Neuro-Oncology

Neuro-Oncology 18:i1–i50, 2015.
doi:10.1093/neuonc/nov297

American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008-2012

Quinn T. Ostrom M.A., M.P.H.[1,2], Haley Gittleman M.S.[1,2], Peter M. de Blank M.D., M.S.C.E.[1,3], Jonathan L. Finlay M.B., Ch.B., F.R.C.P.[4], James G. Gurney Ph.D.[5], Roberta McKean-Cowdin Ph.D.[6], Duncan S. Stearns M.D.[1,3], Johannes E. Wolff M.D.[7], Max Liu[8], Yingli Wolinsky Ph.D., M.B.A.[1,2], Carol Kruchko B.A.[2], and Jill S. Barnholtz-Sloan Ph.D.[1,2]

[1]*Case Comprehensive Cancer Center, Case Western Reserve University School of Medicine, Cleveland, OH USA*
[2]*Central Brain Tumor Registry of the United States, Hinsdale, IL USA*
[3]*Department of Pediatric Hematology-Oncology, Rainbow Babies and Children s Hospital, Cleveland, OH USA*
[4]*Division of Hematology, Oncology and BMT, Nationwide Children's Hospital and The Ohio State University, Columbus, OH USA*
[5]*School of Public Health, University of Memphis, Memphis, TN USA*
[6]*Keck School of Medicine, University of Southern California, Los Angeles, CA USA*
[7]*Department of Pediatric Hematology and Oncology, Cleveland Clinic Children's Hospital, Cleveland, OH USA*
[8]*Solon High School, Solon, OH USA*

Introduction

Brain and central nervous system (CNS) tumors found in adolescents and young adults (AYA) are a distinct group of tumors that pose challenges not only to treatment but also to reporting. Overall, cancer that occurs in this age group is biologically distinct from those that occur in both younger and older age groups[1,2] posing significant challenges for clinicians. The most commonly diagnosed histologies in AYA vary from those in both children age (0-14 years), and older adults (40+ years).[3,4] Prognosis and expected survival also varies between younger and older adults, with those who are diagnosed with brain and CNS tumors at younger ages having significantly longer survival. Despite this survival advantage, recent analyses have reported that while cancer survival has been improving overall, AYA have not experienced these same increases in survival and in some cases may have worse survival than those cancers diagnosed in persons over age 40 years.[5] This report provides an in depth analyses of the epidemiology of brain and CNS tumors in adolescents and young adults in the United States (US), and is the first report to provide histology-specific statistics in this population for both malignant and non-malignant brain and other CNS tumors.

In 2006, the National Institutes of Health, the National Cancer Institute (NCI) and the LiveStrong Young Adult Alliance conducted a Progress Review Group to investigate AYA Oncology entitled *Research and care imperatives for adolescents and young adults with cancer: A Report of the Adolescent and Young Adult Oncology Progress Review Group*. This group established the standard age range for the AYA group as 15-39 years. This is the age range used by the Surveillance Epidemiology and End Results (SEER) program of the NCI, as well as in the 2015 CBTRUS Statistical Report.[3,6] Brain tumors and other CNS tumors are less common in AYA than in older adults, but they have a higher incidence than brain tumors in children (age 0-14 years).[3] Non-malignant tumors are significantly more common in AYA than children (Average annual age adjusted incidence in age 15-39 years: 6.17 per 100,000; age 0-14 years: 0.79 per 100,000), while malignant tumors are slightly more common in those age 0-14 years (Average annual age adjusted incidence in 15-39 years old: 3.26 per 100,000; 0-14 years old: 3.73 per 100,000). While a rare cancer overall, brain and CNS tumors are among the most common cancers occurring in this age group (4.4% of all cancers in those age 15-39 years as compared to 32.4% in children age 0-14 years, and 2.2% of cancers in adults age 40+ years).[3,4,7] Malignant brain and CNS tumors are the 11th most common cancer and the 3rd most common cause of cancer death[7,8] in the AYA population. Incidence rates of brain tumors overall as well as specific histologies vary significantly by age. It is, therefore, important to provide an accurate statistical assessment of brain and other CNS tumors in the adolescent and young adult population to better understand their impact on the US population and to serve as a reference for afflicted individuals, for researchers investigating new therapies and for clinicians treating patients.

Background

CBTRUS is a population-based site-specific registry in the US that works in partnership with a public cancer surveillance organization, the CDC's National Program of Central Registries (NPCR), and from which data are directly received under a special agreement. This agreement permits transfer of data through the NPCR Cancer Surveillance System (NPCR-CSS) Submission Specifications mechanism. CBTRUS researchers combine the NPCR data with data from the NCI SEER program[9] 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 CNS tumors as directed by the North American Association of Central Cancer Registries (NAACCR) (http://www.naaccr.org) and report these data to the central cancer registry

© *The Author(s) 2015. Published by Oxford University Press on behalf of the Society for Neuro-Oncology. All rights reserved.*
For permissions, please e-mail: journals.permissions@oup.com.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

in their state. Along with the UDS, there are quality control checks and a system for rating each central cancer registry to further insure that these data are reported as accurately and completely as possible. As a surveillance partner, CBTRUS can, therefore, report high quality data on brain and CNS tumors with histological specificity useful to the communities it serves. Its database represents the largest aggregation of population-based data on the incidence of primary brain and CNS tumors in the US. Aggregate information on all cancers from all central cancer registries in the United States, including primary brain and CNS, is available in *United States Cancer Statistics*.[7,10]

Technical Notes

Data Collection

CBTRUS contains incidence data from 51 independent central cancer registries (46 NPCR and 5 SEER registries), including 50 state cancer registries and the District of Columbia, representing ~99.9% of the US population for the time period examined in this report (for 1 of 51 registries, data were available only from 2008-2010).[3] Please see *The CBTRUS Statistical Report: Primary and Central Nervous System Tumors Diagnosed in the US in 2008-2012* for additional information about the way that these data are obtained and processed.[3]

Incidence is a measure of newly diagnosed cases of a disease in a population. Crude incidence rates are calculated by dividing total number of new cases, by the overall population for the same time period. Age-adjusted incidence rates are calculated by generating crude rates by age group, and then summing these together based on a standard age distribution which adjusts for the effect of age distribution variation between different populations. Age-adjusted incidence rates per 100,000 for the entire US for selected other cancers were obtained from the US Cancer Statistics (USCS),[7] produced by the CDC and the NCI, via CDC Wide-ranging Online Data for Epidemiologic Research (WONDER), for the purpose of comparison with brain and CNS tumor incidence rates. This database includes both NPCR and SEER data and represents nearly 100% of the US population.

Survival information derived from active patient follow-up is not available in the data that CBTRUS receives from NPCR registries, so SEER data are used to generate these Tables. Survival data for malignant brain and CNS tumors were obtained from 18 SEER registries for the years 1995 to 2012. This dataset spanning 17 years currently provides population-based information for approximately 28% of the US population as of the US 2010 Census,[11,12] and is a subset of the CBTRUS combined NPCR and SEER data used for the incidence calculations in this report.

Mortality data used in this report are from the National Center for Health Statistics and include deaths where primary brain or CNS tumor was listed as cause of death on the death certificate for all 50 states and the District of Columbia. Population data for each geographic region were obtained from the SEER program website[13] for the purpose of rate calculations.

Data Reporting – Definitions

It should be noted that other surveillance organizations and researchers may report brain tumors differently from CBTRUS. CBTRUS uses the site definition agreed upon in the *Consensus Conference on brain tumor definition* and includes lymphoma and other hematopoietic histologies (9590–9989), and olfactory tumors of the nasal cavity [C30.0 (9522–9523)].[13,14] The definition of brain and CNS tumors used by SEER, NPCR, and NAACCR in their published incidence and mortality statistics is based on the Consensus Conference and, like CBTRUS, includes tumors located in the following sites with their International Classification of Disease, Oncology 3rd edition (ICD-O-3)[15] site codes in parentheses: brain (C70.0–9), meninges (C71.0–9), and other central nervous system tumors (C72.0–9), but, unlike CBTRUS, excludes lymphoma and leukemia histologies (ICD-O-3 histology codes 9590–9989) from all brain and CNS sites (Table 1 provides information on included site codes). Leukemias and lymphomas of the brain and CNS are rare, and account for ~1% of all brain and CNS tumors from 2008-2012. This difference in reporting does not significantly affect rates.

Gliomas are tumors that arise from glial (supportive tissue in the brain) or precursor cells and include astrocytoma, glioblastoma, oligodendroglioma, ependymoma, mixed glioma, malignant glioma, not otherwise specified (NOS), and a few rare histologies. Because there is no standard definition for gliomas, CBTRUS defines glioma as ICD-O-3 histology codes 9380-9384 and 9391-9460 as starred in Tables 2a, 2b and 2c. Additional information on glioma histology categorization is provided in Table 2d. Additionally, CBTRUS reports data on all brain and CNS tumors irrespective of behavior, whereas many reporting organizations may only publish rates for malignant brain and CNS tumors (tumors with an ICD-O-3 behavior code of /3). This policy presents a problem for reporting pilocytic astrocytoma. Pilocytic astrocytoma was assigned an ICD-O-3[15] behavior code of uncertain/1 in 2007 *WHO Classification of Tumours of the Central Nervous System.*[16,35] Prior to this classification change, these tumors were historically classified as a malignant tumor,[17] and as a results have been defined as a malignant tumor for the purposes of US cancer registration reporting practices. In keeping with these practices CBTRUS categorizes these tumors as malignant tumors in this report and its other statistical reports.

Caution should be used in comparing incidence rates between statistical reports from different reporting agencies or previous CBTRUS statistical reports due to differences in case definition, data collection, rate calculations, and/or reporting delays.

Methods

Counts, means, rates, ratios, proportions, and other relevant statistics were calculated using R 3.1.2 statistical software[18] and/or SEER*Stat 8.2.1.[19] Figures were created in R 3.1.2[18] using rgeos,[20] rgdal,[21] maptools,[22] ggplot2,[23] plotrix,[24] and SEER2R.[25] Statistics are suppressed when counts are fewer than 16 within a cell. However, the data in the suppressed cells are included in the counts and rates for the totals except when data from only one cell are suppressed within a category to prevent identification of the number in the suppressed cell. Note that reported percentages may not add up to 100% due to rounding.

Population data for each geographic region were obtained from the SEER program website[13] for the purpose of rate calculations.

Age-adjusted incidence rates and 95% confidence intervals[26] were estimated for malignant and non-malignant tumors and for selected histology groupings by gender, race, Hispanic

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

ethnicity, and age groups. Age-adjustment was based on one-year age groupings and standardized to the 2000 US standard population. Combined populations for the regions included in this report are shown in Appendix A and Appendix B.

CBTRUS presents statistics on specific brain and CNS tumor patterns in age groups 15-19, 20-24, 25-29, 30-34 and 35-39 years. 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.[27] The NAACCR regional scheme (http://faststats.naaccr.org/usregions.php) was used for statistics reported by region of the US.

Estimation of Expected Numbers of Brain and CNS Tumors in 2015 and 2016

Estimated numbers of expected malignant and non-malignant brain and CNS tumors in adolescents and young adults (age 15-39 years) were calculated for 2015 and 2016. To project 2015 and 2016 counts of newly diagnosed brain and CNS tumors, age-adjusted annual brain tumor incidence rates were generated for 2000-2012 for malignant tumors and 2006-2012 for non-malignant tumors. These were generated by state, age, and histologic type. Joinpoint 4.2.0[28] was used to fit regression models to these incidence rates,[29] which were used to predict numbers of cases in future years using the parameter from the selected models. The models allowed for a maximum of two joinpoints (one for non-malignant tumors), a minimum of three observations from a joinpoint to either end of the data, and a minimum of three observations between joinpoints.[30] Permutation procedures included in Joinpoint were used to select the best fitting model.

Estimation of Mortality Rates

Age-adjusted mortality rates for deaths resulting in adolescents and young adults (age 15-39 years) from all malignant brain and CNS tumors were calculated using the mortality data available in the CDC WONDER Online Database provided by National Center for Health Statistics (NCHS).[8] The SEER cause of death recode[31] was used to categorize all mortality data used in this report. In addition to total age-adjusted rate for the US, age-adjusted rates are presented by gender and region of the US.

Estimation of Lifetime Risk of Developing or Dying from a Malignant Brain and CNS Tumor

Probability of developing or dying from a malignant brain and CNS tumor was estimated for the years 2009 to 2011 using the SEER 18 incidence data,[32] and total US mortality data using DevCan.[33]

Estimation of Survival Rates

Survival analyses were conducted using multiple-year cohorts which include all persons diagnosed during the time period specified for the survival calculation.[34] 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 the SEER survival data analyses. SEER*Stat 8.2.1 statistical software was used to estimate one-, two-, three-, four-, five-, and ten-year relative survival rates for primary malignant brain tumor cases diagnosed between 1995-2012 in eighteen SEER areas.[19,32] This software utilizes life-table (actuarial) methods to compute survival estimates and accounts for current follow-up. Survival was estimated for brain (C71.0-C71.9), meninges (C70.0-C70.9), spinal cord, cranial nerves, and other parts of the central nervous system (C72.0-C72.9), pituitary and pineal glands (C75.1-C75.3), and olfactory tumors of the nasal cavity [C30.0 (9522-9523)]. Survival was not calculated for non-malignant tumors as collection of these cases has only been mandated since 2004, and, therefore, not enough time has elapsed to accurately calculate relative survival.

Five-year conditional survival estimates were calculated for brain tumor cases diagnosed between 1995-2012 in eighteen SEER areas using SEER*Stat 8.2.1 statistical software.[19,32] Conditional survival is an estimate of the probability that a patient will survive for a specific time period given that they have already survived a certain number of years. For example, 5-year conditional survival for an adolescent (age 15-19 years) who has lived two years since their diagnosis with pilocytic astrocytoma is 98.5%, which means that 98.5% of adolescents who have already survived two years will eventually survive five years.

Results

Cancer is a significant source of morbidity and mortality for adolescents and young adults (age 15-39 years) in the US. Death due to cancer is the fourth most common cause of death overall in this age group (8.78 deaths per 100,000 persons annually) with only accidents (32.95 deaths per 100,000), suicide (12.77 deaths per 100,000), and homicide (10.06 per 100,000) causing more deaths annually in this population between 2008 and 2012. Among all deaths due to cancer by histology, brain and CNS tumors are the 3rd most common cause of cancer death. Approximately 1.5% of persons will be diagnosed with cancer between the ages of 15 and 39 years, and approximately 0.07% will develop a primary malignant brain tumor.[33] Approximately 10,600 brain and CNS tumors are diagnosed in AYA per year, and they are the cause of approximately 450 deaths annually in this age group.

Comparison to Other Common AYA Cancers

Average annual age-adjusted and crude incidence rates for the five most common cancers in adolescents and young adults (age 15-39 years) are shown in Figure 1A-F. Due to the comparatively low mortality rate that many common cancers have, these may not be the same cancers included for mortality comparison.

- Primary brain and CNS tumors are the third most common cancer in those age 15-39 years (10.43 per 100,000 population), with only breast (21.22 per 100,000 population) and

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

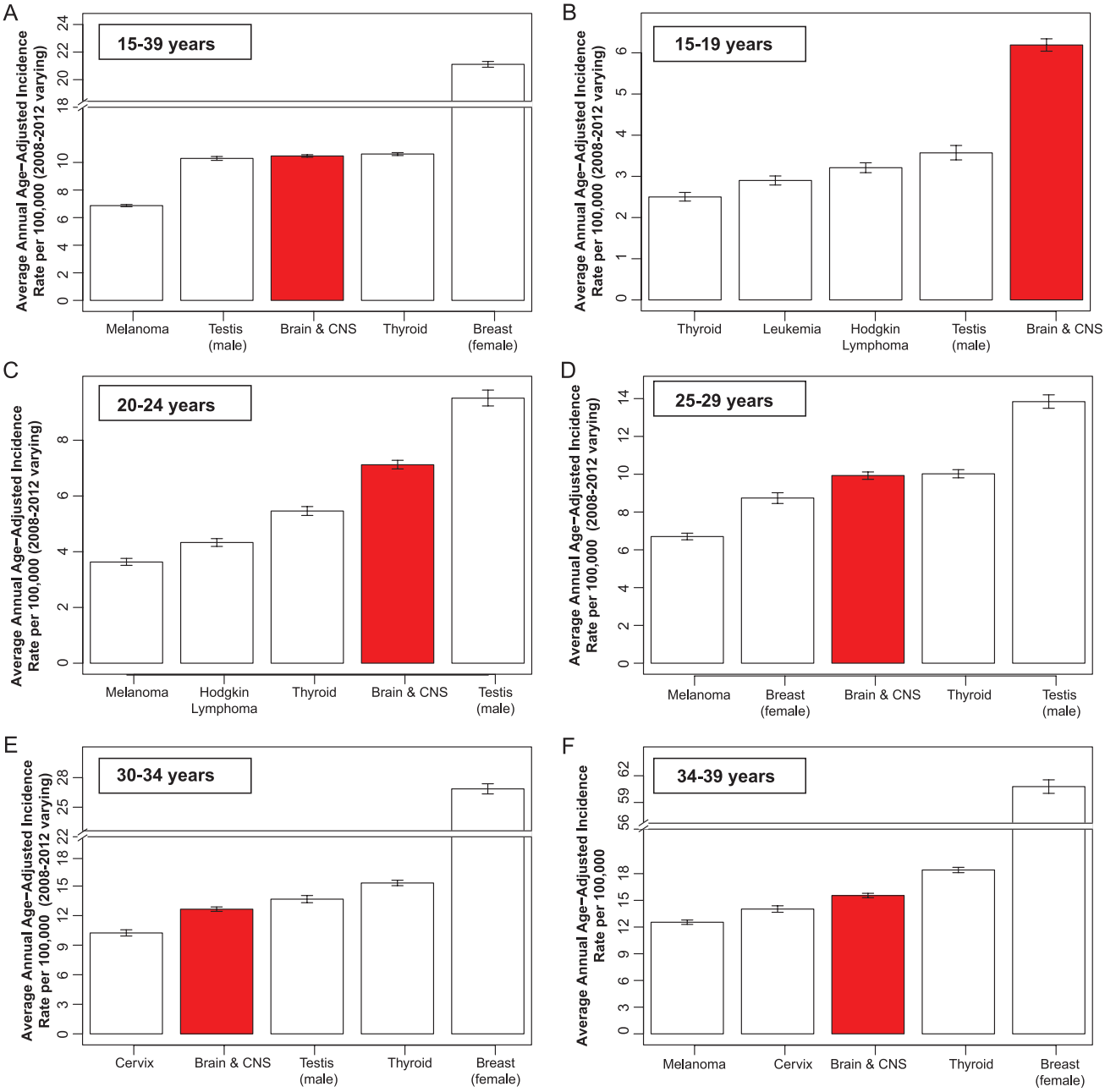


Fig. 1. Average Annual Age-Adjusted Incidence Rates for the Five Most Common Cancers in Persons Age A) 15-39 Years, B) 15-19 Years, C) 20-24 Years, D) 25-29 Years, E) 30-34 Years, and F) 35-39 Years, (CBTRUS 2008-2012 and USCS 2008-2012).

thyroid cancer (10.84 per 100,000 population) occurring more frequently.

- Primary brain and CNS tumors are the most commonly occurring type of cancer in those age 15-19 years (6.19 per 100,000 population), followed by testes (3.61 per 100,000 male population), Hodgkin lymphoma (3.23 per 100,000 population), leukemia (2.92 per 100,000), and thyroid (2.58 per 100,000 population).
- Brain and CNS tumors are the second most commonly occurring cancer in those age 20-24 years (7.12 per 100,000), with only cancer of the testes occurring more frequently (9.43 per 100,000 males).
- Brain and CNS tumors are the third most commonly occurring cancer in those age 25-29 years (9.93 per 100,000 population), preceded by cancer of the testes (14.01 per 100,000 male population) and thyroid (10.23 per 100,000 population).
- Brain and CNS tumors are the fourth most commonly occurring cancer in those age 30-34 years (12.65 per 100,000 population), preceded by cancer of the breast (27.14 per 100,000

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

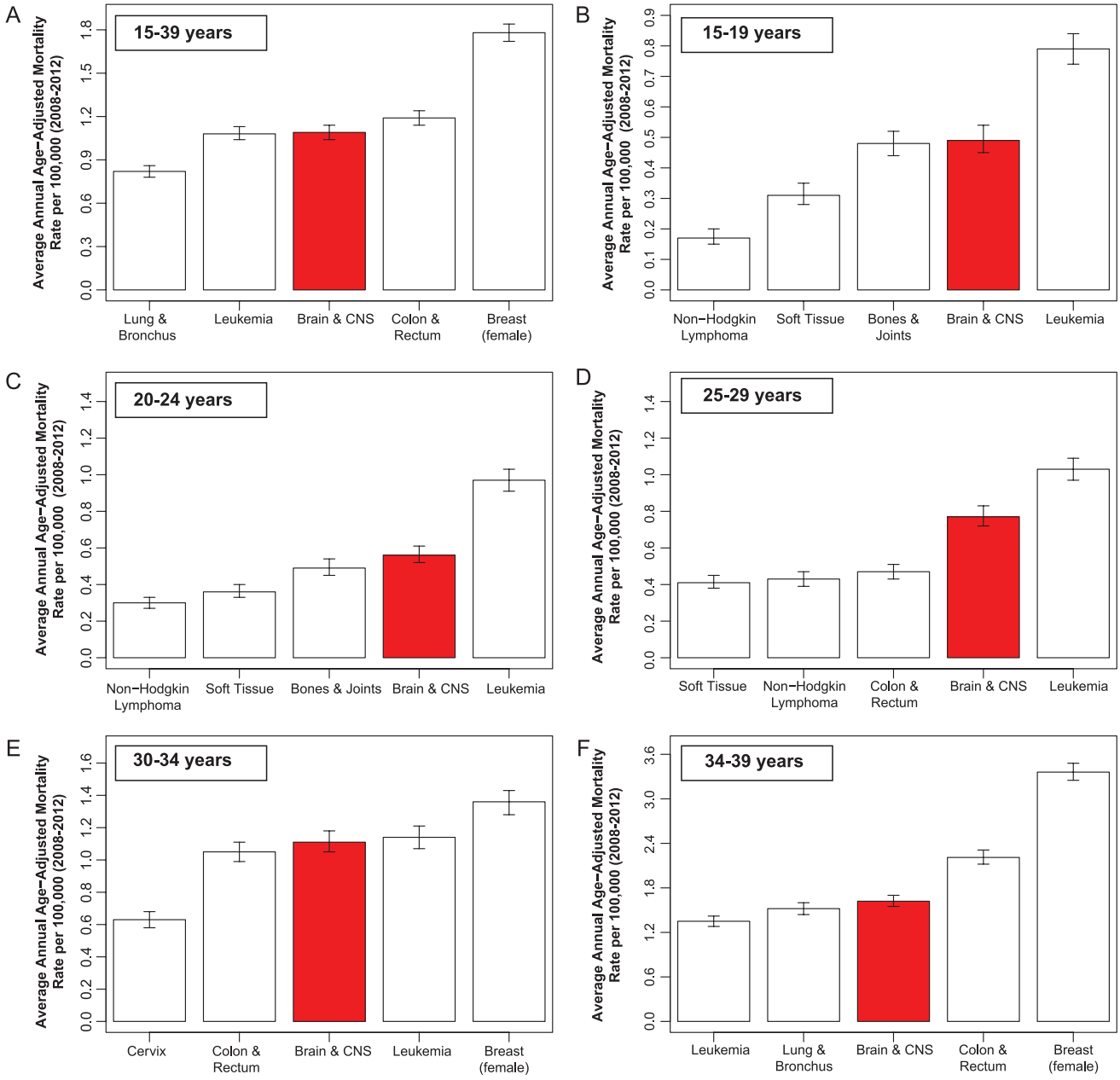


Fig. 2. Average Annual Age-Adjusted and Crude Mortality Rates for the Five Most Common Causes of Death Due to Cancer in Persons Age A) 15-39 Years, B) 15-19 Years, C) 20-24 Years, D) 25-29 Years, E) 30-34 Years, and F) 35-39 Years, (NVSS 2008-2012).

female population), thyroid (15.52 per 100,000 population), and testes (13.84 per 100,000 male population).

- Brain and CNS tumors are the third most commonly occurring cancer in those age 35-39 years (15.54 per 100,000 population), preceded by cancer of the breast (60.91 per 100,000 population), and thyroid (18.87 per 100,000 population).

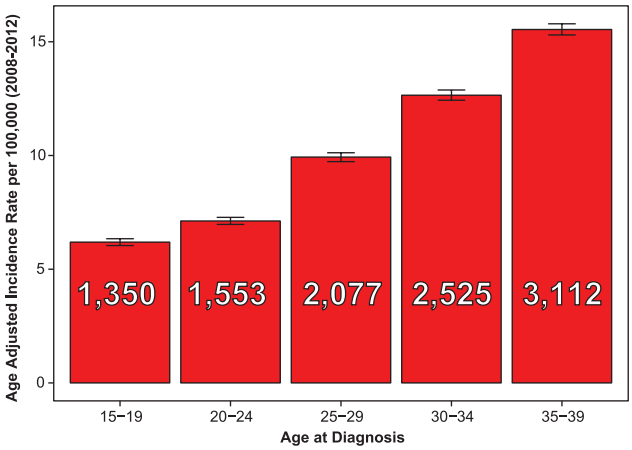
Average annual age-adjusted and crude mortality rates overall and by 5-year age groups for the five most common causes of cancer death in adolescents and young adults are showed in Figure 2A-F. Due to the high mortality caused by cancers with lower incidence, these cancers may be different than those displayed in incidence comparisons. Age ranges for mortality figures reflect age at death, as compared to incidence rates that reflect age at diagnosis. Time period between diagnosis and death can vary substantially by tumor type and by individual.

- Primary brain and CNS tumors are the third most common cause of cancer death in those age 15-39 years (1.09 per 100,000 population), with only breast cancer (1.78 per 100,000 female population) and colorectal cancer (1.19 per 100,000 population population) causing a higher rate of deaths.
- Primary brain and CNS tumors are the second most common cause of cancer death in persons age 15-19 years (0.49 per 100,000 population in age 15-19 years, 0.56 per 100,000 in

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

age 20-24 years, and 0.77 per 100,000 population in age 25-29 years), with only leukemia causing more deaths (0.79 per 100,000 in age 15-19 years, 0.97 per 100,000 population in age 20-24 years, and 1.03 per 100,000 population in age 25-29 years).

- Primary brain and CNS tumors are the third most common cause of cancer death in persons age 30-39 years (1.11 per 100,000 population in age 30-34 years, and 1.62 per 100,000 population in age 35-39 years). In those age 30-34 years, the more common causes of cancer death are leukemia (1.14 per 100,000 population) and breast cancer (1.36 per 100,000 population), while in those age 35-39 years the more common causes are due to colorectal cancer (2.21 per 100,000 population) and breast cancer (3.36 per 100,000 population).



a. Annual average cases were calculated by dividing the five year total by five.

Fig. 3. Average Annual Age-Adjusted Incidence Rates and Annual Average Cases[a] of Primary Brain and CNS Tumors by Age Groups (15-39 Years), (CBTRUS 2008-2012).

Overall Incidence by Age Group and Year of Diagnosis

Between 2008 and 2012, 53,083 primary brain and CNS tumors were diagnosed in adolescents and young adults (age 15-39 years) in the US, for a total annual age-adjusted incidence of 10.43 per 100,000 population (Table 3). Average annual age-adjusted incidence rates of primary brain and CNS tumors and total tumors occurring in the five year period covered in this report are shown in Figure 3 and Table 3.

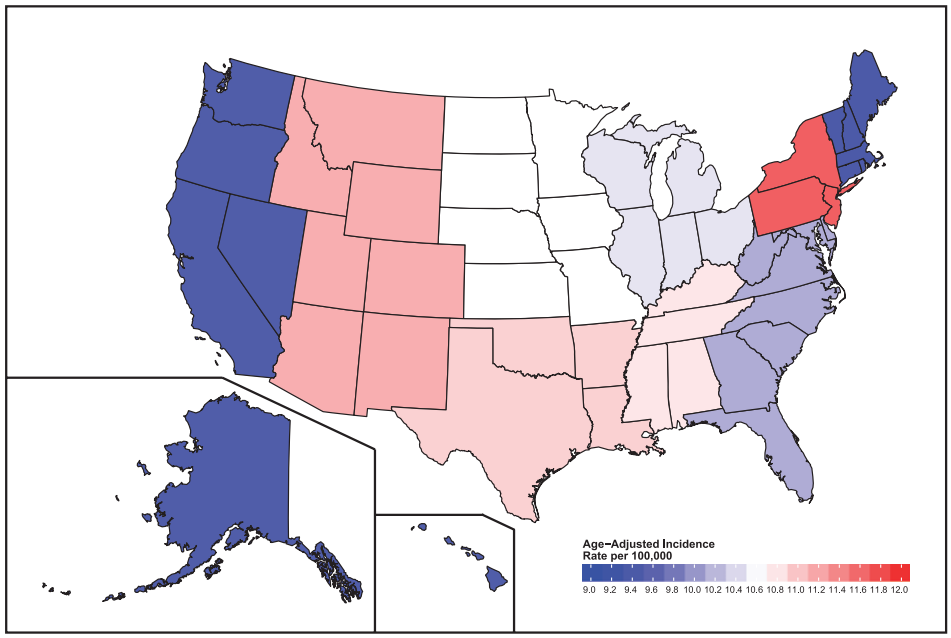
- Incidence of primary brain and CNS tumors increases with increasing age in those age 15-39 years.

Incidence by Region of the US

Incidence of primary brain and CNS tumors in adolescents and young adults (age 15-39 years) by region of the US is shown in Figure 4a. There are many factors that may affect cancer incidence between different geographic regions including cancer registration practices, and diagnostic practices in addition to true incidence differences. In particular, many central cancer registries vary in their collection of tumors diagnosed only radiographically where persons do not receive surgery, which may have a particularly significant effect on reporting incidence of non-malignant tumors.

- Incidence is lowest in New England (9.42 per 100,000 population) and Pacific (9.47 per 100,000 population) regions.
- Incidence is highest in Middle Atlantic (11.66 per 100,000 population) and Mountain (11.14 per 100,000 population) regions.

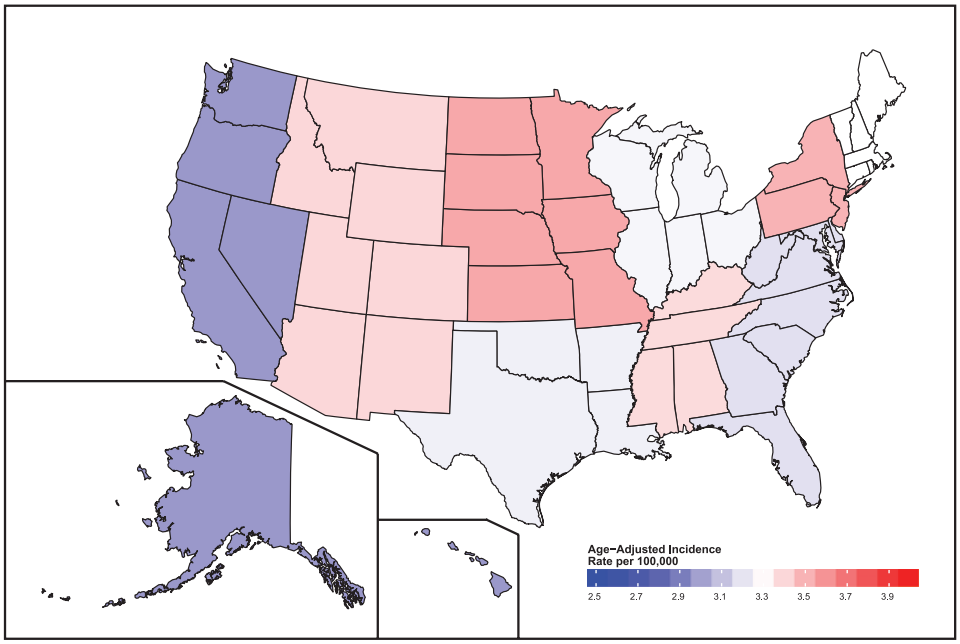
Incidence of malignant primary brain and CNS tumors in adolescents and young adults (age 15-39 years) by region of the US is shown in Figure 4b.



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
b. Data only available from 2008-2010 for Nevada.

Fig. 4a. Average Annual Age-Adjusted Incidence Rates of All Primary Brain and CNS Tumors by Region of the United States (Age 15-39 Years), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
b. Data only available from 2008-2010 for Nevada.

Fig. 4b. Average Annual Age-Adjusted Incidence Rates of All Malignant Brain and CNS Tumors by Region of the United States (Age 15-39 Years), (CBTRUS 2008-2012).

- Incidence is lowest in Pacific (2.98 per 100,000 population) and South Atlantic (3.19 per 100,000 population).
- Incidence is highest in West North Central (3.54 per 100,000 population) and Middle Atlantic (3.50 per 100,000 population) regions.

Incidence of non-malignant primary brain and CNS tumors in adolescents and young adults (age 15-39 years) by region of the US is shown in Figure 4c.

- Incidence is lowest in New England (6.14 per 100,000 population) and Pacific (6.49 per 100,000 population) regions.
- Incidence is highest in Mountain (7.74 per 100,000 population) and West South Central regions (7.70 per 100,000 population).

Distribution and Incidence by Site and Age Group

Distribution of **all** primary brain tumors (Table 2a) in adolescents and young adults (age 15-39 years) by site and age groups are shown in Figures 5 and 6

- In all AYA age groups, the largest proportion of tumors occurs in the pituitary gland and craniopharyngeal duct (31.8%).
- In persons age 25-39 years, tumors of the meninges are the second most common site of tumor occurrence and seem to increase with age (12.3% in age 25-29 years, 18.6% in age 30-34 years, and 25.2% in age 35-39 years).

Distribution of **malignant** primary brain tumors (Table 2b) in adolescents and young adults (age 15-39 years) by site and age groups are shown in Figure 7.

- Overall, the largest proportion of malignant tumors in those age 15-39 years occur in the frontal lobe (28.8%), followed by other brain (15.4%). Together, 50.2% of all malignant tumors occur in the frontal, temporal, parietal, and occipital lobes of the brain.
- In those age 15-19 years, tumors most commonly occur in the cerebellum (17.0%), followed by other brain (15.1%, see Table 1 for more details on what is included in the category other brain). In this group brain stem tumors make up 10.4% of tumors.
- Tumors of the frontal lobe are the most common in persons age 20-39 years.

Distribution of **non-malignant** primary brain tumors (Table 2c) by site and age groups in adolescents and young adults (age 15-39 years) are shown in Figures 9 and 10.

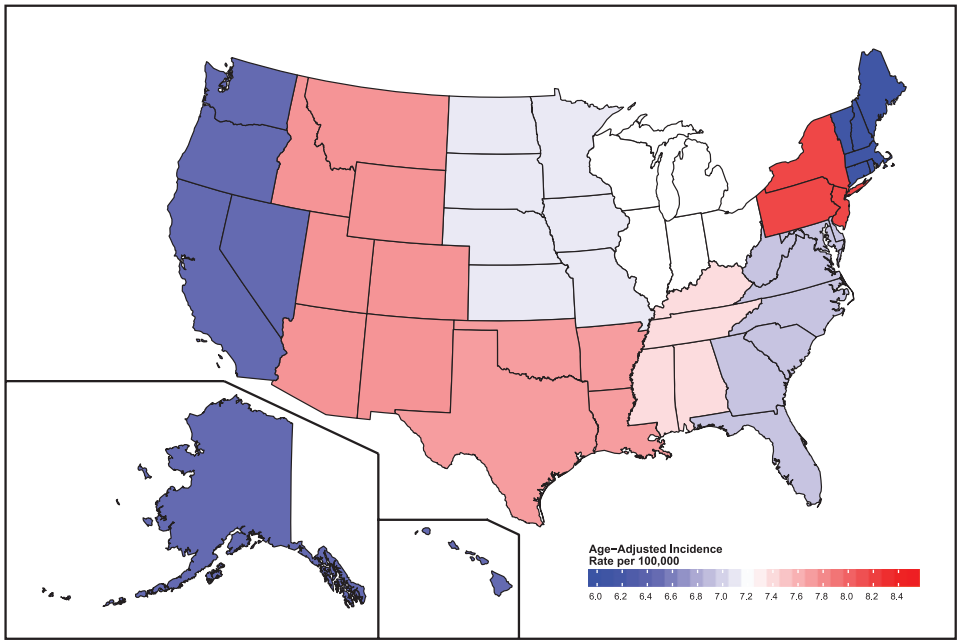
- Overall, the largest proportion of non-malignant tumors occurs in the pituitary gland and craniopharyngeal duct (46.1%).
- The incidence of tumors in the pituitary gland and craniopharyngeal duct decrease with age whereas incidence of those found in the meninges increase with age.

Distribution and Incidence by Histology and Age Group

Distribution of **all** primary brain tumors by histology and age groups in adolescents and young adults (age 15-39 years) are shown in Figures 11 and 12.

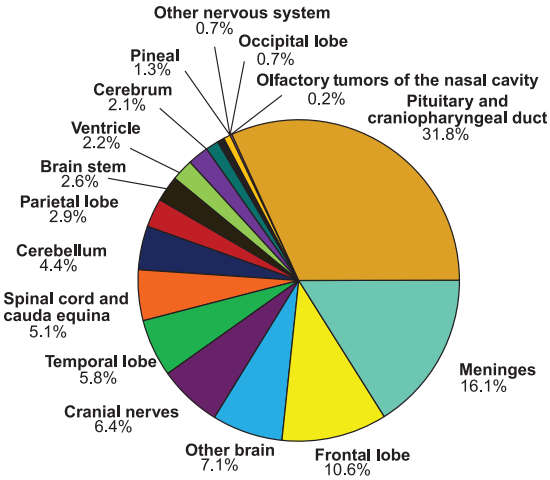
- The most common histologic category among all persons age 15-39 years are tumors of the pituitary (29.9%). These are also the most common tumor within each five-year age group.
- In those age 15-29 years, the second most common histology is astrocytomas (20.5% in those age 15-19 years,

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



a. Rates per 100,000 and age-adjusted to the 2000 United States standard population.
b. Data only available from 2008-2010 for Nevada.

Fig. 4c. Average Annual Age-Adjusted Incidence Rates of All Non-Malignant Brain and CNS Tumors by Region of the United States (Age 15-39 Years), (CBTRUS 2008-2012).



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

Fig. 5. Distribution[a] of All Primary Brain and CNS Tumors by Site, Age 15-39 Years (Five-Year Total = 53,083), (CBTRUS 2008-2012).

17.2% in those age 20-24 years, and 15.5% in those age 25-29 years). The percentage of tumors represented by astrocytomas decreases steadily with increasing age.

- In persons age 30-39 years, meningiomas are the second most common histology (18.4% in those age 30-34 years, and 25.1% in those age 35-39 years). The percentage of meningioma increases steadily with increasing age.

Distribution of **malignant** primary brain tumors by histology and age group in adolescents and young adults (age 15-39 years) are shown in Figures 13 and 14.

- The most common malignant histology in all persons age 15-39 years is astrocytoma, including pilocytic astrocytoma (47.6%), and this is also the most common malignant histology in all age groups.
- The second most common malignant histology in persons age 20-39 years is oligodendroglioma (12.3% in those age 25-29 years, 14.7% in those age 30-34 years, 14.5% in those age 35-39 years). Germ cell tumors are the second most common malignant histology in those age 15-19 years (9.6%)

Distribution of **non-malignant** primary brain tumors by histology and age groups in adolescents and young adults (age 15-39 years) are shown in Figures 15 and 16.

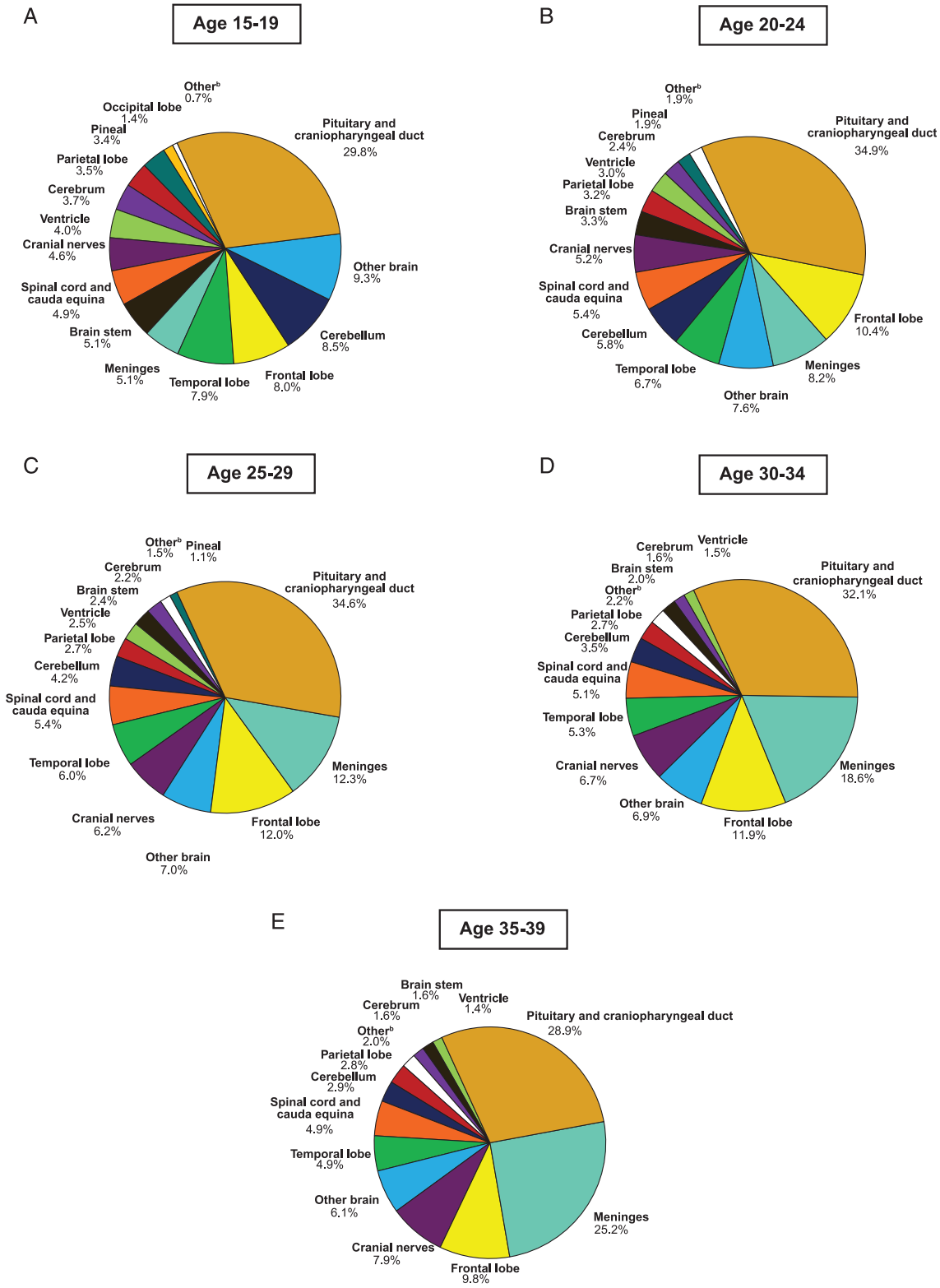
- The most common histology in all AYA age groups is tumors of the pituitary (43.7% of tumors in those age 15-39 years).
- In persons age 15-19 years, neuronal and mixed neuronal-glial tumors are the second most common histology, representing 12.5% of all non-malignant tumors.
- In those age 20-39 years, meningiomas are the second most common histology.

Distribution and Incidence of Gliomas by Site, Histologic Group and Age Group

Distribution of all gliomas by site and age group in adolescents and young adults (age 15-39 years) are shown in Figures 17 and 18.

- The frontal lobe is the most common site for gliomas in all age groups, and the majority of all gliomas occur in the frontal, occipital, parietal, and temporal lobes of the brain.

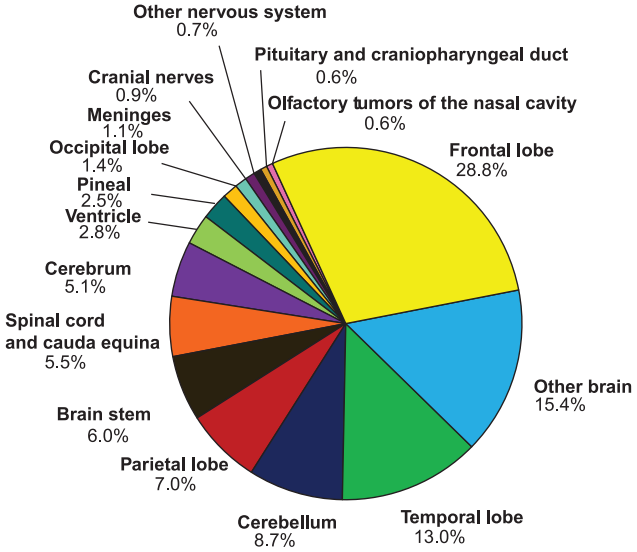
Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



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

Fig. 6. Distribution[a] of All Primary Brain and CNS Tumors by Site and Age Groups A) 15-19 Years (Five-Year Total = 6,747), B) 20-24 Years (Five-Year Total = 7,765), C) 25-29 Years (Five-Year Total = 10,385), D) 30-34 Years (Five-Year Total = 12,626), and E) 35-39 Years (Five-Year Total = 15,560), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



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

Fig. 7. Distribution[a] of Primary Malignant Brain and CNS Tumors by Site, Age 15-39 Years (Five-Year Total = 16,742), (CBTRUS 2008-2012).

- In the AYA population, those age 15-19 years have the highest proportion of brain stem gliomas, where these tumors represent 11.9% of all tumors. The proportion of gliomas occurring in the brain stem decreases with increasing age in AYA age groups.

Distribution of all gliomas by histology and age group in adolescents and young adults (age 15-39 years) are shown in Figures 19 and 20.

- Diffuse astrocytomas (16.1%) and glioblastoma (16.0%) are the most common glioma histologies in those age 15-39 years.
- In persons age 15-19 years, the most common glioma histology is pilocytic astrocytoma, which represents 27.9% of all gliomas in AYA, but decreases in all subsequent AYA age groups.
- In those age 35-39 years glioblastoma is the most common glioma histology, where it represents 23.6% of all gliomas. The proportion of glioblastoma among all gliomas increases with age in the AYA population.

Incidence by Gender and Age Groups

Average annual incidence rates overall and in adolescents and young adult age groups for males are shown in Table 4, and for females in Table 5.

- Overall, the incidence of primary brain and CNS tumors in females (12.24 per 100,000 population) is higher than those in males (8.64 per 100,000 population) in AYA.
- Incidence rates in persons age 15-19 years are only slightly higher in females (6.83 per 100,000 population) as compared to males (5.58 per 100,000 population), but the difference by gender increases with increasing age.

Incidence rate ratios (IRR) by gender (male:female) for selected histologies in adolescents and young adults (age 15-39 years) are shown in Figure 21.

- There are significant differences in incidence of multiple tumor types by gender in AYA.
- Males are diagnosed with germ cells tumors nearly four times as often as females (IRR: males:females = 3.8), and with lymphoma nearly two times as often (IRR: males:females = 1.7).
- Females are diagnosed with meningioma and tumors of the pituitary approximately 2.5 times as often as males (IRR: males:females = 0.4).

Incidence by Race and Ethnicity

Average annual incidence rates by race for adolescents and young adults (age 15-39 years) are shown in Table 6.

- Overall, AYA incidence is highest in Whites (10.68 per 100,000 population), followed by Blacks (9.42 per 100,000 population), and API (9.37 per 100,000 population). AIAN have the lowest incidence of all racial groups, with average annual age-adjusted incidence of 6.99 per 100,000.
- Incidence of tumors of neuroepithelial tissue is higher in whites than in any other racial group in AYA.
- Incidence of tumors of the meninges, tumors of the sellar region, and lymphomas and hematopoietic neoplasms are higher in Blacks in the AYA population.
- Incidence of tumors of the cranial and spinal nerves and germ cell tumors in AYA have the highest incidence in API.

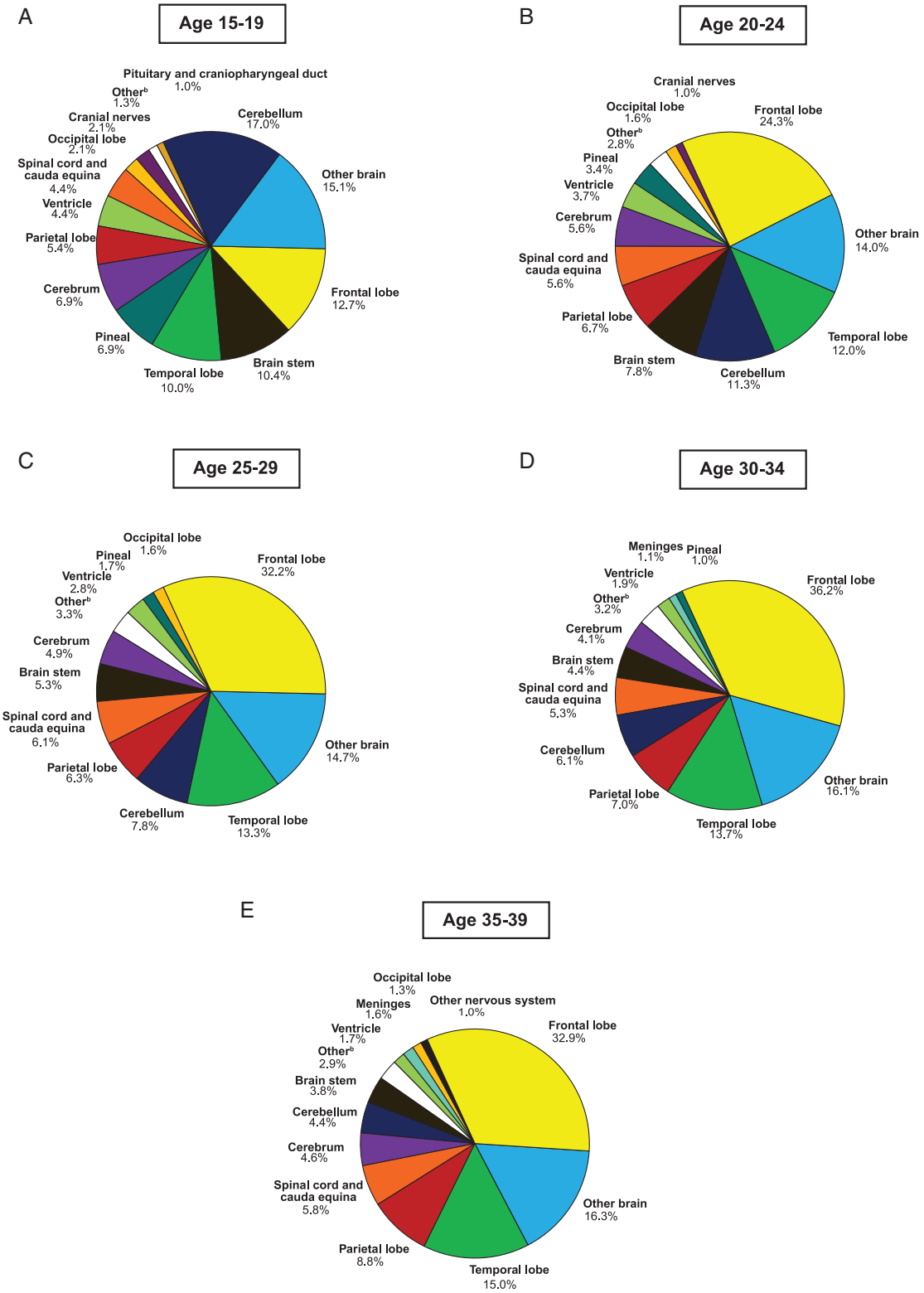
Incidence rate ratios (IRR) by race (White:Black) in adolescents and young adults (age 15-39 years) for selected histologies are shown in Figure 22.

- There are statistically significant differences in incidence by race in AYA for several histologies.
- Gliomas occur significantly more often in Whites than Blacks in adolescents and young adults.
- Oligodendroglioma are diagnosed approximately four times as often in Whites than in Blacks (IRR: Whites:Blacks = 3.7) in adolescents and young adults.
- Non-malignant meningiomas (IRR: Whites:Blacks = 0.9) and tumors of the pituitary (IRR: Whites:Blacks = 0.8) are slightly more common in Blacks, while lymphoma occurs approximately 2.5 times as frequently in Blacks (IRR: Whites:Blacks = 0.4).

Average annual incidence rates by Hispanic ethnicity in adolescents and young adults (age 15-39 years) AYA are shown in Table 7.

- The overall average annual age-adjusted incidence in non-Hispanics (10.86 per 100,000 population) is higher than that of Hispanics (8.70 per 100,000 population).
- Incidence of lymphomas and other hematopoietic neoplasms, as well as tumors of the sellar region are slightly more common among Hispanics.

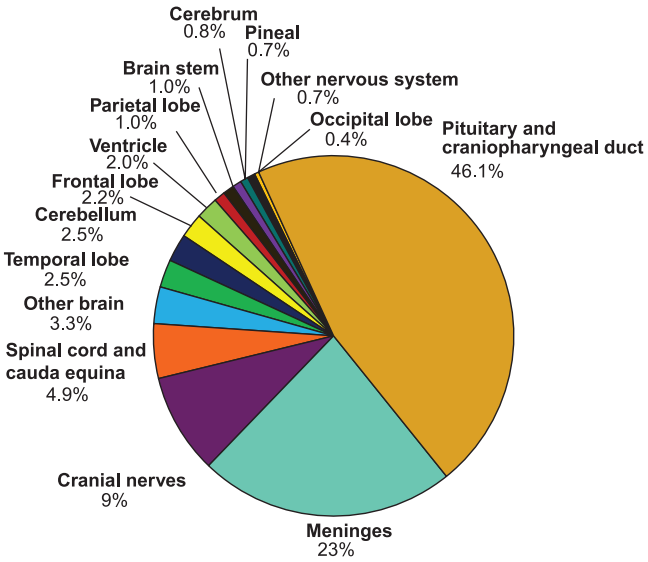
Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



a. Percentages may not add up to 100% due to rounding. b. Includes all sites with frequency of less than 1%

Fig. 8. Distribution[a] of Primary Malignant Brain and CNS Tumors by Site and Age Groups A) 15-19 Years (Five-Year Total = 2,747), B) 20-24 Years (Five-Year Total = 2,728), C) 25-29 Years (Five-Year Total = 3,421), D) 30-34 Years (Five-Year Total = 3,721), and E) 35-39 Years (Five-Year Total = 4,125), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



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

Fig. 9. Distribution[a] of Non-Malignant Primary Brain and CNS Tumors by Site, Age 15-39 Years (Five-Year Total = 36,341), (CBTRUS 2008-2012).

Incidence by Histologic Group and Behavior

Average annual age-adjusted incidence rates by histologic type and behavior in adolescents and young adults (age 15-39 years) are shown in Table 8. Incidence of non-malignant tumors (7.21 per 100,000 population) is higher than malignant tumors (3.26 per 100,000 population) in ages 15-39 years.

Number of Estimated New Cases for 2015 and 2016

Estimated number of new brain and CNS cases in adolescents and young adults (age 15-39 years for 2015 and 2016 by histologic type and behavior are shown in Table 9).

- It is estimated that there will be 2,200 cases of meningioma and 4,730 cases of tumors of the pituitary diagnosed in 2015 in AYA. Estimated cases for 2016 are 2,290 and 5,050, respectively.
- An estimated 3,870 tumors of neuroepithelial tissue will be diagnosed in 2015, and 3,930 in 2016 in AYA.

Mortality Rates by Age Groups, Sex, Race, Ethnicity and Region of the US

Mortality rates due to primary **malignant** brain and CNS tumors in adolescents and young adults (age 15-39 years) by age at death, sex, race and ethnicity are shown in Table 10.

- Overall, average annual age-adjusted mortality for AYA is 1.09 per 100,000 population. It is 0.49 per 100,000 population in those age 15-19 years, and 1.62 per 100,000 population in those age 35-39 years.
- Mortality is higher in males than females (1.34 per 100,000 population in males, and 0.84 per 100,000 population in females). This gap in mortality rate increases with increasing age.
- Mortality is highest in Whites as compared to other race groups. There is no substantial racial difference in mortality in those age 15-19 years, but this difference increases with increasing age.
- Mortality is higher in non-Hispanics as compared to Hispanics (1.18 per 100,000 population in non-Hispanics and 0.70 per 100,000 population in Hispanics).

Mortality rates in AYA due to primary **malignant** brain and CNS tumors in adolescents and young adults (age 15-39 years) by region of the US are shown in Figure 15.

- Mortality is highest in the West North Central (1.32 per 100,000 population) and East South Central (1.25 per 100,000 population).
- Mortality is lowest in the New England (0.90 per 100,000 population), Middle Atlantic, and South Atlantic (both 0.99 per 100,000 population) regions. Though mortality and incidence are inherently linked statistics, higher incidence (as in the case of the Middle Atlantic region) does not necessarily lead to higher mortality within the same age group. Age ranges for mortality figures reflect age at death, as compared to incidence rates that reflect age at diagnosis. Time period between diagnosis and death can vary substantially by tumor type, and by individual.

Incidence by Site and Gender

Average annual age-adjusted incidence rates in AYA by site and gender are shown in Table 11.

- The site with the highest incidence is the pituitary and craniopharyngeal duct (3.30 per 100,000 population) which is more common in females than males followed by the frontal, temporal, parietal, and occipital lobes of the brain (2.08 per 100,000 population) which is more common in males.
- The frontal, temporal, parietal, and occipital lobes are the site with the highest incidence in males (2.31 per 100,000 population).
- In females, pituitary and craniopharyngeal duct (4.72 per 100,000 population) and the cerebral and spinal meninges (2.51 per 100,000 population) are the sites with the highest incidence.

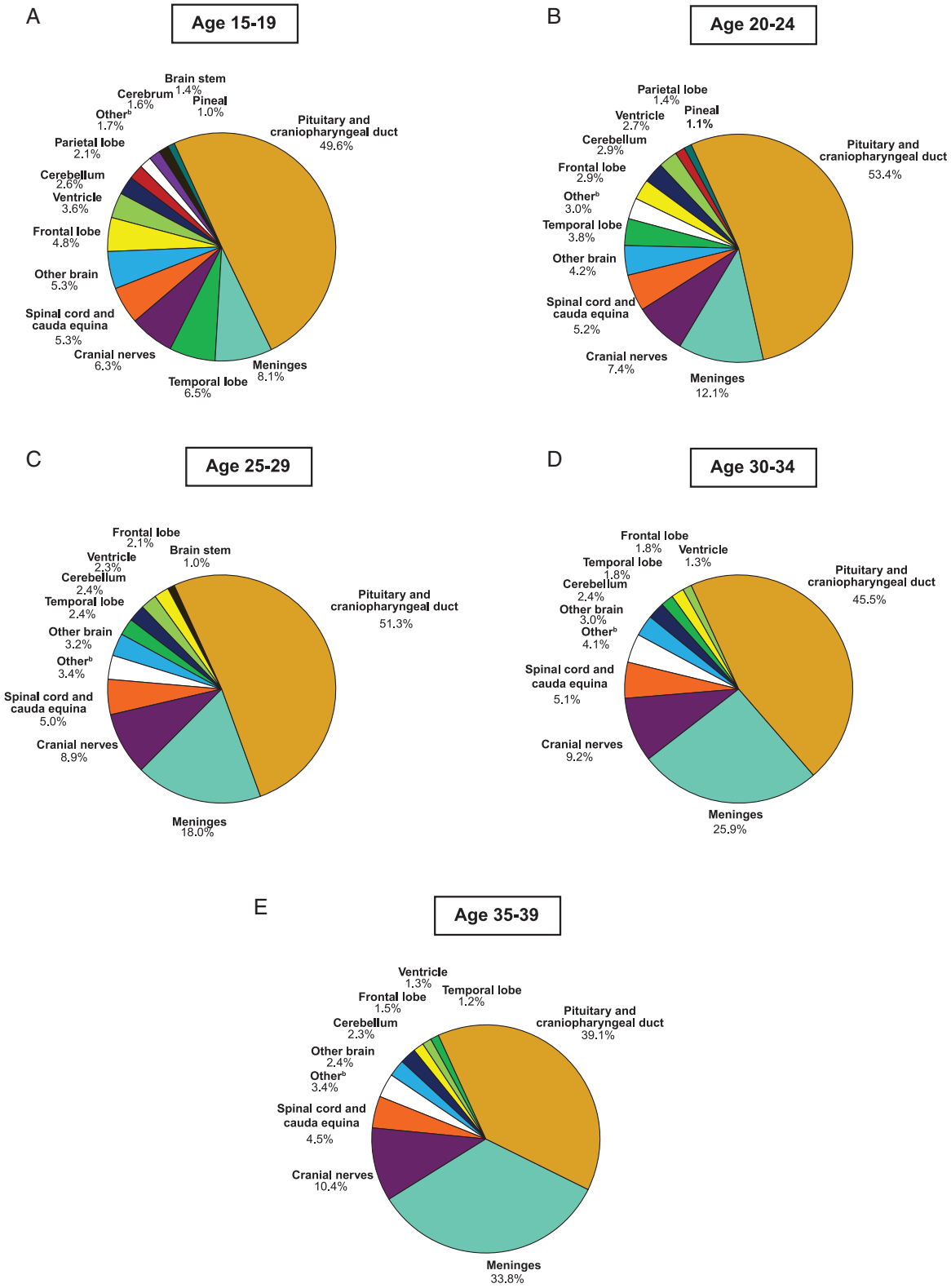
Relative Survival by Site and Year of Diagnosis

Relative survival rates for malignant tumors by site in AYA are presented in Table 12.

- Five-year relative survival is highest for tumors in the pituitary and craniopharyngeal duct (87.6%), and the cranial nerves (87.6%).
- Five-year relative survival is lowest for tumors in the Other nervous system (ICD-O-3 site codes C72.0-C72.9), (41.0%) and the cerebrum (ID-O-3 site code C71.0) (41.3%).

Relative survival rates for malignant tumors by site and 5-year groups in AYA are shown in Table 13. Relative survival rates have improved significantly over time for all sites.

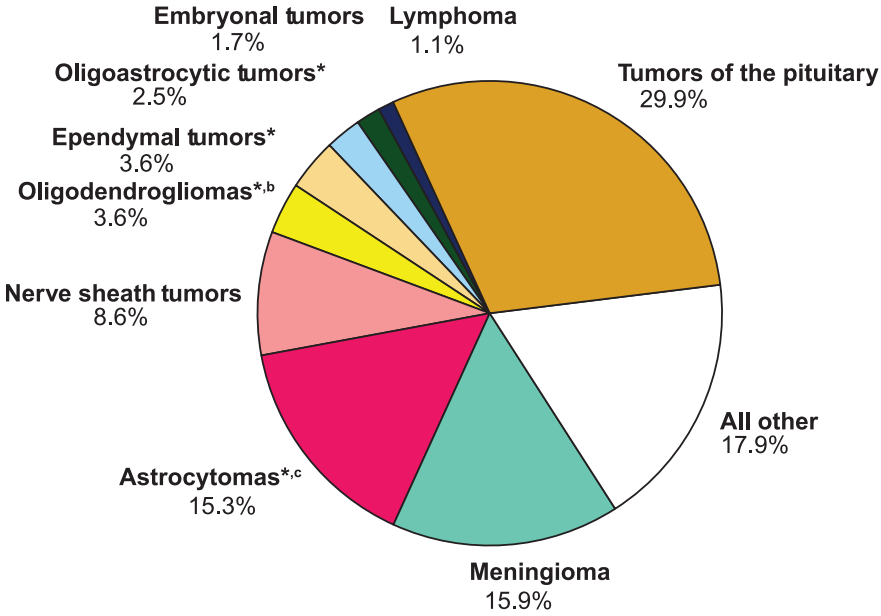
Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



a. Percentages may not add up to 100% due to rounding.
b. Includes all sites with frequency of less than 1%

Fig. 10. Distribution[a] of Non-Malignant Primary Brain and CNS Tumors by Site by Age Groups A) 15-19 Years (Five-Year Total = 4,000), B) 20-24 Years (Five-Year Total = 5,037), C) 25-29 Years (Five-Year Total = 6,964), D) 30-34 Years (Five-Year Total = 8,905), and E) 35-39 Years (Five-Year Total = 11,435), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2a).
a. Percentages may not add up to 100% due to rounding. b. Includes oligodendroglioma and anaplastic oligodendroglioma (Table 2a). c. Includes pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, glioblastoma, and unique astrocytoma variants (Table 2a).

Fig. 11. Distribution[a] of All Primary Brain and CNS Tumors by Histology, Age 15-39 Years (Five-Year Total = 53,083), (CBTRUS 2008-2012).

- Ten-year relative survival for tumors diagnosed supratentorially (frontal, temporal, occipital, or parietal lobes of the brain or the cerebrum) have increased from 25.5% in 1973-1977, to 52.0% in 2003-2007 in adolescents and young adults (age 15-39 years).
- Ten-year relative survival for tumors diagnosed in the brain stem have increased from 29.9% in 1978-1982 to 48.8% in 2003-2007 in AYA.

Relative Survival by Histologic Group and Year of Diagnosis

Relative survival rates in adolescents and young adults for **malignant** primary brain and CNS tumors histology are presented in Table 14.

- Five-year relative survival in AYA is highest for pilocytic astrocytoma (93.1%) and malignant ependymal tumors (89.8%).
- Five-year relative survival is poorest for glioblastoma (22.5%) and lymphoma (31.5%).

Relative survival rates in adolescents and young adults for **malignant** brain and CNS tumors by histology and 5-year groups are presented in Table 15.

- Overall, ten-year survival after diagnosis with a malignant brain and CNS tumor has risen from 36.3% in 1973-1977 to 57.6% in 2003-2007 in AYA.
- For many histologies, relative survival rates in AYA have not seen large improvements over time.

Relative Survival by Age Group and Histologic Group

Relative survival rates for adolescents and young adults (age 15-39 years) by histology and age group are shown in Table 16.

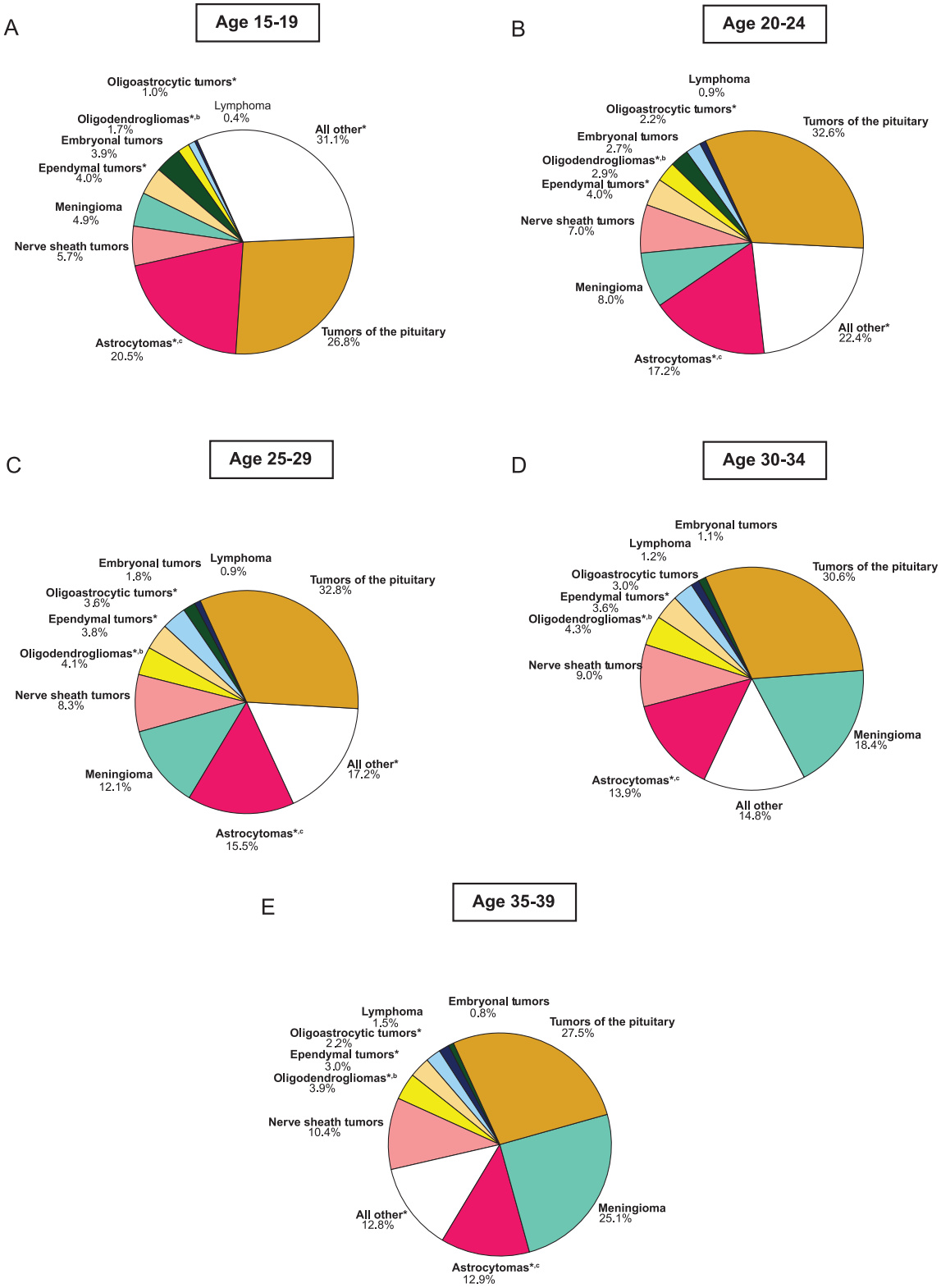
- Overall, persons age 15-19 years have the highest survival after diagnosis with a malignant brain tumor. Ten-year relative survival in this group is 73.5%, as compared to 44.1% in ages 35-39 years.
- A similar trend is seen in most histologies in AYA with the exception of anaplastic astrocytoma and glioblastoma in which there are few differences between age groups.

Relative Survival in Glioma by Age Groups, Sex, Race/Ethnicity and Insurance Status

Relative survival by sex, race/ethnicity, and insurance status in adolescents and young adults (age 15-39 years) is shown in Figures 24A–24D.

- Relative survival rates are highest in younger age groups in AYA and decrease with increasing age. This may be accentuated by the increased incidence of pilocytic astrocytomas in younger age groups, although malignant gliomas show a decrease in survival with increased age at diagnosis as well (Table 16).
- Females have higher relative survival rates than males in AYA.
- White non-Hispanics have the highest survival rates in AYA, although there are not notable differences by race/ethnicity.
- Persons with private insurance have the highest rates of relative survival. This is consistent with analyses done on survival in other cancer types,[36] and is likely due a combination of factors that may be associated with insurance status including: geographic access to care, type of health care facility utilized, differences in treatment pattern, and many factors of socioeconomic status.
- There is little difference between the relative survival rates of persons with no insurance versus persons with Medicaid in AYA. Previous studies have shown that many people enroll in

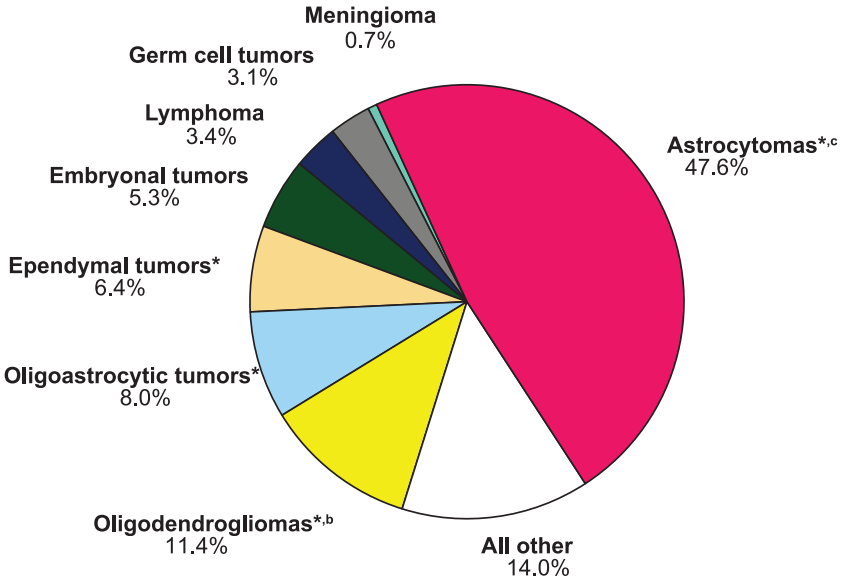
Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2a).
a. Percentages may not add up to 100% due to rounding. b. Includes oligodendroglioma and anaplastic oligodendroglioma (Table 2a). c. Includes pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, glioblastoma, and unique astrocytoma variants (Table 2a).

Fig. 12. Distribution[a] of All Primary Brain and CNS Tumors by Histology by Age Groups A) 15-19 Years (Five-Year Total = 6,747), B) 20-24 Years (Five-Year Total = 7,765), C) 25-29 Years (Five-Year Total = 10,385), D) 30-34 Years (Five-Year Total = 12,626), and E) 35-39 Years (Five-Year Total = 15,560), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2b).
a. Percentages may not add up to 100% due to rounding. b. Includes oligodendroglioma and anaplastic oligodendroglioma (Table 2b). c. Includes pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2b).

Fig. 13. Distribution[a] of Primary Malignant Brain and CNS Tumors by Histology, Age 15-39 Years (Five-Year Total = 16,742), (CBTRUS 2008-2012).

Medicaid after diagnosis with cancer, which may have been delayed due to prior lack of insurance coverage.[37,38] This is one potential explanation for the poorer outcomes seen in this group.

Five-Year Conditional Survival after Diagnosis by Selected Histologic Groups

Relative survival provides data on cancer prognosis that is useful at a population level, but these numbers may not be informative for individual patients. In the case of individuals that have already survived a year, or several years after diagnosis with their brain tumor, conditional survival estimates provide information about the likelihood that they will survive into the next period of time. Five-year conditional survival estimates by age group and selected histologies for adolescents and young adults are presented in Figure 25.

- Diagnosis at a younger age in AYA generally led to higher survival rates in all histologies.
- For a person age 15-19 years at the time of diagnosis with an astrocytoma, 76.5% survived five years. For those that have already survived two years, 91.0% will go on to survive five years.
- For a person age 35-39 years at the time of diagnosis with an astrocytoma, 43.3% survived five years from time of diagnosis. For those that have already survived two years, 68.9% will go on to survive five years.

Time Trends in Incidence of Primary Brain and CNS Tumors in Adolescents and Young Adults

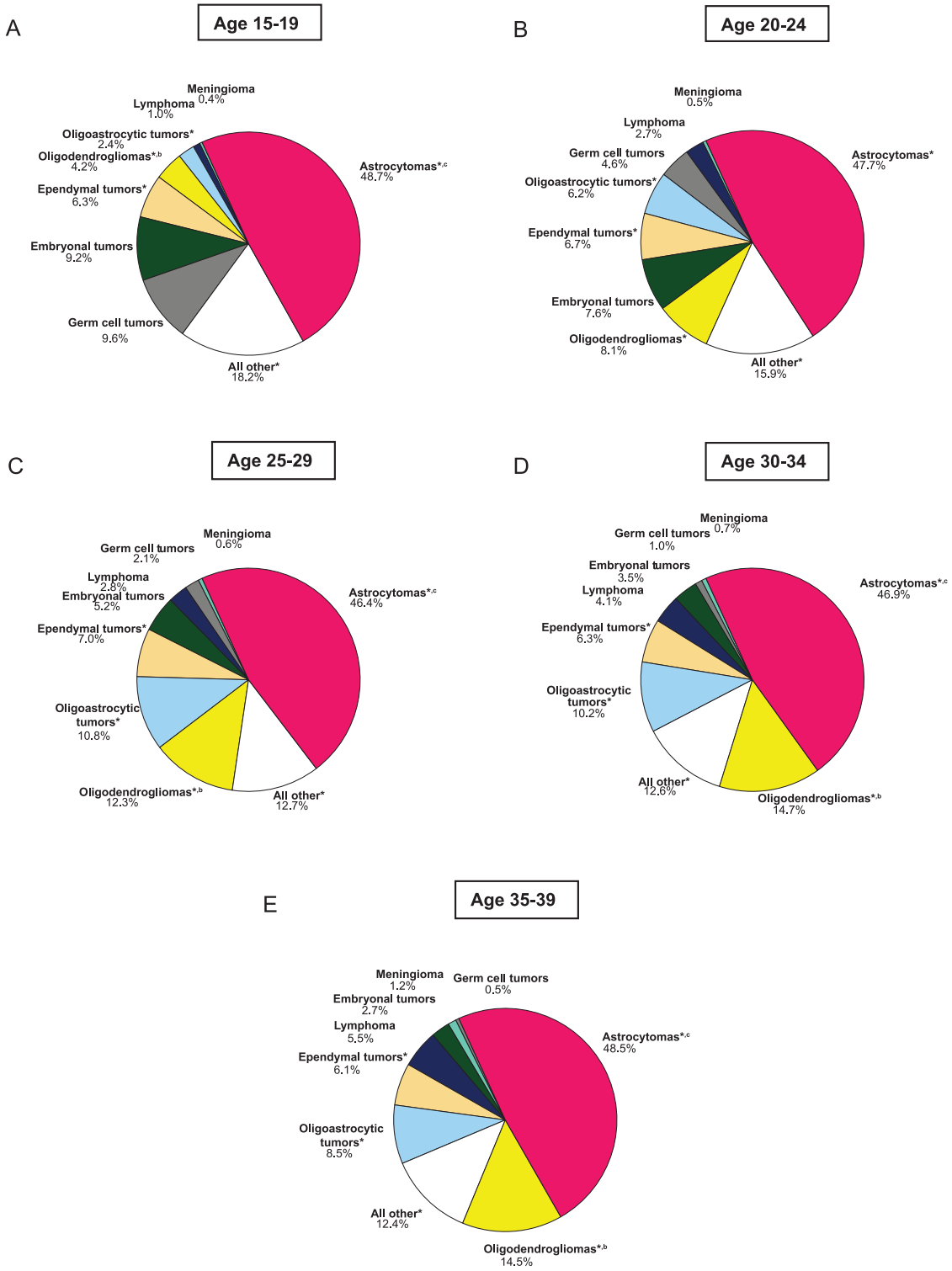
Time trends in cancer incidence rates are an important measure of the changing burden of cancer in a population over time. These time trends are provided for adolescents and young adults in Table 17. Collection of data on non-malignant brain and CNS tumors began in 2004, after the passage of the Benign Brain Tumor Act[39] in 2002. Previous analyses have suggested that increased incidence in the time period between 2004 and 2006 may be the result of the initiation of this collection rather than a 'true' increase in incidence.[40]

- Incidence of anaplastic astrocytoma in AYA has significantly increased from 2006-2012 (Annual Percent Change (APC) = 2.7).
- Incidence of oligodendroglioma (APC = −2.9) and anaplastic oligodendroglioma (APC = −4.1) in AYA has significantly decreased from 2004-2012.
- Incidence of tumors of the meninges in AYA has significantly increased from 2004-2012 (APC = 2.5), which is largely driven by the increase of meningioma incidence during that time (APC = 2.6).
- Incidence of lymphomas and hematopoietic neoplasms has significantly decreased from 2004-2012 (APC = −2.8) in AYA.
- Incidence of tumors of the sellar region in AYA has significantly increased from 2004-2008 (APC = 8.5), which is largely driven by the increase of tumors of the pituitary incidence from 2004-2009 (APC = 7.6).
- Incidence of unclassified tumors in AYA has significantly increased from 2004-2012 (APC = 5.5), which is largely driven by the increase of hemangioma incidence from 2004-2010 (APC = 18.8).

Descriptive Summary of Gliomas, Meningioma, and Tumors of the Pituitary in Adolescents and Young Adults.

The data in the *American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System*

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

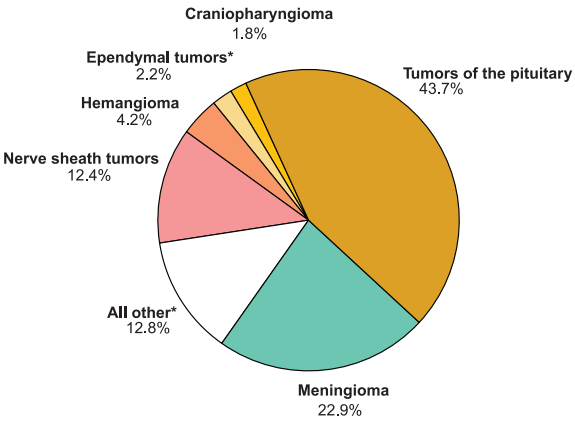


* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2b).
a. Percentages may not add up to 100% due to rounding. b. Includes oligodendroglioma and anaplastic oligodendroglioma (Table 2b). c. Includes pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, and unique astrocytoma variants (Table 2b).

Fig. 14. Distribution[a] of Primary Malignant Brain and CNS Tumors by Histology by Age Groups A) 15-19 Years (Five-Year Total = 2,747), B) 20-24 Years (Five-Year Total = 2,728), C) 25-29 Years (Five-Year Total = 3,421), D) 30-34 Years (Five-Year Total = 3,721), and E) 35-39 Years (Five-Year Total = 4,125), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Tumors Diagnosed in the US in 2008-2012 are synthesized to describe the most common malignant histology groupings in age 15-39 years: gliomas, meningiomas, and tumors of the pituitary.



* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2c).
a. Percentages may not add up to 100% due to rounding.

Fig. 15. Distribution[a] of Non-Malignant Primary Brain and CNS Tumors by Histology, Age 15-39 Years (Five-Year Total = 36,341), (CBTRUS 2008-2012).

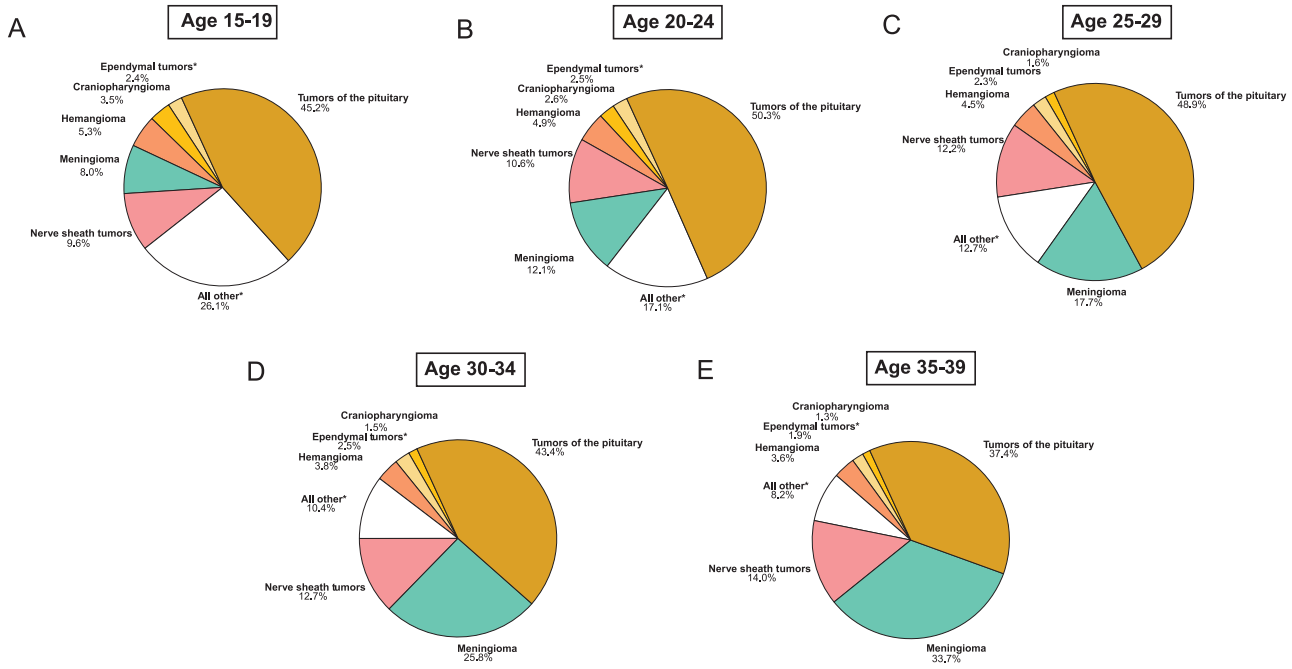
Descriptive Summary of Gliomas

The distribution of gliomas in adolescents and young adults by site and histology are shown in Figures 17–20.

- Gliomas represent approximately 28% of all tumors and 82% of malignant tumors in persons age 15-39 years.
- Overall, gliomas make up the largest percentage of brain and CNS tumors in those age 15-19 years (34.5%) and lowest in those age 35-39 years (24.0%).
- Gliomas make up the largest percentage of malignant brain and CNS tumors in those age 35-39 years (83.9%), and lowest in those age 15-19 years (74.4%).
- The majority of gliomas in AYA occur in the frontal lobe, temporal lobe, and other brain (see Table 1 for more details on what is included in the category other brain) combined (59.9%).
- Diffuse astrocytoma (16.1%) and glioblastoma (16.0%) account for the majority of gliomas in age 15-39 years.
- Relative survival rates decrease with increasing age, male sex, having AIAN race/ethnicity, and not having health insurance among age 15-39 years (Figure 24).

Descriptive Summary of Meningioma

- Meningioma is the second most frequently reported brain and CNS tumor histology, accounting for 15.9% of tumors overall in adolescents and young adults (age 15-39 years) (Figure 11).

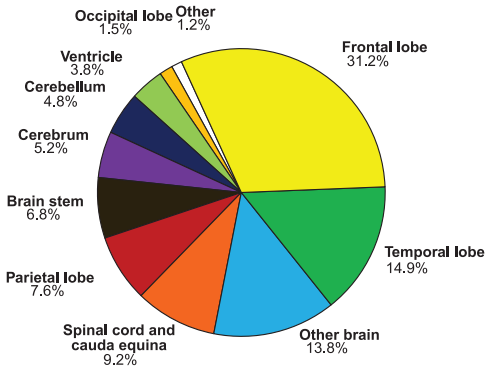


* All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460 (Table 2c)
a. Percentages may not add up to 100% due to rounding.

Fig. 16. Distribution[a] of Non-Malignant Primary Brain and CNS Tumors by Histology and Age Groups A) 15-19 Years (Five-Year Total = 4,000), B) 20-24 Years (Five-Year Total = 5,037), C) 25-29 Years (Five-Year Total = 6,964), D) 30-34 Years (Five-Year Total = 8,905), and E) 35-39 Years (Five-Year Total = 11,435), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

- Non-malignant meningiomas with ICD-O-3 behavior codes /0 (benign) or /1 (uncertain) account for 79.4% of meningiomas (Table 8) in AYA.
- Meningioma is most common in the 35-39 year age group, accounting for 25.1% of tumors, and least common in the 15-19 year age group, accounting for 4.9% of tumors (Figure 12).
- Non-malignant meningioma in AYA is 2.5 times more common in females as compared to males (Figure 21).
- Non-malignant meningioma is 1.1 times more common in Blacks as compared to Whites in AYA (Figure 22).



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

Fig. 17. Distribution[a] of Gliomas by Site, Age 15-39 Years (Five-Year Total = 15,002), (CBTRUS 2008-2012).

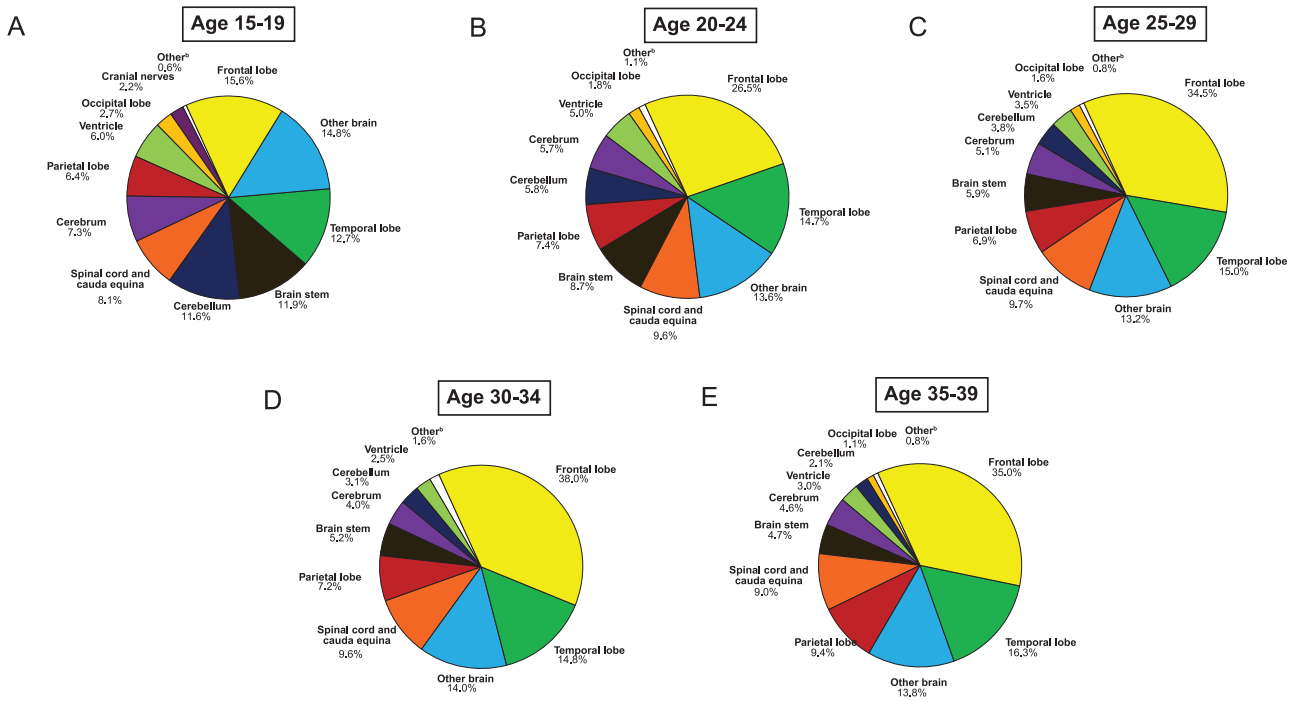
- Ten-year relative survival for malignant meningioma in AYA is 85.6% (Table 14).

Descriptive Summary of Tumors of the Pituitary

- Tumors of the pituitary are the most frequently reported tumors in adolescents and young adults (age 15-39 years), accounting for 29.9% of tumors overall (Figure 11).
- Non-malignant tumors of the pituitary with ICD-O-3 behavior codes /0 (benign) or /1 (uncertain) in AYA account for 79.8% of tumors of the pituitary (Table 8).
- Tumors of the pituitary are most common in the age group 25-29 years, accounting for 32.8% of tumors (Figure 12).
- Tumors of the pituitary are 2.5 times more common in females as compared to males in AYA (Figure 21).
- Tumors of the pituitary in AYA are 1.3 times more common in Blacks as compared to Whites (Figure 22).

Risk Factors for Primary Brain and CNS Tumors

Many environmental and behavioral risk factors have been investigated for brain and CNS tumors. The only well-validated factors are increased risk for these tumors (particularly meningiomas) with exposure to ionizing radiation[41] (the type of radiation generated by atomic bombs, therapeutic radiation treatment, CT scans, MRI scans, and X-rays) and decreased risk for these tumors (particularly glioma) in persons with history of allergy or other atopic disease [42] (including eczema, psoriasis, and asthma). Several recent review articles have further elaborated on the current state of risk factor research in primary brain and CNS tumors.[43–45]



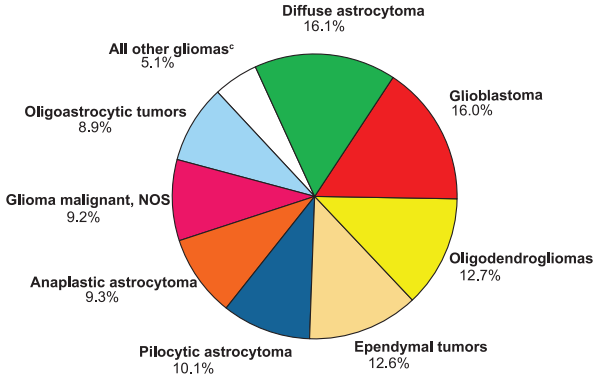
a. Percentages may not add up to 100% due to rounding. b. ICD-O-3 codes = 9380-9384,9391-9460.(Table 2a).

Fig. 18. Distribution[a] of Gliomas by Site and Age Groups A) 15-19 Years (Five-Year Total = 2,327), B) 20-24 Years (Five-Year Total = 2,381), C) 25-29 Years (Five-Year Total = 3,112), D) 30-34 Years (Five-Year Total = 3,454), and E) 35-39 Years (Five-Year Total = 3,728), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Strengths and Limitations

CBTRUS is the largest population-based registry focused exclusively on primary brain and CNS tumors in the US and covers 99.9% of the US population (for 2011-2012 only, data were available for 50 out of 51 registries). The *American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the US in 2008-2012* contains the most up-to-date population-based data on primary AYA brain tumor and CNS tumors available through the surveillance system in the US.



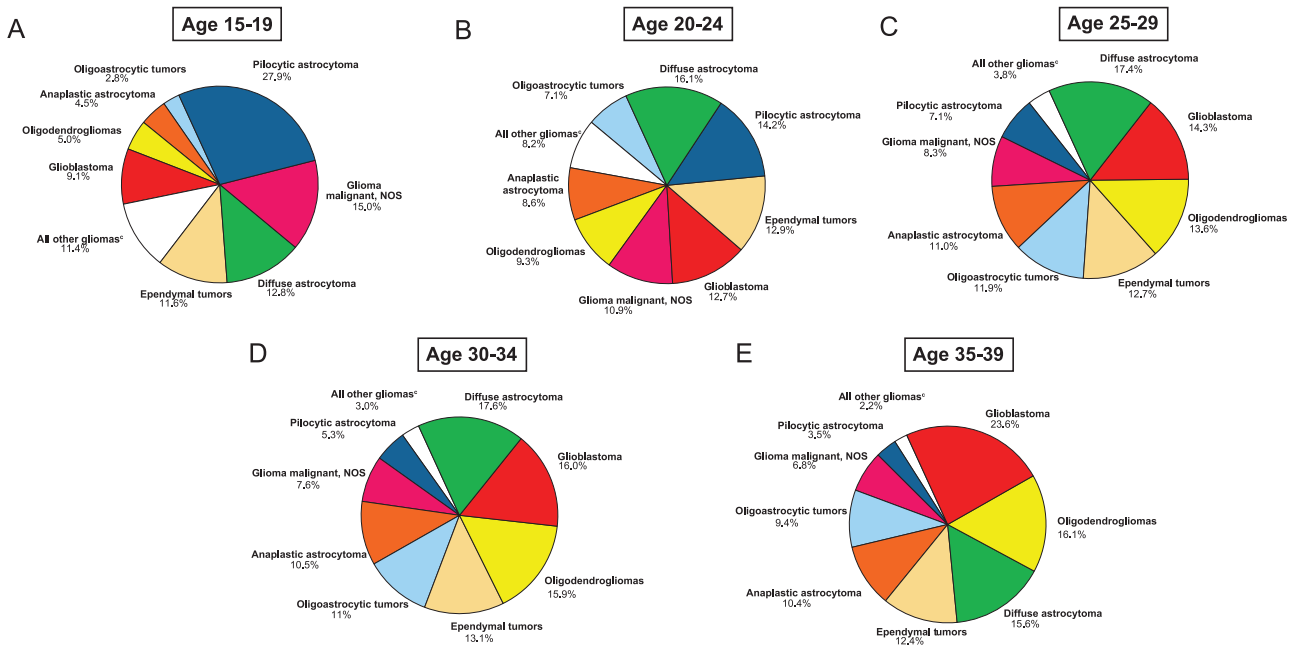
a. Percentages may not add up to 100% due to rounding.
b. ICD-O-3 codes = 9380-9384,9391-9460.(Table 2a).
c. Includes histologies from unique astrocytoma variants,other neuroepithelial tumors, and neuronal and mixed neuronal-glial tumors (Table 2a).

Fig. 19. Distribution[a] of Gliomas by Histology, Age 15-39 Years (Five-Year Total = 15,002), (CBTRUS 2008-2012).

Registration of individual cases is conducted by cancer registrars at the institution where diagnosis 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 the exception of cases from one registry from 2011-2012) with no duplicates.

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. As a result, histologies are reflective of the prevailing histologic criteria for a histology at the time of registration. 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.

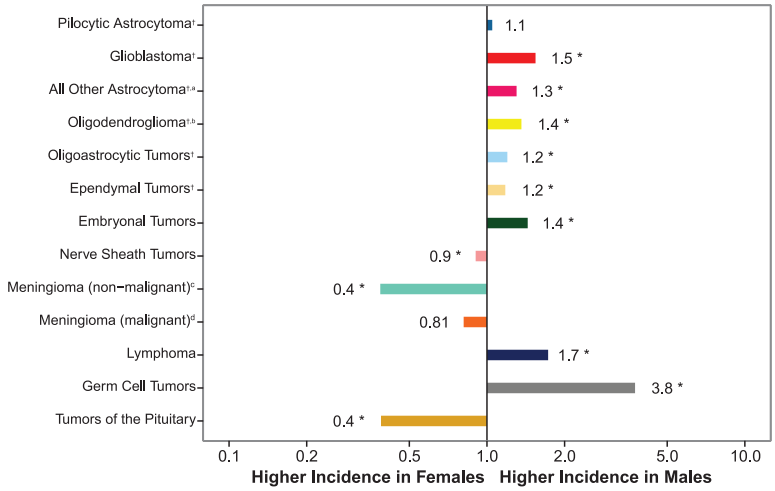
Currently, there is no system for the collection of survival and outcomes data from all geographic regions in the US via the cancer registry system. SEER registries are specifically funded to collect active follow-up on patients, and as a result have highly accurate survival data for patients who are diagnosed within the geographic regions covered by these registries. The SEER 18 population dataset used for the survival analyses is a



a. Percentages may not add up to 100% due to rounding.
b. ICD-O-3 codes = 9380-9384,9391-9460.(Table 2a).
c. Includes histologies from unique astrocytoma variants, other neuroepithelial tumors, and neuronal and mixed neuronal-glial tumors (Table 2a)

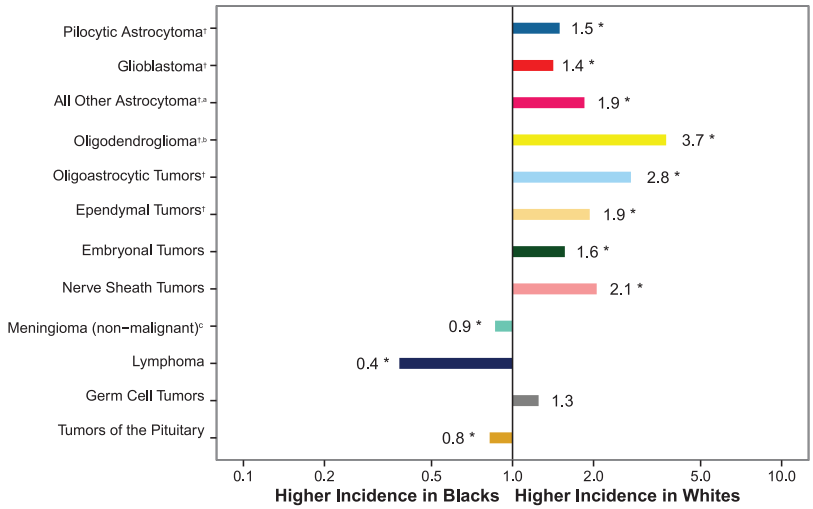
Fig. 20. Distribution[a] of Gliomas by Histology by Age Groups, A) 15-19 Years (Five-Year Total = 2,327), B) 20-24 Years (Five-Year Total = 2,381), C) 25-29 Years (Five-Year Total = 3,112), D) 30-34 Years (Five-Year Total = 3,454), and E) 35-39 Years (Five-Year Total = 3,728), (CBTRUS 2008-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



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

Fig. 21. Incidence Rate Ratios by Gender (Males:Females) in Adolescents and Young Adults Age 15-39 Years for Selected CBTRUS Histology Groupings and Histologies, (CBTRUS 2008-2012).



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

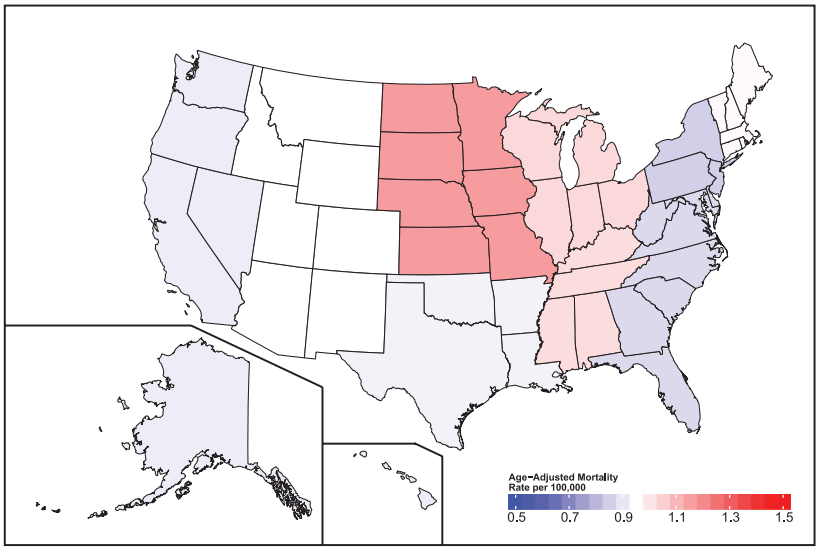
Fig. 22. Incidence Rate Ratios by Race (Whites:Blacks) in Adolescents and Young Adults Age 15-39 Years for Selected CBTRUS Histology Groupings and Histologies, (CBTRUS 2008-2012).

subset of the larger CBTRUS dataset used to generate incidence (99.9% of the US population)[11] and covers approximately 28% of the US population. 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.

Concluding Comment

The *American Brain Tumor Association Adolescent and Young Adult Primary Brain and Central Nervous System Tumors Diagnosed in the US in 2008-2012* comprehensively describes the current population-based incidence of primary malignant

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



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

Fig. 23. Average Annual Age-Adjusted Mortality Rates of All Malignant Brain and CNS Tumors by Region of the United States (Age 15-39 Years), (NVSS 2008-2012).

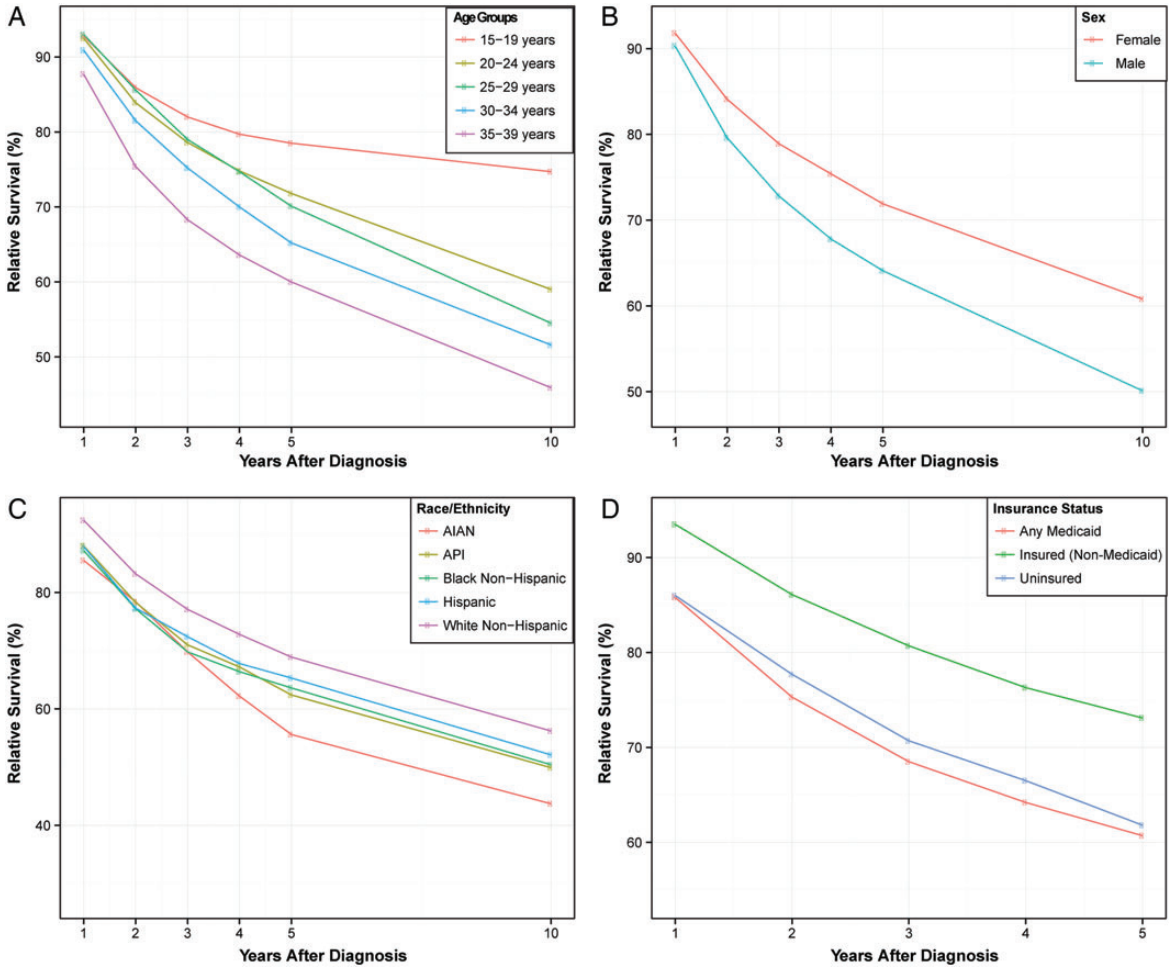
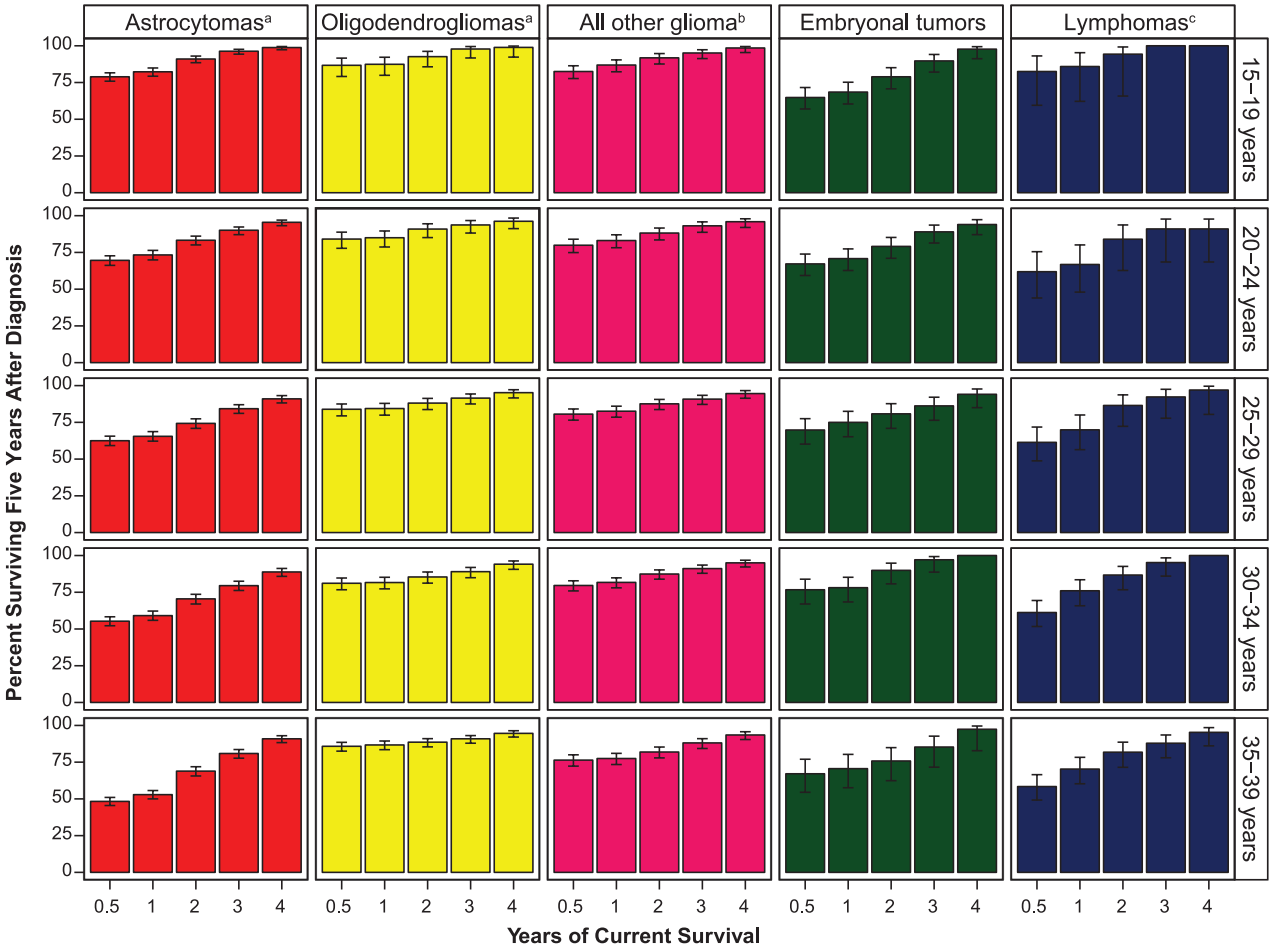


Fig. 24. Relative Survival For 1, 2, 3, 4, 5 and 10 Years after Diagnosis with a Glioma in Persons Age 15-39 Years by A) Age Groups, B) Sex, C) Race/Ethnicity, and D) Insurance Status (data available only from 2007-2012), (SEER 1995-2012).

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016



a. See Table 2d for details on the histologies included in this grouping.
b. Contains all glioma histologies not included in Astrocytomas or Oligodendrogliomas (Table 2d).
c. Includes survival information for CNS lymphomas only.

Fig. 25. Five-Year Conditional Survival by Age Groups and Histology Groupings (Age 15-39 Years), (SEER 1995-2012).

and non-malignant brain and other CNS tumors in adolescents and young adults age 15-39 years collected and reported by central cancer registries covering approximately 99.9% of the US population.

Despite the significant scientific developments that have occurred in treating cancer in recent years, brain tumors remain a significant source of cancer-related morbidity and mortality in adolescents and young adults. Brain tumor mortality has remained relatively stable, and mortality due to other cancers has not significantly improved. This report aims to provide a level of detail in a comprehensive report that allows for more accurate comparison of the incidence and survival of primary brain and CNS tumors affecting adolescents and young adults, to recognize the impact of these tumors on individuals belonging to this age group and on society overall, and to serve as a useful resource for patients and patient families, surveillance organizations, policy makers, advocates, industry, researchers and clinicians.

Abbreviations

AIAN – American Indian/Alaskan Native
APC – Annual percentage change
API – Asian/Pacific Islander
AYA – Adolescents and Young Adults
CBTRUS – Central Brain Tumor Registry of the United States
CDC – Centers for Disease Control and Prevention
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
NAACCR – North American Association of Central Cancer Registries
NCDB – National Cancer Data Base
NCHS – National Center for Health Statistics
NCI – National Cancer Institute
NOS – Not otherwise specified
NPCR – National Program of Cancer Registries
SEER – Surveillance, Epidemiology and End Results
US – United States
USCS – US Cancer Statistics
WHO – World Health Organization

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

References

1. Bleyer A, Barr R, Hayes-Lattin B, et al. The distinctive biology of cancer in adolescents and young adults. *Nat. Rev. Cancer*. Apr 2008;8(4):288–298.
2. Tricoli JV, Seibel NL, Blair DG, et al. Unique characteristics of adolescent and young adult acute lymphoblastic leukemia, breast cancer, and colon cancer. *J Natl Cancer Inst*. Apr 20 2011;103(8):628–635.
3. Ostrom QT, Gittleman H, Fulop J, et al. CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008–2012. *Neuro Oncol*. Oct 2015; 17(Suppl 4):iv1–iv62.
4. 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*. Jan 2015;16(Suppl 10): x1–x36.
5. Lewis DR, Seibel NL, Smith AW, Stedman MR. Adolescent and young adult cancer survival. *J. Natl. Cancer Inst. Monogr*. Nov 2014;2014(49):228–235.
6. Howlader N, NA, Krapcho M, Garshell J, Miller D, Altekruse SF, Kosary CL, Yu M, Ruhl J, Tatalovich Z, Mariotto A, Lewis DR, Chen HS, Feuer EJ, Cronin KA (eds). SEER Cancer Statistics Review, 1975–2012, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2012/, based on November 2014 SEER data submission, posted to the SEER web site, April 2015. 2015.
7. Centers for Disease Control and Prevention National Center for Health Statistics. United States Cancer Statistics: 1999–2012 Incidence, WONDER Online Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; 2015. Accessed at http://wonder.cdc.gov/cancer-v2012.html. http://wonder.cdc.gov/ucd-icd10.html.
8. Centers for Disease Control and Prevention National Center for Health Statistics. Underlying Cause of Death 1999–2013 on CDC WONDER Online Database, released 2015. Data are from the Multiple Cause of Death Files, 1999–2013, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. http://wonder.cdc.gov/ucd-icd10.html.
9. National Cancer Institute. Overview of the SEER Program. http://seer.cancer.gov/about/overview.html.
10. U.S. Cancer Statistics Working Group. United States Cancer Statistics: 1999–2012 Incidence and Mortality Web-based Report. 2015; www.cdc.gov/uscs.
11. Surveillance Research Program - National Cancer Institute. SEER . . . as a Research Resource. 2010; http://seer.cancer.gov/about/factsheets/SEER_Research_Brochure.pdf.
12. Surveillance Epidemiology and End Results (SEER) Program. Number of Persons by Race and Hispanic Ethnicity for SEER Participants (2010 Census Data). 2015.
13. Surveillance Epidemiology and End Results (SEER) Program. SEER*Stat Database: Populations - Total U.S. (1990–2013) - Linked To County Attributes - Total U.S., 1969–2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released December 2014. http://seer.cancer.gov/popdata/.
14. McCarthy BJ, Surawicz T, Bruner JM, et al. 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. International Agency for Research on Cancer. International Classification of Diseases for Oncology, 3rd Edition (ICD-O-3). 2000.
16. Louis DN, Ohgaki H, Wiestler OD, et al. The 2007 WHO classification of tumours of the central nervous system. *Acta Neuropathol*. Aug 2007;114(2):97–109.
17. Kleihues P, Burger PC, Scheithauer BW. Histological Classification of Tumours of the Central Nervous System. *Histological Typing of Tumours of the Central Nervous System*: Springer Berlin Heidelberg; 1993:5–10.
18. R Core Team. R: A language and environment for statistical computing. 2014; http://www.R-project.org/.
19. Surveillance Epidemiology and End Results (SEER) Program. SEER*Stat software version 8.2.1. 2014; www.seer.cancer.gov/seerstat.
20. 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.
21. 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.
22. 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.
23. Wickham H. ggplot2: elegant graphics for data analysis. 2009; http://had.co.nz/ggplot2/book.
24. Lemon J. Plotrix: a package in the red light district of R. *R-News*. 2006;6(4):8–12.
25. Luo J. SEER2R: reading and writing SEER*STAT data files. R package version 1.0. 2012; http://CRAN.R-project.org/package=SEER2R.
26. Tiwari RC, Clegg LX, Zou Z. Efficient interval estimation for age-adjusted cancer rates. *Statistical methods in medical research*. 2006;15(6):547–569. http://www.ncbi.nlm.nih.gov/pubmed/17260923.
27. 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.
28. Joinpoint Regression Program, Version 4.2.0 - April 2015; Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute.
29. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Statistics in medicine*. Feb 15 2000;19(3):335–351.
30. 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*. Feb 15 2012;118(4):1100–1109.
31. Surveillance Epidemiology and End Results (SEER) Program. SEER Cause of Death Recode 1969+. http://seer.cancer.gov/codrecode/1969+_d04162012/index.html.
32. Surveillance Epidemiology and End Results (SEER) Program. SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2014 Sub (1973–2012 varying) - Linked To County Attributes - Total U.S., 1969–2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released April 2015, based on the November 2014 submission.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

33. Surveillance Epidemiology and End Results (SEER) Program. DevCan database: "SEER 18 Incidence and Mortality, 2000–2011, with Kaposi Sarcoma and Mesothelioma". National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch, released August 2014, based on the November 2013 submission. Underlying mortality data provided by NCHS (www.cdc.gov/nchs).
34. Surveillance Epidemiology and End Results (SEER) Program. Cancer Survival Statistics: Cohort Definition Using Diagnosis Year. 2010; http://surveillance.cancer.gov/survival/cohort.html.
35. Kleihues P, Cavenee W. Tumours of the nervous system: World Health Organization classification of tumours. Lyon, France: IARC Press; 2000.
36. Niu X, Roche LM, Pawlish KS, Henry KA. Cancer survival disparities by health insurance status. *Cancer Med*. Jun 2013;2(3):403–411.
37. Bradley CJ, Gardiner J, Given CW, Roberts C. Cancer, Medicaid enrollment, and survival disparities. *Cancer*. Apr 15 2005;103(8): 1712–1718.
38. Rosenberg AR, Kroon L, Chen L, et al. Insurance status and risk of cancer mortality among adolescents and young adults. *Cancer*. Apr 15 2015;121(8):1279–1286.
39. Benign Brain Tumor Cancer Registries Amendment Act, 107th Cong. § 260 (2002). http://www.gpo.gov/fdsys/pkg/PLAW-107publ260/pdf/PLAW-107publ260.pdf.
40. 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*. Spring 2013;40(1):32–35.
41. Braganza MZ, Kitahara CM, Berrington de Gonzalez A, et al. Ionizing radiation and the risk of brain and central nervous system tumors: a systematic review. *Neuro Oncol*. Nov 2012; 14(11):1316–1324.
42. Turner MC. Epidemiology: allergy history, IgE, and cancer. Cancer Immunol. *Immunother*. Sep 2012;61(9):1493–1510.
43. Ostrom QT, Bauchet L, Davis F, et al. The epidemiology of glioma in adults: a "state of the science" review. *Neuro Oncol*. 2014;16(7): 896–913.
44. Johnson KJ, Cullen J, Barnholtz-Sloan JS, et al. Childhood Brain Tumor Epidemiology: A Brain Tumor Epidemiology Consortium Review. *Cancer Epidemiol Biomarkers Prev*. Sep 5 2014.
45. Wiemels J, Wrensch M, Claus EB. Epidemiology and etiology of meningioma. *Journal of neuro-oncology*. Sep 2010;99(3):307–314.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

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

Adolescent and Young Adult Report Major Site Grouping	Site	ICD-O-3[a] Site Code
Supratentorial	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, NOS	Ventricle	C71.5
Cerebellum	Cerebellum	C71.6
Brain Stem	Brain stem	C71.7
Other Brain	Other brain	C71.8-C71.9
	Overlapping lesion of brain	*C71.8*
	Brain, NOS	*C71.9*
Other Nervous System	Spinal cord and cauda equine	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.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

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

Histology	ICD-O-3[a] Histology Code[b]
Tumors of Neuroepithelial Tissue	
Pilocytic astrocytoma*	9421, *9425*[c]
Diffuse astrocytoma*	9400, 9410, 9411, 9420
Anaplastic astrocytoma*	9401
Unique astrocytoma variants*	9381, 9384, 9424
Glioblastoma*	9440, 9441, 9442/3[d]
Oligodendroglioma*	9450
Anaplastic oligodendroglioma*	9451, 9460
Oligoastrocytic tumors*	9382
Ependymal tumors*	9383, 9391, 9392, 9393, 9394
Glioma malignant, NOS*	9380, *9431*[c], *9432*[c]
Choroid plexus tumors	9390
Other neuroepithelial tumors*	9363, 9423, 9430, 9444
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, *9509*[c]
Tumors of the pineal region	9360, 9361, 9362, *9395*[c]
Embryonal tumors	8963, 9364, 9470, 9471, 9472, 9473, 9474, 9480, 9490, 9500, 9501, 9502, 9508
Tumors of Cranial and Spinal Nerves	
Nerve sheath tumors	9540, 9541, 9550, 9560, 9561, 9570, 9571
Other tumors of cranial and spinal nerves	9562
Tumors of Meninges	
Meningioma	9530, 9531, 9532, 9533, 9534, 9537, 9538, 9539
Mesenchymal tumors	8324, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8810, 8815, 8824, 8830, 8831, 8835, 8836, 8850, 8851, 8852, 8853, 8854, 8857, 8861, 8870 , 8880, 8890, 8897, 8900, 8901, 8902, 8910, 8912, 8920, 8921, 8935, 8990, 9040, 9136, 9150, 9170, 9180, 9210, 9241, 9260, 9373
Primary melanocytic lesions	8720, 8728, 8770, 8771
Other neoplasms related to the meninges	9161, 9220, 9231, 9240, 9243, 9370, 9371, 9372, 9535
Lymphomas and Hemopoietic Neoplasms	
Lymphoma	9590, 9591, 9596, 9650, 9651, 9652, 9653, 9654, 9655, 9659, 9661, 9662, 9663, 9664, 9665, 9667, 9670, 9671, 9673, 9675, 9680, 9684, 9687, 9690, 9691, 9695, 9698, 9699, 9701, 9702, 9705, 9714, 9719, 9728, 9729
Other hemopoietic neoplasms	9727, 9731, 9733, 9734, 9740, 9741, 9750, 9751, 9752, 9753, 9754, 9755, 9756, 9757, 9758, 9760, 9766, 9823, 9826, 9827, 9832, 9837, 9860, 9861, 9866, 9930, 9970
Germ Cell Tumors and Cysts	
Germ cell tumors, cysts and heterotopias	8020, 8440, 9060, 9061, 9064, 9065, 9070, 9071, 9072, 9080, 9081, 9082, 9083, 9084, 9085, 9100, 9101
Tumors of Sellar Region	
Tumors of the pituitary	8040, 8140, 8146, 8246, 8260, 8270, 8271, 8272, 8280, 8281, 8290, 8300, 8310, 8323, 9492 (Site C75.1 only), 9582
Craniopharyngioma	9350, 9351, 9352
Unclassified Tumors	
Hemangioma	9120, 9121, 9122, 9123, 9125, 9130, 9131, 9133, 9140
Neoplasm, unspecified	8000, 8001, 8002, 8003, 8004, 8005, 8010, 8021
All other	8320, 8452, 8710, 8711, 8713, 8811, 8840, 8896, 8980, 9173, 9503, 9580

[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]Histology not currently used to US cancer registration, will be included starting with diagnosis year 2015. See NAACCR website: http://www.naaccr.org/LinkClick.aspx?fileticket=4Hx-2XJJqFo%3d&tabid=161&mid=523.
[d]Morphology 9442/3 only.
[e]Morphology 9442/1 only.
*All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 2b. Central Brain Tumor Registry of the United States (CBTRUS), Brain and Central Nervous System Tumor Malignant Histologies[a]

Histology	ICD-O-3[b] Histology Code[c]
Tumors of Neuroepithelial Tissue	
Pilocytic astrocytoma*	9421/1 [Included with malignant tumors], *9425/3*[d]
Diffuse astrocytoma*	9400/3, 9410/3, 9411/3, 9420/3
Anaplastic astrocytoma*	9401/3
Unique astrocytoma variants*	9381/3, 9424/3
Glioblastoma*	9440/3, 9441/3, 9442/3
Oligodendroglioma*	9450/3
Anaplastic oligodendroglioma*	9451/3, 9460/3
Oligoastrocytic tumors*	9382/3
Ependymal tumors*	9391/3, *9392/3*[d], *9393/3*[d]
Glioma malignant, NOS*	9380/3
Choroid plexus tumors	9390/3
Other neuroepithelial tumors*	9423/3, 9430/3
Neuronal and mixed neuronal-glial tumors*	8680/3, 8693/3, 9505/3, 9522/3, 9523/3
Tumors of the pineal region	9362/3, *9395/3*[d]
Embryonal tumors	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
Tumors of Cranial and Spinal Nerves	
Nerve sheath tumors	9540/3, 9560/3, 9561/3, 9571/3
Tumors of Meninges	
Meningioma	9530/3, 9538/3, 9539/3
Mesenchymal tumors	8800/3, 8801/3, 8802/3, 8803/3, 8804/3, 8805/3, 8806/3, 8810/3, 8815/3, 8830/3, 850/3, 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
Primary melanocytic lesions	8720/3, 8728/3, 8770/3, 8771/3
Other neoplasms related to the meninges	9220/3, 9231/3, 9240/3, 9243/3, 9370/3, 9371/3, 9372/3
Lymphomas and Hemopoietic Neoplasms	
Lymphoma	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
Other hemopoietic neoplasms	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
Germ Cell Tumors and Cysts	
Germ cell tumors, cysts and heterotopias	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
Tumors of Sellar Region	
Tumors of the pituitary	8140/3, 8246/3, 8260/3, 8270/3, 8272/3, 8280/3, 8281/3, 8290/3, 8300/3, 8310/3, 8323/3
Unclassified Tumors	
Hemangioma	9120/3, 9130/3, 9133/3, 9140/3
Neoplasm, unspecified	8000/3, 8001/3, 8002/3, 8003/3, 8004/3, 8005/3, 8010/3, 8021/3
All other	8320/3, 8710/3, 8711/3, 8811/3, 8840/3, 8896/3, 8980/3, 9503/3, 9580/3

[a]Includes all the histologies listed in the standard definition of reportable brain tumors from the Consensus Conference on Brain Tumor Definitions.
[b]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[c]See the CBTRUS website for additional information about the specific histology codes included in each group: http://www.cbtrus.org.
[d]Histology not currently used to US cancer registration, will be included starting with diagnosis year 2015. See NAACCR website: http://www.naaccr.org/LinkClick.aspx?fileticket=4Hx-2XJJqFo%3d&tabid=161&mid=523.
*All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 2c. Central Brain Tumor Registry of the United States (CBTRUS), Brain and Central Nervous System Tumor Non-Malignant Histologies[a]

Histology	ICD-O-3[b] Histology Code[c]
Tumors of Neuroepithelial Tissue	
Unique astrocytoma variants*	9384/1
Ependymal tumors*	9383/1, 9394/1
Choroid plexus	9390/0,1
Other neuroepithelial tumors	9363/0, 9444/1
Neuronal and mixed neuronal- glial tumors*	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*[d]
Tumors of the pineal region	9360/1, 9361/1
Embryonal tumors	9490/0
Tumors of Cranial and Spinal Nerves	
Nerve sheath tumors	9540/0,1, 9541/0, 9550/0, 9560/0,1, 9570/0, 9571/0
Other tumors of cranial and spinal nerves	9562/0
Tumors of Meninges	
Meningioma	9530/0,1, 9531/0, 9532/0, 9533/0, 9534/0, 9537/0, 9538/1, 9539/1
Mesenchymal tumors	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	8728/0,1, 8770/0, 8771/0
Other neoplasms related to the meninges	9161/1, 9220/0,1, 9535/0
Lymphomas and Hemopoietic Neoplasms	
Other hemopoietic neoplasms	9740/1, 9751/1, 9752/1, 9753/1, 9766/1, 9970/1
Germ Cell Tumors and Cysts	
Germ cell tumors, cysts and heterotopias	8440/0, 9080/0,1, 9084/0
Tumors of Sellar Region	
Tumors of the pituitary	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	9350/1, 9351/1, 9352/1
Unclassified Tumors	
Hemangioma	9120/0, 9121/0, 9122/0, 9123/0, 9125/0, 9130/0,1, 9131/0, 9133/1
Neoplasm, unspecified	8000/0,1, 8001/0,1, 8005/0, 8010/0
All other	8452/1, 8711/0, 8713/0, 8811/0, 8840/0, 9173/0, 9580/0

[a]Includes all the histologies listed in the standard definition of reportable brain tumors from the *Consensus Conference on brain tumor definition*.
[b]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
[c]See the CBTRUS website for additional information about the specific histology codes included in each group: http://www.cbtrus.org.
[d]Histology not currently used to US cancer registration, will be included starting with diagnosis year 2015. See NAACCR website: http://www.naaccr.org/LinkClick.aspx?fileticket=4Hx-2XJJqFo%3d&tabid=161&mid=523.
*All or some of this histology is included in the CBTRUS definition of gliomas, including ICD-O-3 histology codes 9380-9384, 9391-9460.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 2d. ICD-O-3 Morphology Codes for all Histologies Included in Glioma[a] Major Histology Groupings, Central Brain Tumors Registry of the United States (CBTRUS), 2015

Adolescent and Young Adult Report Major Histology Groupings	CBTRUS Histology Groupings	ICD-O-3[b] Morphology Code	Histology Name	*Sub-histologies*
Astrocytomas	Pilocytic astrocytoma	9421/1	Pilocytic astrocytoma	*Piloid astrocytoma; Juvenile astrocytoma; Spongioblastoma, NOS*
		9425/3	Pilomyxoid astrocytoma	
	Diffuse astrocytoma	9400/3	Astrocytoma, NOS	*Astroglioma; Astrocytic glioma; Diffuse astrocytoma; Astrocytoma, low grade; Cystic astrocytoma; Diffuse astrocytoma, low grade*
		9410/3	Protoplasmic astrocytoma	
		9411/3	Gemistocytic astrocytoma	*Gemistocytoma*
		9420/3	Fibrillary astrocytoma	*Fibrous astrocytoma*
	Anaplastic astrocytoma	9401/3	Astrocytoma, anaplastic	
	Unique astrocytoma variants	9381/3	Gliomatosis cerebri	
		9384/1	Subependymal giant cell astrocytoma	
		9424/3	Pleomorphic xanthoastrocytoma	
	Glioblastoma	9440/3	Glioblastoma	*Glioblastoma multiforme; Spongioblastoma multiforme*
		9441/3	Giant cell glioblastoma	*Monstrocellular sarcoma*
		9442/3	Gliosarcoma	*Glioblastoma with sarcomatous component*
Oligodendrogliomas	Oligodendroglioma	9450/3	Oligodendroglioma, NOS	
	Anaplastic oligodendroglioma	9451/3	Oligodendroglioma, anaplastic	
		9460/3	Oligodendroblastoma	
Oligoastrocytoma	Oligoastrocytic tumors	9382/3	Mixed glioma	*Oligoastrocytoma; Anaplastic oligoastrocytoma*
Ependymal tumors	Ependymal tumors	9383/1	Subependymoma	*Subependymal glioma; Subependymal astrocytoma, NOS; Mixed subependymoma-ependymoma*
		9391/3	Ependymoma, NOS	*Epithelial ependymoma; Cellular ependymoma; Clear cell ependymoma; Tanycytic ependymoma*
		9392/3	Ependymoma, anaplastic	*Ependymoblastoma*
		9393/3	Papillary ependymoma	
		9394/1	Myxopapillary ependymoma	
Glioma malignant, NOS	Glioma malignant, NOS	9380/3	Glioma, malignant	*Glioma, NOS (except nasal glioma, not neoplastic)*
Other neuroepithelial tumors	Other neuroepithelial tumors	9423/3	Polar spongioblastoma	*Spongioblastoma polare; Primitive polar spongioblastoma*
		9430/3	Astroblastoma	
		9444/1	Chordoid glioma	*Chordoid glioma of third ventricle*
Neuronal and mixed neuronal-glial tumors	Neuronal and mixed neuronal-glial tumors	9412/1	Desmoplastic infantile astrocytoma	*Desmoplastic infantile ganglioglioma*
		9413/0	Dysembryoplastic neuroepithelial tumor	
		9442/1	Gliofibroma	

[a]ICD-O-3 histology codes: 9380-9384, 9391-9460.
[b]International Classification of Diseases for Oncology, 3rd Edition, 2000. World Health Organization, Geneva, Switzerland.
Abbreviations: CBTRUS, Central Brain Tumor Registry of the United States; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 3. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] for Brain and Central Nervous System Tumors in Adolescents and Young Adults Ages 15-39 Years Overall and by Major Histology Groupings, Histology, and Age Groups, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	15-39				15-19		20-24		25-29		30-34		35-39	
	5-year total	Annual average	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Tumors of Neuroepithelial Tissue	**17,776**	**3,555**	**3.44**	**(3.39-3.49)**	**2.83**	**(2.73-2.93)**	**2.75**	**(2.65-2.85)**	**3.49**	**(3.38-3.61)**	**3.91**	**(3.79-4.04)**	**4.14**	**(4.01-4.26)**
Pilocytic astrocytoma	1,519	304	0.28	(0.27-0.30)	0.60	(0.55-0.65)	0.31	(0.28-0.35)	0.21	(0.18-0.24)	0.18	(0.16-0.21)	0.13	(0.11-0.15)
Diffuse astrocytoma	2,413	483	0.47	(0.45-0.49)	0.27	(0.24-0.31)	0.35	(0.32-0.39)	0.52	(0.47-0.56)	0.61	(0.56-0.66)	0.58	(0.53-0.63)
Anaplastic astrocytoma	1,398	280	0.27	(0.26-0.29)	0.10	(0.08-0.12)	0.19	(0.16-0.21)	0.33	(0.29-0.36)	0.36	(0.32-0.40)	0.39	(0.35-0.43)
Unique astrocytoma variants	381	76	0.07	(0.06-0.08)	0.11	(0.09-0.13)	0.10	(0.09-0.13)	0.06	(0.05-0.08)	0.05	(0.04-0.06)	0.04	(0.02-0.05)
Glioblastoma	2,393	479	0.48	(0.46-0.50)	0.19	(0.17-0.22)	0.28	(0.25-0.31)	0.43	(0.39-0.47)	0.56	(0.51-0.61)	0.88	(0.82-0.94)
Oligodendroglioma	1,488	298	0.29	(0.28-0.31)	0.09	(0.07-0.11)	0.16	(0.14-0.19)	0.32	(0.28-0.35)	0.43	(0.39-0.47)	0.45	(0.41-0.49)
Anaplastic oligodendroglioma	420	84	0.08	(0.08-0.09)	0.02	(0.01-0.02)	0.04	(0.03-0.05)	0.09	(0.07-0.11)	0.12	(0.10-0.14)	0.15	(0.13-0.17)
Oligoastrocytic tumors	1,333	267	0.26	(0.25-0.28)	0.06	(0.05-0.08)	0.16	(0.13-0.18)	0.36	(0.32-0.39)	0.38	(0.34-0.42)	0.35	(0.31-0.39)
Ependymal tumors	1,888	378	0.37	(0.35-0.38)	0.25	(0.22-0.28)	0.28	(0.25-0.32)	0.38	(0.34-0.42)	0.45	(0.41-0.50)	0.46	(0.42-0.51)
Glioma malignant, NOS	1,384	277	0.26	(0.25-0.28)	0.32	(0.29-0.36)	0.24	(0.21-0.27)	0.25	(0.22-0.28)	0.26	(0.23-0.30)	0.25	(0.22-0.29)
Choroid plexus tumors	183	37	0.03	(0.03-0.04)	0.05	(0.04-0.06)	0.02	(0.01-0.03)	0.04	(0.03-0.05)	0.04	(0.03-0.05)	0.03	(0.02-0.05)
Other neuroepithelial tumors	30	–	0.01	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–
Neuronal and mixed neuronal-glial tumors	1,773	355	0.33	(0.32-0.35)	0.48	(0.44-0.53)	0.37	(0.33-0.41)	0.30	(0.27-0.34)	0.28	(0.25-0.32)	0.25	(0.22-0.28)
Tumors of the pineal region	258	52	0.05	(0.04-0.06)	0.05	(0.03-0.06)	0.05	(0.04-0.06)	0.05	(0.04-0.07)	0.05	(0.03-0.06)	0.05	(0.04-0.07)
Embryonal tumors	915	183	0.17	(0.16-0.18)	0.24	(0.21-0.27)	0.19	(0.17-0.22)	0.18	(0.15-0.20)	0.14	(0.12-0.16)	0.12	(0.10-0.14)
Tumors of Cranial and Spinal Nerves	**4,549**	**910**	**0.91**	**(0.88-0.94)**	**0.36**	**(0.32-0.39)**	**0.50**	**(0.46-0.54)**	**0.83**	**(0.77-0.88)**	**1.14**	**(1.08-1.21)**	**1.61**	**(1.54-1.69)**
Nerve sheath tumors	4,545	909	0.91	(0.88-0.93)	0.35	(0.32-0.39)	0.50	(0.46-0.54)	0.83	(0.77-0.88)	1.14	(1.08-1.21)	1.61	(1.53-1.69)
Other tumors of cranial and spinal nerves	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of Meninges	**9,707**	**1,941**	**1.98**	**(1.95-2.02)**	**0.45**	**(0.41-0.49)**	**0.76**	**(0.71-0.81)**	**1.43**	**(1.36-1.50)**	**2.65**	**(2.55-2.76)**	**4.25**	**(4.12-4.38)**
Meningioma	8,440	1,688	1.74	(1.70-1.77)	0.30	(0.27-0.34)	0.57	(0.53-0.62)	1.20	(1.14-1.27)	2.34	(2.24-2.43)	3.90	(3.78-4.03)
Mesenchymal tumors	336	67	0.07	(0.06-0.07)	0.05	(0.03-0.06)	0.05	(0.04-0.06)	0.04	(0.03-0.06)	0.09	(0.07-0.11)	0.10	(0.08-0.12)
Primary melanocytic lesions	22	–	0.00	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–
Other neoplasms related to the meninges	909	182	0.18	(0.17-0.19)	0.10	(0.08-0.12)	0.14	(0.12-0.16)	0.18	(0.15-0.21)	0.22	(0.20-0.26)	0.24	(0.21-0.27)
Lymphomas and Hematopoietic Neoplasms	**619**	**124**	**0.12**	**(0.11-0.13)**	**0.04**	**(0.03-0.05)**	**0.07**	**(0.06-0.09)**	**0.10**	**(0.08-0.12)**	**0.16**	**(0.14-0.19)**	**0.24**	**(0.21-0.27)**
Lymphoma	576	115	0.12	(0.11-0.13)	0.02	(0.02-0.04)	0.07	(0.05-0.08)	0.09	(0.07-0.11)	0.15	(0.13-0.18)	0.23	(0.20-0.26)
Other hematopoietic neoplasms	43	–	0.01	(0.01-0.01)	–	–	–	–	–	–	–	–	–	–
Germ Cell Tumors and Cysts	**656**	**131**	**0.12**	**(0.11-0.13)**	**0.27**	**(0.24-0.31)**	**0.14**	**(0.12-0.17)**	**0.09**	**(0.07-0.11)**	**0.06**	**(0.05-0.08)**	**0.05**	**(0.04-0.07)**
Germ cell tumors, cysts and heterotopias	656	131	0.12	(0.11-0.13)	0.27	(0.24-0.31)	0.14	(0.12-0.17)	0.09	(0.07-0.11)	0.06	(0.05-0.08)	0.05	(0.04-0.07)
Tumors of Sellar Region	**16,559**	**3,312**	**3.23**	**(3.18-3.28)**	**1.79**	**(1.71-1.87)**	**2.44**	**(2.35-2.54)**	**3.36**	**(3.25-3.47)**	**4.00**	**(3.88-4.13)**	**4.43**	**(4.30-4.56)**
Tumors of the pituitary	15,892	3,178	3.10	(3.05-3.15)	1.66	(1.58-1.73)	2.32	(2.24-2.42)	3.25	(3.14-3.36)	3.87	(3.75-3.99)	4.27	(4.15-4.40)
Craniopharyngioma	667	133	0.13	(0.12-0.14)	0.13	(0.11-0.15)	0.12	(0.10-0.14)	0.11	(0.09-0.13)	0.13	(0.11-0.16)	0.15	(0.13-0.18)
Unclassified Tumors	**3,217**	**643**	**0.63**	**(0.60-0.65)**	**0.46**	**(0.42-0.50)**	**0.46**	**(0.42-0.50)**	**0.63**	**(0.58-0.68)**	**0.72**	**(0.67-0.77)**	**0.83**	**(0.77-0.89)**
Hemangioma	1,538	308	0.30	(0.29-0.32)	0.20	(0.17-0.23)	0.23	(0.20-0.26)	0.31	(0.27-0.34)	0.34	(0.31-0.38)	0.41	(0.37-0.46)
Neoplasm, unspecified	1,667	333	0.32	(0.31-0.34)	0.26	(0.23-0.29)	0.23	(0.20-0.26)	0.32	(0.29-0.36)	0.37	(0.33-0.41)	0.42	(0.38-0.46)
All other	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL[c]	**53,083**	**10,617**	**10.43**	**(10.34-10.52)**	**6.19**	**(6.04-6.34)**	**7.12**	**(6.97-7.28)**	**9.93**	**(9.73-10.12)**	**12.65**	**(12.43-12.88)**	**15.54**	**(15.3-15.79)**

[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. Suppressed cases are included in the total count.
Abbreviations: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 4. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] for Brain and Central Nervous System Tumors in Males Age 15-39 Years by Major Histology Groupings, Histology, and Age Groupings, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	15-39 (Male)				15-19 (Male)		20-24 (Male)		25-29 (Male)		30-34 (Male)		35-39 (Male)	
	5-year total	Annual average	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Tumors of Neuroepithelial Tissue	**9,850**	**1,970**	**3.78**	**(3.71-3.86)**	**3.01**	**(2.87-3.16)**	**2.94**	**(2.80-3.09)**	**3.76**	**(3.60-3.93)**	**4.35**	**(4.17-4.54)**	**4.73**	**(4.54-4.93)**
Pilocytic astrocytoma	792	158	0.29	(0.27-0.31)	0.61	(0.55-0.68)	0.33	(0.29-0.38)	0.20	(0.17-0.24)	0.18	(0.14-0.22)	0.13	(0.10-0.17)
Diffuse astrocytoma	1,373	275	0.53	(0.50-0.56)	0.27	(0.23-0.32)	0.41	(0.36-0.47)	0.58	(0.52-0.65)	0.70	(0.63-0.78)	0.67	(0.60-0.74)
Anaplastic astrocytoma	813	163	0.32	(0.29-0.34)	0.11	(0.08-0.14)	0.21	(0.18-0.26)	0.35	(0.30-0.41)	0.46	(0.40-0.52)	0.44	(0.38-0.50)
Unique astrocytoma variants	200	40	0.07	(0.06-0.08)	0.12	(0.10-0.16)	0.09	(0.07-0.12)	0.07	(0.05-0.10)	0.04	(0.02-0.06)	0.04	(0.03-0.06)
Glioblastoma	1,458	292	0.58	(0.55-0.61)	0.22	(0.18-0.26)	0.31	(0.27-0.36)	0.52	(0.46-0.59)	0.70	(0.63-0.77)	1.08	(0.99-1.17)
Oligodendroglioma	859	172	0.34	(0.31-0.36)	0.10	(0.08-0.13)	0.16	(0.13-0.20)	0.38	(0.33-0.44)	0.51	(0.44-0.57)	0.52	(0.45-0.58)
Anaplastic oligodendroglioma	248	50	0.10	(0.09-0.11)	–	–	0.06	(0.04-0.08)	0.11	(0.08-0.14)	0.13	(0.10-0.17)	0.17	(0.14-0.21)
Oligoastrocytic tumors	732	146	0.28	(0.26-0.31)	0.05	(0.04-0.08)	0.15	(0.12-0.19)	0.40	(0.35-0.46)	0.44	(0.38-0.50)	0.38	(0.33-0.44)
Ependymal tumors	1,025	205	0.40	(0.37-0.42)	0.27	(0.23-0.32)	0.31	(0.27-0.36)	0.38	(0.33-0.44)	0.46	(0.40-0.52)	0.54	(0.48-0.61)
Glioma malignant, NOS	717	143	0.27	(0.25-0.29)	0.33	(0.29-0.39)	0.25	(0.21-0.29)	0.23	(0.19-0.27)	0.27	(0.23-0.32)	0.28	(0.23-0.33)
Choroid plexus tumors	87	17	0.03	(0.03-0.04)	0.05	(0.03-0.07)	–	–	0.04	(0.02-0.06)	–	–	–	–
Other neuroepithelial tumors	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Neuronal and mixed neuronal-glial tumors	898	180	0.33	(0.31-0.36)	0.52	(0.46-0.58)	0.39	(0.34-0.45)	0.26	(0.22-0.31)	0.24	(0.20-0.29)	0.27	(0.23-0.32)
Tumors of the pineal region	98	20	0.04	(0.03-0.05)	0.04	(0.02-0.06)	0.04	(0.02-0.06)	0.04	(0.02-0.06)	0.03	(0.02-0.05)	0.04	(0.03-0.07)
Embryonal tumors	543	109	0.20	(0.18-0.22)	0.31	(0.26-0.36)	0.20	(0.17-0.25)	0.19	(0.16-0.23)	0.16	(0.13-0.20)	0.15	(0.12-0.19)
Tumors of Cranial and Spinal Nerves	**2,167**	**433**	**0.86**	**(0.83-0.90)**	**0.33**	**(0.28-0.38)**	**0.46**	**(0.41-0.52)**	**0.75**	**(0.68-0.83)**	**1.05**	**(0.97-1.15)**	**1.61**	**(1.50-1.72)**
Nerve sheath tumors	2,165	433	0.86	(0.83-0.90)	0.33	(0.28-0.38)	0.46	(0.41-0.52)	0.75	(0.68-0.83)	1.05	(0.97-1.15)	1.60	(1.49-1.72)
Other tumors of cranial and spinal nerves	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of Meninges	**3,089**	**618**	**1.23**	**(1.19-1.28)**	**0.44**	**(0.38-0.50)**	**0.66**	**(0.59-0.73)**	**0.98**	**(0.90-1.07)**	**1.66**	**(1.55-1.78)**	**2.26**	**(2.13-2.40)**
Meningioma	2,429	486	0.98	(0.94-1.02)	0.27	(0.23-0.32)	0.48	(0.42-0.54)	0.76	(0.69-0.84)	1.33	(1.23-1.44)	1.89	(1.77-2.01)
Mesenchymal tumors	160	32	0.06	(0.05-0.07)	0.04	(0.02-0.06)	0.04	(0.03-0.06)	0.05	(0.03-0.07)	0.08	(0.06-0.11)	0.10	(0.07-0.13)
Primary melanocytic lesions	16	–	0.01	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–
Other neoplasms related to the meninges	484	97	0.19	(0.17-0.21)	0.12	(0.09-0.15)	0.13	(0.10-0.16)	0.17	(0.14-0.21)	0.24	(0.20-0.28)	0.27	(0.22-0.32)
Lymphomas and Hematopoietic Neoplasms	**392**	**78**	**0.16**	**(0.14-0.17)**	**0.04**	**(0.03-0.06)**	**0.09**	**(0.07-0.12)**	**0.14**	**(0.11-0.17)**	**0.19**	**(0.16-0.24)**	**0.29**	**(0.25-0.35)**
Lymphoma	368	74	0.15	(0.13-0.16)	–	–	0.09	(0.06-0.11)	0.13	(0.10-0.17)	0.19	(0.15-0.23)	0.28	(0.24-0.33)
Other hematopoietic neoplasms	24	–	0.01	(0.01-0.01)	–	–	–	–	–	–	–	–	–	–
Germ Cell Tumors and Cysts	**524**	**105**	**0.19**	**(0.17-0.21)**	**0.46**	**(0.41-0.52)**	**0.22**	**(0.19-0.27)**	**0.13**	**(0.10-0.16)**	**0.09**	**(0.06-0.12)**	**0.06**	**(0.04-0.09)**
Germ cell tumors, cysts and heterotopias	524	105	0.19	(0.17-0.21)	0.46	(0.41-0.52)	0.22	(0.19-0.27)	0.13	(0.10-0.16)	0.09	(0.06-0.12)	0.06	(0.04-0.09)
Tumors of Sellar Region	**4,721**	**944**	**1.86**	**(1.81-1.92)**	**0.87**	**(0.80-0.95)**	**1.07**	**(0.99-1.16)**	**1.74**	**(1.62-1.85)**	**2.39**	**(2.25-2.53)**	**3.07**	**(2.92-3.23)**
Tumors of the pituitary	4,398	880	1.74	(1.69-1.79)	0.76	(0.69-0.84)	0.95	(0.87-1.03)	1.64	(1.53-1.75)	2.25	(2.12-2.38)	2.93	(2.78-3.08)
Craniopharyngioma	323	65	0.12	(0.11-0.14)	0.11	(0.09-0.14)	0.12	(0.10-0.16)	0.10	(0.07-0.13)	0.14	(0.11-0.17)	0.14	(0.11-0.18)
Unclassified Tumors	**1,425**	**285**	**0.55**	**(0.52-0.58)**	**0.43**	**(0.37-0.48)**	**0.43**	**(0.38-0.49)**	**0.51**	**(0.45-0.58)**	**0.65**	**(0.58-0.73)**	**0.71**	**(0.63-0.78)**
Hemangioma	644	129	0.25	(0.23-0.27)	0.18	(0.15-0.22)	0.21	(0.17-0.25)	0.24	(0.20-0.28)	0.29	(0.24-0.34)	0.32	(0.27-0.37)
Neoplasm, unspecified	776	155	0.30	(0.28-0.32)	0.24	(0.20-0.29)	0.22	(0.18-0.26)	0.27	(0.23-0.32)	0.36	(0.31-0.42)	0.39	(0.34-0.45)
All other	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL[c]	**22,168**	**4,434**	**8.64**	**(8.52-8.75)**	**5.58**	**(5.39-5.78)**	**5.88**	**(5.68-6.08)**	**8.01**	**(7.77-8.26)**	**10.39**	**(10.1-10.67)**	**12.73**	**(12.42-13.05)**

[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. Suppressed cases are included in the total count.
Abbreviations: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 5. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] for Brain and Central Nervous System Tumors in Females Age 15-39 Years by Major Histology Groupings, Histology, and Age Groupings, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	15-39 (Female)				15-19 (Female)		20-24 (Female)		25-29 (Female)		30-34 (Female)		35-39 (Female)	
	5-year total	Annual Average	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Tumors of Neuroepithelial Tissue	**7,926**	**1,585**	**3.09**	**(3.02-3.16)**	**2.63**	**(2.49-2.77)**	**2.54**	**(2.40-2.68)**	**3.22**	**(3.07-3.38)**	**3.48**	**(3.31-3.64)**	**3.55**	**(3.38-3.72)**
Pilocytic astrocytoma	727	145	0.28	(0.26-0.30)	0.58	(0.52-0.65)	0.29	(0.25-0.34)	0.22	(0.18-0.26)	0.18	(0.15-0.23)	0.12	(0.09-0.16)
Diffuse astrocytoma	1,040	208	0.41	(0.38-0.43)	0.28	(0.23-0.33)	0.29	(0.25-0.34)	0.45	(0.39-0.51)	0.51	(0.45-0.58)	0.50	(0.44-0.56)
Anaplastic astrocytoma	585	117	0.23	(0.21-0.25)	0.09	(0.06-0.12)	0.16	(0.12-0.19)	0.30	(0.26-0.35)	0.26	(0.22-0.31)	0.33	(0.29-0.39)
Unique astrocytoma variants	181	36	0.07	(0.06-0.08)	0.10	(0.07-0.13)	0.12	(0.09-0.15)	0.05	(0.03-0.07)	0.06	(0.04-0.08)	–	–
Glioblastoma	935	187	0.38	(0.35-0.40)	0.16	(0.13-0.20)	0.24	(0.20-0.29)	0.33	(0.28-0.38)	0.42	(0.36-0.48)	0.69	(0.62-0.76)
Oligodendroglioma	629	126	0.25	(0.23-0.27)	0.08	(0.06-0.11)	0.16	(0.13-0.20)	0.25	(0.21-0.30)	0.36	(0.31-0.41)	0.39	(0.33-0.44)
Anaplastic oligodendroglioma	172	34	0.07	(0.06-0.08)	–	–	–	–	0.06	(0.04-0.09)	0.11	(0.08-0.14)	0.12	(0.10-0.16)
Oligoastrocytic tumors	601	120	0.24	(0.22-0.26)	0.07	(0.05-0.09)	0.16	(0.13-0.19)	0.31	(0.27-0.37)	0.32	(0.28-0.38)	0.32	(0.27-0.37)
Ependymal tumors	863	173	0.34	(0.31-0.36)	0.22	(0.19-0.27)	0.25	(0.21-0.29)	0.37	(0.32-0.42)	0.45	(0.39-0.51)	0.39	(0.34-0.45)
Glioma malignant, NOS	667	133	0.26	(0.24-0.28)	0.31	(0.26-0.36)	0.23	(0.19-0.28)	0.27	(0.23-0.32)	0.25	(0.21-0.30)	0.23	(0.19-0.28)
Choroid plexus tumors	96	19	0.04	(0.03-0.05)	0.05	(0.03-0.07)	–	–	0.03	(0.02-0.05)	0.05	(0.03-0.07)	0.04	(0.02-0.06)
Other neuroepithelial tumors	23	–	0.01	(0.01-0.01)	–	–	–	–	–	–	–	–	–	–
Neuronal and mixed neuronal-glial tumors	875	175	0.33	(0.31-0.36)	0.45	(0.39-0.51)	0.34	(0.30-0.40)	0.34	(0.29-0.40)	0.32	(0.27-0.37)	0.23	(0.19-0.27)
Tumors of the pineal region	160	32	0.06	(0.05-0.07)	0.06	(0.04-0.08)	0.06	(0.04-0.08)	0.07	(0.05-0.10)	0.06	(0.04-0.08)	0.07	(0.05-0.09)
Embryonal tumors	372	74	0.14	(0.13-0.16)	0.17	(0.14-0.21)	0.18	(0.15-0.22)	0.16	(0.13-0.20)	0.12	(0.09-0.15)	0.09	(0.06-0.12)
Tumors of Cranial and Spinal Nerves	**2,382**	**476**	**0.95**	**(0.92-0.99)**	**0.38**	**(0.33-0.44)**	**0.53**	**(0.47-0.60)**	**0.90**	**(0.82-0.99)**	**1.23**	**(1.14-1.34)**	**1.62**	**(1.51-1.74)**
Nerve sheath tumors	2,380	476	0.95	(0.92-0.99)	0.38	(0.33-0.44)	0.53	(0.47-0.60)	0.90	(0.82-0.99)	1.23	(1.14-1.34)	1.62	(1.51-1.74)
Other tumors of cranial and spinal nerves	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of Meninges	**6,618**	**1,324**	**2.74**	**(2.67-2.80)**	**0.47**	**(0.41-0.53)**	**0.86**	**(0.79-0.95)**	**1.88**	**(1.76-2.00)**	**3.65**	**(3.49-3.82)**	**6.22**	**(6.01-6.45)**
Meningioma	6,011	1,202	2.50	(2.43-2.56)	0.33	(0.28-0.38)	0.67	(0.60-0.74)	1.66	(1.55-1.77)	3.35	(3.19-3.51)	5.91	(5.70-6.12)
Mesenchymal tumors	176	35	0.07	(0.06-0.08)	0.05	(0.04-0.08)	0.05	(0.04-0.08)	0.04	(0.02-0.06)	0.09	(0.07-0.12)	0.10	(0.08-0.14)
Primary melanocytic lesions	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other neoplasms related to the meninges	425	85	0.17	(0.15-0.18)	0.08	(0.06-0.11)	0.14	(0.11-0.18)	0.18	(0.15-0.22)	0.21	(0.17-0.26)	0.21	(0.17-0.25)
Lymphomas and Hematopoietic Neoplasms	**227**	**45**	**0.09**	**(0.08-0.11)**	**0.03**	**(0.02-0.05)**	**0.05**	**(0.04-0.08)**	**0.06**	**(0.04-0.08)**	**0.13**	**(0.10-0.16)**	**0.18**	**(0.14-0.22)**
Lymphoma	208	42	0.08	(0.07-0.10)	–	–	0.05	(0.03-0.07)	0.05	(0.03-0.07)	0.12	(0.09-0.16)	0.17	(0.14-0.21)
Other hematopoietic neoplasms	19	–	0.01	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–
Germ Cell Tumors and Cysts	**132**	**26**	**0.05**	**(0.04-0.06)**	**0.07**	**(0.05-0.10)**	**0.06**	**(0.04-0.08)**	**0.05**	**(0.03-0.07)**	**0.04**	**(0.02-0.06)**	**0.04**	**(0.02-0.06)**
Germ cell tumors, cysts and heterotopias	132	26	0.05	(0.04-0.06)	0.07	(0.05-0.10)	0.06	(0.04-0.08)	0.05	(0.03-0.07)	0.04	(0.02-0.06)	0.04	(0.02-0.06)
Tumors of Sellar Region	**11,838**	**2,368**	**4.62**	**(4.53-4.70)**	**2.75**	**(2.61-2.89)**	**3.88**	**(3.71-4.05)**	**5.01**	**(4.82-5.21)**	**5.62**	**(5.42-5.84)**	**5.77**	**(5.56-5.98)**
Tumors of the pituitary	11,494	2,299	4.48	(4.40-4.57)	2.60	(2.46-2.74)	3.76	(3.60-3.93)	4.89	(4.70-5.08)	5.50	(5.29-5.71)	5.61	(5.40-5.82)
Craniopharyngioma	344	69	0.13	(0.12-0.15)	0.15	(0.12-0.19)	0.11	(0.09-0.15)	0.12	(0.09-0.15)	0.13	(0.10-0.16)	0.16	(0.13-0.20)
Unclassified Tumors	**1,792**	358	**0.70**	**(0.67-0.74)**	**0.50**	**(0.44-0.56)**	**0.50**	**(0.44-0.56)**	**0.76**	**(0.68-0.83)**	**0.78**	**(0.71-0.86)**	**0.95**	**(0.87-1.04)**
Hemangioma	894	179	0.35	(0.33-0.38)	0.21	(0.17-0.25)	0.25	(0.21-0.30)	0.37	(0.32-0.43)	0.40	(0.34-0.46)	0.51	(0.45-0.58)
Neoplasm, unspecified	891	178	0.35	(0.32-0.37)	0.28	(0.24-0.33)	0.24	(0.20-0.29)	0.38	(0.33-0.44)	0.38	(0.33-0.44)	0.44	(0.39-0.51)
All other	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL[c]	**30,915**	**6,183**	**12.24**	**(12.10-12.38)**	**6.83**	**(6.61-7.06)**	**8.42**	**(8.18-8.67)**	**11.87**	**(11.57-12.17)**	**14.93**	**(14.6-15.28)**	**18.33**	**(17.96-18.71)**

[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. Suppressed cases are included in the total count.
Abbreviations: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 6. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] for Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Major Histology Groupings, Histology, and Race[c], American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	White				Black				AIAN				API			
	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	**14,928**	**2,986**	**3.75**	**(3.69-3.81)**	**1,635**	**327**	**2.11**	**(2.00-2.21)**	**161**	**32**	**1.93**	**(1.64-2.26)**	**878**	**176**	**2.58**	**(2.41-2.76)**
Pilocytic astrocytoma	1,257	251	0.31	(0.29-0.32)	172	34	0.20	(0.17-0.24)	–	–	–	–	65	–	0.20	(0.16-0.26)
Diffuse astrocytoma	2,050	410	0.52	(0.49-0.54)	217	43	0.29	(0.25-0.33)	27	–	0.32	(0.21-0.47)	96	19	0.28	(0.22-0.34)
Anaplastic astrocytoma	1,208	242	0.31	(0.29-0.32)	94	19	0.13	(0.10-0.15)	–	–	–	–	64	–	0.19	(0.14-0.24)
Unique astrocytoma variants	288	58	0.07	(0.06-0.08)	58	–	0.07	(0.05-0.09)	–	–	–	–	23	–	0.07	(0.04-0.10)
Glioblastoma	1,948	390	0.51	(0.48-0.53)	260	52	0.36	(0.31-0.40)	–	–	–	–	149	30	0.43	(0.37-0.51)
Oligodendroglioma	1,330	266	0.34	(0.32-0.36)	70	–	0.10	(0.07-0.12)	–	–	–	–	66	–	0.19	(0.15-0.24)
Anaplastic oligodendroglioma	378	76	0.10	(0.09-0.11)	16	–	0.02	(0.01-0.04)	–	–	–	–	18	–	0.05	(0.03-0.08)
Oligoastrocytic tumors	1,165	233	0.29	(0.28-0.31)	77	–	0.11	(0.08-0.13)	–	–	–	–	61	–	0.17	(0.13-0.22)
Ependymal tumors	1,585	317	0.40	(0.38-0.42)	157	31	0.21	(0.18-0.24)	17	–	0.20	(0.12-0.33)	115	23	0.33	(0.27-0.40)
Glioma malignant, NOS	1,124	225	0.28	(0.26-0.30)	163	33	0.20	(0.17-0.24)	–	–	–	–	68	–	0.20	(0.16-0.26)
Choroid plexus tumors	153	31	0.04	(0.03-0.04)	18	–	0.02	(0.01-0.04)	–	–	–	–	–	–	–	–
Other neuroepithelial tumors	26	–	0.01	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–	–	–
Neuronal and mixed neuronal-glial tumors	1,447	289	0.36	(0.34-0.37)	190	38	0.23	(0.20-0.27)	–	–	–	–	102	20	0.31	(0.25-0.38)
Tumors of the pineal region	205	41	0.05	(0.04-0.06)	41	–	0.05	(0.04-0.07)	–	–	–	–	–	–	–	–
Embryonal tumors	764	153	0.19	(0.17-0.20)	100	20	0.12	(0.10-0.15)	–	–	–	–	35	–	0.11	(0.07-0.15)
Tumors of Cranial and Spinal Nerves	**3,752**	**750**	**0.97**	**(0.94-1.00)**	**344**	**69**	**0.47**	**(0.42-0.53)**	**50**	**–**	**0.67**	**(0.50-0.89)**	**345**	**69**	**1.01**	**(0.90-1.12)**
Nerve sheath tumors	3,749	750	0.97	(0.94-1.00)	344	69	0.47	(0.42-0.53)	50	–	0.67	(0.50-0.89)	344	69	1.01	(0.90-1.12)
Other tumors of cranial and spinal nerves	–	–	0.00	(0.00-0.00)	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of Meninges	**7,467**	**1,493**	**1.98**	**(1.93-2.02)**	**1,540**	**308**	**2.20**	**(2.09-2.32)**	**89**	**18**	**1.19**	**(0.95-1.47)**	**538**	**108**	**1.59**	**(1.46-1.73)**
Meningioma	6,469	1,294	1.73	(1.68-1.77)	1,385	277	1.99	(1.89-2.10)	76	–	1.03	(0.81-1.29)	447	89	1.33	(1.20-1.45)
Mesenchymal tumors	262	52	0.07	(0.06-0.08)	41	–	0.06	(0.04-0.08)	–	–	–	–	26	–	0.08	(0.05-0.11)
Primary melanocytic lesions	19	–	0.01	(0.00-0.01)	–	–	–	–	–	–	–	–	–	–	–	–
Other neoplasms related to the meninges	717	143	0.18	(0.17-0.20)	113	23	0.15	(0.12-0.18)	–	–	–	–	64	–	0.19	(0.14-0.24)
Lymphomas and Hematopoietic Neoplasms	**395**	**79**	**0.10**	**(0.09-0.11)**	**176**	**35**	**0.25**	**(0.21-0.29)**	**–**	**–**	**–**	**–**	**32**	**–**	**0.09**	**(0.06-0.13)**
Lymphoma	357	71	0.09	(0.08-0.10)	174	35	0.25	(0.21-0.29)	–	–	–	–	31	–	0.09	(0.06-0.13)
Other hematopoietic neoplasms	38	–	0.01	(0.01-0.01)	–	–	–	–	–	–	–	–	–	–	–	–
Germ Cell Tumors and Cysts	**508**	**102**	**0.12**	**(0.11-0.13)**	**82**	**16**	**0.10**	**(0.08-0.12)**	**–**	**–**	**–**	**–**	**61**	**–**	**0.19**	**(0.15-0.25)**
Germ cell tumors, cysts and heterotopias	508	102	0.12	(0.11-0.13)	82	16	0.10	(0.08-0.12)	–	–	–	–	61	–	0.19	(0.15-0.25)
Tumors of Sellar Region	**12,266**	**2,453**	**3.10**	**(3.04-3.15)**	**2,785**	**557**	**3.79**	**(3.64-3.93)**	**210**	**42**	**2.57**	**(2.23-2.95)**	**1,148**	**230**	**3.33**	**(3.14-3.53)**
Tumors of the pituitary	11,777	2,355	2.97	(2.92-3.03)	2,662	532	3.62	(3.48-3.76)	207	41	2.53	(2.19-2.91)	1,099	220	3.19	(3.00-3.38)
Craniopharyngioma	489	98	0.12	(0.11-0.13)	123	25	0.16	(0.14-0.20)	–	–	–	–	49	–	0.15	(0.11-0.19)
Unclassified Tumors	**2,589**	**518**	**0.65**	**(0.63-0.68)**	**374**	**75**	**0.50**	**(0.45-0.56)**	**36**	**–**	**0.45**	**(0.31-0.62)**	**195**	**39**	**0.57**	**(0.49-0.65)**
Hemangioma	1,297	259	0.33	(0.31-0.35)	127	25	0.17	(0.14-0.20)	18	–	0.23	(0.14-0.37)	88	18	0.25	(0.20-0.31)
Neoplasm, unspecified	1,282	256	0.32	(0.30-0.34)	247	49	0.33	(0.29-0.38)	18	–	0.21	(0.13-0.34)	105	21	0.30	(0.25-0.37)
All other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL[d]	**41,905**	**8,381**	**10.68**	**(10.58-10.78)**	**6,936**	**1,387**	**9.42**	**(9.19-9.64)**	**560**	**112**	**6.99**	**(6.42-7.61)**	**3,197**	**639**	**9.37**	**(9.04-9.70)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]Individuals with unknown race were excluded (N = 1,967).
[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: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified; AIAN, American Indian/Alaskan Native; API, Asian/Pacific Islander.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 7. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] for Brain and Central Nervous System Tumor in Adolescents and Young Adults Age 15-39 Years by Major Histology Groupings, Histology, and Hispanic Ethnicity[c], American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	Hispanic				Non-Hispanic			
	5-year total	Annual average	Rate	95% CI	5-year total	Annual average	Rate	95% CI
Tumors of Neuroepithelial Tissue	**2,473**	**495**	**2.39**	**(2.30-2.49)**	**15,301**	**3,060**	**3.70**	**(3.64-3.76)**
Pilocytic astrocytoma	199	40	0.18	(0.16-0.21)	1,320	264	0.31	(0.29-0.33)
Diffuse astrocytoma	296	59	0.29	(0.26-0.33)	2,117	423	0.51	(0.49-0.53)
Anaplastic astrocytoma	182	36	0.18	(0.15-0.20)	1,216	243	0.30	(0.28-0.31)
Unique astrocytoma variants	57	–	0.05	(0.04-0.07)	324	65	0.08	(0.07-0.08)
Glioblastoma	380	76	0.38	(0.35-0.43)	2,013	403	0.50	(0.48-0.53)
Oligodendroglioma	171	34	0.17	(0.15-0.20)	1,316	263	0.32	(0.31-0.34)
Anaplastic oligodendroglioma	60	12	0.06	(0.05-0.08)	360	72	0.09	(0.08-0.10)
Oligoastrocytic tumors	146	29	0.14	(0.12-0.17)	1,187	237	0.29	(0.27-0.31)
Ependymal tumors	286	57	0.28	(0.24-0.31)	1,602	320	0.39	(0.37-0.41)
Glioma malignant, NOS	169	34	0.16	(0.14-0.19)	1,214	243	0.29	(0.27-0.31)
Choroid plexus tumors	34	–	0.03	(0.02-0.05)	149	30	0.04	(0.03-0.04)
Other neuroepithelial tumors	–	–	–	–	24	–	0.01	(0.00-0.01)
Neuronal and mixed neuronal-glial tumors	235	47	0.22	(0.19-0.25)	1,538	308	0.36	(0.35-0.38)
Tumors of the pineal region	34	–	0.03	(0.02-0.04)	224	45	0.05	(0.05-0.06)
Embryonal tumors	218	44	0.20	(0.18-0.23)	697	139	0.16	(0.15-0.18)
Tumors of Cranial and Spinal Nerves	**602**	**120**	**0.60**	**(0.56-0.66)**	**3,947**	**789**	**0.98**	**(0.95-1.02)**
Nerve sheath tumors	601	120	0.60	(0.56-0.65)	3,944	789	0.98	(0.95-1.01)
Other tumors of cranial and spinal nerves	–	–	–	–	–	–	0.00	(0.00-0.00)
Tumors of Meninges	**1,510**	**302**	**1.55**	**(1.48-1.63)**	**8,197**	**1,639**	**2.09**	**(2.05-2.14)**
Meningioma	1,302	260	1.35	(1.28-1.43)	7,138	1,428	1.83	(1.79-1.88)
Mesenchymal tumors	43	–	0.04	(0.03-0.06)	293	59	0.07	(0.06-0.08)
Primary melanocytic lesions	–	–	0.00	(0.00-0.01)	19	–	0.00	(0.00-0.01)
Other neoplasms related to the meninges	162	32	0.16	(0.13-0.18)	747	149	0.18	(0.17-0.20)
Lymphomas and Hematopoietic Neoplasms	**150**	**30**	**0.15**	**(0.13-0.18)**	**469**	**94**	**0.12**	**(0.11-0.13)**
Lymphoma	140	28	0.14	(0.12-0.17)	436	87	0.11	(0.10-0.12)
Other hemopoietic neoplasms	–	–	–	–	33	–	0.01	(0.01-0.01)
Germ Cell Tumors and Cysts	**120**	**24**	**0.11**	**(0.09-0.13)**	**536**	**107**	**0.12**	**(0.11-0.14)**
Germ cell tumors, cysts and heterotopias	120	24	0.11	(0.09-0.13)	536	107	0.12	(0.11-0.14)
Tumors of Sellar Region	**3,418**	**684**	**3.32**	**(3.21-3.43)**	**13,141**	**2,628**	**3.20**	**(3.15-3.26)**
Tumors of the pituitary	3,263	653	3.17	(3.06-3.28)	12,629	2,526	3.08	(3.03-3.13)
Craniopharyngioma	155	31	0.15	(0.12-0.17)	512	102	0.12	(0.11-0.14)
Unclassified Tumors	**584**	**117**	**0.57**	**(0.52-0.62)**	**2,633**	**527**	**0.64**	**(0.62-0.67)**
Hemangioma	234	47	0.23	(0.20-0.26)	1,304	261	0.32	(0.30-0.34)
Neoplasm, unspecified	347	69	0.34	(0.30-0.38)	1,320	264	0.32	(0.30-0.34)
All other	–	–	–	–	–	–	–	–
TOTAL[d]	**8,857**	**1,771**	**8.70**	**(8.52-8.89)**	**44,224**	**8,845**	**10.86**	**(10.76-10.96)**

[a]Annual average cases are calculated by dividing the five-year total by five.
[b]Rates are per 100,000 and are age-adjusted to the 2000 US standard population.
[c]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: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 8. Distribution and Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] of Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Major Histology Groupings, Histology, and Behavior, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report, CBTRUS, 2008-2012

Histology	Total					Malignant				Non-Malignant			
	5-year total	Annual average	% of All Tumors	Rate	(95% CI)	5-year total	Annual average	Rate	(95% CI)	5-year total	Annual average	Rate	(95% CI)
Tumors of Neuroepithelial Tissue	**17,776**	**3,555**	**33.5%**	**3.44**	**(3.39-3.49)**	**14,894**	**2,979**	**2.90**	**(2.85-2.95)**	**2,307**	**461**	**0.55**	**(0.53-0.57)**
Pilocytic astrocytoma	1,519	304	2.9%	0.28	(0.27-0.30)	1,519	304	0.28	(0.27-0.30)	–	–	–	–
Diffuse astrocytoma	2,413	483	4.5%	0.47	(0.45-0.49)	2,413	483	0.47	(0.45-0.49)	–	–	–	–
Anaplastic astrocytoma	1,398	280	2.6%	0.27	(0.26-0.29)	1,398	280	0.27	(0.26-0.29)	–	–	–	–
Unique astrocytoma variants	381	76	0.7%	0.07	(0.06-0.08)	251	50	0.05	(0.04-0.05)	107	21	0.02	(0.02-0.03)
Glioblastoma	2,393	479	4.5%	0.48	(0.46-0.50)	2,393	479	0.48	(0.46-0.50)	–	–	–	–
Oligodendroglioma	1,488	298	2.8%	0.29	(0.28-0.31)	1,488	298	0.29	(0.28-0.31)	–	–	–	–
Anaplastic oligodendroglioma	420	84	0.8%	0.08	(0.08-0.09)	420	84	0.08	(0.08-0.09)	–	–	–	–
Oligoastrocytic tumors	1,333	267	2.5%	0.26	(0.25-0.28)	1,333	267	0.26	(0.25-0.28)	–	–	–	–
Ependymal tumors	1,888	378	3.6%	0.37	(0.35-0.38)	1,079	216	0.21	(0.20-0.22)	641	128	0.16	(0.14-0.17)
Glioma malignant, NOS	1,384	277	2.6%	0.26	(0.25-0.28)	1,384	277	0.27	(0.25-0.28)	–	–	–	–
Choroid plexus tumors	183	37	0.3%	0.03	(0.03-0.04)	–	–	–	–	136	27	0.03	(0.03-0.04)
Other neuroepithelial tumors	30	–	0.1%	0.01	(0.00-0.01)	20	–	0.00	(0.00-0.01)	–	–	–	–
Neuronal and mixed neuronal-glial tumors	1,773	355	3.3%	0.33	(0.32-0.35)	182	36	0.04	(0.03-0.04)	1,282	256	0.30	(0.29-0.32)
Tumors of the pineal region	258	52	0.5%	0.05	(0.04-0.06)	121	24	0.02	(0.02-0.03)	109	22	0.03	(0.02-0.03)
Embryonal tumors	915	183	1.7%	0.17	(0.16-0.18)	881	176	0.17	(0.15-0.18)	24	–	0.01	(0.00-0.01)
Tumors of Cranial and Spinal Nerves	**4,549**	**910**	**8.6%**	**0.91**	**(0.88-0.94)**	**53**	**--**	**0.01**	**(0.01-0.01)**	**3,592**	**718**	**0.90**	**(0.87-0.93)**
Nerve sheath tumors	4,545	909	8.6%	0.91	(0.88-0.93)	53	–	0.01	(0.01-0.01)	3,589	718	0.90	(0.87-0.93)
Other tumors of cranial and spinal nerves	–	–	–	–	–	–	–	–	–	–	–	–	–
Tumors of Meninges	**9,707**	**1,941**	**18.3%**	**1.98**	**(1.95-2.02)**	**304**	**61**	**0.06**	**(0.05-0.07)**	**7,558**	**1,512**	**1.94**	**(1.89-1.98)**
Meningioma	8,440	1,688	15.9%	1.74	(1.70-1.77)	124	25	0.03	(0.02-0.03)	6,704	1,341	1.73	(1.69-1.77)
Mesenchymal tumors	336	67	0.6%	0.07	(0.06-0.07)	99	20	0.02	(0.02-0.02)	187	37	0.05	(0.04-0.05)
Primary melanocytic lesions	22	–	0.0%	0.00	(0.00-0.01)	–	–	–	–	–	–	–	–
Other neoplasms related to the meninges	909	182	1.7%	0.18	(0.17-0.19)	68	14	0.01	(0.01-0.02)	659	132	0.16	(0.15-0.17)
Lymphomas and Hematopoietic Neoplasms	**619**	**124**	**1.2%**	**0.12**	**(0.11-0.13)**	**611**	**122**	**0.12**	**(0.11-0.13)**	**--**	**--**	**--**	**--**
Lymphoma	576	115	1.1%	0.12	(0.11-0.13)	576	115	0.12	(0.11-0.13)	–	–	–	–
Other hematopoietic neoplasms	43	–	0.1%	0.01	(0.01-0.01)	35	–	0.01	(0.00-0.01)	–	–	–	–
Germ Cell Tumors and Cysts	**656**	**131**	**1.2%**	**0.12**	**(0.11-0.13)**	**517**	**103**	**0.10**	**(0.09-0.10)**	**115**	**23**	**0.03**	**(0.02-0.03)**
Germ cell tumors, cysts and heterotopias	656	131	1.2%	0.12	(0.11-0.13)	517	103	0.10	(0.09-0.10)	115	23	0.03	(0.02-0.03)
Tumors of Sellar Region	**16,559**	**3,312**	**31.2%**	**3.23**	**(3.18-3.28)**	**19**	**--**	**0.00**	**(0.00-0.01)**	**13,234**	**2,647**	**3.24**	**(3.18-3.29)**
Tumors of the pituitary	15,892	3,178	29.9%	3.10	(3.05-3.15)	18	–	0.00	(0.00-0.01)	12,689	2,538	3.10	(3.05-3.16)
Craniopharyngioma	667	133	1.3%	0.13	(0.12-0.14)	–	–	–	–	545	109	0.13	(0.12-0.14)
Unclassified Tumors	**3,217**	**643**	**6.1%**	**0.63**	**(0.60-0.65)**	**344**	**69**	**0.07**	**(0.06-0.08)**	**2,282**	**456**	**0.56**	**(0.53-0.58)**
Hemangioma	1,538	308	2.9%	0.30	(0.29-0.32)	–	–	–	–	1,188	238	0.29	(0.27-0.31)
Neoplasm, unspecified	1,667	333	3.1%	0.32	(0.31-0.34)	329	66	0.06	(0.06-0.07)	1,089	218	0.26	(0.25-0.28)
All other	–	–	–	–	–	–	–	–	–	–	–	–	–
TOTAL[c]	**53,083**	**10,617**	**100.0%**	**10.43**	**(10.34-10.52)**	**16,742**	**3,348**	**3.26**	**(3.21-3.31)**	**29,095**	**5,819**	**7.21**	**(7.13-7.29)**

[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. The suppressed cases are included in the counts 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.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 9. Estimated Number of Cases[a,b] of Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years Overall and by Behavior by Major Histology Groupings and Histology, 2015, 2016, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report

Histology	2015 Estimated New Cases			2016 Estimated New Cases		
	All	Malignant	Non-Malignant	All	Malignant	Non-Malignant
Tumors of Neuroepithelial Tissue	**3,870**	**3,150**	**730**	**3,930**	**3,180**	**760**
Pilocytic astrocytoma	290	290	–	290	290	–
Diffuse astrocytoma	500	500	–	500	500	–
Anaplastic astrocytoma	260	260	–	260	260	–
Unique astrocytoma variants	110	70	–	110	70	–
Glioblastoma	450	450	–	450	450	–
Oligodendroglioma	260	260	–	260	260	–
Anaplastic oligodendroglioma	70	70	–	70	70	–
Oligoastrocytic tumors	360	360	–	380	380	–
Ependymal tumors	450	270	170	460	280	170
Glioma malignant, NOS	360	360	–	380	380	–
Choroid plexus tumors	–	–	–	–	–	–
Other neuroepithelial tumors	–	–	–	–	–	–
Neuronal and mixed neuronal-glial tumors	430	–	420	450	–	440
Tumors of the pineal region	90	–	50	90	–	60
Embryonal tumors	200	190	–	200	190	–
Tumors of Cranial and Spinal Nerves	**960**	–	**950**	**970**	–	**960**
Nerve sheath tumors	960	–	950	960	–	960
Other tumors of cranial and spinal nerves	–	–	–	–	–	–
Tumors of Meninges	**2,490**	**60**	**2,430**	**2,600**	**60**	**2,540**
Meningioma	2,200	–	2,170	2,290	–	2,270
Mesenchymal tumors	90	–	70	90	–	70
Primary melanocytic lesions	–	–	–	–	–	–
Other neoplasms related to the meninges	200	–	190	200	–	190
Lymphomas and Hematopoietic Neoplasms	**110**	**100**	–	**110**	**100**	–
Lymphoma	90	90	–	80	80	–
Other hematopoietic neoplasms	–	–	–	–	–	–
Germ Cell Tumors and Cysts	**120**	**110**	**--**	**120**	**110**	**--**
Germ cell tumors, cysts and heterotopias	140	120	–	140	130	–
Tumors of Sellar Region	**4,860**	–	**4,850**	**5,180**	–	**5,180**
Tumors of the pituitary	4,730	–	4,720	5,050	–	5,050
Craniopharyngioma	130	–	130	130	–	130
Unclassified Tumors	**1,150**	–	**1,100**	**1,300**	–	**1,260**
Hemangioma	790	–	790	940	–	940
Neoplasm, unspecified	350	–	310	360	–	320
All other	–	–	–	–	–	–
TOTAL‡	**13,750**	**3,510**	**10,240**	**13,770**	**3,530**	**10,240**

[a]Source: Estimation based on CBTRUS 2000-2010 data for malignant tumors, and CBTRUS 2006-2010 data for non-malignant tumors.
[b]Rounded to the nearest 10. Numbers may not add up due to rounding.
–Estimated number is less than 50 and may affect 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.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 10. Five-Year Total, Annual Average Total[a] of Deaths due to Malignant Brain and CNS Tumors and Average Annual Age-Adjusted Mortality[b] Rates in Adolescents and Young Adults Age 15-39 Years by Sex, Race, Ethnicity, and Age Groupings, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: NVSS, 2008-2012

Histology	15-39				15-19		20-24		25-29		30-34		35-39	
	5-year total	Annual Average	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI	Rate	95% CI
Sex														
Male	1,331	266	1.34	(1.27-1.41)	0.56	(0.50-0.63)	0.65	(0.58-0.72)	0.96	(0.88-1.05)	1.40	(1.29-1.50)	2.03	(1.90-2.16)
Female	840	168	0.84	(0.79-0.90)	0.42	(0.37-0.48)	0.48	(0.42-0.54)	0.58	(0.51-0.64)	0.83	(0.75-0.91)	1.22	(1.13-1.32)
Race														
White	1,826	365	1.19	(1.14-1.25)	0.50	(0.45-0.55)	0.61	(0.55-0.66)	0.85	(0.79-0.92)	1.26	(1.18-1.34)	1.81	(1.72-1.91)
Black	228	46	0.75	(0.65-0.85)	0.51	(0.41-0.62)	0.50	(0.40-0.62)	0.52	(0.42-0.65)	0.62	(0.50-0.77)	0.96	(0.80-1.14)
AIAN	16	–	0.56	(0.32-0.91)	–	–	–	–	–	–	–	–	–	–
API	101	20	0.76	(0.62-0.92)	0.48	(0.32-0.70)	0.30	(0.18-0.46)	0.41	(0.28-0.59)	0.64	(0.47-0.85)	1.00	(0.79-1.26)
Ethnicity														
Hispanic	277	55	0.70	(0.62-0.79)	0.41	(0.33-0.50)	0.40	(0.32-0.49)	0.42	(0.34-0.52)	0.70	(0.59-0.83)	0.96	(0.83-1.11)
Non-Hispanic	1,892	378	1.18	(1.13-1.24)	0.51	(0.47-0.56)	0.60	(0.55-0.66)	0.86	(0.80-0.92)	1.22	(1.14-1.30)	1.78	(1.69-1.87)
TOTAL[c]	**2,171**	**434**	**1.09**	**(1.04-1.14)**	**0.49**	**(0.45-0.54)**	**0.56**	**(0.52-0.61)**	**0.77**	**(0.72-0.83)**	**1.11**	**(1.05-1.18)**	**1.62**	**(1.55-1.70)**

[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. Suppressed cases are included in the total count.
Abbreviations: NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology and End Results program; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 11. Five-Year Total, Annual Average Total[a] and Average Annual Age-Adjusted Incidence Rates[b] in Adolescents and Young Adults Age 15-39 Years by Site[c] and Gender, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

ICD-O-3 Code	Site	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
C71.0	Cerebrum	1,126	225	0.22	(0.20-0.23)	626	125	0.24	(0.22-0.26)	500	100	0.20	(0.18-0.21)
C71.1-C71.4	Frontal, temporal, parietal, and occipital lobes of the brain	10,646	2,129	2.08	(2.04-2.12)	5,945	1,189	2.31	(2.25-2.37)	4,701	940	1.85	(1.80-1.91)
	C71.1 - Frontal lobe	5,624	1,125	1.10	(1.08-1.13)	3,128	626	1.22	(1.18-1.26)	2,496	499	0.99	(0.95-1.03)
	C71.2 - Temporal lobe	3,094	619	0.60	(0.58-0.62)	1,739	348	0.67	(0.64-0.71)	1,355	271	0.53	(0.50-0.56)
	C71.3 - Parietal lobe	1,535	307	0.30	(0.29-0.32)	856	171	0.33	(0.31-0.36)	679	136	0.27	(0.25-0.29)
	C71.4 - Occipital lobe	393	79	0.08	(0.07-0.08)	222	44	0.08	(0.07-0.10)	171	34	0.07	(0.06-0.08)
C71.5	Ventricle	1,173	235	0.22	(0.21-0.24)	596	119	0.22	(0.21-0.24)	577	115	0.22	(0.21-0.24)
C71.6	Cerebellum	2,352	470	0.45	(0.43-0.47)	1,270	254	0.48	(0.46-0.51)	1,082	216	0.42	(0.39-0.45)
C71.7	Brain stem	1,359	272	0.26	(0.25-0.27)	702	140	0.27	(0.25-0.29)	657	131	0.25	(0.24-0.27)
C71.8-C71.9	Other brain	3,762	752	0.73	(0.71-0.76)	2,032	406	0.79	(0.75-0.82)	1,730	346	0.68	(0.65-0.71)
C72.0-C72.1	Spinal cord and cauda equina	2,710	542	0.53	(0.51-0.55)	1,488	298	0.58	(0.55-0.61)	1,222	244	0.48	(0.45-0.51)
C72.2-C72.5	Cranial nerves	3,419	684	0.69	(0.66-0.71)	1,567	313	0.63	(0.6-0.66)	1,852	370	0.75	(0.71-0.78)
C72.8-C72.9	Other nervous system	375	75	0.07	(0.07-0.08)	174	35	0.07	(0.06-0.08)	201	40	0.08	(0.07-0.09)
C70.0-C70.9	Meninges (cerebral & spinal)	8,527	1,705	1.76	(1.72-1.80)	2,505	501	1.01	(0.97-1.05)	6,022	1,204	2.51	(2.45-2.58)
C75.1-C75.2	Pituitary and craniopharyngeal duct	16,867	3,373	3.30	(3.25-3.35)	4,807	961	1.90	(1.85-1.96)	12,060	2,412	4.72	(4.63-4.80)
C75.3	Pineal	672	134	0.13	(0.12-0.14)	408	82	0.15	(0.14-0.17)	264	53	0.10	(0.09-0.12)
C30.0[c]	Olfactory tumors of the nasal cavity	95	19	0.02	(0.02-0.02)	48	–	0.02	(0.01-0.03)	47	–	0.02	(0.01-0.02)
TOTAL		**53,083**	**10,617**	**10.47**	**(10.38-10.56)**	**22,168**	**4,434**	**8.67**	**(8.55-8.78)**	**30,915**	**6,183**	**12.28**	**(12.15-12.42)**

[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.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 12. One-, Two-, Five-, and Ten-Year Relative Survival Rates[a] for Malignant Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Site[b], American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: SEER 1995-2012[c]

ICD-O-3 CODE	SITE[b]	N	1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
C71.1	Frontal lobe of the brain	3,809	92.2	(91.2-93.0)	84.2	(82.9-85.4)	68.6	(66.9-70.2)	52.2	(50.0-54.3)
C71.2	Temporal lobe of the brain	1,751	92.9	(91.5-94.0)	82.3	(80.4-84.1)	67.5	(64.9-69.9)	52.4	(49.3-55.5)
C71.3	Parietal lobe of the brain	999	87.1	(84.9-89.1)	76.7	(73.9-79.3)	60.1	(56.6-63.3)	46.2	(42.2-50.0)
C71.4	Occipital lobe of the brain	225	84.9	(79.4-89.1)	74.6	(68.1-80.0)	62.1	(54.8-68.5)	57.4	(49.3-64.8)
C71.0	Cerebrum	722	74.1	(70.6-77.2)	58.5	(54.6-62.1)	41.3	(37.3-45.3)	33.9	(29.6-38.3)
C71.5	Ventricle	371	87.7	(83.9-90.8)	83.5	(79.2-87.1)	77.8	(72.8-82.0)	74.8	(69.2-79.5)
C71.6	Cerebellum	1,138	91.0	(89.2-92.6)	87.5	(85.3-89.3)	79.0	(76.2-81.5)	73.3	(70.0-76.2)
C71.7	Brain stem	831	83.1	(80.3-85.5)	70.9	(67.5-74.0)	59.6	(55.9-63.2)	52.1	(47.8-56.2)
C71.8-C71.9	Other brain	2,174	77.0	(75.2-78.8)	66.3	(64.2-68.3)	52.3	(50.0-54.6)	41.3	(38.8-43.8)
C72.0-C72.1	Spinal cord and cauda equina	754	92.1	(89.8-93.8)	86.4	(83.6-88.8)	80.5	(77.2-83.4)	76.9	(72.9-80.4)
C72.2-C72.5	Cranial nerves	103	93.1	(85.9-96.7)	92.1	(84.6-96.0)	87.4	(78.5-92.8)	85.8	(75.6-91.9)
C72.8-C72.9	Other nervous system	133	58.2	(49.2-66.2)	44.7	(35.8-53.2)	41.0	(32.1-49.7)	35.5	(26.2-44.9)
C70.0-C70.9	Meninges (cerebral and spinal)	158	92.3	(86.7-95.6)	88.9	(82.6-93.0)	83.1	(75.6-88.4)	80.5	(72.5-86.3)
C75.1-C75.2	Pituitary and craniopharyngeal duct	81	96.3	(88.7-98.8)	96.3	(88.7-98.8)	87.6	(77.0-93.5)	83.2	(70.2-90.9)
C75.3	Pineal	367	90.1	(86.5-92.8)	85.0	(80.7-88.4)	78.5	(73.5-82.8)	74.4	(68.4-79.5)
C30.0[d]	Olfactory tumors of the nasal cavity	85	95.3	(87.7-98.3)	92.9	(84.6-96.8)	85.7	(75.1-92.0)	70.5	(52.6-82.7)
All Codes	**All Sites**	**13,701**	**87.3**	**(86.7-87.8)**	**78.5**	**(77.7-79.2)**	**65.4**	**(64.5-66.3)**	**54.2**	**(53.1-55.2)**

[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]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER Site/Histology Validation List.
[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 2014 Sub (1973-2012 varying) - Linked To County Attributes - Total U.S., 1969-2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2015, based on the November 2014 submission.
[d]ICD-O-3 histology codes 9522-9523 only.
Katrina Impacted Louisiana Cases, Nov 2013 Sub (1973-2011 varying) - Linked To County Attributes - Total U.S., 1969-2012 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2014, based on the November 2013 submission.
Abbreviations: SEER, Survival, Epidemiology and End Results; CI, confidence interval.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 13. One-, Five-, and Ten-Year Relative Survival Rates[a] for Malignant Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Site[b] and Year of Diagnosis, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: SEER 1973-2012[c]

ICD-O-3 Code	Site[b]	Years of Diagnosis	N	1-Year		5-Year		10-Year	
				%	95% CI	%	95% CI	%	95% CI
C71.0-C71.4	Supratentorial	1973-1977	412	78.3	(73.9-81.9)	37.4	(32.7-42.1)	25.5	(21.3-29.8)
		1978-1982	612	83.1	(79.9-85.9)	46.7	(42.6-50.6)	31.9	(28.2-35.7)
		1983-1987	801	85.4	(82.7-87.7)	54.1	(50.6-57.5)	38.8	(35.3-42.2)
		1988-1992	979	80.2	(77.5-82.5)	51.7	(48.5-54.8)	42.1	(38.9-45.2)
		1993-1997	1,292	77.4	(75.0-79.6)	55.8	(53.0-58.5)	43.0	(40.3-45.8)
		1998-2002	1,925	88.1	(86.6-89.5)	61.9	(59.7-64.1)	47.7	(45.4-50.0)
		2003-2007	2,397	91.0	(89.8-92.1)	65.2	(63.2-67.1)	52.0	(49.2-54.8)
		2008-2012	2,429	93.5	(92.3-94.4)	71.2	(67.8-74.3)	–	–
C71.5	Ventricle, NOS	1973-1977	–	–	–	–	–	–	–
		1978-1982	–	–	–	–	–	–	–
		1983-1987	53	81.2	(67.8-89.5)	66.5	(52.0-77.6)	64.8	(50.2-76.1)
		1988-1992	63	85.7	(74.2-92.3)	76.4	(63.6-85.2)	71.9	(58.7-81.6)
		1993-1997	62	79.1	(66.7-87.3)	64.9	(51.5-75.4)	63.3	(50.0-74.0)
		1998-2002	89	82.9	(73.2-89.4)	72.6	(61.8-80.8)	71.6	(60.7-80.0)
		2003-2007	124	92.0	(85.5-95.6)	80.7	(72.4-86.7)	–	–
		2008-2012	126	87.8	(80.2-92.6)	75.2	(52.7-88.1)	–	–
C71.6	Cerebellum, NOS	1973-1977	90	86.8	(77.8-92.3)	57.0	(46.1-66.6)	50.5	(39.7-60.4)
		1978-1982	123	86.3	(78.8-91.3)	67.0	(57.9-74.7)	60.9	(51.5-69.0)
		1983-1987	113	89.5	(82.1-93.9)	75.8	(66.6-82.7)	66.5	(56.8-74.6)
		1988-1992	153	81.8	(74.7-87.1)	66.4	(58.2-73.4)	60.6	(52.2-67.9)
		1993-1997	168	85.2	(78.9-89.8)	71.3	(63.7-77.6)	62.6	(54.7-69.5)
		1998-2002	292	90.8	(86.8-93.6)	78.5	(73.2-82.9)	75.2	(69.7-79.9)
		2003-2007	373	92.2	(89.0-94.6)	81.7	(77.3-85.4)	–	–
		2008-2012	375	92.1	(88.6-94.6)	–	–	–	–
C71.7	Brain stem	1973-1977	–	–	–	–	–	–	–
		1978-1982	62	61.4	(48.1-72.2)	43.9	(31.3-55.7)	29.9	(17.2-43.8)
		1983-1987	75	73.4	(61.8-82.0)	60.3	(48.2-70.4)	32.8	(21.4-44.6)
		1988-1992	101	70.2	(60.2-78.2)	53.5	(43.2-62.7)	51.2	(39.2-62.0)
		1993-1997	120	81.7	(73.5-87.6)	59.7	(50.2-68.0)	45.8	(35.7-55.3)
		1998-2002	191	83.2	(77.1-87.9)	57.9	(50.5-64.7)	53.2	(43.6-61.9)
		2003-2007	269	82.4	(77.3-86.5)	59.3	(53.1-65.0)	48.8	(41.4-55.9)
		2008-2012	291	84.5	(79.5-88.3)	–	–	–	–
C71.8-C71.9	Other Brain	1973-1977	213	78.0	(71.8-83.0)	49.1	(42.2-55.7)	40.3	(33.6-46.9)
		1978-1982	215	78.3	(72.1-83.2)	49.9	(43.0-56.4)	32.0	(25.7-38.4)
		1983-1987	251	77.0	(71.2-81.7)	43.1	(36.9-49.2)	31.6	(25.9-37.5)
		1988-1992	410	56.8	(51.9-61.5)	35.0	(30.4-39.7)	25.5	(21.3-29.8)
		1993-1997	560	53.5	(49.3-57.5)	34.9	(30.9-38.9)	25.7	(22.1-29.4)
		1998-2002	604	78.9	(75.4-82.0)	49.8	(45.7-53.8)	39.6	(35.6-43.6)
		2003-2007	655	81.6	(78.4-84.4)	59.3	(55.3-63.0)	–	–
		2008-2012	592	81.4	(77.9-84.5)	54.8	(47.7-61.3)	–	–
C70.0-C70.9, C72.0-C72.9 C75.1-C75.3 C30.0[d]	Other Nervous System	1973-1977	97	84.7	(75.8-90.5)	67.4	(57.0-75.8)	59.5	(48.9-68.6)
		1978-1982	140	87.9	(81.2-92.4)	66.0	(57.3-73.2)	59.9	(51.1-67.7)
		1983-1987	151	87.4	(80.9-91.8)	68.9	(60.6-75.7)	67.9	(59.5-74.9)
		1988-1992	192	78.2	(71.6-83.4)	64.3	(57.0-70.7)	59.5	(52.0-66.2)
		1993-1997	262	79.5	(74.0-83.9)	68.3	(62.2-73.6)	65.6	(59.3-71.1)
		1998-2002	400	87.5	(83.9-90.4)	74.1	(69.5-78.2)	71.0	(66.1-75.3)
		2003-2007	503	90.1	(87.1-92.4)	81.3	(77.6-84.6)	–	–
		2008-2012	534	92.1	(89.3-94.2)	79.9	(73.6-84.8)	–	–

Continued

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 13. *Continued*

ICD-O-3 Code	Site[b]	Years of Diagnosis	N	1-Year		5-Year		10-Year	
				%	95% CI	%	95% CI	%	95% CI
All Codes	**All Sites**	**1973-1997**	**887**	**78.9**	**(76.1-81.5)**	**46.3**	**(43.0-49.6)**	**36.3**	**(33.1-39.5)**
		1978-1982	**1,199**	**81.7**	**(79.4-83.8)**	**52.0**	**(49.1-54.8)**	**39.1**	**(36.3-41.9)**
		1983-1987	**1,447**	**83.7**	**(81.7-85.5)**	**56.3**	**(53.6-58.8)**	**44.4**	**(41.8-47.0)**
		1988-1992	**1,902**	**74.7**	**(72.7-76.6)**	**51.5**	**(49.2-53.7)**	**43.0**	**(40.7-45.2)**
		1993-1997	**2,471**	**73.1**	**(71.3-74.8)**	**54.0**	**(51.9-55.9)**	**44.0**	**(42.0-45.9)**
		1998-2002	**3,521**	**86.3**	**(85.1-87.4)**	**62.7**	**(61.1-64.3)**	**52.0**	**(50.3-53.7)**
		2003-2007	**4,355**	**89.1**	**(88.1-90.0)**	**67.9**	**(66.4-69.3)**	**57.6**	**(55.7-59.5)**
		2008-2012	**4,375**	**90.8**	**(89.9-91.7)**	**70.7**	**(68.3-72.9)**	–	–

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time period, and they may not necessarily reflect the long-term survival outlook of newly diagnosed cases.
[b]The sites referred to in this table are loosely based on the categories and site codes defined in the SEER Site/Histology Validation List.
[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 2014 Sub (1973-2012 varying) – Linked To County Attributes – Total U.S., 1969-2014 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2014, based on the November 2014 submission.
[d]ICD-O-3 histology codes 9522-9523 only.
– Rates are excluded when calculated based on a population of less than 50, when less than 16 remain alive in the survival period, or when not enough follow up time has passed to calculate survival for the listed period.
Abbreviations: SEER, Survival, Epidemiology and End Results; CI, confidence interval.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 14. One-, Two-, Three-, Four-, Five-, and Ten-Year Relative Survival Rates[a,b] for Selected Malignant Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Histology, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: SEER, 1995-2012[c]

Histology	N	1-Year		2-Year		3-Year		4-Year		5-Year		10-Year	
		%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Pilocytic astrocytoma	1,148	97.2	(96.0-98.0)	95.8	(94.3-96.8)	94.8	(93.2-96.0)	93.8	(92.1-95.2)	93.1	(91.3-94.6)	90.4	(87.9-92.4)
Diffuse astrocytoma	2,050	93.5	(92.3-94.5)	86.7	(85.0-88.1)	80.6	(78.7-82.4)	74.9	(72.8-76.9)	69.5	(67.2-71.7)	51.7	(48.8-54.5)
Anaplastic astrocytoma	1,107	88.5	(86.4-90.3)	74.4	(71.5-77.0)	64.1	(60.9-67.1)	57.5	(54.2-60.8)	51.3	(47.8-54.7)	37.6	(33.7-41.5)
Glioblastoma	1,901	71.8	(69.6-73.8)	44.8	(42.4-47.1)	32.1	(29.8-34.4)	26.0	(23.9-28.3)	22.5	(20.4-24.7)	13.7	(11.7-15.9)
Oligodendroglioma	1,476	98.4	(97.6-99.0)	96.1	(94.9-97.0)	93.6	(92.1-94.8)	90.8	(89.1-92.3)	87.6	(85.5-89.3)	71.0	(67.8-73.9)
Anaplastic oligodendroglioma	403	93.4	(90.4-95.5)	83.6	(79.3-87.0)	79.5	(74.9-83.3)	73.1	(68.1-77.5)	67.2	(61.8-72.1)	50.0	(43.5-56.2)
Ependymal tumors	842	96.6	(95.1-97.7)	94.0	(92.0-95.5)	92.5	(90.3-94.2)	91.0	(88.5-92.9)	89.8	(87.2-91.9)	86.2	(82.8-88.9)
Oligoastrocytic tumors	928	96.8	(95.4-97.8)	90.9	(88.7-92.7)	84.6	(81.9-87.0)	79.7	(76.6-82.4)	74.4	(71.0-77.5)	57.1	(52.5-61.5)
Glioma malignant, NOS	872	89.2	(86.9-91.1)	81.8	(78.9-84.3)	76.6	(73.3-79.4)	73.1	(69.6-76.2)	69.4	(65.7-72.7)	56.8	(52.2-61.1)
Neuronal and mixed neuronal-glial tumors	132	96.2	(91.0-98.5)	91.4	(84.8-95.2)	86.0	(78.2-91.2)	79.9	(71.0-86.3)	78.9	(69.8-85.5)	66.6	(53.2-77.0)
Embryonal tumors	773	88.6	(86.1-90.7)	79.7	(76.6-82.5)	71.9	(68.3-75.1)	67.3	(63.5-70.7)	64.9	(61.0-68.5)	55.7	(51.3-59.9)
Meningioma	103	98.1	(92.1-99.6)	98.1	(92.1-99.6)	94.0	(86.4-97.4)	91.7	(83.4-96.0)	89.4	(80.4-94.4)	85.6	(75.4-91.8)
Lymphoma	824	42.5	(39.0-45.9)	36.5	(33.2-39.9)	34.0	(30.7-37.3)	32.5	(29.2-35.8)	31.5	(28.2-34.8)	26.0	(22.6-29.6)
TOTAL: All Brain and Other Nervous System[d]	**13,701**	**87.3**	**(86.7-87.8)**	**78.5**	**(77.7-79.2)**	**72.8**	**(72.0-73.6)**	**68.8**	**(67.9-69.6)**	**65.4**	**(64.5-66.3)**	**54.2**	**(53.1-55.2)**

[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, three, four, five, and ten year, respectively.
[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 2014 Sub (1973-2012 varying) - Linked To County Attributes - Total U.S., 1969-2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2015, based on the November 2014 submission.
[d]Includes histologies not listed in this table.
Abbreviations: SEER, Survival, Epidemiology and End Results; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 15. One-, Five-, and Ten-Year Relative Survival Rates[a,b] for Selected Malignant Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Histology and Year of Diagnosis, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: SEER, 1973-2012[c]

Histology	Years of Diagnosis	N	1-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI
Pilocytic astrocytoma	1973-1977	–	–	–	–	–	–	–
	1978-1982	–	–	–	–	–	–	–
	1983-1987	–	–	–	–	–	–	–
	1988-1992	69	98.7	(89.4-99.8)	93.3	(83.5-97.3)	89.4	(78.5-94.9)
	1993-1997	154	96.8	(92.4-98.7)	92.5	(86.8-95.8)	90.5	(84.2-94.4)
	1998-2002	275	96.4	(93.4-98.1)	90.9	(86.7-93.8)	87.6	(82.8-91.2)
	2003-2007	394	97.5	(95.4-98.7)	93.7	(90.7-95.8)	–	–
	2008-2012	380	97.7	(95.3-98.9)	–	–	–	–
Diffuse astrocytoma	1973-1977	288	87.3	(82.8-90.6)	57.0	(51.0-62.5)	44.6	(38.7-50.3)
	1978-1982	535	86.5	(83.3-89.1)	53.7	(49.4-57.9)	38.8	(34.6-43.0)
	1983-1987	600	89.0	(86.1-91.2)	57.4	(53.3-61.3)	41.7	(37.7-45.7)
	1988-1992	475	90.0	(86.9-92.4)	62.8	(58.2-67.0)	49.5	(44.9-54.0)
	1993-1997	386	92.1	(88.9-94.4)	67.9	(63.0-72.4)	52.0	(46.8-57.0)
	1998-2002	541	92.5	(89.9-94.4)	66.2	(62.0-70.1)	47.6	(43.2-51.8)
	2003-2007	658	93.5	(91.3-95.2)	70.1	(66.3-73.5)	53.6	(47.4-59.4)
	2008-2012	650	94.6	(92.4-96.2)	74.3	(66.6-80.4)	–	–
Anaplastic astrocytoma	1973-1977	–	–	–	–	–	–	–
	1978-1982	–	–	–	–	–	–	–
	1983-1987	103	85.6	(77.1-91.1)	57.7	(47.5-66.6)	42.4	(32.7-51.9)
	1988-1992	195	85.2	(79.3-89.5)	52.2	(44.9-59.0)	37.9	(31.0-44.8)
	1993-1997	194	81.5	(75.2-86.3)	46.0	(38.7-52.9)	34.2	(27.4-41.0)
	1998-2002	278	86.4	(81.7-89.9)	47.4	(41.4-53.3)	33.3	(27.7-39.1)
	2003-2007	333	87.3	(83.2-90.5)	51.6	(46.0-56.9)	–	–
	2008-2012	400	93.5	(90.4-95.7)	60.3	(48.6-70.2)	–	–
Glioblastoma	1973-1977	230	60.1	(53.5-66.1)	17.5	(12.9-22.7)	13.3	(9.2-18.0)
	1978-1982	172	62.8	(55.1-69.5)	20.3	(14.6-26.7)	–	–
	1983-1987	194	63.5	(56.3-69.9)	16.7	(11.8-22.3)	11.3	(7.3-16.4)
	1988-1992	225	62.1	(55.3-68.1)	13.9	(9.7-18.9)	13.0	(9.0-17.9)
	1993-1997	297	56.2	(50.3-61.7)	16.1	(12.1-20.5)	11.2	(7.8-15.2)
	1998-2002	505	68.0	(63.7-71.9)	20.7	(17.2-24.4)	12.8	(10.0-16.0)
	2003-2007	607	73.9	(70.2-77.2)	24.3	(20.9-27.9)	–	–
	2008-2012	623	76.5	(72.7-79.8)	23.0	(16.5-30.2)	–	–
Oligodendroglioma	1973-1977	–	–	–	–	–	–	–
	1978-1982	59	86.6	(74.8-93.1)	70.1	(56.4-80.2)	58.6	(44.7-70.1)
	1983-1987	89	94.5	(87.0-97.7)	81.3	(71.2-88.1)	63.5	(52.3-72.8)
	1988-1992	149	97.4	(93.0-99.1)	82.3	(75.0-87.7)	72.7	(64.5-79.3)
	1993-1997	305	97.2	(94.5-98.6)	85.7	(81.1-89.3)	65.2	(59.3-70.4)
	1998-2002	448	98.3	(96.5-99.2)	84.9	(81.1-88.0)	69.9	(65.2-74.0)
	2003-2007	452	99.0	(97.4-99.6)	88.4	(84.9-91.2)	–	–
	2008-2012	374	98.6	(96.5-99.5)	–	–	–	–
Anaplastic oligodendroglioma	1973-1977	–	–	–	–	–	–	–
	1978-1982	–	–	–	–	–	–	–
	1983-1987	–	–	–	–	–	–	–
	1988-1992	–	–	–	–	–	–	–
	1993-1997	–	–	–	–	–	–	–
	1998-2002	128	93.9	(88.0-96.9)	65.3	(56.3-72.9)	47.6	(38.6-56.1)
	2003-2007	122	91.8	(85.3-95.6)	66.1	(56.8-73.9)	–	–
	2008-2012	118	95.3	(88.9-98.1)	80.6	(58.9-91.6)	–	–

Continued

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 15. *Continued*

Histology	Years of Diagnosis	N	1-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI
Ependymal tumors	1973-1977	–	–	–	–	–	–	–
	1978-1982	54	89.0	(77.0-95.0)	78.2	(64.5-87.2)	64.0	(49.4-75.4)
	1983-1987	59	96.7	(86.9-99.2)	95.3	(84.9-98.6)	89.5	(77.3-95.4)
	1988-1992	74	93.3	(84.5-97.2)	90.9	(81.2-95.7)	83.8	(72.4-90.7)
	1993-1997	117	94.1	(87.9-97.2)	87.8	(80.1-92.6)	82.9	(74.5-88.7)
	1998-2002	192	95.9	(91.9-98.0)	90.0	(84.5-93.6)	85.5	(79.2-90.0)
	2003-2007	278	96.5	(93.4-98.1)	90.5	(86.2-93.5)	–	–
	2008-2012	299	98.2	(95.6-99.3)	85.6	(74.4-92.2)	–	–
Oligoastrocytic tumors	1973-1977	–	–	–	–	–	–	–
	1978-1982	–	–	–	–	–	–	–
	1983-1987	–	–	–	–	–	–	–
	1988-1992	78	97.6	(89.9-99.4)	74.8	(63.4-83.1)	60.8	(48.8-70.9)
	1993-1997	118	90.8	(83.9-94.8)	70.8	(61.6-78.2)	56.7	(47.1-65.2)
	1998-2002	202	97.1	(93.5-98.7)	69.3	(62.3-75.3)	55.1	(47.7-61.8)
	2003-2007	339	97.4	(95.0-98.7)	76.9	(71.9-81.2)	–	–
	2008-2012	319	97.3	(94.4-98.7)	79.0	(68.6-86.3)	–	–
Embryonal tumors	1973-1977	52	84.7	(71.6-92.1)	38.7	(25.6-51.7)	31.1	(19.1-43.9)
	1978-1982	59	90.0	(78.8-95.4)	56.3	(42.7-67.9)	48.2	(34.8-60.3)
	1983-1987	59	91.6	(80.9-96.5)	66.6	(52.9-77.1)	51.6	(38.0-63.6)
	1988-1992	103	81.7	(72.7-87.9)	57.6	(47.4-66.5)	48.9	(38.7-58.2)
	1993-1997	109	89.1	(81.5-93.7)	62.6	(52.6-71.0)	50.6	(40.7-59.7)
	1998-2002	220	88.6	(83.6-92.2)	65.2	(58.3-71.2)	59.6	(52.6-65.9)
	2003-2007	244	88.1	(83.3-91.6)	65.7	(59.2-71.4)	–	–
	2008-2012	243	89.0	(84.0-92.5)	–	–	–	–
Lymphoma	1973-1977	–	–	–	–	–	–	–
	1978-1982	–	–	–	–	–	–	–
	1983-1987	57	38.7	(26.2-51.0)	29.7	(18.4-41.9)	29.7	(18.4-41.9)
	1988-1992	281	12.1	(8.6-16.3)	3.8	(1.9-6.5)	2.7	(1.2-5.2)
	1993-1997	458	16.6	(13.4-20.2)	8.4	(6.1-11.2)	6.0	(4.0-8.4)
	1998-2002	195	37.4	(30.6-44.2)	27.4	(21.3-33.9)	24.4	(18.5-30.7)
	2003-2007	195	59.6	(52.3-66.1)	51.8	(44.4-58.7)	–	–
	2008-2012	160	66.5	(58.2-73.6)	–	–	–	–
TOTAL: All Brain and Other Nervous System[d]	**1973-1977**	**887**	**78.9**	**(76.1-81.5)**	**46.3**	**(43.0-49.6)**	**36.3**	**(33.1-39.5)**
	1978-1982	**1,199**	**81.7**	**(79.4-83.8)**	**52.0**	**(49.1-54.8)**	**39.1**	**(36.3-41.9)**
	1983-1987	**1,447**	**83.7**	**(81.7-85.5)**	**56.3**	**(53.6-58.8)**	**44.4**	**(41.8-47.0)**
	1988-1992	**1,902**	**74.7**	**(72.7-76.6)**	**51.5**	**(49.2-53.7)**	**43.0**	**(40.7-45.2)**
	1993-1997	**2,471**	**73.1**	**(71.3-74.8)**	**54.0**	**(51.9-55.9)**	**44.0**	**(42.0-45.9)**
	1998-2002	**3,521**	**86.3**	**(85.1-87.4)**	**62.7**	**(61.1-64.3)**	**52.0**	**(50.3-53.7)**
	2003-2007	**4,355**	**89.1**	**(88.1-90.0)**	**67.9**	**(66.4-69.3)**	**57.6**	**(55.7-59.5)**
	2008-2012	**4,375**	**90.8**	**(89.9-91.7)**	**70.7**	**(68.3-72.9)**	–	–

[a]The cohort analysis of survival rates was utilized for calculating the survival estimates presented in this table. Long-term cohort-based survival estimates reflect the survival experience of individuals diagnosed over the time 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, three, four, five, and ten year, respectively.
[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 2014 Sub (1973-2012 varying) - Linked To County Attributes - Total U.S., 1969-2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2015, based on the November 2014 submission.
[d]Includes histologies not listed in this table.
– Rates are excluded when calculated based on a population of less than 50, when less than 16 remain alive in the survival period, or when not enough follow up time has passed to calculate survival for the listed period.
Abbreviations: SEER, Survival, Epidemiology and End Results; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 16. One-, Two-, Five-, and Ten-Year Relative Survival Rates[a,b] for Selected Malignant Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Age Groups, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: SEER, 1995-2012[c]

Histology	Age Group (years)	N	1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
Pilocytic astrocytoma	15-19	475	98.1	(96.2-99.0)	97.6	(95.6-98.7)	95.5	(92.8-97.2)	95.3	(92.4-97.1)
	20-24	261	98.1	(95.3-99.2)	96.5	(93.2-98.2)	93.8	(89.5-96.4)	91.0	(85.2-94.6)
	25-29	165	97.6	(93.5-99.1)	95.6	(90.8-98.0)	89.7	(83.1-93.8)	83.6	(74.9-89.5)
	30-34	138	94.7	(89.1-97.5)	92.3	(85.9-95.8)	90.6	(83.4-94.7)	84.8	(74.8-91.0)
	35-39	109	93.5	(86.7-96.9)	90.5	(82.8-94.9)	89.5	(81.2-94.3)	84.5	(72.9-91.5)
Diffuse astrocytoma	15-19	222	96.8	(93.3-98.5)	88.6	(83.3-92.3)	84.0	(77.7-88.6)	79.8	(72.5-85.3)
	20-24	342	92.7	(89.3-95.1)	85.0	(80.4-88.5)	69.0	(63.0-74.2)	51.0	(43.8-57.7)
	25-29	421	95.6	(93.1-97.3)	92.0	(88.8-94.3)	73.0	(67.8-77.5)	48.6	(42.0-55.0)
	30-34	515	93.9	(91.4-95.7)	88.5	(85.3-91.1)	68.0	(63.2-72.3)	49.6	(44.0-55.0)
	35-39	550	90.6	(87.8-92.8)	81.1	(77.4-84.2)	63.4	(58.8-67.7)	46.0	(40.4-51.5)
Anaplastic astrocytoma	15-19	88	79.4	(69.0-86.7)	54.6	(30.5-53.3)	42.2	(42.7-65.0)	32.8	(20.2-46.1)
	20-24	160	91.5	(85.7-95.0)	75.7	(50.1-67.2)	59.2	(67.8-82.0)	38.3	(28.0-48.5)
	25-29	238	92.7	(88.4-95.5)	81.5	(47.6-63.3)	55.9	(75.3-86.3)	45.3	(36.3-53.8)
	30-34	292	90.9	(86.8-93.7)	75.2	(42.2-55.7)	49.2	(69.5-80.0)	37.7	(30.5-44.8)
	35-39	329	84.4	(79.9-88.0)	73.3	(42.3-54.6)	48.6	(67.9-77.9)	34.3	(27.5-41.1)
Glioblastoma	15-19	136	71.5	(62.8-78.4)	41.7	(6.4-19.5)	12.0	(32.7-50.4)	8.0	(3.0-16.2)
	20-24	198	73.2	(66.2-78.9)	50.6	(22.3-36.4)	29.2	(43.0-57.6)	14.8	(8.5-22.8)
	25-29	339	74.1	(68.9-78.5)	51.4	(22.1-32.8)	27.3	(45.6-56.9)	18.1	(12.9-24.0)
	30-34	455	72.8	(68.3-76.8)	48.1	(18.1-27.3)	22.5	(43.1-53.0)	14.4	(10.3-19.1)
	35-39	773	69.9	(66.4-73.0)	39.2	(17.3-23.6)	20.4	(35.6-42.8)	12.2	(9.4-15.3)
Oligodendroglioma	15-19	116	98.3	(93.0-99.6)	94.6	(88.2-97.6)	91.7	(84.1-95.7)	87.8	(78.6-93.2)
	20-24	166	–	–	97.6	(93.2-99.1)	90.5	(84.1-94.4)	81.0	(72.0-87.4)
	25-29	312	98.5	(96.1-99.4)	95.8	(92.7-97.6)	87.5	(82.7-91.0)	65.5	(57.9-72.1)
	30-34	389	98.8	(96.8-99.5)	95.7	(92.8-97.4)	85.0	(80.3-88.6)	70.3	(63.7-75.9)
	35-39	493	97.7	(95.8-98.7)	96.5	(94.3-97.9)	87.5	(83.9-90.4)	67.7	(62.1-72.6)
Anaplastic oligodendroglioma	15-19	–	–	–	–	–	–	–	–	–
	20-24	39	84.5	(68.6-92.7)	62.7	(45.2-76.1)	50.7	(33.4-65.7)	44.6	(25.8-61.8)
	25-29	83	96.3	(88.8-98.8)	84.4	(74.0-90.9)	67.6	(55.1-77.4)	46.1	(32.4-58.7)
	30-34	105	93.2	(86.1-96.7)	83.7	(74.6-89.7)	62.7	(51.0-72.3)	50.2	(37.4-61.8)
	35-39	155	96.1	(91.3-98.3)	91.1	(84.8-94.8)	77.8	(69.1-84.2)	55.4	(44.1-65.3)
Ependymal tumors	15-19	137	96.2	(91.0-98.4)	92.8	(86.5-96.3)	86.9	(78.9-92.1)	77.9	(67.0-85.7)
	20-24	138	94.1	(88.4-97.0)	92.5	(86.3-96.0)	87.3	(79.3-92.4)	82.5	(72.1-89.3)
	25-29	161	96.3	(91.7-98.3)	92.9	(87.5-96.1)	88.5	(81.8-92.9)	85.6	(77.8-90.8)
	30-34	196	97.5	(93.8-99.0)	95.8	(91.6-98.0)	92.0	(86.4-95.4)	88.2	(80.3-93.0)
	35-39	210	98.1	(94.7-99.3)	94.8	(90.3-97.3)	91.9	(86.4-95.2)	91.4	(85.5-95.0)
Oligoastrocytic tumors	15-19	54	90.6	(78.8-96.0)	86.7	(73.9-93.5)	84.5	(70.8-92.1)	75.9	(59.5-86.3)
	20-24	109	98.1	(92.4-99.6)	90.8	(82.9-95.2)	73.8	(62.9-82.0)	62.4	(48.5-73.6)
	25-29	229	96.9	(93.4-98.5)	90.9	(86.0-94.2)	77.3	(70.3-82.8)	61.6	(52.5-69.5)
	30-34	296	96.6	(93.6-98.2)	91.6	(87.5-94.4)	73.9	(67.5-79.3)	52.3	(43.5-60.4)
	35-39	240	98.0	(94.8-99.2)	90.9	(86.1-94.1)	70.1	(62.9-76.2)	51.4	(42.3-59.8)
Glioma malignant, NOS	15-19	172	90.3	(84.7-94.0)	83.6	(76.8-88.6)	75.1	(67.0-81.4)	73.8	(65.3-80.5)
	20-24	151	90.2	(83.9-94.1)	84.6	(77.2-89.7)	73.8	(64.5-81.0)	65.7	(53.5-75.4)
	25-29	159	88.8	(82.6-92.9)	83.7	(76.6-88.8)	69.6	(60.6-76.9)	51.7	(39.9-62.2)
	30-34	195	87.3	(81.5-91.3)	75.7	(68.7-81.4)	68.3	(60.5-74.8)	48.4	(38.9-57.3)
	35-39	195	89.8	(84.4-93.4)	82.6	(76.1-87.5)	62.1	(53.6-69.5)	50.2	(40.5-59.1)

Continued

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 16. *Continued*

Histology	Age Group (years)	N	1-Year		2-Year		5-Year		10-Year	
			%	95% CI	%	95% CI	%	95% CI	%	95% CI
Neuronal and mixed neuronal-glial tumors	15-19	–	–	–	–	–	–	–	–	–
	20-24	–	–	–	–	–	–	–	–	–
	25-29	–	–	–	–	–	–	–	–	–
	30-34	–	–	–	–	–	–	–	–	–
	35-39	–	–	–	–	–	–	–	–	–
Embryonal tumors	15-19	205	90.5	(85.5-93.9)	78.5	(71.9-83.7)	62.5	(54.7-69.3)	56.7	(48.2-64.3)
	20-24	194	90.0	(84.7-93.5)	81.5	(75.0-86.5)	65.0	(57.1-71.8)	54.7	(45.9-62.6)
	25-29	151	88.0	(81.3-92.4)	81.7	(74.0-87.3)	66.1	(56.7-73.9)	59.6	(49.2-68.5)
	30-34	124	90.0	(83.0-94.2)	78.3	(69.5-84.8)	71.4	(61.8-79.0)	58.8	(47.4-68.5)
	35-39	99	81.2	(71.7-87.7)	77.8	(67.9-85.0)	59.7	(48.1-69.5)	48.1	(35.4-59.7)
Meningioma	15-19	–	–	–	–	–	–	–	–	–
	20-24	–	–	–	–	–	–	–	–	–
	25-29	–	–	–	–	–	–	–	–	–
	30-34	–	–	–	–	–	–	–	–	–
	35-39	–	–	–	–	–	–	–	–	–
Lymphoma	15-19	–	–	–	–	–	–	–	–	–
	20-24	66	62.7	(49.3-73.4)	51.3	(37.8-63.3)	43.3	(30.1-55.9)	39.6	(25.6-53.3)
	25-29	151	44.2	(36.1-52.0)	36.3	(28.6-44.1)	31.6	(24.0-39.4)	30.4	(22.9-38.3)
	30-34	247	40.1	(33.9-46.2)	36.2	(30.1-42.2)	31.8	(25.9-37.8)	25.0	(18.9-31.5)
	35-39	329	36.1	(30.9-41.3)	30.7	(25.7-35.9)	25.5	(20.7-30.6)	19.3	(14.5-24.6)
TOTAL: All Brain and Other Nervous System[d]	**15-19**	**2,066**	**92.2**	**(90.9-93.3)**	**85.2**	**(83.5-86.7)**	**77.4**	**(75.4-79.4)**	**73.5**	**(71.1-75.7)**
	20-24	**2,084**	**90.7**	**(89.3-91.9)**	**83.1**	**(81.3-84.7)**	**71.5**	**(69.3-73.6)**	**61.3**	**(58.6-63.9)**
	25-29	**2,641**	**88.8**	**(87.5-90.0)**	**80.9**	**(79.3-82.4)**	**66.8**	**(64.8-68.8)**	**53.1**	**(50.5-55.5)**
	30-34	**3,180**	**86.5**	**(85.2-87.7)**	**77.8**	**(76.2-79.3)**	**62.9**	**(61.0-64.7)**	**50.5**	**(48.2-52.7)**
	35-39	**3,730**	**82.3**	**(81.0-83.5)**	**71.2**	**(69.6-72.7)**	**56.8**	**(55.0-58.5)**	**44.1**	**(42.1-46.1)**

[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 year, respectively. Rates were not presented for categories with 50 or less cases and were suppressed for rates where less 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 2014 Sub (1973-2012 varying) - Linked To County Attributes - Total U.S., 1969-2013 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2015, based on the November 2014 submission.
[d]Includes histologies not listed in this table.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Table 17. Incidence Time Trends for Selected Brain and Central Nervous System Tumors in Adolescents and Young Adults Age 15-39 Years by Histology, American Brain Tumor Association Adolescent and Young Adult Brain Tumor Report: CBTRUS, 2008-2012

Histology	Malignant									Non-malignant					
	Trend 1			Trend 2			Trend 3			Trend 1			Trend 2		
	Years	APC	95% CI	Years	APC	95% CI	Years	APC	95% CI	Years	APC	95% CI	Years	APC	95% CI
Tumors of Neuroepithelial Tissue	**1995-2012**	**0.1**	**(−0.1,0.3)**							**2004-2012**	**2.2**	**(0.3,4.1)***			
Pilocytic astrocytoma	1995-2012	1.1	(0.3,1.8)*							–	–	–			
Diffuse astrocytoma	1995-2002	−2.5	(−4.1,-0.9)*	2002-2012	−1.1	(−2.0,-0.2)*				–	–	–			
Anaplastic astrocytoma	1995-2000	2.0	(−0.8,4.9)	2000-2006	−3.2	(−6.1,-0.3)*	2006-2012	2.5	(0.3,4.8)*	–	–	–			
Unique astrocytoma variants	1995-2012	4.5	(2.1,7.0)*							–	–	–			
Glioblastoma	1995-2012	0.6	(0.0,1.2)							–	–	–			
Oligodendroglioma	1995-1997	9.2	(−7.5,29)	1997-2012	−3.2	(−4.0,-2.4)*				–	–	–			
Anaplastic oligodendroglioma	1995-1998	23.3	(8.3,40.3)*	1998-2012	−4.3	(−5.3,-3.3)*				–	–	–			
Oligoastrocytic tumors	1995-2012	4.3	(3.4,5.3)*							–	–	–			
Ependymal tumors	1995-2002	−1.5	(−4.8,1.9)	2002-2004	14.8	**	2004-2012	−1.6	(−3.5,0.3)	2004-2012	1.5	(−2.4,5.6)			
Glioma malignant, NOS	1995-2012	3.1	(2.1,4.1)*												
Choroid plexus tumors	–	–	–	–	–	–	–	–	–	2004-2012	−3.5	(−7.4,0.6)			
Neuronal and mixed neuronal-glial tumors	–	–	–	–	–	–	–	–	–	2004-2012	2.6	(0.8,4.3)*			
Embryonal tumors	1995-2012	−0.6	(−1.3,0.0)												
Tumors of Cranial and Spinal Nerves	**–**	**–**	**–**							**2004-2012**	**0.3**	**(−1.5,2.0)**			
Nerve sheath tumors	–	–	–							2004-2012	0.3	(−1.5,2.0)			
Tumors of Meninges	**1995-2012**	**−1.8**	**(−3.6,0.1)**							**2004-2006**	**10.4**	**(−7.3,31.5)**	**2006-2012**	**1.2**	**(−1.4,3.8)**
Meningioma	–	–	–							2004-2012	2.8	(0.8,4.7)*			
Mesenchymal tumors	–	–	–							2004-2012	1.2	(−5.3,8.1)			
Other neoplasms related to the meninges	–	–	–							2004-2012	1.4	(−0.5,3.4)			
Lymphomas and Hematopoietic Neoplasms	**1995-1998**	**−32.7**	**(−39.6,-25)***	**1998-2012**	**-4.4**	**(−5.6,-3.1)***									
Lymphoma	1995-1998	−31.8	(−40.1,-22.3)*	1998-2012	−5.0	(−6.4,-3.5)*									
Germ Cell Tumors and Cysts	**1995-2012**	**0.6**	**(−0.5,1.8)**												
Germ cell tumors, cysts and heterotopias	1995-2012	0.6	(−0.5,1.8)												
Tumors of Sellar Region	**–**	**–**	**–**							**2004-2008**	**8.6**	**(5.3,12)***	**2008-2012**	**0.5**	**(−2.3,3.5)**
Tumors of the pituitary	–	–	–							2004-2009	7.6	(4.9,10.5)*	2009-2012	−0.9	(−6.4,4.8)
Craniopharyngioma	–	–	–							2004-2012	−1.6	(−3.6,0.4)			
Unclassified Tumors	**1995-2012**	**-3.7**	**(−4.8,-2.6)***							**2004-2012**	**6.7**	**(4.4,8.9)***			
Hemangioma	–	–	–							2004-2010	18.5	(12.3,25.2)*	2010-2012	2.4	(−20.8,32.2)
Neoplasm, unspecified	1995-2012	−2.9	(−3.9,-2.0)*							2004-2012	1.6	(−0.4,3.7)			
TOTAL[c]	**1995-2012**	**-0.6**	**(−0.8,-0.4)***							**2004-2006**	**11.0**	**(−4.3,28.9)**	**2006-2012**	**1.9**	**(−0.5,4.3)**

*Statistic is significantly statistic at the $p < .05$ level.
** Confidence interval unable to be calculated.
– Rates are excluded when annual rate is based on a population of less than 16.
Abbreviation: APC, annual percentage change; NPCR, National Program of Cancer Registries; SEER, Survival, Epidemiology and End Results; CI, confidence interval; NOS, not otherwise specified.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Appendix A. Average Annual Populations[a] for 2008-2012[b] by Age, Gender, and Race

Male					
Age Group	White	Black	AIAN	API	Total
15-19	8,515,937	1,888,284	197,230	591,389	11,192,840
20-24	8,525,811	1,713,867	190,386	670,783	11,100,847
25-29	8,296,572	1,465,887	173,417	700,196	10,636,071
30-34	7,846,363	1,345,942	157,470	679,973	10,029,748
35-39	7,842,959	1,300,866	145,846	685,568	9,975,239
TOTAL	41,027,642	7,714,846	864,349	3,327,909	52,934,745

Female					
Age Group	White	Black	AIAN	API	Total
15-19	8,036,429	1,824,444	187,411	564,881	10,613,165
20-24	8,063,674	1,733,094	173,432	654,697	10,624,898
25-29	7,954,215	1,576,831	160,632	753,699	10,445,377
30-34	7,575,765	1,494,150	149,669	760,239	9,979,823
35-39	7,680,538	1,465,788	141,416	761,376	10,049,117
TOTAL	39,310,621	8,094,307	812,560	3,494,892	51,712,380

[a]Population data source for 51 population-based geographic regions: Estimates from the United States. Bureau of the Census <http://seer.cancer.gov/popdata/index.html>.
Abbreviations: AIAN, American Indian Alaskan Native; API, Asian Pacific Islander.
[b]Estimated population for Nevada is for 2008-2010 only.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016

Appendix B. Average Annual Populations[a] for 2008-2012[b] by Age, Gender, and Hispanic Ethnicity

Male			
Age Group	Hispanic	Non-Hispanic	Total
15-19	2,307,027	8,885,813	11,192,840
20-24	2,295,374	8,805,474	11,100,847
25-29	2,270,630	8,365,441	10,636,071
30-34	2,143,149	7,886,599	10,029,748
35-39	1,964,206	8,011,034	9,975,239
TOTAL	10,980,386	41,954,361	52,934,745

Female			
Age Group	Hispanic	Non-Hispanic	Total
15-19	2,149,441	8,463,724	10,613,165
20-24	2,017,353	8,607,545	10,624,898
25-29	2,009,218	8,436,159	10,445,377
30-34	1,966,944	8,012,879	9,979,823
35-39	1,867,593	8,181,524	10,049,117
TOTAL	10,010,549	41,701,831	51,712,380

[a]Population data source for 51 population-based geographic regions: Estimates from the U.S. Census Bureau http://seer.cancer.gov/popdata/index.html.
[b]Estimated population for Nevada is for 2008-2010 only.

Downloaded from http://neuro-oncology.oxfordjournals.org/ by guest on February 25, 2016