Consensus Conference on Brain Tumor Definition for Registration¹

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The Consensus Conference on Brain Tumor Definition was facilitated by the Central Brain Tumor Registry of the United States and held on November 10, 2000, in Chicago, Illinois, to reach multidisciplinary agreement on a standard definition of brain tumors for collecting and comparing data in the U.S. The Brain Tumor Working Group, convened in 1998 to determine the status of brain tumor collection in the U.S., outlined 4 recommendations of which the first 2 guided the discussion for the Consensus Conference: (1) standardization of a definition of primary brain tumors that is based on site alone, rather than on site and behavior, and that can be used by surveillance organizations in collecting these tumors; and (2) development of a reporting scheme that can be used for comparing estimates of primary brain tumors across registries. Consensus was reached on the collection of all primary brain tumor histologies found and reported in the brain or CNS ICD-O site codes (C70.0-C72.9 and C75.1-C75.3), including those coded benign and uncertain as well as those coded malignant. In addition, a comprehensive listing of histologies occurring in the brain and CNS, based

on the CBTRUS grouping scheme, was formulated to provide a template for reporting in accordance with the second recommendation of the Brain Tumor Working Group. With consensus achieved on the first 2 recommendations, the stage is set to move forward in estimating additional resources necessary for the collection of these tumors, including funding, training for cancer registrars, identifying quality control measures, and developing computerized edit checks, as outlined in the last 2 recommendations of the Brain Tumor Working Group. *Neuro-Oncology* 4, 134-145, 2002 (Posted to *Neuro-Oncology* [serial online], Doc. 01-059, February 21, 2002. URL <neuro-oncology.mc.duke.edu>)

In February 1998, the NCCCS³ appointed a working group to assess the status of benign and malignant brain tumor surveillance in the U.S. The rationale for convening this group is well documented in the literature (Davis et al., 1997; Gurney et al., 1999; Schoenberg et al., 1976) and provides scientific reasons for ascertaining all primary brain tumors by cancer surveillance systems, including facilitating epidemiologic classification of tumors consistent with the classification used in clinical settings. The BTWG included representatives of several public and private organizations involved in cancer surveillance in the U.S. as well as experts in brain tumor epidemiology and cancer registration. The BTWG "described the clinical and epidemiological significance of benign and malignant intracranial and CNS tumors; reviewed the current status of nonmalignant brain tumor surveillance among cancer registries in the U.S.; analyzed data for brain and other CNS tumors, as well as non-CNS intracranial tumors; and assessed the feasibility of routine collection of data for nonmalignant brain tumors (BTWG, 1998)."⁴

Among the members of the BTWG were representatives from the National Program of Cancer Registries of the Centers for Disease Control, the North American Association of Central Cancer Registries, the Surveillance, Epidemiology and End Results Program of the

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³Abbreviations used are as follows: BTWG, Brain Tumor Working Group; CBTRUS, Central Brain Tumor Registry of the United States; ICDO, International Classification of Diseases for Oncology; NCCCS, National Coordinating Council for Cancer Surveillance; NOS, not otherwise specified; WHO, World Health Organization.

⁴Surveillance of Benign and Malignant Tumors, National Coordinating Council for Cancer Surveillance, September, 1998.

National Cancer Institute, the National Cancer Data Base of the American College of Surgeons, the National Cancer Registrars Association, and several state registries. These organizations actively collect and report U.S. cancer incidence, morbidity, mortality, and survival data. CBTRUS, a North American Association of Central Cancer Registries member that provides brain tumor statistics by aggregating data from state cancer registries that collect data on all primary brain tumors, including those coded as benign, was also part of the BTWG.

The BTWG presented a final report to NCCCS that included 4 recommendations (BTWG, 1998). On September 8, 1998, NCCCS voted to approve 2 recommendations of BTWG: (1) to derive a standard definition for all primary intracranial and CNS tumors; and (2) to develop a standard site and histology definition for tabulating and estimating rates of these tumors. Recommendations 3 and 4, concerning implementation of a site definition, were deferred pending acceptance of the first 2 recommendations.

Rationale

The Consensus Conference on Brain Tumor Definition was facilitated by CBTRUS and held on November 10, 2000, in Chicago, Illinois, at the time of the annual meeting of the Society for Neuro-Oncology. The objective of this meeting was to reach consensus on the first 2 recommendations of BTWG. The participants from member organizations of NCCCS, including members of the BTWG, brain tumor researchers, clinicians, neuropathologists, and other interested individuals (Table 1), were charged with agreeing on a definition that surveillance organizations could use for collecting primary brain tumors, a definition based on site rather than on site and behavior. The latter definition currently guides the data collection of member organizations of NCCCS. Participants also undertook the development of a reporting scheme that can be used to compare estimates of primary brain tumors across registries.

Methods

Materials used for the preparation of Table 2 for the Consensus Conference included the BTWG report (BTWG, 1998), the CBTRUS statistical report (CBTRUS, 2000), data standards manuals that guide the collection of neoplasms for Surveillance, Epidemiology and End Results (Fritz & Ries, 1998), National Program of Cancer Registries (CDCP, 2000), North American Association of Central Cancer Registries (Hultstrom, 2001), and the Histological Groups for Comparative Studies (Parkin et al., 1998), a publication of the International Agency for Research on Cancer of WHO. The histologic grouping scheme (Table 4) was developed by CBTRUS in collaboration with our consulting neuropathologist, Dr. Janet Bruner. These groupings were broadly based on the WHO categories for brain tumors (Kleihues and Cavenee, 2000; Kleihues et al., 1993) and were revised to include ICDO-3 (Fritz et al., 2000) as well as ICDO-2 (Percy et al., 1990) histology codes. For further information on the classification of lymphomas and hemopoietic neoplasms, refer to *WHO Classification of Tumors, Pathology and Genetics*

Table 1. Organizations invited to the Consensus Conference

American Cancer Society (ACS)
^a American College of Surgeons (ACOS)
^a American Joint Committee on Cancer (AJCC)
^a Armed Forces Institute of Pathology (AFIP)
^a Brain Tumor Working Group (BTWG)
^a Central Brain Tumor Registry of the United States (CBTRUS)
^a Centers for Disease Control and Prevention (CDCP)
Children's Oncology Group (COG)
^a College of American Pathology
International Association of Cancer Registries (IACR)
International Agency for Research on Cancer (IARC)
^a Joint Section on Tumors
^a Massachusetts Cancer Registry
^a National Association of Central Cancer Registries (NAACCR)
National Center for Health Statistics (NCHS)
^a National Cancer Institute: Clinical Trials
^a National Cancer Institute: Surveillance, Epidemiology and End Results (SEER)
^a National Cancer Registrars Association (NCRA)
^a New Mexico Tumor Registry
^a Progress Review Group (PRG)
^a Society for Neuro-Oncology (SNO)
^a World Health Organization (WHO)

Consensus Conference Panel Members

Janet M. Bruner: Professor and Chair, Department of Pathology, M.D. Anderson Cancer Center and CBTRUS Consulting Neuropathologist

Faith Davis: Principal Investigator, CBTRUS and Professor and Director, Division of Epidemiology and Biostatistics, University of Illinois at Chicago School of Public Health

Carol Kruchko: President, CBTRUS

Bernd W. Scheithauer: Department of Laboratory Medicine and Pathology, Mayo Clinics and WHO author

Tanya Surawicz: CBTRUS Research Associate, Division of Epidemiology and Biostatistics, University of Illinois at Chicago School of Public Health

Linda Taylor: New Mexico Tumor Registry, University of New Mexico Health Sciences Center

^aRepresented at the conference.

of Tumours of Haematopoietic and Lymphoid Tissues (Jaffe et al., 2001).

Results

Unanimous agreement was reached among participants of the Consensus Conference to collect all histologies of primary neoplasms found (regardless of behavior) and reported in the brain or CNS ICDO site codes (C70.0-C72.9 and C75.1-C75.3; Table 2) and available within the most recent coding and classification schemes, ICDO-3 (Fritz et al., 2000) and WHO 2000 (Kleihues and Cavenee, 2000). Agreement was also reached to include malignant tumors of the nasal cavity (C30.0), but to exclude tumors of the retina (C69.2). This discussion achieves consensus on the site definition recommended by BTWG and provides the surveillance community with a standard brain tumor definition to guide their collection

Table 2. Comparison of site definitions for case ascertainment of primary brain and CNS tumors

Site definition	Code	BTWG	CBTRUS	SEER, NPCR, NAACCR	IARC ^a	Consensus Conference recommendation
Brain	C71.0-C71.9	Yes	Yes	Yes	Yes	Yes
Meninges	C70.0-C70.9	Yes	Yes	Yes	Yes	Yes
Spinal cord, cranial nerves, other CNS	C72.0-C72.9	Yes	Yes	Yes	Yes	Yes
Pituitary and pineal glands	C75.1-C75.3	Yes	Yes	Yes	Yes	Yes
Nasal cavity (olfactory tumors)	C30.0 (9520-9523)	No	No	Yes	Yes	Yes
Retina (retinoblastoma)	C69.2 (9510-9512)	No	No	Yes	Yes	No

Abbreviations: NPCR, National Program of Cancer Registries; also see Table 1.

^aDerived from text in Parkin et al. (1998).

of all primary brain tumors in the U.S. Collection of tumors in addition to those currently ascertained is recommended for the brain and other CNS site codes (Table 3). However, no additional collection will be necessary for the nasal cavity because the cancer registries already collect these malignant tumors.

To aid in the collection process and provide a template for reporting in accordance with Recommendation 2 of the BTWG, a comprehensive listing of histologies occurring in the brain and CNS, based on the CBTRUS grouping scheme, was formulated (Table 4). Suggestions made during the Consensus Conference resulted in changes to the original template, but care was taken to remain within the classification and coding schemes currently available (ICDO-3 [Fritz et al., 2000] and WHO 2000 [Kleihues and Cavenee, 2000]). Obsolete terminology was included in this table to assist in classifying histologies used in the past, thus serving as a source for historical searching and comparisons. All subdivisions of histological categories can be regrouped according to international standards, such as those suggested by the International Agency for Research on Cancer (Parkin et al., 1998).

Discussion

Consensus on a standard definition for the collection of primary brain tumors (Recommendation 1 of the BTWG) has been achieved and now paves the way for “the development of a standard site and histology definition for tabulating and estimating rates of these tumors” recommended by BTWG (1998). The rationale for this recommendation is well established in the literature (Davis et al., 1997; Gurney et al., 1999; Schoenberg et al., 1976). This expanded site definition will result in the additional collection of benign and uncertain brain and CNS tumors that are currently not reportable in many registries

(Table 3). Rationale for the collection of tumors of the pituitary and pineal gland comes from the definition of intracranial neoplasms as “any tumor...located within the cranial cavity,” provided by Walker et al. (1985); neoplasms of the orbit are specifically excluded from this definition. The classification scheme for brain and nervous system tumors proposed in Parkin et al. (1998), and which follows closely the scheme proposed by van der Sanden et al. (1998), also recommends the inclusion of pineal and pituitary tumors, as well as tumors of the nasal cavity. Tumors such as olfactory neuroblastoma, although peripheral to the CNS, can infiltrate the cranial cavity (Finkelstein et al. (1997)), and participants of the Consensus Conference recommended including these tumors. This recommendation to include tumors of the nasal cavity in the site definition will not result in additional collection, as these malignant tumors are already collected, but will result in a difference in how these tumors are classified and reported.

With a consensus achieved on the first and second BTWG recommendations, the foundation was laid to begin to address the issues related to the third recommendation, “a pilot study should be conducted to assess the procedures and quality control functions needed, as well as the costs for collecting data for these tumors” and the fourth recommendation, “development and implementation of special training programs and curricula ... as well as the development of computerized edit-checking procedures” (BTWG, 1998). Sufficient funding, as well as training initiatives for the hospital and state registrars, will be necessary to ensure the accurate and timely collection of these additional tumors in the work load of the cancer registries. The procedures developed by the North American Association of Central Cancer Registries assure the highest quality data when combining rates for malignant tumors in the U.S. (Howe et al., 2001). Combined efforts

Table 3. Recommended site and behavior definitions for collection and reporting of primary brain and CNS tumors

Site definition	Code	Additional collecting		Currently collected	
		Benign	Uncertain	In situ	Malignant
Brain	C71.0-C71.9	Yes	Yes	Yes	Yes
Meninges	C70.0-C70.9	Yes	Yes	Yes	Yes
Spinal cord, cranial nerves, other CNS	C72.0-C72.9	Yes	Yes	Yes	Yes
Pituitary and pineal glands	C75.1-C75.3	Yes	Yes	Yes	Yes
Nasal cavity (olfactory tumors)	C30.0 (9520-9523)	No	No	Yes	Yes

Table 4. Sample histology grouping for reporting brain and CNS system tumors, CBTRUS grouping scheme revised, Consensus Conference November 10, 2000

Histology	ICDO-2/ICDO-3 histology codes ^a
Neuroepithelial tumors	
Diffuse astrocytoma (protoplasmic, fibrillary)	Protoplasmic astrocytoma (9410/3) Fibrillary astrocytoma; fibrous astrocytoma (9420/3)
Anaplastic astrocytoma	Anaplastic astrocytoma (9401/3) Gemistocytic astrocytoma; gemistocytoma (9411/3)
Glioblastoma	Glioblastoma NOS; glioblastoma multiforme; spongioblastoma multiforme (9440/3) Giant cell glioblastoma; <i>monstrocellular sarcoma</i> (9481/3) (9441/3) Gliosarcoma; glioblastoma with sarcomatous component (9442/3)
Pilocytic astrocytoma	Pilocytic astrocytoma; piloid astrocytoma; juvenile astrocytoma; <i>spongioblastoma NOS</i> (9422/3) (9421/1)
Unique astrocytoma variants	Subependymoma; subependymal glioma; subependymal astrocytoma NOS; mixed subependymoma-ependymoma (9383/1) Subependymal giant cell astrocytoma (9384/1) Pleomorphic xanthoastrocytoma (9424/3)
Oligodendroglioma	Oligodendroglioma NOS (9450/3)
Anaplastic oligodendroglioma	Oligodendroglioma, anaplastic (9451/3) <i>Oligodendroblastoma</i> (9460/3)
Ependymoma/anaplastic ependymoma	Ependymoma NOS; epithelial ependymoma; cellular ependymoma; clear cell ependymoma; tanyctic ependymoma (9391/3) Anaplastic ependymoma; ependymoblastoma (9392/3) Papillary ependymoma (9393/3)
Ependymoma variants	Myxopapillary ependymoma (9394/1)
Mixed glioma	Mixed glioma; mixed oligoastrocytoma; anaplastic oligoastrocytoma (9382/3)
Astrocytoma, NOS	Astrocytoma NOS; astrocytic glioma; <i>astroglioma</i> ; diffuse astrocytoma; astrocytoma, low grade; diffuse astrocytoma, low grade; Cystic astrocytoma (9400/3)
Glioma malignant, NOS	Malignant glioma; glioma NOS (except nasal glioma, not neoplastic) (9380/3)
Choroid plexus	Choroid plexus papilloma NOS (9390/0) Atypical choroid plexus papilloma (9390/1) Choroid plexus carcinoma ; choroid plexus papilloma, anaplastic; choroid plexus papilloma, malignant (9390/3)
Neuroepithelial	Gliomatosis cerebri (9381/3) Polar spongioblastoma ; spongioblastoma polare; <i>Primitive polar spongioblastoma</i> (9443/3) (9423/3) Astroblastoma (9430/3) Chordoid glioma; chordoid glioma of the 3rd ventricle (9444/1)
Benign and malignant neuronal/glial, neuronal and mixed	Paranglioma, benign (8680/0) Paranglioma NOS (8680/1) Paranglioma, malignant (8680/3) Parasympatheic paranglioma (8682/1) Glomus jugulare tumor; jugular paranglioma; jugulotympanic paranglioma (8690/1) Extra-adrenal paranglioma NOS; nonchromaffin paranglioma NOS; chemodectoma (8693/1) Extra-adrenal paranglioma, malignant; nonchromaffin paranglioma, malignant (8693/3) Dysembryoplastic neuroepithelial tumor (9413/0) Gliofibroma (9442/1) Desmoplastic infantile astrocytoma; desmoplastic infantile ganglioglioma (9412/1) Ganglioneuroma (9490/0) Ganglioneuroblastoma (9490/3) Ganglioneuromatosis (9491/0) Gangliocytoma (9492/0) Dysplastic gangliocytoma of cerebellum (Lhermitte-Duclos) (9493/0) Neuroblastoma NOS; sympathicoblastoma; central neuroblastoma (9500/3) Ganglioglioma NOS; <i>glioneuroma; neuroastrocytoma</i> (9505/1)

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in italics are obsolete in ICDO-3.

Table 4 continued

	Ganglioglioma, anaplastic (9505/3)
	Central neurocytoma ; neurocytoma; cerebellar liponeurocytoma ; lipomatous medulloblastoma ; neurolipocytoma ; medullocytoma (9506/1)
	Olfactory neuroblastoma; esthesioneuroblastoma (9522/3)
	Olfactory neuroepithelioma; esthesioneuroepithelioma (9523/3)
Pineal parenchymal	Pinealoma (9360/1)
	Pineocytoma (9361/1)
	Pineoblastoma; mixed pineocytoma-pineoblastoma ; mixed pineal tumor ; transitional pineal tumor ; pineal parenchymal tumor of intermediate differentiation (9362/3)
Embryonal/primitive/medulloblastoma	Malignant rhabdoid tumor ; rhabdoid sarcoma; rhabdoid tumor NOS (8963/3)
	Melanotic neuroectodermal tumor; retinal anlage tumor; melanoameloblastoma; melanotic progonoma (9363/0)
	Peripheral neuroectodermal tumor; peripheral primitive neuroectodermal tumor NOS ; neuroectodermal tumor NOS; PPNET (9364/3)
	Medulloblastoma NOS; melanotic medulloblastoma (9470/3)
	Desmoplastic medulloblastoma; desmoplastic nodular medulloblastoma; <i>circumscribed arachnoidal cerebellar sarcoma</i> (9471/3)
	Medullomyoblastoma (9472/3)
	Primitive neuroectodermal tumor NOS; PNET NOS; central primitive neuroectodermal tumor NOS ; CPNET ; supratentorial PNET (9473/3)
	Large cell medulloblastoma (9474/3)
	Medulloepithelioma NOS (9501/3)
	Teratoid medulloepithelioma (9502/3)
	Neuroepithelioma NOS (9503/3)
	Atypical teratoid/rhabdoid tumor (9508/3)
Tumors of cranial and spinal nerves	
Nerve sheath, benign and malignant	Neurofibroma NOS (9540/0)
	Neurofibromatosis NOS; multiple neurofibromatosis; Von Recklinghausen disease (except of bone); Recklinghausen disease (except of bone) (9540/1)
	Malignant peripheral nerve sheath tumor ; MPNST NOS ; <i>neurofibrosarcoma</i> ; <i>neurogenic sarcoma</i> ; <i>neurosarcoma</i> ; MPNST with glandular differentiation ; epithelioid MPNST ; MPNST with mesenchymal differentiation ; melanotic MPNST ; melanotic psammomatous MPNST (9540/3)
	Melanotic neurofibroma (9541/0)
	Plexiform neurofibroma; plexiform neuroma (9550/0)
	Neurilemoma NOS; schwannoma NOS; neurinoma; acoustic neuroma; pigmented schwannoma; melanocytic schwannoma; plexiform schwannoma ; cellular schwannoma ; degenerated schwannoma ; ancient schwannoma ; psammomatous schwannoma (9560/0)
	Neurinomatosis (9560/1)
	<i>Malignant neurilemmoma</i> ; <i>malignant schwannoma NOS</i> ; <i>neurilemosarcoma</i> (9560/3)
	Malignant peripheral nerve sheath tumor with rhabdomyoblastic differentiation ; MPNST with rhabdomyoblastic differentiation ; triton tumor, malignant; malignant schwannoma with rhabdomyoblastic differentiation (9561/3)
	Neuroma NOS (9570/0)
	Perineurioma NOS ; intraneural perineurioma ; soft tissue perineurioma (9571/0)
	Perineurioma, malignant ; perineural MPNST (9571/3)
	Neurothekeoma; nerve sheath myxoma (9562/0)
Other tumors of cranial and spinal nerves	
Tumors of the meninges	
Meningioma	Meningioma NOS; microcystic meningioma ; secretory meningioma ; lymphoplasmacyte-rich meningioma ; metaplastic meningioma (9530/0)
	Meningiomatosis NOS; diffuse meningiomatosis; multiple meningiomas (9530/1)
	Malignant meningioma; anaplastic meningioma ; leptomeningeal sarcoma; meningeal sarcoma; meningotheial sarcoma (9530/3)
	Meningothelial meningioma; meningotheiomatous meningioma; endotheliomatous meningioma; syncytial meningioma (9531/0)
	Fibrous meningioma; fibroblastic meningioma (9532/0)

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in italics are obsolete in ICDO-3.

Table 4 continued

Other mesenchymal, benign and malignant	Psammomatous meningioma (9533/0)
	Angiomatous meningioma (9534/0)
	Transitional meningioma; mixed meningioma (9537/0)
	Clear cell meningioma; chordoid meningioma (9538/1)
	Papillary meningioma; rhabdoid meningioma (9538/3)
	Atypical meningioma (9539/1)
	Meningeal sarcomatosis (9539/3)
	Lipoadenoma; adenolipoma (8324/0)
	Diffuse melanocytosis (8728/0)
	Meningeal melanocytoma (8728/1)
	Meningeal melanomatosis (8728/3)
	Soft tissue tumor benign (8800/0)
	Sarcoma NOS; soft tissue sarcoma; soft tissue tumor, malignant; mesenchymal tumor, malignant (8800/3)
	Spindle cell sarcoma (8801/3)
	Giant cell sarcoma; pleomorphic cell sarcoma (8802/3)
	Small cell sarcoma; round cell sarcoma (8803/3)
	Epithelioid sarcoma; epithelioid cell sarcoma (8804/3)
	Undifferentiated sarcoma (8805/3)
	Desmoplastic small round cell tumor (8806/3)
	Fibroma NOS; fibroma durum (8810/0)
	Fibrosarcoma NOS (8810/3)
	Solitary fibrous tumor; localized fibrous tumor (8815/0)
	Solitary fibrous tumor, malignant (8815/3)
	Myofibroma (8824/0)
	Myofibromatosis (8824/1)
	Benign fibrous histiocytoma; fibrous histiocytoma NOS; fibroxanthoma NOS; xanthofibroma (8830/0)
	Atypical fibrous histiocytoma; atypical fibroxanthoma (8830/1)
	Malignant fibrous histiocytoma; fibroxanthoma, malignant (8830/3)
	Histiocytoma NOS; deep histiocytoma; juvenile histiocytoma; reticulohistiocytoma (8831/0)
	Lipoma NOS (8850/0)
	Atypical lipoma (8850/1)
	Liposarcoma NOS; fibroliposarcoma (8850/3)
	Fibrolipoma; Fibroma molle; soft fibroma (8851/0)
	Liposarcoma, well differentiated; liposarcoma, differentiated; lipoma-like liposarcoma; sclerosing liposarcoma; inflammatory liposarcoma (8851/3)
	Spindle cell lipoma (8857/0)
	Fibroblastic liposarcoma (8857/3)
	Angiolipoma NOS (8861/0)
	Leiomyoma NOS; fibromyoma; leiomyofibroma; lipoleiomyoma; plexiform leiomyoma (8890/0)
	Leiomyomatosis NOS; intravascular leiomyomatosis (8890/1)
	Leiomyosarcoma NOS (8890/3),
	Smooth muscle tumor of uncertain malignant potential; smooth muscle tumor NOS (8897/1),
	Rhabdomyoma NOS (8900/0)
	Rhabdomyosarcoma NOS; rhabdosarcoma (8900/3)
	Embryonal rhabdomyosarcoma NOS; embryonal rhabdomyosarcoma, pleomorphic; sarcoma botryoides; botryoid sarcoma (8910/3)
	Mesenchymoma, benign (8990/0)
	Mesenchymoma NOS; mixed mesenchymal tumor (8990/1)
	Mesenchymoma, malignant; mixed mesenchymal sarcoma (8990/3)
	Synovioma, benign (9040/0)
	Synovial sarcoma NOS; synovioma NOS; synovioma, malignant (9040/3)

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in *italics* are obsolete in ICDO-3.

Table 4 continued

	Hemangiopericytoma, benign (9150/0)
	Hemangiopericytoma NOS; <i>hemangiopericytic meningioma</i> (9536/0) (9150/1)
	Hemangiopericytoma malignant (9150/3)
	Osteoma NOS (9180/0)
	Osteosarcoma NOS; osteogenic sarcoma NOS; osteochondrosarcoma; osteoblastic sarcoma (9180/3)
	Osteochondroma; cartilaginous exostosis; osteocartilaginous exostosis; ecchondroma (9210/0)
	Chondromyxoid fibroma (9241/0)
	Ewing sarcoma; Ewing tumor (9260/3)
	<i>Cerebellar sarcoma</i> NOS (9480/3)
Hemangioblastoma	Hemangioblastoma; angioblastoma (9161/1)
	<i>Hemangioblastic meningioma; angioblastic meningioma</i> (9535/0)
Lymphomas and hemopoietic neoplasms	
Lymphoma	<p>Malignant lymphoma NOS; lymphoma NOS; <i>microglioma</i> (9594/3) (9590/3)</p> <p>Malignant lymphoma; non-Hodgkin NOS; non-Hodgkin lymphoma NOS; B-cell lymphoma NOS; malignant lymphoma, non-cleaved cell, NOS; malignant lymphoma, diffuse NOS (9595/3); <i>malignant lymphoma, lymphocytic, intermediate differentiation, nodular</i> (9694/3); <i>malignant lymphoma, small cell, noncleaved, diffuse</i> (9686/3); <i>malignant lymphoma, undifferentiated cell, non-Burkitt</i> (9686/3); <i>malignant lymphoma, undifferentiated cell type, NOS</i> (9686/3); <i>lymphosarcoma</i> NOS (9592/3); <i>lymphosarcoma, diffuse</i> (9592/3); <i>reticulum cell sarcoma</i> NOS (9593/3); <i>reticulum cell sarcoma, diffuse</i> (9593/3); <i>reticulosarcoma</i> NOS (9593/3); <i>reticulosarcoma, diffuse</i> (9593/3); <i>malignant lymphoma, small cleaved cell, diffuse</i> (9672/3); <i>malignant lymphoma, lymphocytic, poorly differentiated, diffuse</i> (9672/3); <i>malignant lymphoma, small cleaved cell, NOS</i> (9672/3); <i>malignant lymphoma, cleaved cell, NOS</i> (9672/3) (9591/3)</p> <p>Composite Hodgkin and non-Hodgkin lymphoma (9596/3)</p> <p>Hodgkin lymphoma NOS; Hodgkin disease NOS; malignant lymphoma; Hodgkin (9650/3)</p> <p>Hodgkin lymphoma, lymphocyte-rich; classical Hodgkin lymphoma, lymphocyte-rich (9651/3)</p> <p>Hodgkin lymphoma, mixed cellularity, NOS; classical Hodgkin lymphoma, mixed cellularity, NOS (9652/3)</p> <p>Hodgkin lymphoma, lymphocyte depletion, NOS; classical Hodgkin lymphoma, lymphocyte depletion, NOS (9653/3)</p> <p>Hodgkin lymphoma, lymphocyte depletion, diffuse fibrosis; classical Hodgkin lymphoma, lymphocyte depletion, diffuse fibrosis (9654/3)</p> <p>Hodgkin lymphoma, lymphocyte depletion, reticular; classical Hodgkin lymphoma, lymphocyte depletion, reticular (9655/3)</p> <p>Hodgkin lymphoma, nodular lymphocyte predominance; Hodgkin lymphoma, lymphocyte predominance, nodular; <i>Hodgkin paraganuloma</i> NOS; <i>Hodgkin paraganuloma, nodular</i> (9659/3)</p> <p><i>Hodgkin granuloma</i> (9661/3)</p> <p><i>Hodgkin sarcoma</i> (9662/3)</p> <p>Hodgkin lymphoma, nodular sclerosis, NOS; classical Hodgkin lymphoma, nodular sclerosis, NOS; Hodgkin disease, nodular sclerosis, NOS (9663/3)</p> <p>Hodgkin lymphoma, nodular sclerosis, cellular phase; classical Hodgkin lymphoma, nodular sclerosis, cellular phase (9664/3)</p> <p>Hodgkin lymphoma, nodular sclerosis, grade 1; classical Hodgkin lymphoma, nodular sclerosis, grade 1; Hodgkin disease, nodular sclerosis, lymphocytic predominance; Hodgkin disease, nodular sclerosis, mixed cellularity (9665/3)</p> <p>Hodgkin lymphoma, nodular sclerosis, grade 2; classical Hodgkin lymphoma, nodular sclerosis, grade 2; Hodgkin disease, nodular sclerosis, lymphocyte depletion; Hodgkin disease, nodular sclerosis, syncytial variant (9667/3)</p> <p>Malignant lymphoma, small B lymphocytic, NOS, includes types: small lymphocytic NOS, well differentiated, diffuse, lymphocytic NOS, lymphocytic, diffuse NOS, small cell NOS, small lymphocytic, diffuse, small cell diffuse (9670/3)</p> <p>Malignant lymphoma, lymphoplasmacytic; malignant lymphoma, lymphoplasmacytoid; <i>immunocytoma</i>; <i>malignant lymphoma, plasmacytoid</i>; <i>plasmacytic lymphoma</i> (9671/3)</p>

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in italics are obsolete in ICDO-3.

Table 4 continued

Mantle cell lymphoma includes all variants: blastic, pleomorphic, small cell; <i>mantle zone lymphoma</i> ; <i>malignant lymphoma, lymphocytic, intermediate differentiation, diffuse</i> ; <i>malignant lymphoma, centrocytic</i> (9674/3) ; malignant lymphomatous polyposis (9677/3) (9673/3)
<i>Malignant lymphoma, mixed small and large cell, diffuse</i> ; <i>malignant lymphoma, mixed lymphocytic-histiocytic, diffuse</i> ; <i>malignant lymphoma, mixed cell type, diffuse</i> ; <i>malignant lymphoma, centroblastic-centrocytic, NOS or diffuse</i> (9676/3) (9675/3)
Malignant lymphoma, large B-cell, diffuse, NOS; diffuse large B-cell lymphoma NOS; malignant lymphoma, large cell, NOS; malignant lymphoma, large B-cell, NOS; <i>malignant lymphoma, histiocytic, NOS</i> ; malignant lymphoma, histiocytic, diffuse; <i>malignant lymphoma, large cell, cleaved and noncleaved</i> ; <i>malignant lymphoma, large cell, diffuse, NOS</i> ; <i>malignant lymphoma, large cleaved cell, NOS</i> ; malignant lymphoma, large cell, cleaved, diffuse; <i>malignant lymphoma, large cell, cleaved, NOS</i> (9681/3) ; malignant lymphoma, large cell, noncleaved, diffuse; malignant lymphoma, large cell, noncleaved, NOS (9682/3) ; <i>malignant lymphoma, noncleaved, diffuse, NOS</i> ; malignant lymphoma, noncleaved, NOS; malignant lymphoma, large B-cell, diffuse, centroblastic, NOS; malignant lymphoma, centroblastic, NOS; malignant lymphoma, centroblastic, diffuse (9683/3) ; intravascular B-cell lymphoma; angioendotheliomatosis (9742/3) ; angiotropic lymphoma; T-cell-rich large B-cell lymphoma; histiocyte-rich large B-cell lymphoma; T-cell-rich/histiocyte-rich large B-cell lymphoma; anaplastic large B-cell lymphoma (9680/3)
Malignant lymphoma, large B-cell, diffuse, immunoblastic, NOS; malignant lymphoma, immunoblastic NOS; <i>immunoblastic sarcoma</i> ; malignant lymphoma, large cell, immunoblastic; plasmablastic lymphoma (9684/3)
Burkitt lymphoma NOS; <i>Burkitt tumor</i> ; <i>malignant lymphoma, undifferentiated, Burkitt type</i> ; <i>malignant lymphoma, small noncleaved, Burkitt type</i> ; Burkitt-like lymphoma (9687/3)
Follicular lymphoma NOS; malignant lymphoma, follicular, NOS; malignant lymphoma, follicle center, follicular; malignant lymphoma, follicle center, NOS; <i>malignant lymphoma, centroblastic-centrocytic, follicular</i> (9692/3) ; <i>malignant lymphoma, nodular NOS</i> ; <i>malignant lymphoma, lymphocytic nodular, NOS</i> (9690/3)
Follicular lymphoma, grade 2; <i>malignant lymphoma, mixed small cell cleaved and large cell follicular</i> ; <i>malignant lymphoma, mixed lymphocytic-histiocytic, nodular</i> ; <i>malignant lymphoma, mixed cell type, follicular</i> ; <i>malignant lymphoma, mixed cell type, nodular</i> (9691/3)
Follicular lymphoma, grade 1; <i>malignant lymphoma, small cleaved cell, follicular</i> ; follicular lymphoma, small cleaved cell; <i>malignant lymphoma, lymphocytic, poorly differentiated, nodular</i> (9696/3) (9695/3)
Follicular lymphoma, grade 3; malignant lymphoma, large cell follicular NOS; <i>malignant lymphoma, large cell, noncleaved follicular</i> ; <i>malignant lymphoma, histiocytic, nodular</i> ; <i>malignant lymphoma, noncleaved, follicular NOS</i> ; <i>malignant lymphoma, large cleaved cell follicular</i> ; malignant lymphoma, centroblastic, follicular; <i>malignant lymphoma, lymphocytic, well-differentiated, nodular</i> (9693/3) (9698/3)
Marginal zone B-cell lymphoma NOS; marginal zone lymphoma NOS; mucosal-associated lymphoid tissue lymphoma; MALT lymphoma; monocytoid B-cell lymphoma (9744/3) ; nodal marginal zone lymphoma (9699/3)
Sezary syndrome; Sezary disease (9701/3)
Mature T-cell lymphoma NOS; peripheral T-cell lymphoma NOS; T-cell lymphoma NOS; peripheral T-cell lymphoma, pleomorphic small cell (9706/3) ; peripheral T-cell lymphoma, pleomorphic medium and large cell (9707/3) ; peripheral T-cell lymphoma, large cell; T-zone lymphoma; lymphoepithelioid lymphoma; Lennert lymphoma (9702/3)
Angioimmunoblastic T-cell lymphoma; peripheral T-cell lymphoma; AILD; <i>angioimmunoblastic lymphadenopathy with dysproteinemia</i> ; <i>angioimmunoblastic lymphoma</i> (9705/3)
Anaplastic large-cell lymphoma, T-cell and Null-cell type; <i>large-cell (Ki-1+) lymphoma</i> ; anaplastic large cell lymphoma NOS; anaplastic large cell lymphoma, CD30 ⁺ (9714/3)
NK/T-cell lymphoma, nasal and nasal-type; T/NK-cell lymphoma; <i>angiocentric T-cell lymphoma</i> ; <i>malignant reticulosis, NOS</i> ; <i>malignant midline reticulosis</i> ; <i>polymorphic reticulosis</i> (9719/3)
Precursor cell lymphoblastic lymphoma NOS; malignant lymphoma, lymphoblastic, NOS; <i>malignant lymphoma convoluted cell</i> ; <i>lymphoblastoma</i> (9685/3) (9727/3)

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in italics are obsolete in ICDO-3.

Table 4 continued

	<p>Precursor B-cell lymphoblastic lymphoma (9728/3)</p> <p>Precursor T-cell lymphoblastic lymphoma (9729/3)</p> <p>Plasmacytoma NOS; plasma cell tumor; extramedullary plasmacytoma; solitary myeloma; solitary plasmacytoma (9731/3)</p> <p>Plasma cell leukemia; plasmacytic leukemia (9830/3) (9733/3)</p> <p>Plasmacytoma, extramedullary (9734/3)</p> <p>Mastocytoma NOS; mast cell tumor NOS (9740/1)</p> <p>Mast cell sarcoma; malignant mast cell tumor; malignant mastocytoma (9740/3)</p> <p>Malignant mastocytosis; systemic tissue mast cell disease (9741/3)</p> <p>Malignant histiocytosis; <i>histiocytic medullary reticulosis</i> (9720/3) (9750/3)</p> <p>Histiocytic sarcoma; true histiocytic lymphoma (9723/3) (9755/3)</p> <p>Langerhans cell sarcoma (9756/3)</p> <p>Interdigitating dendritic cell sarcoma; interdigitating cell sarcoma; dendritic cell sarcoma NOS (9757/3)</p> <p>Follicular dendritic cell sarcoma; follicular dendritic cell tumor (9758/3)</p> <p>Angiocentric immunoproliferative lesion; lymphoid granulomatosis (9766/1)</p> <p>Adult T-cell leukemia/lymphoma (HTLV-1 positive), <i>includes all variants</i>; adult T-cell lymphoma/leukemia; adult T-cell lymphoma; adult T-cell leukemia (9827/3)</p> <p>Myeloid sarcoma; granulocytic sarcoma; chloroma (9930/3)</p> <p>Lymphoproliferative disorder NOS; lymphoproliferative disease NOS (9970/1)</p>
Germ cell tumors and cysts	
Germ cell tumors, cysts, and heterotopias	<p>Carcinoma, undifferentiated, NOS (8020/3)</p> <p>Dysgerminoma (9060/3)</p> <p>Seminoma NOS (9061/3)</p> <p>Germinoma; germ cell tumor NOS (9064/3)</p> <p>Germ cell tumor, nonseminomatous (9065/3)</p> <p>Embryonal carcinoma NOS; embryonal adenocarcinoma (9070/3)</p> <p>Endodermal sinus tumor; yolk sac tumor; polyvesicular vitelline tumor; orchioblastoma; embryonal carcinoma, infantile; hepatoid yolk sac tumor (9071/3)</p> <p>Polyembroma; embryonal carcinoma, polyembryonal type (9072/3)</p> <p>Teratoma, benign; adult cystic teratoma; adult teratoma NOS; cystic teratoma NOS; teratoma, differentiated; mature teratoma (9080/0)</p> <p>Teratoma NOS; solid teratoma (9080/1)</p> <p>Teratoma malignant, NOS; embryonal teratoma; teratoblastoma, malignant; immature teratoma, malignant; immature teratoma NOS (9080/3)</p> <p>Teratocarcinoma; mixed embryonal carcinoma and teratoma (9081/3)</p> <p>Malignant teratoma, undifferentiated; malignant teratoma, anaplastic (9082/3)</p> <p>Malignant teratoma, intermediate (9083/3)</p> <p>Dermoid cyst NOS; dermoid NOS (9084/0)</p> <p>Teratoma with malignant transformation; dermoid cyst with malignant transformation; dermoid cyst with secondary tumor (9084/3)</p> <p>Mixed germ cell tumor; mixed teratoma and seminoma (9085/3)</p> <p>Choriocarcinoma; chorionepithelioma; chorioepithelioma (9100/3)</p>
Tumors of the sellar region	
Pituitary	<p>Pleomorphic carcinoma (8022/3)</p> <p>Tumorlet benign (8040/0)</p> <p>Tumorlet NOS (8040/1)</p> <p>Adenoma NOS (8140/0)</p> <p>Atypical adenoma (8140/1)</p> <p>Adenocarcinoma NOS (8140/3)</p> <p>Monomorphic adenoma (8146/0)</p> <p>Neuroendocrine carcinoma NOS (8246/3)</p> <p>Papillary adenoma NOS; glandular papilloma (8260/0)</p> <p>Papillary adenocarcinoma NOS (8260/3)</p> <p>Chromophobe adenoma (8270/0)</p> <p>Chromophobe carcinoma; chromophobe adenocarcinoma (8270/3)</p>

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Table 4 continued

	Prolactinoma (8271/0)
	Pituitary adenoma NOS (8272/0)
	Pituitary carcinoma NOS (8272/3)
	Acidophil adenoma; eosinophil adenoma (8280/0)
	Acidophil carcinoma; acidophil adenocarcinoma; eosinophil carcinoma; eosinophil adenocarcinoma (8280/3)
	Mixed acidophil-basophil adenoma (8281/0)
	Mixed acidophil-basophil carcinoma (8281/3)
	Oxyphilic adenoma; oncocytic adenoma; oncocytoma (8290/0)
	Oxyphilic adenocarcinoma; oncocytic carcinoma; oncocytic adenocarcinoma (8290/3)
	Basophil adenoma; mucoid cell adenoma (8300/0)
	Basophil carcinoma; basophil adenocarcinoma; mucoid cell adenocarcinoma (8300/3)
	Mixed cell adenoma (8323/0)
	Mixed cell adenocarcinoma (8323/3)
	Microfollicular adenoma; fetal adenoma (8833/0)
	Fetal adenocarcinoma (8333/3)
	Macrofollicular adenoma; colloid adenoma (8334/0)
	Granular cell tumor of the sellar region (9582/0)
Craniopharyngioma	Craniopharyngioma; Rathke's pouch tumor (9350/1)
	Adamantinomatous craniopharyngioma (9351/1)
	Papillary craniopharyngioma (9352/1)
Local extensions from regional tumors	
Chordoma/chondrosarcoma	Chondroma NOS; Enchondroma (9220/0)
	Chondromatosis NOS (9220/1)
	Chondrosarcoma NOS; fibrochondrosarcoma (9220/3)
	Myxoid chondrosarcoma (9231/3)
	Mesenchymal chondrosarcoma (9240/3)
	Chordoma NOS (9370/3)
	Chondroid chordoma (9371/3)
	Dedifferentiated chordoma (9372/3)
	Parachordoma (9373/0)
Unclassified tumors	
Hemangioma	Hemangioma NOS; angioma NOS; chorioangioma (9120/0)
	Hemangiosarcoma; angiosarcoma (9120/3)
	Cavernous hemangioma (9121/0)
	Venous hemangioma (9122/0)
	Racemose hemangioma; arteriovenous hemangioma (9123/0)
	Epithelioid hemangioma; histiocytoid hemangioma (9124/0) (9125/0)
	Hemangioendothelioma benign (9130/0)
	Hemangioendothelioma NOS; angioendothelioma; kaposiform hemangioendothelioma (9130/1)
	Hemangioendothelioma malignant; hemangioendothelial sarcoma (9130/3)
	Capillary hemangioma; hemangioma simplex; infantile hemangioma; plexiform hemangioma; juvenile hemangioma (9131/0)
	Epithelioid hemangioendothelioma NOS (9133/1)
	Epithelioid hemangioendothelioma, malignant (9133/3)
	Kaposi sarcoma; multiple hemorrhagic sarcoma (9140/3)
Neoplasm, unspecified	Neoplasm, benign; tumor, benign; unclassified tumor, benign (8000/0)
	Neoplasm, uncertain whether benign or malignant; neoplasm NOS; tumor NOS; unclassified tumor, uncertain whether benign or malignant; unclassified tumor, borderline malignancy (8000/1)
	Neoplasm, malignant; tumor, malignant, NOS; malignancy; cancer; unclassified tumor, malignant; blastoma NOS (8000/3)
	Tumor cells, benign (8001/0)
	Tumor cells, uncertain whether benign or malignant; tumor cells NOS (8001/1)
	Tumor cells, malignant (8001/3)

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Table 4 continued

	Malignant tumor, small cell type (8002/3)
	Malignant tumor, giant cell type (8003/3)
	Malignant tumor, spindle cell type; malignant tumor, fusiform cell type (8004/3)
	Clear cell tumor NOS (8005/0)
	Malignant tumor, clear cell type (8005/3)
	Epithelial tumor, benign (8010/0)
	Carcinoma NOS; epithelial tumor, malignant (8010/3)
All other	Malignant melanoma NOS; melanoma NOS (8720/3)
	Cystic lymphangioma; hygroma NOS; cystic hygroma (9173/0)
	Granular cell tumor NOS; granular cell myoblastoma NOS (9580/0)
	Granular cell tumor, malignant; granular cell myoblastoma, malignant (9580/3)
	Langerhans cell histiocytosis NOS; Langerhans cell granulomatosis; <i>histiocytosis X NOS (9751/1)</i>
	Langerhans cell histiocytosis, disseminated; Langerhans cell histiocytosis, generalized; Letterer-Siwe disease; acute differentiated progressive histiocytosis; acute progressive histiocytosis X; nonlipid reticuloendotheliosis (9722) (9754/3)

Abbreviations: AILD, angioimmunoblastic lymphadenopathy with dysproteinemia; ICDO, International Classification of Diseases for Oncology; NOS, not otherwise specified.

Any additional ICDO histologies that are reported, but are not included in this table, will be reviewed and, if appropriate, classified by a neuropathologist into this grouping scheme.

^aCodes in bold are new codes or terminology in ICDO-3. Codes and terms with strike-through are deleted in ICDO-3. Terms in italics are obsolete in ICDO-3.

of the various surveillance groups belonging to NCCCS have been enlisted to ensure that registration of all brain tumors is complete and of good quality.

Bound by the site and histology codes available in the fully compatible ICDO-3 (Fritz et al., 2000) and WHO 2000 (Kleihues and Cavenee, 2000), the most current tools for the classification of tumors, the research and clinical participants of the Consensus Conference agreed on a standard site and histology definition for reporting as well as for the collection of all primary brain tumors (Table 4). Table 4 has been designed as a reference with a complete listing of histologies, bound by the current ICDO-3 but with the potential for adding additional ICD-O histology codes (Table 4, Footnote a), which may occur in the brain and CNS site codes recommended by the participants of the Consensus Conference. This standard site and histology definition will enable researchers to compare data from other reports or studies either directly or through secondary analysis, such as collapsing data to correspond to existing international standards. The next step would require each surveillance organization to coordinate the standards governing their data analyses and reports to facilitate data comparisons. As a part of this next step, the NCCCS has formed a committee to coordinate efforts for implementation of Recommendations 3 and 4 of the BTWG (1998).

A separate action initiated from the brain tumor research and clinical community is needed to address the limitations of current ICDO (Fritz et al., 2000) and WHO 2000 (Kleihues and Cavenee, 2000) site classifications for histology codes with regard to the collection of data on

all primary brain tumors. Participants from the clinical community (including neuropathologists and neurosurgeons) suggested additional site classifications and histologies within the brain and CNS that would be beneficial for clinical research but do not have codes in the present coding system. However, the primary responsibility for expanding ICDO codes lies within the brain tumor research and clinical communities rather than within the surveillance community. The Consensus Conference brought these issues to the forefront, with the hope that they will be addressed in a continuing joint effort between the surveillance and clinical communities. Recommendations for additional site and/or histology classifications also need to be discussed and decided on a broad-based international level to maintain compatibility worldwide. These subsequent actions are consistent with the Brain Tumor Progress Review Group, a joint effort of the National Cancer Institute and the National Institute for Neurological Disorders and Stroke, to have as part of its research priorities for the next 5 years the “expand[ing] and enhanc[ing of] databases to include all primary brain and spinal tumors—malignant and non-malignant, adult and pediatric—and to have the flexibility to accommodate new histological and molecular classifications of tumors.”

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References

- BTWG (Brain Tumor Working Group) (1998) Surveillance of primary intracranial and central nervous system tumors: Recommendations from the Brain Tumor Working Group. National Coordinating Council for Cancer Surveillance. Cited January 3, 2002. URL: <www.naaccr.org/stats/epireports.html>.
- CBTRUS (Central Brain Tumor Registry of the United States) (2000) *Statistical*

- Report: *Primary Brain Tumors in the United States, 1992-1997*. Chicago, Ill.: Central Brain Tumor Registry of the United States.
- CDCP (Centers for Disease Control and Prevention) (2000) *National Program of Cancer Registries Notice of Availability of Funds*. Program Announcement No. 00027. Last reviewed December 7, 2001; cited January 3, 2002. Atlanta, Ga.: Centers for Disease Control and Prevention. URL: <www.cdc.gov/cancer/npcr/027fy00.htm>.
- Davis, F.G., Bruner, J.M., and Surawicz, T.S. (1997) The rationale for standardized registration and reporting of brain and central nervous system tumors in population-based cancer registries. *Neuroepidemiology* **16**, 308-316.
- Finkelstein, S.D., Papadaki, H., Kounelis, S., Przygowski, R.M. (1997) Olfactory neuroblastoma. In: Kleihues, P., and Cavenee, W.K. (Eds.), *Pathology and Genetics of Tumours of the Nervous System*. Lyon: IARC Press. pp. 114-116.
- Fritz, A.G., and Ries, L.A.G. (Eds.) (1998) *The SEER Program Code Manual*. Third edition. NIH Pub. No. 98-1999. Bethesda, Md.: National Institutes of Health.
- Fritz, A.G., Percy, C., Jack, A., Shanmugaratnam, K., Sobin, L., Parkin, D.M., and Whelan, S. (Eds.) (2000) *International Classification of Diseases for Oncology*. Third edition. Geneva: World Health Organization.
- Gurney, J.G., Wall, D.A., Jukich, P.J., and Davis, F.G. (1999) The contribution of nonmalignant tumors to CNS tumor incidence rates among children in the United States. *Cancer Causes Control* **10**, 101-105.
- Howe, H.L., Chen, V.W., Hotes, J.L., Wu, X.C., Correa, C.N., Fulton, J.P. (Eds.) (2001) *Cancer in North America, 1994-1998*. Vol. 1. Incidence. Springfield, Ill.: North American Association of Central Cancer Registries.
- Hultstrom, D. (Ed.) (2001) *Standards for Cancer Registries. Volume II. Data Standards and Data Dictionary*. Version 9.1, sixth edition. Springfield, Ill.: North American Association of Central Cancer Registries.
- Jaffe, E.S., Harris, N.L., Stein, H., and Vardiman, J.W. (Eds.) (2001) *WHO Classification of Tumours: Pathology and Genetics of Tumours of Haematopoietic and Lymphoid Tissues*. Lyon: IARC Press.
- Kleihues, P., and Cavenee, W.K. (Eds.) (2000) *Pathology and Genetics of Tumours of the Nervous System*. 2nd Edition. Lyon: IARC Press.
- Kleihues, P., Burger, P.C., and Scheithauer, B.W. (1993) The new WHO classification of brain tumours. *Brain Pathol.* **3**, 255-268.
- Parkin, D.M., Shanmugaratnam, K., Sobin, L., Ferlay, J., and Whelan, S.L. (1998) *Histological Groups for Comparative Studies*. IARC Technical Report No. 31. Lyon: IARC Press. pp. 24-25, 40-41.
- Percy, C.L., Van Holten, V., and Muir, C.S. (Eds.) (1990) *International Classification for Diseases of Oncology*. Second edition. Geneva: World Health Organization.
- Schoenberg, B.S., Christine, B.W., and Whisnatt, J.P. (1976) The descriptive epidemiology of primary intracranial neoplasms: The Connecticut experience. *Am. J. Epidemiol.* **104**, 499-510.
- van der Sanden, G.A., Wesseling, P., Schouten, L.J., Teepen, H.L., and Coebergh, J. (1998). A uniform histological cluster scheme for ICD-O coded primary central nervous system tumors. *Neuroepidemiology* **17**, 233-246.
- Walker, A.E., Robins, M., and Weinfield, F. (1985) Epidemiology of brain tumors: The national survey of intracranial neoplasms. *Neurology* **35**, 219-226.