	75.7-87.8	81.2	73.6-86.8	67.3	52.9-78.2
	75+	97	68.1	56.7-77.1	63.4	51.0-73.5	51.2	36.4-64.3	30.7	13.7-49.6
Oligoastrocytic tumors	0-19	126	93.6	87.5-96.8	88.5	81.2-93.1	81.2	72.6-87.3	76.5	67.0-83.6
	20-44	1,194	96.9	95.6-97.7	91.0	89.1-92.6	73.8	70.8-76.5	55.3	51.4-58.9
	45-54	450	89.8	86.5-92.3	79.4	75.1-83.0	66.6	61.5-71.2	48.2	41.5-54.5
	55-64	259	74.0	68.0-79.0	51.6	45.0-57.8	34.2	27.7-40.8	26.4	19.3-34.0
	65-74	145	66.3	57.7-73.6	48.4	39.5-56.7	26.6	18.5-35.4	13.3	6.2-23.2
	75+	--	--	--	--	--	--	--	--	--
Glioma malignant, NOS	0-19	1,969	78.6	76.6-80.4	68.0	65.8-70.1	65.1	62.8-67.3	63.4	61.0-65.7
	20-44	1,058	88.2	86.0-90.0	80.0	77.3-82.4	69.1	65.9-72.2	56.6	52.4-60.6
	45-54	509	75.0	70.9-78.6	60.3	55.7-64.6	49.7	44.9-54.4	39.5	34.0-44.9
	55-64	452	58.9	54.1-63.5	45.3	40.3-50.2	35.7	30.6-40.9	29.4	23.5-35.4
	65-74	430	39.9	35.2-44.7	26.5	22.1-31.1	17.7	13.6-22.3	15.6	11.1-20.8
	75+	787	18.9	16.1-21.9	14.1	11.5-17.0	9.7	7.0-12.7	8.5	5.5-12.4
Neuronal and mixed neuronal-glial tumors	0-19	73	94.4	85.8-97.9	88.5	78.2-94.1	83.6	72.1-90.6	83.6	72.1-90.6
	20-44	161	95.6	90.7-97.9	90.1	83.9-94.0	78.5	70.3-84.7	63.9	53.1-72.8
	45-54	143	93.8	88.0-96.9	90.3	83.5-94.4	85.1	77.0-90.5	77.3	64.8-85.8
	55-64	124	91.4	84.3-95.4	82.5	73.5-88.7	69.7	58.5-78.5	51.3	36.4-64.4
	65-74	68	86.2	74.2-92.9	84.5	71.2-92.0	76.1	58.3-87.1	55.1	28.1-75.6
	75+	--	--	--	--	--	--	--	--	--

Table 21 *Continued*

Histology	Age Group (years) N[d]		1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
Embryonal tumors	0-19	2,312	81.5	79.8-83.1	71.8	69.9-73.7	62.8	60.6-64.8	56.7	54.3-59.0
	20-44	627	87.1	84.1-89.5	80.0	76.5-83.1	66.9	62.6-70.8	58.9	54.1-63.4
	45-54	91	82.4	72.7-88.9	69.8	58.9-78.4	54.0	42.2-64.5	38.4	25.7-50.9
	55-64	52	68.2	53.1-79.3	48.7	33.8-62.1	--	--	--	--
	65-74	--	--	--	--	--	--	--	--	--
	75+	--	--	--	--	--	--	--	--	--
Meningioma	0-19	--	--	--	81.4	52.4-93.7	81.4	52.4-93.7	81.4	52.4-93.7
	20-44	149	94.7	89.4-97.4	94.1	88.6-97.0	87.7	80.5-92.3	78.7	69.7-85.3
	45-54	195	93.1	88.2-96.0	85.8	79.7-90.2	77.9	70.6-83.6	70.8	62.2-77.8
	55-64	291	88.2	83.6-91.5	81.1	75.7-85.4	68.7	62.1-74.4	59.9	52.2-66.7
	65-74	270	80.6	75.0-85.1	69.5	63.0-75.2	51.4	43.8-58.5	46.1	36.6-55.1
	75+	307	63.4	57.1-69.0	55.6	48.7-61.9	46.4	38.1-54.2	34.3	24.1-44.7
Lymphoma	0-19	70	84.0	72.9-90.8	76.5	64.4-84.9	71.7	59.2-81.0	67.3	53.9-77.7
	20-44	834	57.7	54.2-61.0	52.0	48.4-55.4	45.9	42.2-49.5	40.7	36.8-44.6
	45-54	784	63.0	59.5-66.4	54.2	50.5-57.7	42.7	38.8-46.5	32.2	28.1-36.4
	55-64	1,121	62.5	59.5-65.3	53.6	50.5-56.6	39.8	36.5-43.1	29.3	25.6-33.1
	65-74	1,311	51.5	48.7-54.3	42.6	39.7-45.5	29.0	26.0-32.1	18.9	15.5-22.7
	75+	1,083	34.0	31.0-37.0	24.6	21.8-27.5	16.1	13.2-19.2	11.6	7.9-16.1
TOTAL	**0-19**	**11,985**	**87.4**	**86.8-88.0**	**80.0**	**79.3-80.8**	**74.1**	**73.2-74.9**	**70.7**	**69.7-71.6**
	20-44	**16,324**	**86.8**	**86.3-87.4**	**76.3**	**75.6-77.0**	**62.2**	**61.4-63.1**	**50.1**	**49.1-51.1**
	45-54	**12,738**	**69.8**	**68.9-70.6**	**48.5**	**47.6-49.4**	**33.5**	**32.6-34.4**	**26.2**	**25.2-27.2**
	55-64	**15,805**	**54.4**	**53.6-55.2**	**31.6**	**30.8-32.4**	**18.5**	**17.8-19.2**	**13.7**	**13.0-14.4**
	65-74	**13,797**	**37.3**	**36.4-38.1**	**20.9**	**20.2-21.6**	**11.5**	**10.9-12.2**	**8.2**	**7.5-8.9**
	75+	**12,511**	**18.3**	**17.6-19.1**	**10.4**	**9.8-11.0**	**6.1**	**5.6-6.7**	**4.0**	**3.4-4.7**

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2017 Sub (2000-2015) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018, based on the November 2017 submission.
[d]Total number of case that occurred within the SEER registries between 2000 and 2015.
[e]Total includes histologies not listed in this table.
-- Counts and rates are not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category. The suppressed cases are included in the counts and rates for totals.
Abbreviation: CBTRUS, Central Brain Tumor Registry of the United States; SEER, Survival, Epidemiology, and End Results; CI, confidence interval; NOS, not otherwise specified

Table 22 One-, Two-, Five-, and Ten-Year Relative Survival Rates[a,b] with 95% Confidence Intervals for Selected Non-Malignant Brain and Other Central Nervous System Tumors by NCI Age Group, SEER 18 Registries, 2004-2015[c]

			1-Year		2-Year		5-Year		10-Year	
Histology	Age Group (years)	N[d]	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Unique astrocytoma variants	Children[e] (0-14)	147	97.9	93.5-99.4	97.9	93.5-99.4	97.9	93.5-99.4	93.3	79.6-97.9
	AYA[f] (15-39)	98	95.8	89.1-98.5	95.8	89.1-98.5	89.2	79.8-94.4	83.0	67.2-91.6
	Adults (40+)	--	--	--	--	--	--	--	--	--
	All Ages	263	96.9	93.8-98.5	95.7	92.1-97.6	93.2	88.8-95.9	85.8	76.6-91.6
Ependymal tumors	Children[e] (0-14)	78	100.0	**	98.4	88.3-99.8	94.2	82.5-98.2	94.2	82.5-98.2
	AYA[f] (15-39)	524	99.7	98.0-100.0	99.4	97.6-99.8	98.6	96.1-99.5	98.3	95.5-99.3
	Adults (40+)	1,066	96.9	95.4-97.9	96.7	94.9-97.9	96.5	94.4-97.8	95.4	88.5-98.2
	All Ages	1,668	97.9	96.9-98.6	97.6	96.4-98.4	97.4	96.0-98.3	96.6	92.6-98.5
Choroid plexus tumors	Children[e] (0-14)	179	98.4	94.3-99.5	97.7	93.4-99.2	95.2	89.7-97.8	95.2	89.7-97.8
	AYA[f] (15-39)	146	98.6	94.1-99.7	98.6	94.1-99.7	97.9	92.6-99.4	94.8	78.2-98.9
	Adults (40+)	157	83.9	76.6-89.1	81.8	73.8-87.5	76.7	67.1-83.9	76.1	64.3-84.4
	All Ages	482	93.7	90.9-95.7	92.8	89.8-95.0	90.1	86.2-92.9	89.2	83.7-93.0
Neuronal and mixed neuronal-glial tumors	Children[e] (0-14)	731	98.9	97.7-99.5	98.4	97.0-99.1	97.0	95.1-98.1	95.3	92.1-97.3
	AYA[f] (15-39)	1,054	98.3	97.2-98.9	97.7	96.5-98.5	95.6	93.8-96.9	94.0	91.3-95.8
	Adults (40+)	590	93.5	90.9-95.3	91.2	88.1-93.5	86.3	82.2-89.6	81.3	74.7-86.4
	All Ages	2,375	97.3	96.5-97.9	96.3	95.4-97.1	93.8	92.4-94.9	91.3	89.2-93.0
Nerve sheath tumors	Children[e] (0-14)	543	100.0	**	100.0	**	99.8	94.6-100.0	98.1	94.7-99.3
	AYA[f] (15-39)	3,109	99.6	99.2-99.8	99.2	98.7-99.5	98.7	98.0-99.1	97.6	96.3-98.5
	Adults (40+)	16,489	99.4	99.1-99.6	99.3	99.0-99.6	99.3	99.0-99.6	99.3	99.0-99.6
	All Ages	20,141	99.4	99.2-99.6	99.3	99.0-99.5	99.3	99.0-99.5	99.3	99.0-99.5
Meningioma	Children[e] (0-14)	166	98.1	94.1-99.4	97.4	93.0-99.0	97.4	93.0-99.0	97.4	93.0-99.0
	AYA[f] (15-39)	5,497	98.7	98.4-99.0	98.2	97.8-98.6	96.6	96.0-97.2	94.5	93.3-95.5
	Adults (40+)	79,071	92.1	91.9-92.4	90.1	89.9-90.4	86.0	85.6-86.4	80.5	79.7-81.2
	All Ages	84,734	92.6	92.4-92.8	90.7	90.4-90.9	86.7	86.3-87.1	81.5	80.8-82.2
Mesenchymal tumors	Children[e] (0-14)	204	99.6	93.3-100.0	98.3	93.9-99.5	97.1	91.2-99.0	94.7	85.2-98.2
	AYA[f] (15-39)	171	98.2	94.2-99.5	98.2	94.2-99.5	95.3	88.6-98.1	90.3	79.4-95.6
	Adults (40+)	426	96.0	93.1-97.7	95.2	91.7-97.3	90.7	85.3-94.2	78.7	67.1-86.7
	All Ages	801	97.4	95.7-98.4	96.6	94.6-97.9	93.0	89.7-95.3	84.6	77.4-89.7
Other neoplasms related to the meninges	Children[e] (0-14)	--	--	--	--	--	--	--	--	--
	AYA[f] (15-39)	600	97.4	95.7-98.5	96.8	94.8-98.0	96.0	93.8-97.5	90.4	85.6-93.6
	Adults (40+)	1,185	94.8	93.1-96.1	94.0	92.0-95.4	90.3	87.4-92.5	86.7	81.7-90.4
	All Ages	1,822	95.7	94.5-96.6	94.9	93.6-96.0	92.3	90.3-93.9	87.7	84.2-90.4
Germ cell tumors, cysts and heterotopias	Children[e] (0-14)	98	93.5	85.9-97.1	93.5	85.9-97.1	93.5	85.9-97.1	93.5	85.9-97.1

Table 22 *Continued*

Histology	Age Group (years)	N[d]	1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
	AYA[f] (15-39)	102	99.0	91.9-99.9	96.7	89.4-99.0	96.7	89.4-99.0	96.7	89.4-99.0
	Adults (40+)	92	92.1	83.1-96.4	92.1	83.1-96.4	92.1	83.1-96.4	84.6	50.4-96.0
	All Ages	292	95.0	91.4-97.1	94.6	90.7-96.9	94.6	90.7-96.9	92.0	80.8-96.8
Tumors of the pituitary	Children[e] (0-14)	509	99.8	98.4-100.0	99.6	98.0-99.9	98.9	96.6-99.6	98.4	95.8-99.4
	AYA[f] (15-39)	12,945	99.6	99.5-99.7	99.6	99.4-99.7	99.2	99.0-99.4	98.6	98.2-99.0
	Adults (40+)	27,875	97.3	97.0-97.5	96.6	96.3-96.9	95.3	94.8-95.8	92.6	91.5-93.6
	All Ages	41,329	98.0	97.9-98.2	97.6	97.3-97.8	96.6	96.2-96.9	94.6	93.9-95.3
Craniopharyngioma	Children[e] (0-14)	476	97.6	95.6-98.6	96.8	94.6-98.1	93.2	89.9-95.4	91.8	88.2-94.4
	AYA[f] (15-39)	455	96.1	93.8-97.6	94.6	91.9-96.5	89.9	86.1-92.7	87.1	82.5-90.6
	Adults (40+)	999	88.9	86.6-90.9	85.1	82.4-87.4	76.0	72.4-79.2	66.6	60.9-71.6
	All Ages	1,930	92.8	91.4-93.9	90.2	88.6-91.6	83.5	81.3-85.5	77.7	74.4-80.7
Hemangioma	Children[e] (0-14)	181	98.9	95.1-99.8	98.9	95.1-99.8	98.9	95.1-99.8	98.9	95.1-99.8
	AYA[f] (15-39)	830	99.3	98.3-99.7	99.1	98.0-99.6	99.0	97.6-99.6	96.7	92.1-98.6
	Adults (40+)	1,919	94.8	93.5-95.9	93.3	91.7-94.6	90.4	88.0-92.3	86.2	80.9-90.1
	All Ages	2,930	96.3	95.5-97.1	95.3	94.2-96.2	93.4	91.9-94.7	90.2	86.8-92.7
TOTAL	**Children[d] (0-14)**	**3,693**	**98.5**	**98.0-98.9**	**98.0**	**97.5-98.5**	**96.8**	**96.0-97.4**	**95.5**	**94.3-96.4**
	AYA[e] (15-39)	**26,492**	**99.1**	**99.0-99.2**	**98.8**	**98.6-98.9**	**97.9**	**97.7-98.1**	**96.5**	**96.1-96.9**
	Adults (40+)	**133,255**	**93.5**	**93.3-93.7**	**92.0**	**91.8-92.2**	**89.1**	**88.8-89.4**	**85.0**	**84.5-85.6**
	All Ages	**163,440**	**94.5**	**94.4-94.7**	**93.2**	**93.1-93.4**	**90.7**	**90.5-91.0**	**87.2**	**86.8-87.7**

** Confidence interval could not be calculated.
[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]Rates are an estimate of the percentage of patients alive at one, two, five, and ten years, respectively. Rates were not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category.
[c]Estimated by CBTRUS using Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2017 Sub (2000-2015) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2018, based on the November 2017 submission.
[d]Total number of case that occurred within the SEER registries between 2004 and 2015.
[e]Children as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/pediatric.
[f]Adolescents and Young Adults (AYA), as defined by the National Cancer Institute, see: http://www.cancer.gov/researchandfunding/snapshots/adolescent-young-adult.
[g]Total includes histologies not listed in this table.
-- Counts and rates are not presented for categories with 50 or fewer cases and were suppressed for rates where fewer than 16 cases were surviving within a category. The suppressed cases are included in the counts and rates for totals.
Abbreviation: CBTRUS, Central Brain Tumor Registry of the United States; SEER, Survival, Epidemiology, and End Results; CI, confidence interval; NOS, not otherwise specified

Table 23 Summary of Biomarkers Identified for Primary Brain and Other CNS Tumors

Histology	Gene or Marker	Outcome	Related scientific publications	Collected by US Cancer Registry System
Glioma (especially oligodendroglial tumors)	Large deletions (missing parts of the chromosome) in the short arm of chromosome 1 (1p) and the long arm of chromosome 19 (19q)	Improved response to chemotherapy and radiation, and increased survival	Cairncross, et al. (1998)[1] Vogelbaum, et al. (2015)[2] Van de Bent, et al. (2013)[3] The Cancer Genome Atlas Research Network, et al. (2015)[4] Ceccarelli, et al. (2016)[5]	Yes Site-specific factor 5: http://web2.facs.org/cstage0205/brain/Brain_nph.html Site-specific factor 6: http://web2.facs.org/cstage0205/brain/Brain_opf.html
Glioma (especially low grade astrocytomas and oligodendroglial tumors)	Protein-truncating mutation in isocitrate dehydrogenase 1 (*IDH1*) or in isocitrate dehydrogenase 2 (*IDH2*)	Increased survival time	Yan, et al. (2009)[6] The Cancer Genome Atlas Research Network, et al. (2015)[4] Ceccarelli, et al. (2016)[5]	Yes Beginning in collection year 2018, http://datadictionary.naaccr.org/default.aspx?c=10#3816
Glioblastoma	Methylation of the promoter of O-6-methylguanine-DNA methyltransferase (*MGMT*)	Limits ability of the tumor cells to repair DNA damage caused by chemotherapy and radiation; results in increased survival time	Hegi, et al. (2005)[7] Stupp, et al. (2007)[8] Hegi, et al. (2008)[9]	Yes Site-specific factor 4: *http://web2.facs.org/cstage0205/brain/Brain_mpn.html*
Glioblastoma	Glioma-CpG island methylator phenotype (G-CIMP), Genome-wide DNA methylation	Significantly increased survival time	Noushmer, et al. (2010)[10]	No
Medulloblastoma	Wingless subtype	Low prevalence of metastatic disease (~5-10%) Highest five-year survival (~95%)	Kool, et al. (2012)[11] Northcott, et al. (2012a)[12] Northcott, et al. (2012b)[13] Northcott, et al. (2017)[14]	Yes Beginning in collection year 2018, http://datadictionary.naaccr.org/default.aspx?c=10#3816
Medulloblastoma	Sonic hedgehog subtype	Moderate prevalence of metastatic disease (~15-20%) Moderate five-year survival (~75%)	Kool, et al. (2012)[11] Northcott, et al. (2012a)[12] Northcott, et al. (2012b)[13] Northcott, et al. (2017)[14]	Yes Beginning in collection year 2018, http://datadictionary.naaccr.org/default.aspx?c=10#3816

Table 23 *Continued*

Histology	Gene or Marker	Outcome	Related scientific publications	Collected by US Cancer Registry System
Medulloblastoma	Group 3 subtype (also known as Group C)	Increased prevalence of metastatic disease (~40-45%) Poorest five-year survival (~50%)	Kool, et al. (2012)[11] Northcott, et al. (2012a)[12] Northcott, et al. (2012b)[13] Northcott, et al. (2017)[14]	Yes Beginning in collection year 2018, http://datadictionary.naaccr.org/default.aspx?c=10#3816
Medulloblastoma	Group 4 subtype (also known as Group D)	Increased prevalence of metastatic disease (40-45%) Moderate five-year survival (~75%)	Kool, et al. (2012)[11] Northcott, et al. (2012a)[12] Northcott, et al. (2012b)[13] Northcott, et al. (2017)[14]	Yes Beginning in collection year 2018, http://datadictionary.naaccr.org/default.aspx?c=10#3816

1. Cairncross JG, Ueki K, Zlatescu MC, Lisle DK, Finkelstein DM, Hammond RR, Silver JS, Stark PC, Macdonald DR, Ino Y, Ramsay DA, Louis DN. Specific genetic predictors of chemotherapeutic response and survival in patients with anaplastic oligodendrogliomas. J Natl Cancer Inst 1998;**90**: 1473-9.
2. Vogelbaum MA, Hu C, Peereboom DM, Macdonald DR, Giannini C, Suh JH, Jenkins RB, Laack NN, Brachman DG, Shrieve DC, Souhami L, Mehta MP. Phase II trial of pre-irradiation and concurrent temozolomide in patients with newly diagnosed anaplastic oligodendrogliomas and mixed anaplastic oligoastrocytomas: long term results of RTOG BR0131. Journal of neuro-oncology 2015;124: 413-20.
3. van den Bent MJ, Brandes AA, Taphoorn MJ, Kros JM, Kouwenhoven MC, Delattre JY, Bernsen HJ, Frenay M, Tijssen CC, Grisold W, Sipos L, Enting RH, et al. Adjuvant procarbazine, lomustine, and vincristine chemotherapy in newly diagnosed anaplastic oligodendroglioma: long-term follow-up of EORTC brain tumor group study 26951. Journal of clinical oncology: official journal of the American Society of Clinical Oncology 2013;31: 344-50.
4. The Cancer Genome Atlas Research Network, Brat DJ, Verhaak RG, Aldape KD, Yung WK, Salama SR, Cooper LA, Rheinbay E, Miller CR, Vitucci M, Morozova O, Robertson AG, et al. Comprehensive, Integrative Genomic Analysis of Diffuse Lower-Grade Gliomas. N Engl J Med 2015;372: 2481-98.
5. Ceccarelli M, Barthel FP, Malta TM, Sabedot TS, Salama SR, Murray BA, Morozova O, Newton Y, Radenbaugh A, Pagnotta SM, Anjum S, Wang J, et al. Molecular Profiling Reveals Biologically Discrete Subsets and Pathways of Progression in Diffuse Glioma. Cell 2016;164: 550-63.
6. Yan H, Parsons DW, Jin G, McLendon R, Rasheed BA, Yuan W, Kos I, Batinic-Haberle I, Jones S, Riggins GJ, Friedman H, Friedman A, et al. IDH1 and IDH2 mutations in gliomas. N Engl J Med 2009;360: 765-73.
7. Hegi ME, Diserens AC, Gorlia T, Hamou MF, de Tribolet N, Weller M, Kros JM, Hainfellner JA, Mason W, Mariani L, Bromberg JE, Hau P, et al. MGMT gene silencing and benefit from temozolomide in glioblastoma. N Engl J Med 2005;352: 997-1003.
8. Stupp R, Hegi ME, Gilbert MR, Chakravarti A. Chemoradiotherapy in malignant glioma: standard of care and future directions. J Clin Oncol 2007;25: 4127-36.
9. Hegi ME, Liu L, Herman JG, Stupp R, Wick W, Weller M, Mehta MP, Gilbert MR. Correlation of O6-methylguanine methyltransferase (MGMT) promoter methylation with clinical outcomes in glioblastoma and clinical strategies to modulate MGMT activity. Journal of clinical oncology: official journal of the American Society of Clinical Oncology 2008;26: 4189-99.
10. Noushmehr H, Weisenberger DJ, Diefes K, Phillips HS, Pujara K, Berman BP, Pan F, Pelloski CE, Sulman EP, Bhat KP, Verhaak RG, Hoadley KA, et al. Identification of a CpG island methylator phenotype that defines a distinct subgroup of glioma. Cancer Cell 2010;17: 510-22.
11. Kool M, Korshunov A, Remke M, Jones DT, Schlanstein M, Northcott PA, Cho YJ, Koster J, Schouten-van Meeteren A, van Vuurden D, Clifford SC, Pietsch T, et al. Molecular subgroups of medulloblastoma: an international meta-analysis of transcriptome, genetic aberrations, and clinical data of WNT, SHH, Group 3, and Group 4 medulloblastomas. Acta neuropathologica 2012;123: 473-84.
12. Northcott PA, Dubuc AM, Pfister S, Taylor MD. Molecular subgroups of medulloblastoma. Expert Rev Neurother 2012;12: 871-84.
13. Northcott PA, Jones DT, Kool M, Robinson GW, Gilbertson RJ, Cho YJ, Pomeroy SL, Korshunov A, Lichter P, Taylor MD, Pfister SM. Medulloblastomics: the end of the beginning. Nat Rev Cancer 2012;12: 818-34.
14. Northcott PA, Buchhalter I, Morrissy AS, Hovestadt V, Weischenfeldt J, Ehrenberger T, Grobner S, Segura-Wang M, Zichner T, Rudneva VA, Warnatz HJ, Sidiropoulos N, et al. The whole-genome landscape of medulloblastoma subtypes. Nature 2017;547: 311-7.