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Hospitalizations for Brain Cancer, 2006

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Introduction

Each year, an estimated 51,400 Americans are diagnosed with a brain tumor in the United States. About 40 percent of these brain tumors are malignant.[1] Cancerous brain tumors can grow rapidly and the effects can be debilitating, including memory loss, emotional disturbances, speech difficulties, seizures, paralysis, and death. [2] Even though this form of cancer is generally difficult to cure, the five- and ten-year survival rates for brain cancer have continually improved over the past ten years. [3,4]

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on stays related to brain cancer, or malignant brain tumors, in U.S. community hospitals in 2006. Characteristics of stays for brain cancer are compared to all hospital stays, excluding newborns and maternal stays for childbirth. Differences by age, gender, payer, and region are also investigated for principal and secondary brain cancer diagnoses. In addition, common principal diagnoses for brain cancer-related stays are outlined. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

Findings

In 2006, there were nearly 73,500 hospitalizations involving brain cancer in the U.S., a rate of about 24.6 hospitalizations per 100,000 population. Slightly fewer than half of these stays (35,200 hospitalizations) were principally for brain cancer and totaled approximately $655.5 million in hospital costs. Nearly 38,300 hospitalizations cited brain cancer as a secondary diagnosis.

Highlights

- There were nearly 73,500 hospitalizations related to brain cancer in 2006, or nearly 24.6 stays per 100,000 population.
- Between 1995 and 2006, the rate of hospitalizations principally for brain cancer remained stable, but the rate with brain cancer as a secondary diagnosis increased over 18 percent.
- Deaths in the hospital due to brain cancer have decreased by nearly one-third since 1995, from 6.2 percent to 4.4 percent.
- The rate of brain cancer-related hospitalization increased dramatically with age; men over 65 had the highest rates of hospitalization for brain cancer.
- The Northeast had the highest rates of hospitalization related to brain cancer.
- About 55 percent of all brain cancer-related hospitalizations had some form of cancer or cancer therapy as the principal reason for admission. Many of the remaining cases were admitted for treatment of conditions that are likely sequelae of cancer and its treatment.
- Compared with adults, children have lower hospitalization rates for frontal, temporal, parietal, and occipital lobe tumors and higher rates for cerebellar and brain stem tumors.

[1]Statistical Report: Primary Brain Tumors in the United States, 2000–2004. Central Brain Tumor Registry of the United States. Hinsdale, IL. 2008. http://www.cbtrus.org/reports/reports.html (Accessed 2/6/2009).
[2]What You Need to Know About Brain Tumors. National Cancer Institute. Bethesda, MD. 2003. http://www.cancer.gov/cancertopics/wyntk/brain/ Accessed 2/6/2009).
[3]Brain Tumor—Adults. Medline Plus. National Library of Medicine, National Institutes of Medicine, 2009. http://www.nlm.nih.gov/medlineplus (Accessed 2/19/2009).
[4]Ries LAG, Melbert D, Krapcho M, Stinchcomb DG, Howlader N, Horner MJ, Mariotto A, Miller BA, Feuer EJ, Altekruse SF, Lewis DR, Clegg L, Eisner MP, Reichman M, Edwards BK (eds). SEER Cancer Statistics Review, 1975–2005, National Cancer Institute. Bethesda, MD. http://seer.cancer.gov/ (Accessed 2/6/2009).

As shown in figure 1, the overall rate of brain cancer hospitalizations increased slightly between 1995 and 2006. As a principal diagnosis, the rate has remained stable. However, as a secondary condition, the rate has increased over 18 percent, from 10.8 stays per 100,000 population to 12.8 stays per 100,000 population. The greatest number of stays occurred in 2005, when there was a substantial increase in all hospitalizations involving a brain cancer diagnosis, particularly those as a secondary diagnosis.[5]

General characteristics

Table 1 presents general characteristics of brain cancer hospitalizations in 2006. Compared with all other hospitalizations (excluding newborns and maternal stays for childbirth), the mean length of stay for hospitalizations principally for brain cancer was nearly 2 days longer (6.9 days versus 5.1 days). For hospitalizations with a secondary diagnosis of brain cancer, the average length of stay was also longer than for all stays—6.4 days. Though brain cancer-related stays were longer, the average cost per day was dependent on the type of hospitalization. Stays principally for brain cancer were approximately $800 more costly than average ($2,700 versus $1,900), yet costs for secondary stays were no different from the average hospitalization ($1,800 versus $1,900).

Patients principally admitted for brain cancer were substantially less likely to be admitted from the emergency department than the average hospitalization (35.1 percent versus 55.7 percent). Furthermore, brain cancer patients were more likely to die in the hospital than the average patient (4.4 percent versus 2.6 percent). Over time there has been a decline in deaths in the hospital for patients admitted for brain cancer—deaths decreased by nearly one-third from 1995 to 2006 for brain cancer hospitalizations, from 6.2 percent to 4.4 percent (not shown).

Private insurance was the primary payer for nearly half of all brain cancer-related stays (50.5 percent of principal stays, and 46.0 percent of secondary stays), followed by Medicare, which covered about a third of stays. This varied from the average hospitalization, in which Medicare was the payer for nearly half of all stays and private insurance covered one-third. Uninsured patients accounted for a smaller percentage of brain cancer-related stays than the average hospitalization (3.5 percent of principal stays and 2.1 percent of secondary stays compared with 5.8 percent uninsured among all stays).

Brain cancer hospitalizations, by age and gender

The overall rate of brain cancer-related hospitalizations increased with patient age (table 1 and figure 2). Patients 45 years and older accounted for nearly two-thirds of all brain cancer-related hospitalizations, but the highest rates of hospitalization occurred among patients 65 and older (28.5 stays per 100,000 population for principal brain cancer and 27.5 stays per 100,000 population for those with the disease as a secondary diagnosis). Patients 45 and older were hospitalized slightly more often with brain cancer noted as the principal diagnosis. On the other hand, patients younger than 18 were hospitalized twice as often for secondary brain cancer—4.8 stays per 100,000 population for principal brain cancer versus 9.8 stays per 100,000 population for brain cancer as a secondary diagnosis—possibly indicating follow-up treatment for other conditions associated with brain cancer.

Overall, brain cancer-related hospitalizations occurred more often among males than females. Males accounted for 55.7 percent of hospitalizations principally for brain cancer and 54.2 percent of stays with a secondary diagnosis of brain cancer (table 1). Figure 3 provides the rates of hospitalization for brain cancer by age and gender. While males had slightly higher rates of brain cancer-related hospitalizations than females among patients younger than 45 years old, the difference between males and females was much higher among patients 45 years and older. In fact, the rate of brain cancer hospitalizations was highest among men over the age of 65, with 36.6 stays per 100,000 population for principal brain cancer hospitalizations (62 percent higher than females) and 34.5 stays per 100,000 population for stays with a secondary brain cancer diagnosis (55 percent higher than females).

[5]While it is not known what caused this increase, the spike in hospital admissions in 2005 is corroborated by the National Hospital Discharge Survey (NHDS), a survey of hospital stays based on a different sampling strategy from the data used in this report.

Brain cancer hospitalizations, by region
As shown in Figure 4, hospitalizations with a brain cancer diagnosis occurred more frequently in the Northeast than any other region—30.1 stays per 100,000 population. As a principal diagnosis, there were 13.0 stays per 100,000 population in the Northeast, and 17.1 stays per 100,000 population with a secondary diagnosis of a brain cancer.

Overall, the South and West had the lowest rates of all brain cancer hospitalizations, each with nearly 23 stays per 100,000 population. When viewed by type of diagnosis, however, the rate of hospitalization varied: the Midwest had the lowest rate of stays for brain cancer as a principal diagnosis, and the West had the lowest rate for secondary diagnoses of brain cancer—each with 10.7 stays per 100,000 population.

Specific locations of brain cancers
Table 2 shows the percentage of hospital stays for brain cancer by the specific location of the tumor for various age groups, based on a principal diagnosis of brain cancer. Compared with adults, children younger than 18 years have lower hospitalization rates for supratentorial tumors, or tumors in the upper brain (i.e., cerebrum, frontal, temporal, parietal, and occipital lobe tumors) and higher rates for infratentorial tumors, or tumors in the lower brain (cerebellar and brain stem). In general, frontal lobe tumor hospitalizations decrease with age while temporal and parietal lobe tumor hospital stays increase with age.

Principal diagnoses for brain cancer-related hospitalizations
Less than half (47.9 percent) of all hospitalizations related to brain cancer had the diagnosis as the principal reason for the hospitalization. More often, another condition was listed as the principal reason for admission. Table 3 lists the top 20 principal diagnoses for all brain cancer-related hospitalizations. About 55 percent of all hospitalizations related to brain cancer had a form of cancer or cancer therapy as a principal diagnosis, including brain and nervous system cancer (47.9 percent), maintenance chemotherapy and radiotherapy (6.0 percent), secondary malignancies (1.0 percent), and other cancers (0.9 percent)—lung, leukemia, kidney, breast, and other forms.

Other disorders affecting the nervous system were also common principal diagnoses among hospitalizations related to brain cancer. Epilepsy and convulsions accounted for 4.0 percent of stays, followed by other nervous system disorders (1.3 percent) and other hereditary and degenerative nervous system conditions (0.8 percent). Acute cerebrovascular disease, or stroke, was the principal diagnosis for 1.7 percent of brain cancer-related stays. Other conditions reflect the severity of illness for these patients—pneumonia, septicemia, pulmonary heart disease, aspiration pneumonitis, and respiratory failure. Over three percent of brain cancer patients experienced some complication of medical care.

Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2006 Nationwide Inpatient Sample (NIS) and the 2006 Kids Inpatient Database (KID). Historical data were drawn from the 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, and 2005 NIS. The statistics were generated from HCUPnet, a free, online query system that provides users with immediate access to largest set of publicly available, all-payer national, regional, and State-level hospital care databases from HCUP. Supplemental sources included data from the U.S. Census Bureau, Population Division, Annual Estimates of the Population for the United States, Regions, and Divisions and U.S. Census Bureau, Current Population Reports, P60-226, Coverage by Type of Health Insurance.

Definitions

Diagnoses, ICD-9-CM, and Clinical Classifications Software (CCS)
The principal diagnosis is that condition established after study to be chiefly responsible for the patient's admission to the hospital. Secondary diagnoses are concomitant conditions that coexist at the time of admission or that develop during the stay.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 13,600 ICD-9-CM diagnosis codes.

CCS categorizes ICD-9-CM diagnoses into a manageable number of clinically meaningful categories.[6] This "clinical grouper" makes it easier to quickly understand patterns of diagnoses and procedures.

Case Definition
For this report, Brain Cancer diagnoses were defined as CCS diagnosis:
– **35: Cancer of Brain and Nervous System**

Types of hospitals included in HCUP
HCUP is based on data from community hospitals, defined as short-term, non-Federal, general and other hospitals, excluding hospital units of other institutions (e.g., prisons). HCUP data include OB-GYN, ENT, orthopedic, cancer, pediatric, public, and academic medical hospitals. They exclude long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals, but these types of discharges are included if they are from community hospitals.

Unit of analysis
The unit of analysis is the hospital discharge (i.e., the hospital stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in one year will be counted each time as a separate "discharge" from the hospital.

Costs and charges
Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare and Medicaid Services (CMS).[7] Costs will tend to reflect the actual costs of production, while charges represent what the hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used because detailed charges are not available across all HCUP States. Hospital charges reflect the amount the hospital charged for the entire hospital stay and does not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundred.

Payer
Payer is the expected primary payer for the hospital stay. To make coding uniform across all HCUP data sources, payer combines detailed categories into more general groups:

- Medicare includes fee-for-service and managed care Medicare patients.
- Medicaid includes fee-for-service and managed care Medicaid patients. Patients covered by the State Children's Health Insurance Program (SCHIP) may be included here. Because most state data do not identify SCHIP patients specifically, it is not possible to present this information separately.
- Private insurance includes Blue Cross, commercial carriers, and private HMOs and PPOs.
- Other includes Worker's Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs.
- Uninsured includes an insurance status of "self-pay" and "no charge."

When more than one payer is listed for a hospital discharge, the first-listed payer is used.

[6] HCUP CCS. Healthcare Cost and Utilization Project (HCUP). May 2008. U.S. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp
[7] HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2006 . U.S. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/db/state/costtocharge.jsp

Region
Region is one of the four regions defined by the U.S. Census Bureau:

- Northeast: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania
- Midwest: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas
- South: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas
- West: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii

Admission source
Admission source indicates where the patient was located prior to admission to the hospital. Emergency admission indicates the patient was admitted to the hospital through the emergency department. Admission from another hospital indicates the patient was admitted to this hospital from another short-term, acute-care hospital. This usually signifies that the patient required the transfer in order to obtain more specialized services that the originating hospital could not provide. Admission from long-term care facility indicates the patient was admitted from a long-term facility such as a nursing home.

Discharge status
Discharge status indicates the disposition of the patient at discharge from the hospital, and includes the following six categories: routine (to home), transfer to another short-term hospital, other transfers (including skilled nursing facility, intermediate care, and another type of facility such as a nursing home), home health care, against medical advice (AMA), or died in the hospital.

About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

Arizona Department of Health Services
Arkansas Department of Health
California Office of Statewide Health Planning and Development
Colorado Hospital Association
Connecticut Hospital Association
Florida Agency for Health Care Administration
Georgia Hospital Association
Hawaii Health Information Corporation
Illinois Department of Public Health
Indiana Hospital Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Maine Health Data Organization
Maryland Health Services Cost Review Commission
Massachusetts Division of Health Care Finance and Policy

Michigan Health & Hospital Association
Minnesota Hospital Association
Missouri Hospital Industry Data Institute
Nebraska Hospital Association
Nevada Department of Health and Human Services
New Hampshire Department of Health & Human Services
New Jersey Department of Health and Senior Services
New York State Department of Health
North Carolina Department of Health and Human Services
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Rhode Island Department of Health
South Carolina State Budget & Control Board
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health and Family Services
Wyoming Hospital Association

About the NIS

The HCUP Nationwide Inpatient Sample (NIS) is a nationwide database of hospital inpatient stays. The NIS is nationally representative of all community hospitals (i.e., short-term, non-Federal, non-rehabilitation hospitals). The NIS is a sample of hospitals and includes all patients from each hospital, regardless of payer. It is drawn from a sampling frame that contains hospitals comprising about 90 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

About the KID

The HCUP Kids' Inpatient Database (KID) is a nationwide database of hospital inpatient stays. The KID is the only dataset on hospital use, outcomes, and charges designed to study children's use of hospital services in the United States. The KID is a sample of discharges from all community, non-rehabilitation hospitals in States participating in HCUP. The target universe includes pediatric discharges from community, non-rehabilitation hospitals in the United States. Pediatric discharges are defined as all discharges where the patient was age 20 or less at admission. For this analysis only discharges for children 17 years and younger were included. The KID's large sample size enables analyses of rare conditions, such as congenital anomalies and uncommon treatments, such as organ transplantation. It can be used to study a wide range of topics including the economic burden of pediatric conditions, access to services, quality of care and patient safety, and the impact of health policy changes. The KID is produced every three years; prior databases are available for 1997, 2000, and 2003.

About HCUPnet

HCUPnet is an online query system that offers instant access to the largest set of all-payer health care databases that are publicly available. HCUPnet has an easy step-by-step query system, allowing for tables and graphs to be generated on national and regional statistics, as well as trends for community hospitals in the U.S. HCUPnet generates statistics using data from HCUP's Nationwide Inpatient Sample

(NIS), the Kids' Inpatient Database (KID), the State Inpatient Databases (SID) and the State Emergency Department Databases (SEDD).

For More Information

For a detailed description of HCUP, please refer to the following publication:

Steiner, C., Elixhauser, A., Schnaier, J. The Healthcare Cost and Utilization Project: An Overview. *Effective Clinical Practice* 5(3):143–51, 2002.

Suggested Citation

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at hcup@ahrq.gov or send a letter to the address below:

Irene Fraser, Ph.D., Director
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Rockville, MD 20850

Table 1. Characteristics of hospitalizations related to brain cancer compared to hospitalizations for all conditions, 2006

	Hospital stays principally for brain cancer	Hospital stays with a secondary diagnosis of a brain cancer	Hospital stays for all conditions*
Utilization characteristics			
Total number of hospitalizations	35,200	38,300	30,142,300
Mean length of stay, days	6.9	6.4	5.1
Mean cost per hospitalization	$18,700	$11,300	$9,900
Mean cost per day	$2,700	$1,800	$1,900
Aggregate costs	$655.5 million	$433.5 million	$297.6 billion
Percentage admitted through the Emergency Department	35.1%	46.0%	55.7%
Percentage died in hospital	4.4%	4.1%	2.6%
Expected primary payer:			
Private Insurance	50.5%	46.0%	29.5%
Medicare	31.5%	34.2%	48.7%
Medicaid	10.9%	15.3%	12.3%
Uninsured	3.5%	2.1%	5.8%
Patient characteristics			
Percentage by age group:			
Younger than 18 years	10.0%	19.2%	6.5%
18 to 44 years	20.5%	18.9%	18.5%
45 to 64 years	39.0%	34.5%	30.2%
65 years and older	30.2%	26.7%	44.7%
Percentage of male patients	55.7%	54.2%	46.4%

*Hospital stays for newborns and maternal childbirth have been excluded.
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2006

Table 2. Hospitalization rates for specific types of brain cancer by age group, 2006*

	Stays per 100,000 population			
Brain cancer type*	**<18 years**	**18-44 years**	**45-64 years**	**65+ years**
Supratentorial				
Cerebrum	7.6	3.6	2.9	2.9
Frontal lobe	7.5	33.5	28.2	23.2
Temporal lobe	5.0	14.6	17.9	20.7
Parietal lobe	3.2	8.9	14.1	16.7
Occipital lobe	1.4	2.2	3.5	4.0
Infratentorial				
Cerebellum	16.7	5.1	1.3	1.2
Brain stem	11.4	2.7	1.2	1.2
Spinal cord	3.5	3.0	1.9	0.8
Ventricles	11.4	2.1	1.3	0.0
Unspecified	16.9	9.5	11.7	12.1

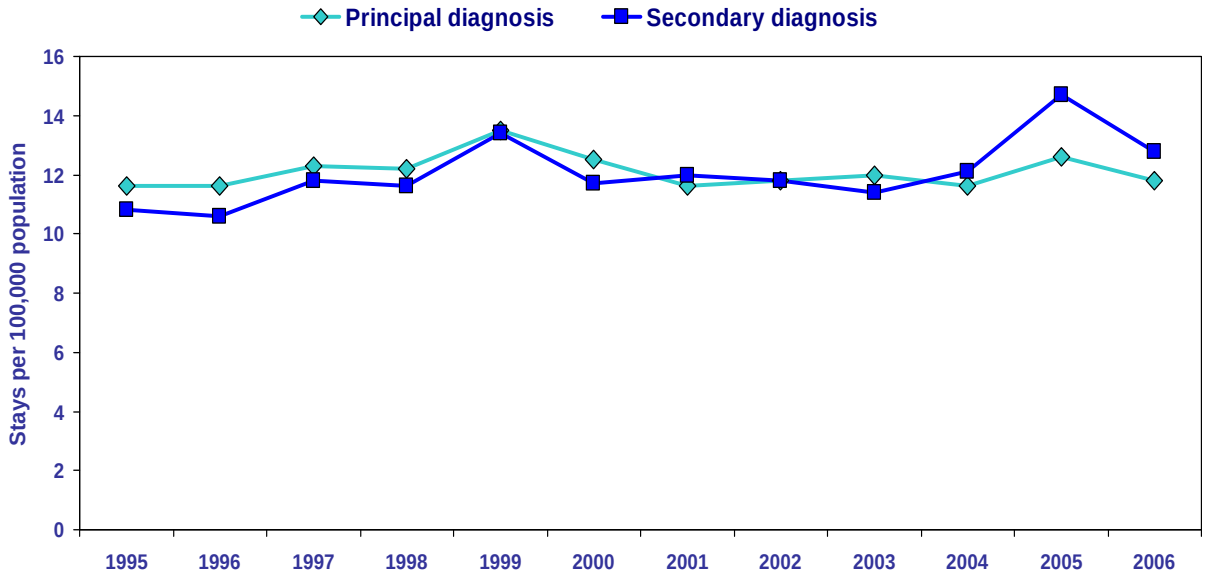
* Brain cancer is the principal diagnosis.
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2006 and Kids' Inpatient Database, 2006

Table 3. Top 20 principal diagnoses among all brain cancer-related hospitalizations, 2006

Rank	Principal diagnosis	Number of stays	Percentage of all brain cancer hospitalizations
1	Brain and nervous system cancers	35,200	47.9%
2	Maintenance chemotherapy, radiotherapy	4,400	6.0%
3	Rehabilitation care, fitting of prostheses, and adjustment of devices	3,100	4.3%
4	Epilepsy, convulsions	2,900	4.0%
5	Pneumonia	1,400	1.9%
6	Complication of device, implant or graft	1,300	1.8%
7	Complications of surgical procedures or medical care	1,300	1.8%
8	Acute cerebrovascular disease (stroke)	1,200	1.7%
9	Septicemia (except in labor)	1,200	1.7%
10	Disease of white blood cells	1,100	1.5%
11	Phlebitis, thrombophlebitis, and thromboembolism	1,000	1.4%
12	Fluid and electrolyte disorders	1,000	1.3%
13	Other nervous system disorders	900	1.3%
14	Pulmonary heart disease	900	1.2%
15	Secondary malignancies	800	1.0%
16	Other cancers	700	0.9%
17	Urinary tract infections	600	0.8%
18	Other hereditary and degenerative nervous system conditions	600	0.8%
19	Aspiration pneumonitis, food/vomitus	600	0.8%
20	Respiratory failure, insufficiency, arrest (adult)	600	0.8%

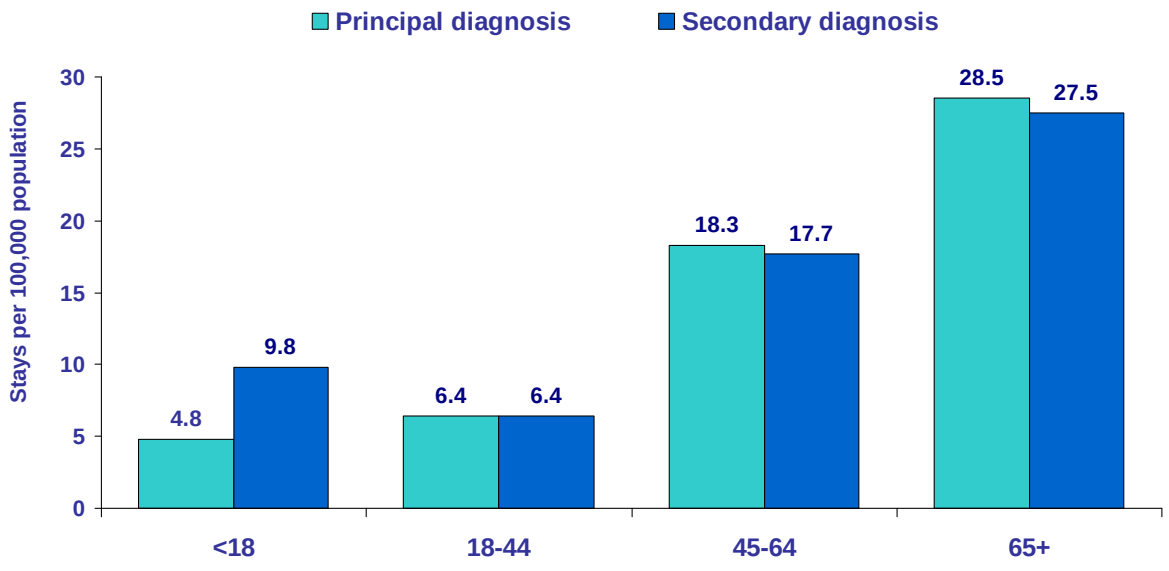
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2006

Figure 1. Between 1995 and 2006, the rate of stays principally for brain cancer remained relatively stable, yet increased as a secondary diagnosis by 18 percent



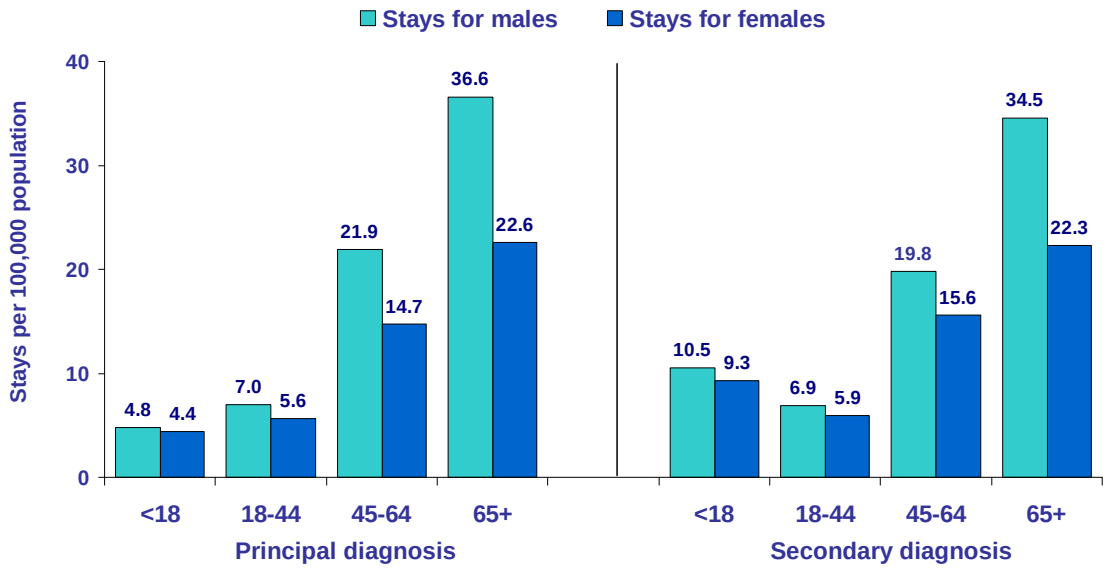
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, HCUPnet, Nationwide Inpatient Sample, 2006

Figure 2. The rate of brain cancer-related hospitalizations increases with age, 2006



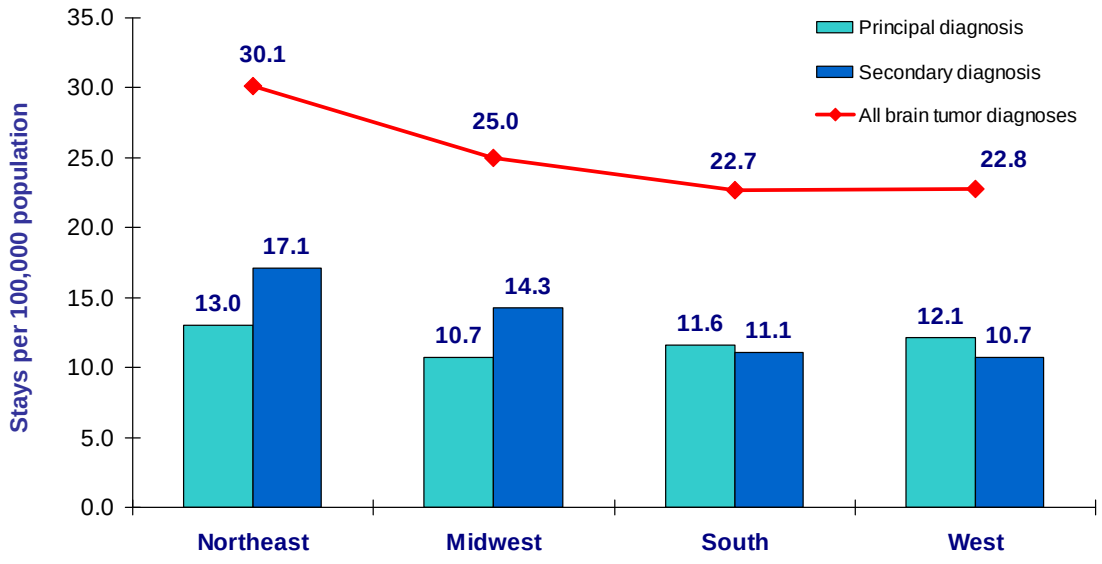
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, HCUPnet, Nationwide Inpatient Sample, 2006

Figure 3. The rate of brain cancer-related hospitalizations was highest among men age 65 and older, 2006



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, HCUPnet, Nationwide Inpatient Sample, 2006

Figure 4. Overall, the Northeast had the highest rate of brain cancer stays, and the West and South had the lowest, 2006



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, HCUPnet, Nationwide Inpatient Sample, 2006