

## STATISTICAL BRIEF #46

January 2008

# Hospitalizations for Epilepsy and Convulsions, 2005

Laurel Holmquist, M.A., C. Allison Russo, M.P.H., and Anne Elixhauser, Ph.D.

### Introduction

Convulsions are a type of seizure caused by disorganized, abnormal electrical activity in the brain which results in repeated muscular contraction and uncontrolled body movements. Epilepsy is a chronic condition that is diagnosed when seizures occur repeatedly. Not all convulsions are epilepsy-related. Convulsions may occur as a result of high fever (especially among young children), subdural hematoma, stroke, CNS infection, uremia, hyperglycemia, hypoglycemia, hyponatremia, substance abuse and withdrawal, among other causes. Epilepsy can originate from physical injury, biological, or unknown causes. The severity of epileptic seizures can vary greatly, from a tingling sensation to convulsions and loss of consciousness. While medication can in many cases control the severity and symptoms of seizures, hospitalization may be required to treat severe or frequent seizures. These events can lead to permanent brain damage, death, or loss of quality of life.<sup>1</sup> Depending on how epilepsy is defined, it is estimated that 0.4–1.0 percent of the U.S. population is affected by epilepsy,<sup>2,3</sup> which impacts the lives of approximately 2.7 million Americans.

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on characteristics of hospital admissions related to the treatment of epilepsy and convulsions in 2005. Characteristics of stays for epilepsy and convulsions are compared to all hospitalizations. Additionally, trends in hospitalizations for epilepsy and convulsions are examined from 1993 to 2005. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

<sup>1</sup> Generalized tonic-clonic seizure, MedlinePlus, U.S. National Library of Medicine, National Institutes of Health, 2007. <http://www.nlm.nih.gov/medlineplus/ency/article/000695.htm> (Accessed January 16, 2008).

<sup>2</sup> CDC. Prevalence of self-reported epilepsy—United States, 1986–1990. *MMWR* 1994;43:810–1.

<sup>3</sup> *Targeting Epilepsy: One of the Nation's Most Common Disabling Neurological Conditions*. Center for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Atlanta, GA. 2007 (<http://www.cdc.gov/nccdp/publications/AAG/pdf/epilepsy.pdf>).

### Highlights

- In 2005, nearly 1.4 million hospital stays identified epilepsy or convulsions as a diagnosis. About 277,000 stays had epilepsy or convulsions as the principal reason for hospitalization, totaling nearly \$1.8 billion in hospital costs.
- The number of convulsion-related hospitalizations increased between 1993 and 2005. Stays principally for convulsions increased 27 percent, and stays with any mention of convulsions increased 69 percent.
- Epilepsy-related stays showed a U-shaped trend between 1993 and 2005. While hospital stays for epilepsy declined between 1993 and 2000, they increased during the later years. Between 2000 and 2005, hospitalizations principally for epilepsy rose 51 percent and stays with any mention of epilepsy rose 43 percent.
- While the rate of epilepsy hospitalizations was nearly equal across the regions, there was regional variation in the rate of hospitalizations with any mention of convulsions, ranging from 48 stays per 10,000 population in the Northeast to 30 stays per 10,000 population in the West.
- For epilepsy-related stays, over half of all hospitalizations were principally for epilepsy (53.3 percent). Only 16.7 percent of convulsion-related stays had convulsions as a principal diagnosis, with pneumonia, stroke, sepsis, alcohol-related mental disorders, and mood disorders comprising another 15 percent of cases.

## Findings

In 2005, epilepsy or convulsions were identified in nearly 1.4 million (3.6 percent) of the 39.2 million total hospitalizations. About 277,000 stays had epilepsy or convulsions as the principal reason for hospitalization and totaled nearly \$1.8 billion in hospital costs in 2005 (Table 1).

### *Trends in hospital stays for epilepsy and convulsions*

Figures 1 and 2 depict the trend in hospitalizations for epilepsy and convulsions. As shown in Figure 1, the rate of convulsion-related hospitalizations increased between 1993 and 2005 for both stays with a principal diagnosis and those with any mention of the condition in the record (all-listed diagnoses). Stays principally for convulsions increased 27 percent between 1993 and 2005, rising 15 percent between 2000 and 2005. Hospitalizations with any mention of convulsions increased 69 percent from 1993 to 2005, and 20 percent since 2000.

Figure 2 shows a U-shaped trend in hospitalizations associated with epilepsy between 1993 and 2005. Although the number of epilepsy-related stays declined from 1993 to 2000, hospitalizations principally for epilepsy increased 51 percent since 2000. Hospitalizations with any mention of epilepsy increased 43 percent from 2000 to 2005.

### *Resource use and outcomes associated with hospital stays for epilepsy and convulsions*

Table 1 describes the resource use associated with epilepsy/convulsion-related stays in comparison to all hospital stays. Stays principally for epilepsy/convulsions originated in the emergency department more frequently than all hospital stays (65.5 percent versus 42.5 percent). Stays in which patients were admitted principally for epilepsy/convulsions were, on average, one day shorter (3.6 days versus 4.6 days) than the typical hospital stay, yet the cost per day was the same (about \$1,800 per day). As shown in Figure 3, the average cost per day for patients younger than 18 years was 47 percent higher than the average cost per day for patients 65 and older—\$2,200 versus \$1,500. As compared with all hospital stays, patients hospitalized for epilepsy/convulsions rarely died in the hospital (less than 1 percent versus 2.1 percent overall).

### *Comparison of hospital stays for epilepsy and convulsions*

Table 2 compares hospital stays for epilepsy to those for convulsions based on any mention of these conditions in the record. Nearly two-thirds of patients diagnosed with epilepsy were younger than 45 years, while two-thirds of patients with convulsions were middle-aged or elderly. This age distribution was reflected in the distribution of expected source of payment—more patients with epilepsy were covered by Medicaid and private insurance compared with more Medicare-covered patients among those with convulsions.

### *Hospital stays for epilepsy and convulsions, by age*

While epilepsy-related hospitalizations were fairly constant across age groups, the number of hospital stays with a convulsion diagnosis increased from 18 per 10,000 population among those 17 years and younger to 114 stays per 10,000 population over 65 years (Figure 4). Among patients with epilepsy, those younger than 18 years and older than 65 years had a hospitalization rate of nearly 6 stays per 10,000 population, while the average rate for patients between these ages was 4 epilepsy-related stays per 10,000 population.

### *Hospital stays for epilepsy and convulsions, by region*

Figure 5 shows the rates of hospitalization for epilepsy and convulsions for the four regions of the country. Epilepsy hospitalization rates were nearly equal across the regions, with 6 stays per 10,000 population in the Northeast, Midwest, and West and 4 stays per 10,000 in the South. Conversely, there was regional variation in the rate of hospitalization with any mention of convulsions. The Northeast had the highest rate of convulsion-related hospitalizations, with over 48 stays per 10,000 population. Convulsion hospitalization rates in the West were the lowest, at approximately 30 stays per 10,000 population.

### *Principal diagnoses associated with epilepsy and convulsions*

Table 3 lists the most frequent principal diagnoses associated with any hospitalization that included a diagnosis of epilepsy and convulsions. For epilepsy-related stays, over half of all hospitalizations were principally for epilepsy (53.3 percent). On the other hand, for convulsion-related stays, only 16.7 percent of stays had a principal diagnosis of convulsions. A number of principal diagnoses were similar among

the top ten for both epilepsy and convulsions—pneumonia, stroke, mood disorders, aspiration pneumonitis, sepsis, and complication of device, implant or graft. Among patients with epilepsy, other principal diagnoses included respiratory failure, rehabilitation care, and complications of pregnancy. Among patients with convulsions, other top 10 principal diagnoses included alcohol-related mental disorders, urinary tract infections, and fluid and electrolyte disorders.

## Data Source

The estimates in this Statistical Brief are based on data from the HCUP 2005 Nationwide Inpatient Sample. Historical data were drawn from the 1993–2005 NIS.

Supplemental source included data on regional population estimates from Table 8: Annual Estimates of the Population for the United States, Regions, and Divisions: April 1, 2000 to July 1, 2006 (NST-EST2006-01), Population Division, U.S. Census Bureau, Release date: December 22, 2006 (<http://www.census.gov/popest/states/tables/NST-EST2006-01.xls>).

## 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. All-listed diagnoses include the principal diagnosis plus these additional secondary conditions.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 12,000 ICD-9-CM diagnosis codes.

CCS categorizes ICD-9-CM diagnoses into 260 clinically meaningful categories.<sup>4</sup> This "clinical grouper" makes it easier to quickly understand patterns of diagnoses and procedures.

### *Case Definition*

The ICD-9-CM codes defining epilepsy include diagnosis codes in the following range: 345.00–345.91.

The ICD-9-CM codes defining convulsions include diagnosis codes in the following range: 780.3–780.39.

Combined epilepsy/convulsions diagnoses were defined as CCS category:

– 105: Epilepsy, convulsions

### *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).<sup>5</sup> Costs will tend to reflect the actual costs of production, while charges represent what the hospital billed for the case. For each

---

<sup>4</sup> HCUP CCS. Healthcare Cost and Utilization Project (HCUP). August 2006. U.S. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/toolsoftware/ccs/ccs.jsp](http://www.hcup-us.ahrq.gov/toolsoftware/ccs/ccs.jsp)

<sup>5</sup> HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2003. U.S. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/db/state/costtocharge.jsp](http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp)

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.

#### *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.

#### *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 & Human Services  
**California** Office of Statewide Health Planning & Development  
**Colorado** Health & Hospital Association  
**Connecticut** Integrated Health Information (Chime, Inc.)

**Florida** Agency for Health Care Administration  
**Georgia** GHA: An Association of Hospitals & Health Systems  
**Hawaii** Health Information Corporation  
**Illinois** Health Care Cost Containment Council and Department of Public Health  
**Indiana** Hospital & Health Association  
**Iowa** Hospital Association  
**Kansas** Hospital Association  
**Kentucky** Cabinet for Health and Family Services  
**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** Division of Health Care Financing and Policy, Department of Human Resources  
**New Hampshire** Department of Health & Human Services  
**New Jersey** Department of Health & Senior Services  
**New York** State Department of Health  
**North Carolina** Department of Health and Human Services  
**Ohio** Hospital Association  
**Oklahoma** Health Care Information Center for Health Statistics  
**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 & Family Services

## 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 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 more information about HCUP, visit [www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov).

For additional HCUP statistics, visit HCUPnet, our interactive query system, at [www.hcup.ahrq.gov](http://www.hcup.ahrq.gov).

For information on other hospitalizations in the U.S., download *HCUP Facts and Figures: Statistics on Hospital-based Care in the United States in 2005*, located at <http://www.hcup-us.ahrq.gov/reports.jsp>.

For a detailed description of HCUP, more information on the design of the NIS, and methods to calculate estimates, please refer to the following publications:

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

*Design of the HCUP Nationwide Inpatient Sample, 2005*. Online. June 13, 2007. U.S. Agency for Healthcare Research and Quality.  
[http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS\\_2005\\_Design\\_Report.pdf](http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS_2005_Design_Report.pdf)

Houchens, R., Elixhauser, A. *Final Report on Calculating Nationwide Inpatient Sample (NIS) Variances, 2001*. HCUP Methods Series Report #2003-2. Online. June 2005 (revised June 6, 2005). U.S. Agency for Healthcare Research and Quality.  
<http://www.hcup-us.ahrq.gov/reports/CalculatingNISVariances200106092005.pdf>

Houchens RL, Elixhauser A. *Using the HCUP Nationwide Inpatient Sample to Estimate Trends. (Updated for 1988–2004)*. HCUP Methods Series Report #2006-05 Online. August 18, 2006. U.S. Agency for Healthcare Research and Quality.  
[http://www.hcup-us.ahrq.gov/reports/2006\\_05\\_NISTrendsReport\\_1988-2004.pdf](http://www.hcup-us.ahrq.gov/reports/2006_05_NISTrendsReport_1988-2004.pdf)

### Suggested Citation

Holmquist, L. (Thomson Healthcare), Russo, C. A. (Thomson Healthcare), and Elixhauser, A. (AHRQ). *Hospitalizations for Epilepsy and Convulsions, 2005*. HCUP Statistical Brief #46. January 2008. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb46.pdf>

\* \* \*

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 [hcp@ahrq.gov](mailto:hcp@ahrq.gov) or send a letter to the address below:

Irene Fraser, Ph.D., Director  
Center for Delivery, Organization, and Markets  
Agency for Healthcare Research and Quality  
540 Gaither Road  
Rockville, MD 20850

**Table 1. Resource use for admissions for epilepsy/convulsions in U.S. hospitals, 2005**

	<b>Epilepsy/ Convulsions*</b>	<b>All Hospital Stays</b>
Number of discharges	277,000	39,164,000
Aggregate costs	\$1.8 billion	\$ 316.3 billion
Mean length of stay, days	3.6	4.6
Cost per hospitalization	\$6,600	\$8,100
Mean cost per day	\$1,800	\$1,800
Percentage of in-hospital deaths	0.7%	2.1%
Percentage admitted through the emergency department	65.5%	42.5%

\*Based on principal diagnosis.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), HCUPnet, Nationwide Inpatient Sample (NIS), 2005.

**Table 2. Age and payer characteristics of stays with any mention of epilepsy or convulsions in U.S. hospitals compared to all hospital stays, 2005**

	<b>Epilepsy*</b>	<b>Convulsions*</b>	<b>All Hospital Stays</b>
Age			
<18 years	31.2%	10.6%	18.0%
18–44 years	30.0%	23.4%	25.6%
45–64 years	23.6%	31.5%	22.1%
>65 years	14.9%	34.4%	34.2%
Primary payer			
Medicare	28.0%	48.6%	37.2%
Medicaid	28.2%	21.7%	19.5%
Privately insured	35.6%	21.5%	34.9%
Uninsured	4.7%	5.4%	5.4%

\*Based on all-listed diagnoses.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), HCUPnet, Nationwide Inpatient Sample (NIS), 2005.

**Table 3. Most common principal diagnoses associated with epilepsy and convulsions, 2005**

<b>Epilepsy*</b>		<b>Convulsions*</b>	
<b>Principal diagnosis</b>	<b>Percent of all epilepsy-related stays</b>	<b>Principal diagnosis</b>	<b>Percent of all convulsion-related stays</b>
1. Epilepsy/convulsions	53.3%	1. Epilepsy/convulsions	16.7%
2. Respiratory failure, insufficiency, arrest	2.0%	2. Pneumonia	4.4%
3. Pneumonia	1.9%	3. Stroke	3.1%
4. Stroke	1.6%	4. Sepsis	2.9%
5. Mood disorders	1.4%	5. Alcohol-related mental disorders	2.5%
6. Aspiration pneumonitis	1.2%	6. Mood disorders	2.4%
7. Complication of device, implant or graft	1.1%	7. Urinary tract infections	2.1%
8. Sepsis	1.1%	8. Fluid and electrolyte disorders	2.1%
9. Rehabilitation care	1.0%	9. Complication of device, implant or graft	2.0%
10. Complications of pregnancy	1.0%	10. Aspiration pneumonitis	2.0%
<b>Percent all cases in the top 10</b>	<b>65.6%</b>	<b>Percent all cases in the top 10</b>	<b>40.2%</b>

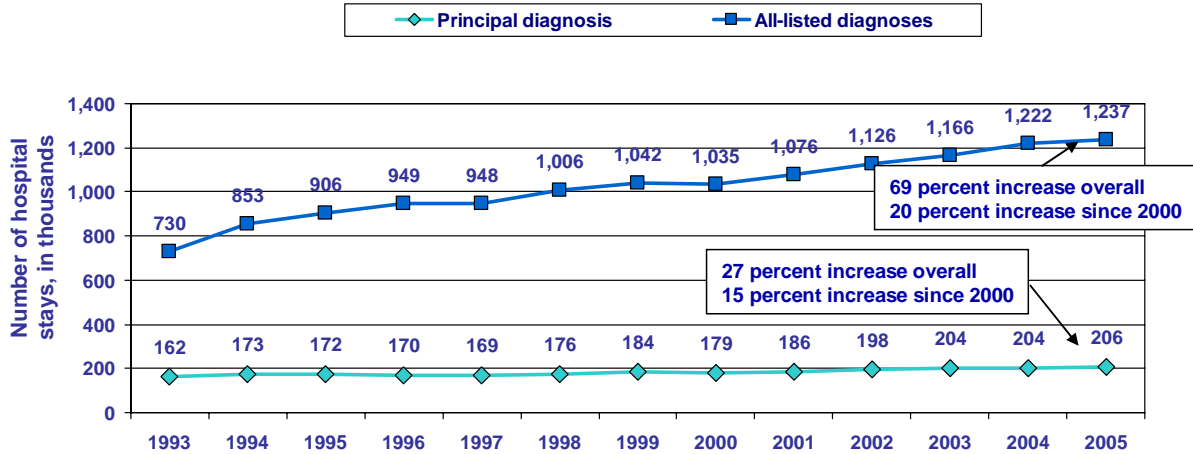
\*Based on all-listed diagnoses.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), HCUPnet, Nationwide Inpatient Sample (NIS), 2005.





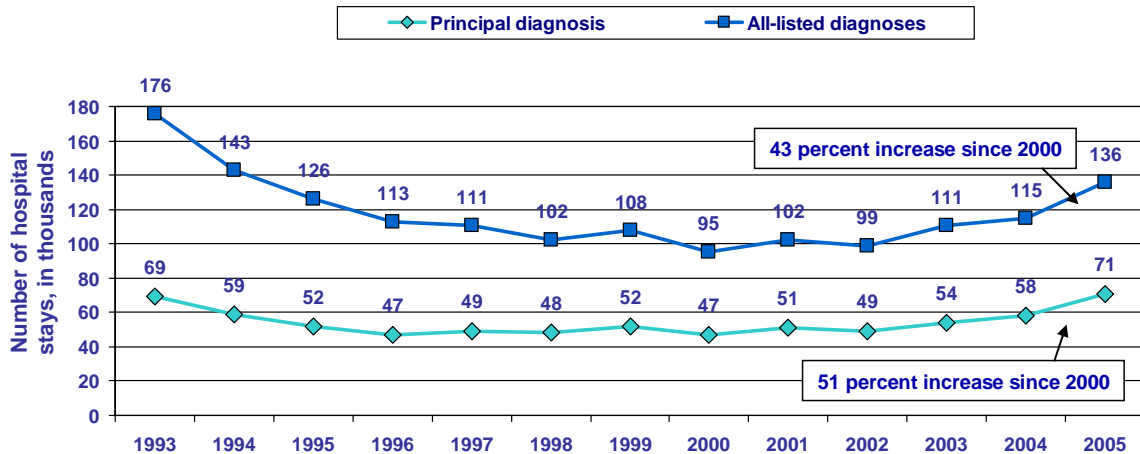
**Figure 1. Increasing trend in hospital stays associated with convulsions, 1993–2005**



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2005



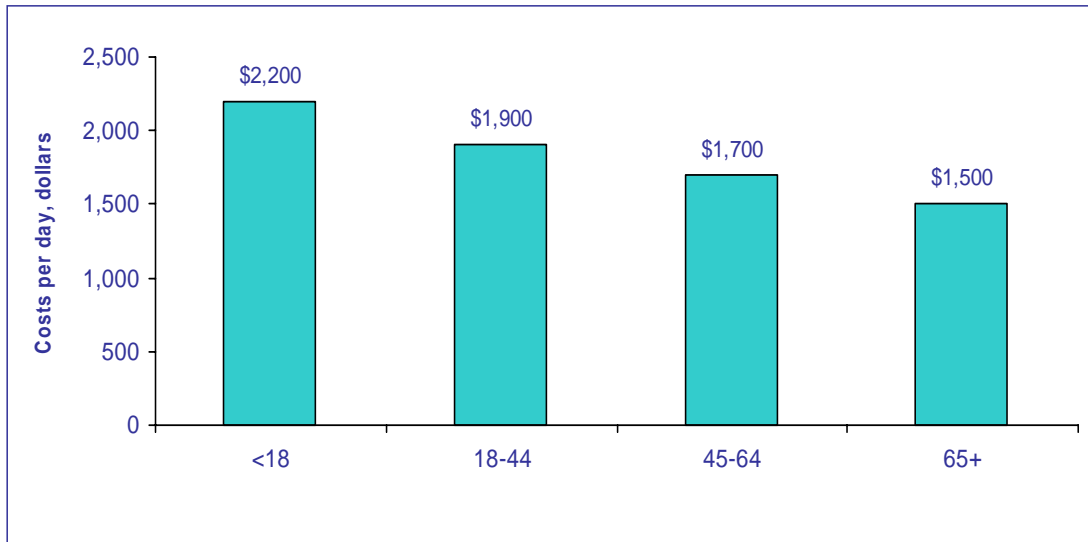
**Figure 2. U-shaped trend in hospital stays associated with epilepsy, 1993–2005**



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2005



**Figure 3. Costs per day for epilepsy/convulsion hospitalizations are higher for younger patients, 2005\***

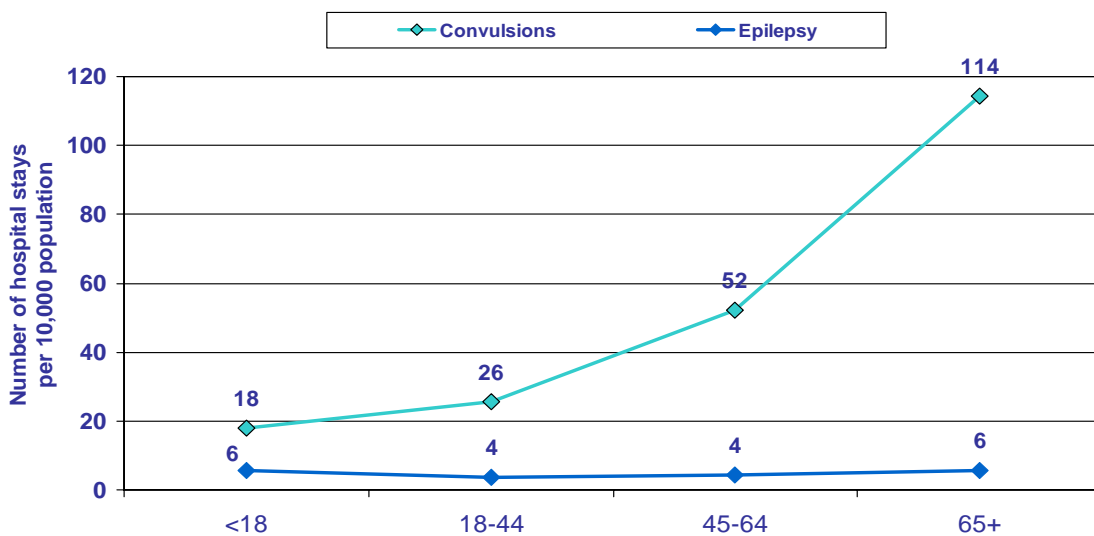


\* Based on principal diagnosis.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2005



**Figure 4. Convulsion hospitalization rate increases drastically by age, but remains constant for epilepsy, 2005\***

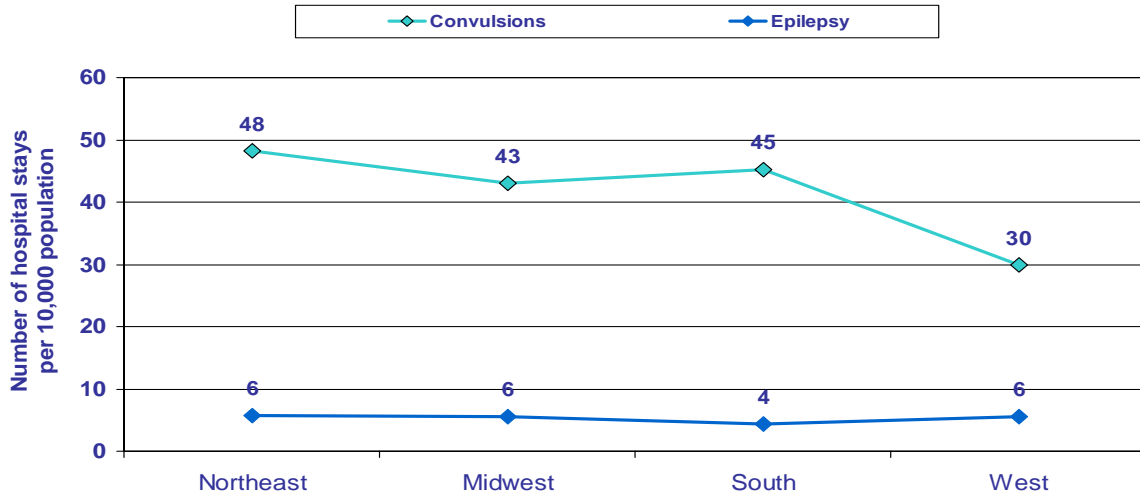


\* Based on all-listed diagnoses.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2005



**Figure 5. Convulsion hospitalization rate varies by region, but remains constant for epilepsy, 2005\***



\* Based on all-listed diagnoses.

Source: AHRQ, Center for Delivery, Organization, and Markets; Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2005