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Emergency Department Visits and Hospital Admissions for Kidney Stone Disease, 2009

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Introduction

Kidney stone disease (also known as urolithiasis) represents a significant health care expenditure for the United States. The lifetime prevalence of experiencing kidney stone disease has been estimated to be 13 percent for men and 7 percent for women[1] though these numbers are on the rise.[2] Furthermore, the likelihood of reoccurrence has been estimated to be as high as 50 percent within 5 years of the initial event.[3]

Kidney stone disease is frequently treated in the emergency department (ED) due to the pain associated with the condition. Most commonly, patients experience severe flank and lower back pain which may radiate down to the groin. Additional symptoms may include blood in the urine (hematuria), nausea and vomiting.[4]

The decision on how to treat kidney stone disease depends on the severity and location of the stone(s).[5,6] Small stones, several millimeters in size, often pass without intervention and are often treated with pain medication and observation. Conversely, large stones or those causing significant side effects such as infection, renal (kidney) failure or severe pain require surgical intervention.[3]

The purpose of this Statistical Brief is to analyze ED visits and hospital admissions related to kidney stone disease and to further characterize the frequency of visits to the ED and hospital over time.

Highlights

- In 2009, there were approximately 1.3 million ED visits for kidney stone disease. On average, there were over 3,600 ED visits for kidney stone disease every day.
- Rates of ED visits for kidney stone disease have increased 20 percent between 2005 and 2009, from 372 per 100,000 people to 441 per 100,000 people. Rates of hospitalization for kidney stone disease increased 14 percent over the same time period, from 111 per 100,000 people in 2005 to 126 per 100,000 people in 2009.
- Approximately 20 percent of ED visits for kidney stone disease resulted in a hospitalization; older patients were more likely to be admitted than younger patients.
- There was a significant rise in the percent of kidney stone-related disease ED visits during the hottest months of the year, particularly in July and August.
- People living in rural areas were more likely to have an ED visit for kidney stone disease (580 per 100,000 people) than people living in the most urban areas (351 per 100,000) people. However the people in urban areas (25 percent) were more likely to be hospitalized after their ED visit than people in rural areas (14 percent).

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[1] Pearle MS, Calhoun EA, Curhan GC. Urologic diseases in America project: urolithiasis. Journal of Urology 2005;173:848–57.
[2] Romero V, Akpinar H, Assimos, DG. Kidney stones: A global picture of prevalence, incidence, and associated risk factors. Reviews in Urology 2010;12:e86-e96.
[3] National Institutes of Health http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001493/ as accessed on January 12, 2012.
[4] Graham A, Luber S, Wolfson AB. Urolithiasis in the emergency department. Emergency Medicine Clinic of North America 2011;29(3):519-38.
[5] Seitz C, Liatsikos E, Porpiglia F, Tiselius HG, Zwergel U. Medical therapy to facilitate the passage of stones: what is the evidence? European Urology 2009;56(3):455-71.
[6] Singh A, Alter H, Littlepage A. A systematic review of medical therapy to facilitate passage of ureteral calculi. Annals of Emergency Medicine 2007;50(5):552-563.

In this Statistical Brief we use the term kidney stone disease to represent all stones in the urinary tract. However, stones of the urinary tract can actually be located in several different anatomic locations. Upper urinary tract stones refer to those located in the kidney or ureter (the tube connecting the kidney to the bladder). Lower urinary tract stones refer to those stones located in the bladder or urethra (the tube that allows urine to pass out of the body).

Findings

In 2009 there were approximately 1.3 million ED visits related to kidney stone disease (table 1). This translates to an average of 3,642 ED visits for kidney stone disease each day. The majority of these visits were treated and released in the ED, while about 20 percent resulted in a hospitalization.

More than 70 percent of all ED visits related to kidney stone disease had a documented principal diagnosis related to kidney stone disease. Among those with a principal diagnosis of kidney stone disease, the probability of being admitted to the hospital from the ED was 12 percent, while among those without principal diagnosis of kidney stone disease the probability being admitted was significantly higher, 39 percent.

Men (497 per 100,000) were more likely than women (369 per 100,000) to have an ED visit for kidney stone disease. Approximately 43 percent of all kidney stone-related ED visits were for women (table 3). However men and women had identical rates of ED visits resulting in a hospitalization (85 per 100,000).

Table 1. Frequency of kidney stone disease visits to the ED, 2009

	All ED visits related to kidney stone disease	Treat and release ED visits related to kidney stone disease	ED visits related to kidney stone disease resulting in a hospitalization
Total number of visits	1,329,200	1,067,900	261,300
Principal Diagnosis	950,200	838,100	112,100
Not principal Diagnosis	379,000	229,800	149,200
Average number of ED visits per day in the U.S.	3,600	2,900	700
Rate/100,000 population males per year	500	400	100
Rate/100,000 population females per year	400	300	100

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

The vast majority of ED visits for kidney stone disease were related to a stone in the upper urinary tract (table 2), with 55 percent in the kidney and 49 percent in the ureter. (The sum of the specific locations of stones is more than the overall total because the same patient can have stones in multiple locations.) About 2 percent of ED visits for kidney stone disease involved a stone in the lower urinary tract (bladder and urethra).

Table 2. Anatomic location of kidney stone disease visits to the ED, 2009

	All ED visits related to kidney stone disease	Treat and release ED visits related to kidney stone disease	ED visits related to kidney stone disease resulting in a hospitalization
Kidney	733,300	579,500	153,700
Ureter	657,300	530,300	127,100
Urinary calculus, unspecified[1]	15,400	13,200	2,200
Lower urinary tract[2]	28,900	18,600	10,300

[1]Includes uric acid nephrolithiasis (274.11) ED visits
[2]Refers to the bladder and urethra
Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

Kidney stone disease ED visits for children and adolescents were rare (table 3). The highest rates of ED visits for kidney stone disease were experienced by persons between the ages of 26 and 64 years, with the highest rates in the 35–44 year age group. Rates of ED visits for kidney stone disease leading to a hospital admission increased uniformly as age increased. The mean age of patients among all ED visits with kidney stone disease was 45.9 years, but patients who were admitted to hospital averaged 55.5 years. This indicates that even though the overall frequency of ED visits for kidney stones decreases with age, the likelihood of a hospital admission as a result of the ED visit increases with age.

ED visits for kidney stone disease were more common among people living in rural areas than among people living in urban areas. In large central metropolitan areas the kidney stone disease ED rate per 100,000 people was 351 per 100,000 people compared to 580 per 100,000 people in rural areas. However, people from large central metropolitan and large fringe metropolitan areas had the highest admission rates from the ED (88 and 91 per 100,000 people respectively), while those from rural, micropolitan, and small metropolitan areas (79, 80, and 79 per 100,000 people respectively) had the lowest admissions rates.

Private insurance was the most common principal payer of kidney stone disease ED visits (50 percent). Medicare was the primary payer for 18 percent of kidney stone disease ED visits overall, but 38 percent of patients admitted to the hospital were covered by Medicare.

ED visits for kidney stone disease were most frequent in the South and Midwest regions at 490 and 469 per 100,000 people respectively, compared to the Northeast and West (395 and 339 per 100,000 people). However, among ED visits leading to a hospitalization, the Northeast (102 per 100,000 people) had the highest rate while the West (63 per 100,000 people) had the lowest rate.

ED visits for kidney stone disease rarely ended in death (0.2 percent).

Table 3. Characteristics of kidney stone disease ED visits, 2009

	All ED visits related to kidney stone disease	**Treat and release ED visits related to kidney stone disease**	**ED visits related to kidney stone disease resulting in a hospitalization**
Patient Characteristics			
Percentage female	43.3	41.4	50.9
Mean Age	45.9	43.6	55.5
Percentage died during visit	0.2	0.0	0.8
Age group (number per 100,000 people)			
<=4	2	1	1
5–17	42	37	6
18–25	398	357	41
26–34	630	561	69
35–44	682	591	91
45–54	606	502	104
55–64	571	436	135
65–74	554	361	193
75–84	510	242	268
85+	494	158	336
Patient location (number per 100,000 people)			
Central metropolitan, large	351	263	88
Fringe metropolitan, large	398	308	91
Metropolitan, medium	479	398	80
Metropolitan, small	471	393	79
Micropolitan	515	435	80
Rural	580	501	79

Payer (percentage)			
Medicare	17.7	12.7	38.2
Medicaid	12.1	11.7	13.6
Private	49.6	53.0	35.9
Self-pay	16.0	18.0	8.0
Other	4.5	4.6	4.2
Hospital region (rate per 100,000)			
Northeast	395	293	102
Midwest	469	378	91
South	490	402	87
West	339	276	63

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009

Table 4 shows the most frequent hospital procedures performed among patients admitted to the hospital following an ED visit with a principal diagnosis of kidney stone disease. Multiple procedures may have been performed during each hospitalization; however, it is possible that definitive treatment of kidney stone disease took place subsequent to the hospitalization and was not captured in our data set.

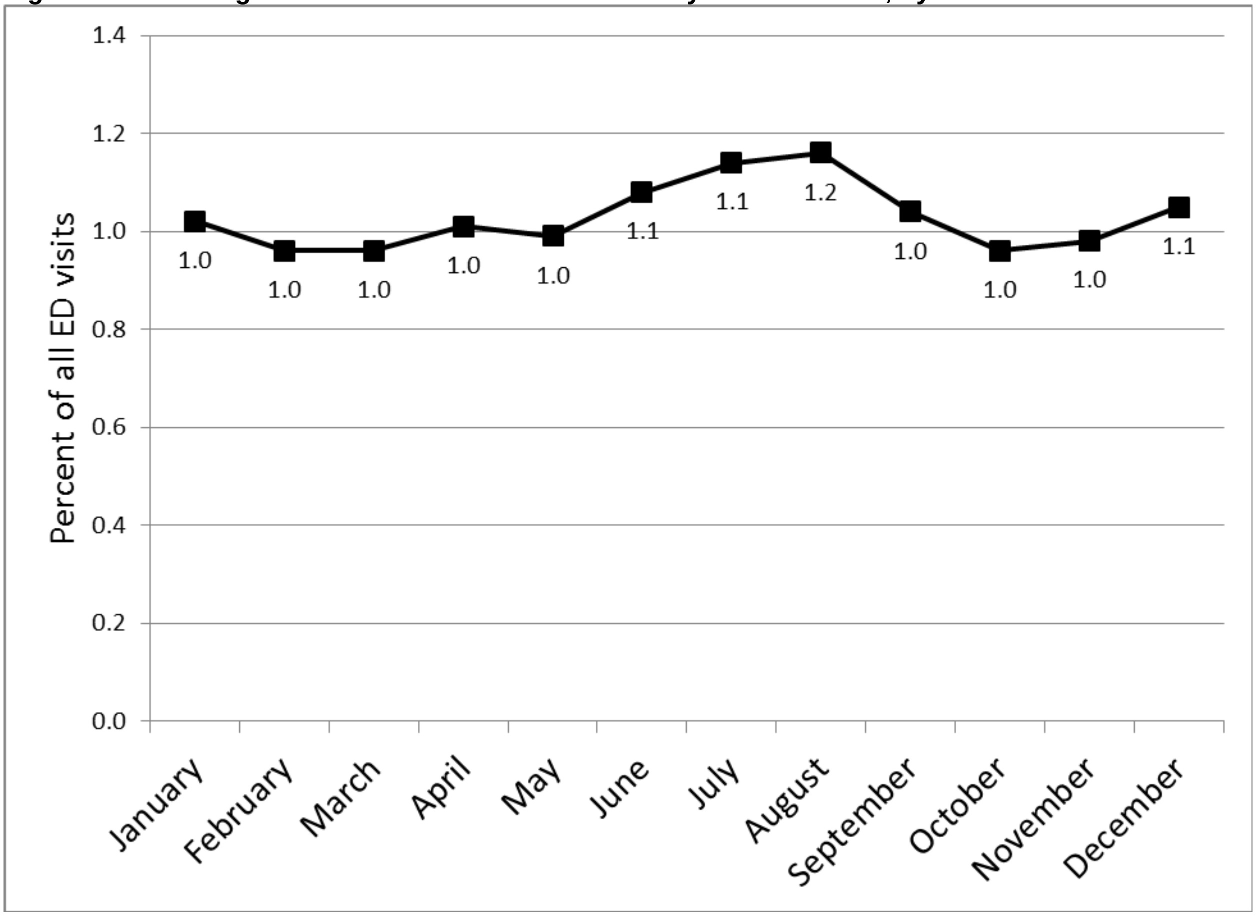
Table 4. Top 10 procedures performed during hospitalizations following an ED visit with a principal diagnosis of kidney stone disease

Procedure (ICD-9 procedure code)	Number of visits with procedure performed during hospitalization after ED visit for kidney stone disease	Percentage of hospitalizations during which a procedure was performed (denominator=112,100)
Any procedure performed	78,500	70.0
Any top 10 procedure performed	75,100	66.9
Ureteral catheterization (598)	59,800	53.3
Retrograde pyelogram (8774)	34,200	30.5
Transurethral removal of obstruction from ureter and renal pelvis (560)	32,700	29.2
Other cystoscopy (5732)	15,100	13.4
Ureteroscopy (5631)	10,400	9.2
Extracorporeal shockwave lithotripsy of the kidney, ureter, and/or bladder (9851)	5,300	4.8
Computerized axial tomography of abdomen (8801)	4,500	4.0
Percutaneous nephrostomy without fragmentation (5503)	2,700	2.4
Ultrasonic fragmentation of urinary stones (5995)	1,900	1.7
Transurethral clearance of bladder (570)	1,800	1.6

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2009 and the Nationwide Inpatient Sample, 2009

Figure 1 displays the monthly number of ED visits for kidney stone disease. There were significantly more ED visits during the hottest months of year, July and August. The number of visits per month varied from a low of 80,000 in February to a high of 108,800 in August.

Figure 1. Percentage of ED visits that are due to kidney stone disease, by month



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample (NEDS), 2009

Both ED visits and hospitalizations for kidney stone disease have increased over the past several years, which is consistent with an increased prevalence of kidney stones[7] (figure 2); however, the increase in ED visits outpaced the increase in hospitalizations. This may be indicative of a change in practice patterns with stones being treated more frequently in an outpatient rather than inpatient setting.[3]

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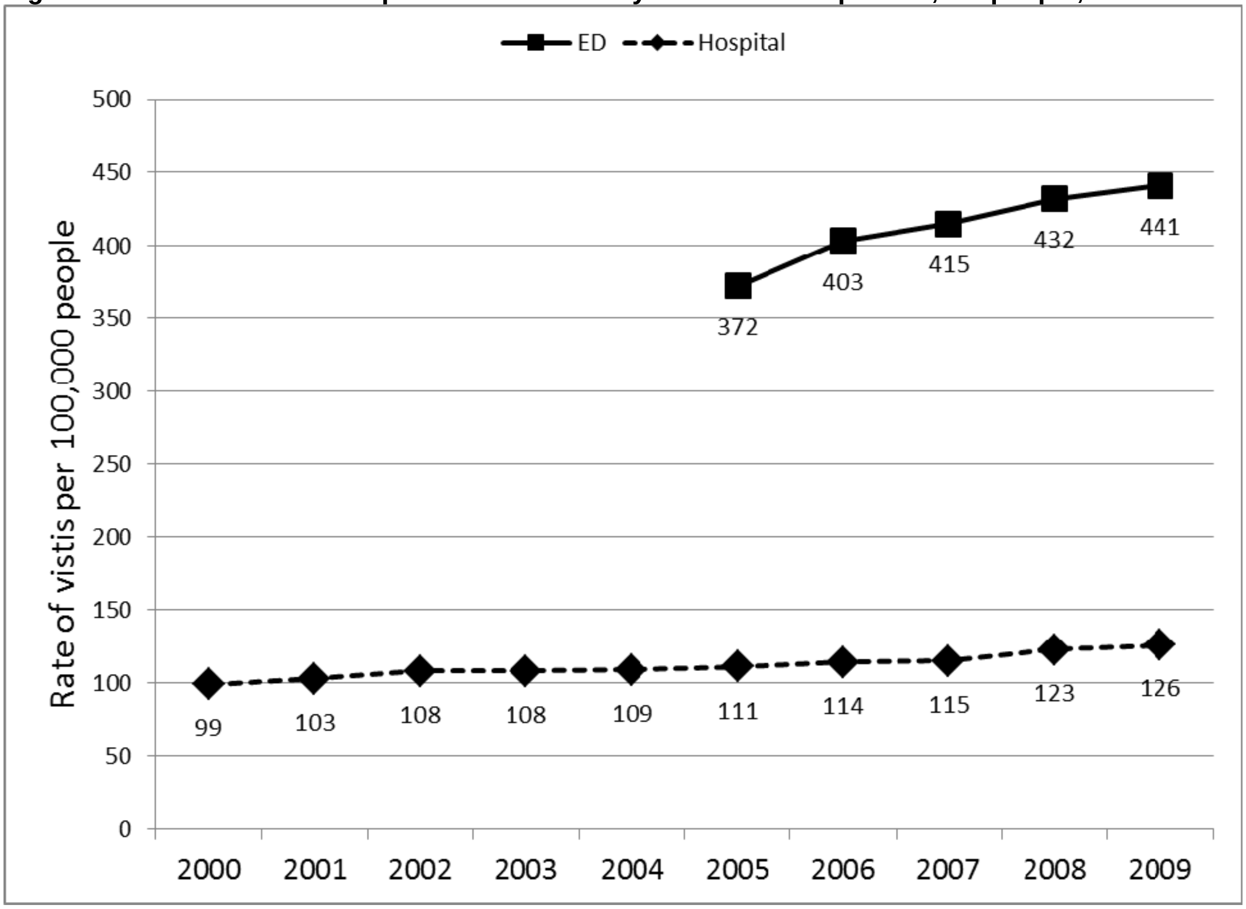
[3] Ibid.
[7] Scales Jr. CD, Smith AC, Hanley JM, Saigal CS. Prevalence of kidney stones in America. European Urology 2012; 62(1):160-5.

Figure 2. Rates of ED and hospital visits for kidney stone disease per 100,000 people, over time



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Emergency Department Sample, 2005–2009 and the Nationwide Inpatient Sample, 2000–2009

Data Source

The estimates in tables 1–3 and Figure 1 in this Statistical Brief are based upon data from the HCUP 2009 Nationwide Emergency Department Sample (NEDS). The estimates in Table 4 and Figure 2 are based upon data from the HCUP 2005–2009 Nationwide Emergency Department Sample (NEDS) and the 2000–2009 Nationwide Inpatient Sample (NIS). Supplemental source included data on the civilian non-institutionalized population from the U.S. Census Bureau (http://www.census.gov/popest/data/national/asrh/2009/2009-nat-ni.html as accessed on Jan 10, 2012) and information in the methods report entitled "Population Denominator Data for Use with the HCUP Databases (Updated with 2009 Population Data", HCUP Methods Series Report #2010-02. Online April 12, 2010. US Agency for Healthcare Research and Quality (https://www.hcup-us.ahrq.gov/reports/methods/methods.jsp).

Definitions

Procedures, diagnoses, and ICD-9-CM
Multiple surgical procedures can be listed on a record in the SID and SASD. A hierarchical algorithm assigns the most extensive procedure (review order of procedures presented under “Case definition”) to each record by evaluating all procedures listed on the record. Procedures are de-duplicated: if a particular procedure occurs multiple times during the same surgical visit or hospital stay, it is counted only once.

Similarly, multiple diagnoses can be listed on a record in the SID and SASD. A hierarchical algorithm assigns the most serious diagnosis (see order of diagnoses presented under "Case definition" below) to each record by evaluating all diagnoses listed on the record.

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 and procedures. There are about 14,000 ICD-9-CM diagnosis codes and about 4,000 ICD-9-CM procedure codes.

Case definition

The ICD-9-CM codes defining kidney stone disease include diagnosis codes in the following range. The anatomical location, as reported in Table 2, is specified in parentheses:

592.0: Calculus of kidney (Kidney)
592.1: Calculus of ureter (Ureter)
592.9: Urinary calculus, unspecified (Urinary calculus, unspecified)
594.0: Calculus in divericulum of bladder (Lower urinary tract)
594.1: Other calculus in bladder (Lower urinary tract)
594.2: Calculus in urethra (Lower urinary tract)
594.8: Other lower urinary tract calculus (Lower urinary tract)
594.9: Calculus of lower urinary tract, unspecified (Lower urinary tract)
274.11: Uric acid nephrolithiasis (Urinary calculus, unspecified)

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 obstetrics and gynecology, otolaryngology, orthopedic, cancer, pediatric, public, and academic medical hospitals. Excluded are long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. However, if a patient received long-term care, rehabilitation, or treatment for psychiatric or chemical dependency conditions in a community hospital, the discharge record for that stay will be included in the NIS.

Unit of analysis

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

Location of patients' residence

Place of residence is based on the urban-rural classification scheme for U.S. counties developed by the National Center for Health Statistics (NCHS):

– Large Central Metropolitan: Central counties of metropolitan areas with 1 million or more residents
– Large Fringe Metropolitan: Fringe counties of counties of metropolitan areas with 1 million or more residents
– Medium Metropolitan: Counties in metropolitan areas of 250,000-999,999 residents
– Small Metropolitan: Counties in metropolitan areas of 50,000-249,999 residents
– Micropolitan: Nonmetropolitan counties, i.e., a nonmetropolitan county with an area of 10,000 or more residents
– Rural: Nonmetropolitan and nonmicropolitan counties.

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

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:

Alaska State Hospital and Nursing Home Association
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
Louisiana Department of Health and Hospitals
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
Mississippi Department of Health
Missouri Hospital Industry Data Institute
Montana MHA - An Association of Montana Health Care Providers
Nebraska Hospital Association
Nevada Department of Health and Human Services
New Hampshire Department of Health & Human Services
New Jersey Department of Health
New Mexico Department of Health
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
Oregon Health Policy and Research
Pennsylvania Health Care Cost Containment Council
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 Services
Wyoming Hospital Association

About the NEDS

The HCUP Nationwide Emergency Department Sample (NEDS) is a unique and powerful database that yields national estimates of emergency department visits. The NEDS was constructed using records from both the HCUP State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID). The SEDD capture information on ED visits that do not result in an admission (i.e., treat-and-release visits and transfers to another hospital); the SID contain information on patients initially seen in the emergency room and then admitted to the same hospital. The NEDS was created to enable analyses of ED utilization patterns and support public health professionals, administrators, policymakers, and clinicians in their decision-making regarding this critical source of care. The NEDS is produced annually beginning in 2006.

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 95 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.

For More Information

For more information about HCUP, visit http://www.hcup-us.ahrq.gov.

For additional HCUP statistics, visit HCUPnet, our interactive query system, at 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 2009*, located at http://www.hcup-us.ahrq.gov/reports.jsp (Accessed July 25, 2012).

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:

Introduction to the HCUP Nationwide Inpatient Sample, 2009. Online. May 2011. U.S. Agency for Healthcare Research and Quality. Available at http://hcup-us.ahrq.gov/db/nation/nis/NIS_2009_INTRODUCTION.pdf. (Accessed July 25, 2012).

Introduction to the HCUP Nationwide Emergency Department Sample, 2009. Online. September 2011. U.S. Agency for Healthcare Research and Quality. Available at http://hcup-us.ahrq.gov/db/nation/neds/NEDS2009Introductionv3.pdf. (Accessed July 25, 2012).

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. Available at http://www.hcup-us.ahrq.gov/reports/methods/2006_05_NISTrendsReport_1988-2004.pdf. (Accessed July 25, 2012).

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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:

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