

## STATISTICAL BRIEF #128

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### Hospital Stays with Cardiac Stents, 2009

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#### Introduction

Coronary or cardiac stents are used in surgical procedures called percutaneous transluminal coronary angioplasty (PTCA), also known as balloon angioplasty. These procedures are intended to reduce the risk of heart attacks or other complications stemming from coronary heart disease that involves the blockage of the arteries. In a PTCA, a catheter is inserted through an artery in the leg and drawn into the area of the blockage. The artery is opened with a balloon, and a stent is often used to maintain the opening and prevent the artery from reclosing (restenosis). Stents have been shown to reduce restenosis and the need to repeat the procedure.<sup>1</sup>

Drug-eluting stents, which were introduced in the early 2000s, release a drug that is intended to prevent restenosis. Drug-eluting stents can effectively reduce the rate of restenosis in some cases, but are considerably more costly resulting in some controversy over their cost-effectiveness.<sup>2</sup> A more recent study of drug-eluting stents in heart disease patients 65 years and older demonstrated lower mortality and less heart attacks as compared to non-drug-eluting stents.<sup>3</sup>

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on hospitalizations involving cardiac stents. Virtually all cardiac stent procedures, as reported in this Brief, are associated with a balloon angioplasty (PTCA).<sup>4</sup> Specifically, variation in hospitalizations by patient demographics, hospital, and payer characteristics in 2009 and utilization trends over time are discussed, in some cases separately for drug-eluting and non-drug-eluting stents. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

#### Highlights

- In 2009, there were 644,240 hospital stays that included the implantation of a cardiac stent.
- The rate of any cardiac stent procedure rose steadily from 1999 to 2006 by 61 percent and then declined sharply between 2006 and 2009 by 27 percent.
- Medicare was the payer in 51 percent of hospitalizations (329,420 stays) with cardiac stent procedures.
- Males received treatments involving cardiac stents at roughly twice the rate of females.
- The use of drug-eluting stents increased sharply from 2003 to 2006, while the use of non-drug-eluting stents fell. However, beginning in 2007 the use of drug-eluting stents declined. The ratio of drug-eluting to non-drug-eluting stents was 8 to 1 in 2005 before dropping back to less than 3 to 1 in 2009.
- The proportion of cardiac stent procedures that used drug-eluting stents as compared to non-drug-eluting stents varied significantly by payer: 78 percent of cardiac stent procedures paid by private insurance used drug-eluting stents compared to 59 percent among uninsured stays.

<sup>1</sup>Serruys, P.W., et al. "A Comparison of Balloon-Expandable Stent Implantation with Balloon Angioplasty in Patients with Coronary Artery Disease." *New England Journal of Medicine*, Vol. 331, No. 8 (1994): 489–495.

<sup>2</sup>Firth, B. G., Cooper, L. M., Fearn, S. "The Appropriate Role Of Cost-Effectiveness In Determining Device Coverage: A Case Study Of Drug-Eluting Stents." *Health Affairs*. 2008. 27(6): 1577–86.

<sup>3</sup>Douglas, P. S., et al. "Clinical Effectiveness of Coronary Stents in the Elderly: Results from 262,700 Medicare Patients in ACC-NCDR." *Journal of the American College of Cardiology*. 2009. 53(18): 1629–1641.

<sup>4</sup>A total of 7.3 percent of PTCA procedures did not have any cardiac stents and 0.2 percent (1,273 discharges) of cardiac stent procedures did not involve any PTCAs.

## Findings

In 2009, there were 644,240 hospital stays that involved the implantation of a cardiac stent with a balloon angioplasty (table 1). Those hospitalizations averaged about 3 days in length, incurred a mean cost of \$18,560, and amounted to almost \$12 billion nationally. Drug-eluting stents were used in roughly three-fourths of cases and had a one-day shorter average length of stay and lower average cost per hospital stay compared to discharges with a non-drug-eluting stent.

**Table 1. Hospital stays involving a cardiac stent insertion procedure, 2009**

	Hospital stays involving a cardiac stent insertion procedure*		
	Any type of stent†	Drug-eluting stent	Non-drug-eluting stent
Total number of stays	644,240	484,530	172,450
Percent of total stays	100.0%	75.2%	26.8%
Mean age (years)	64.6	64.4	65.0
Mean length of stay (days)	3.2	2.9	3.9
Mean hospital cost	\$18,560	\$18,440	\$19,320
Aggregate national costs (billions)	\$12.0	\$8.9	\$3.3
<i>Primary expected payer</i>			
Medicare	329,420 (51.1%)	246,670 (50.9%)	89,540 (51.9%)
Private insurance	222,560 (34.5%)	177,430 (36.6%)	49,430 (28.7%)
Medicaid	35,530 (5.5%)	24,360 (5.0%)	11,850 (6.9%)
Uninsured	38,130 (5.9%)	22,920 (4.7%)	15,850 (9.2%)
Other	17,500 (2.7%)	12,290 (2.5%)	5,510 (3.2%)
<i>Median income of patient's ZIP Code</i>			
Quartile 1 (lowest income)	166,580 (25.9%)	123,000 (25.4%)	46,820 (27.1%)
Quartile 2	175,010 (27.2%)	130,600 (27.0%)	47,920 (27.8%)
Quartile 3	155,070 (24.1%)	116,690 (24.1%)	41,420 (24.0%)
Quartile 4 (highest income)	132,150 (20.5%)	102,990 (21.3%)	31,800 (18.4%)
<i>Patient residence</i>			
Large central metro area	156,390 (24.3%)	118,100 (24.4%)	41,290 (23.9%)
Large fringe metro area	158,720 (24.6%)	120,840 (24.9%)	41,110 (23.8%)
Medium and small metro area	181,580 (28.2%)	135,780 (28.0%)	49,220 (28.5%)
Micropolitan and noncore area (rural)	139,940 (21.7%)	105,120 (21.7%)	37,810 (21.9%)

\*Based on all-listed procedure

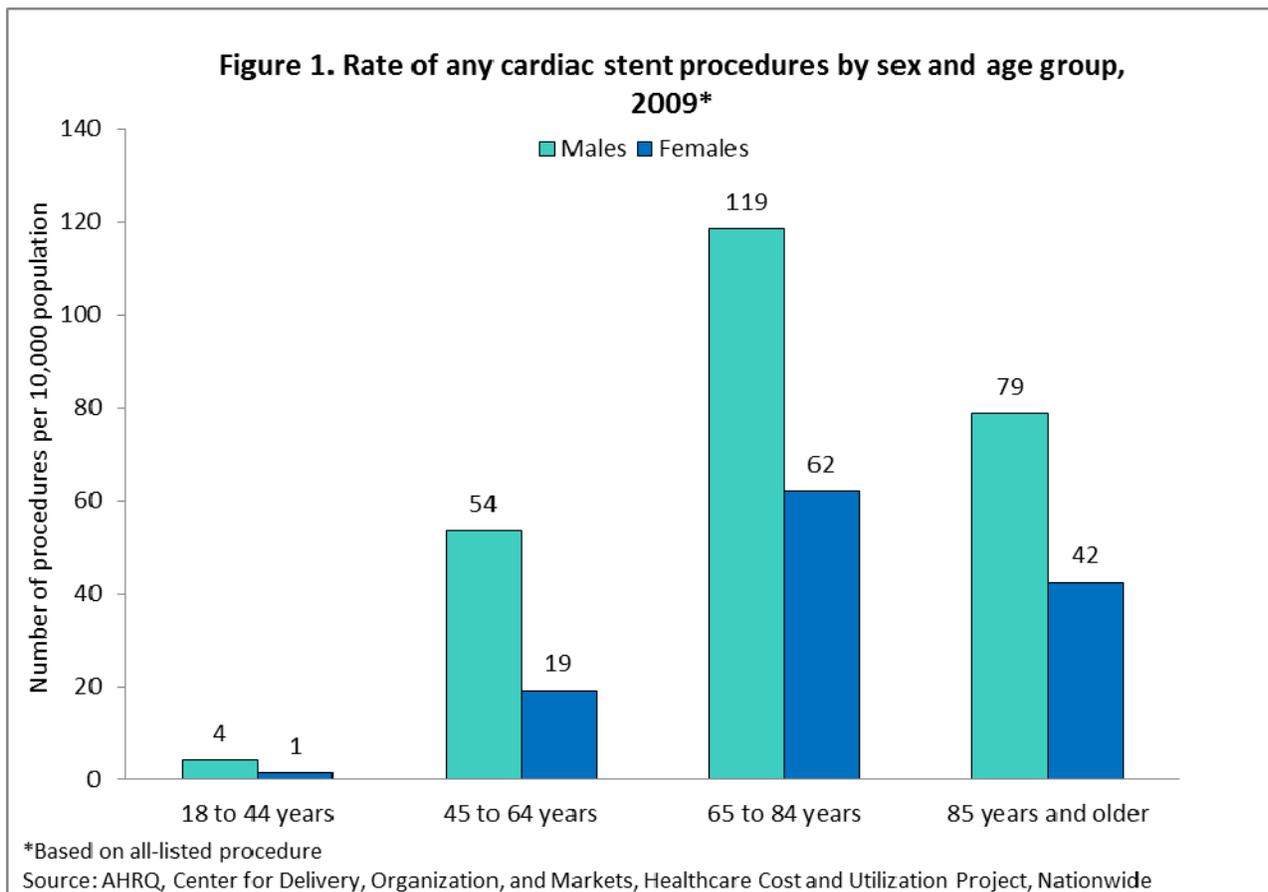
†12,740 stays involved the insertion of both a drug-eluting and a non-drug-eluting stent. Such stays were counted once in tabulations of total stays involving a stent procedure, while in analyses of drug and non-drug-eluting stents, those stays were counted in both groups.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2009

Among patients receiving any type of cardiac stent during a hospitalization, the average age was just under 65. Medicare was the payer in a slight majority of those stays (51.1 percent), followed by private insurance, which paid for just over one-third of stays (34.5 percent).

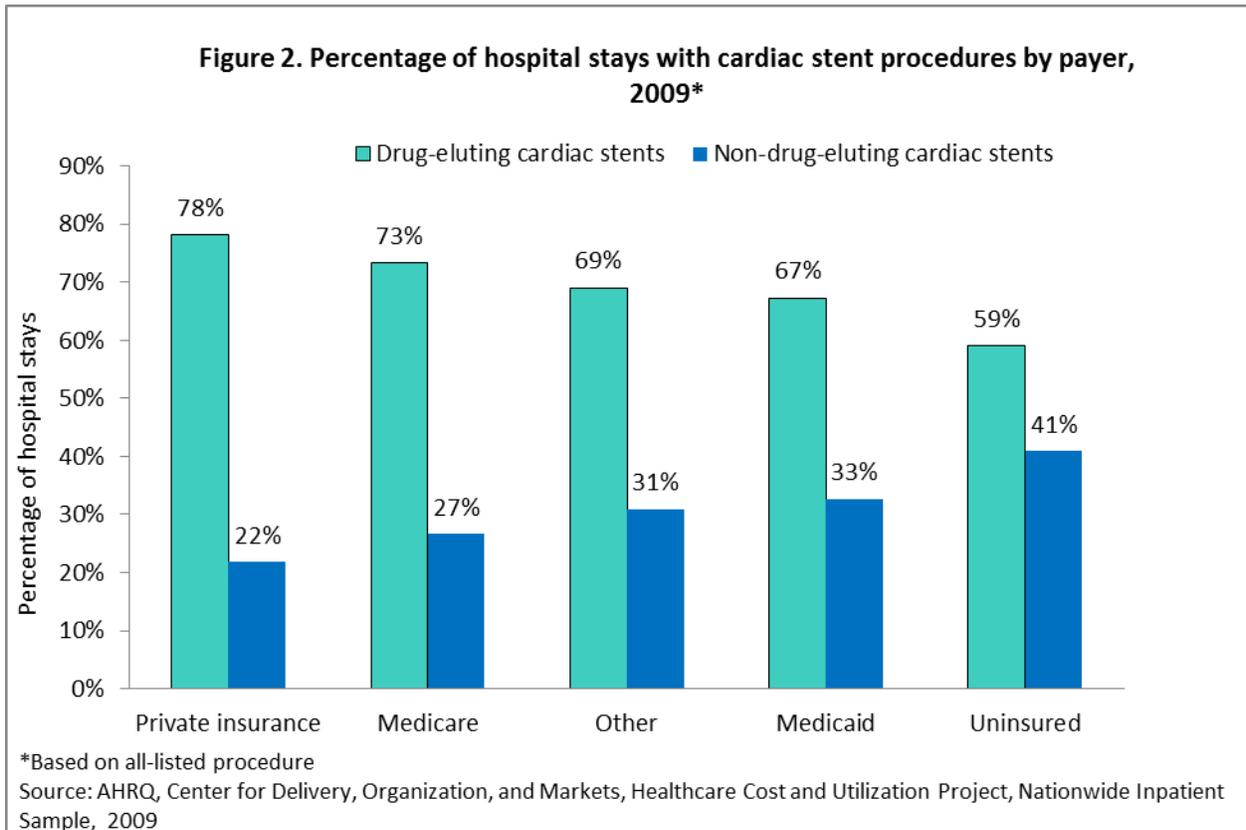
For the most part, patients receiving any type of cardiac stent were spread fairly evenly across income categories and urban/rural metro areas, although patients living in the highest income areas had fewer stays than the second lowest income category and patients from rural areas had fewer stays than medium and small metro areas.

Figure 1 shows that males received PTCA with a stent at more than twice the rate of females for patients younger than age 65 and at roughly twice the rate of females for patients ages 65 to 84 years and age 85 and older. This is roughly in accordance with their higher rates of hospitalization for heart disease.<sup>5</sup> Cardiac stent procedures were most commonly performed among patients aged 65 to 84 years old for both sexes—and were rare among patients under the age of 45.

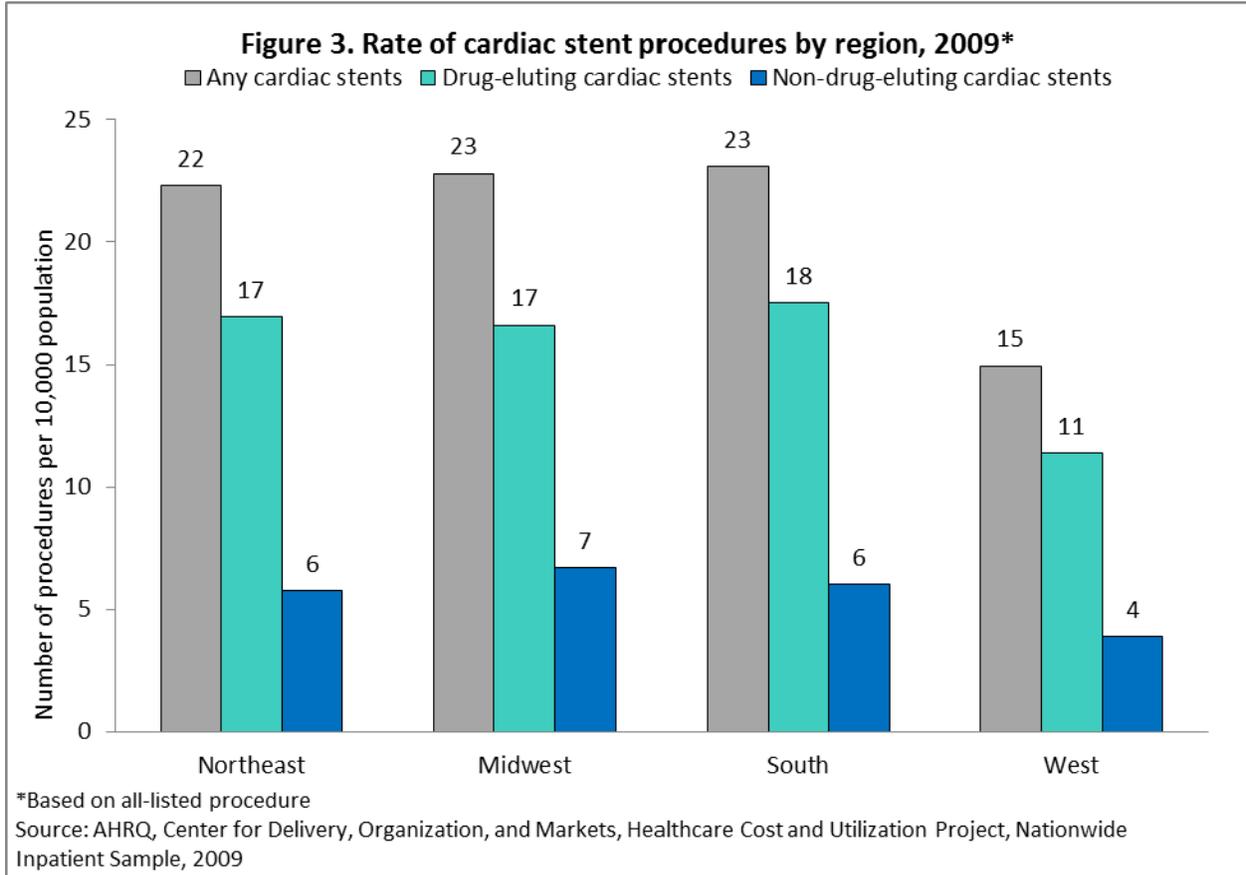


<sup>5</sup> Wier, L. M., Pfunter, A., Maeda, J., Stranges, E., Ryan, K., Jagadish, P., Collins-Sharp, B., Elixhauser, A. *HCUP Facts and Figures: Statistics on Hospital-Based Care in the United States, 2009*. Rockville, MD: Agency for Healthcare Research and Quality, 2011 (<http://www.hcup-us.ahrq.gov/reports.jsp>).

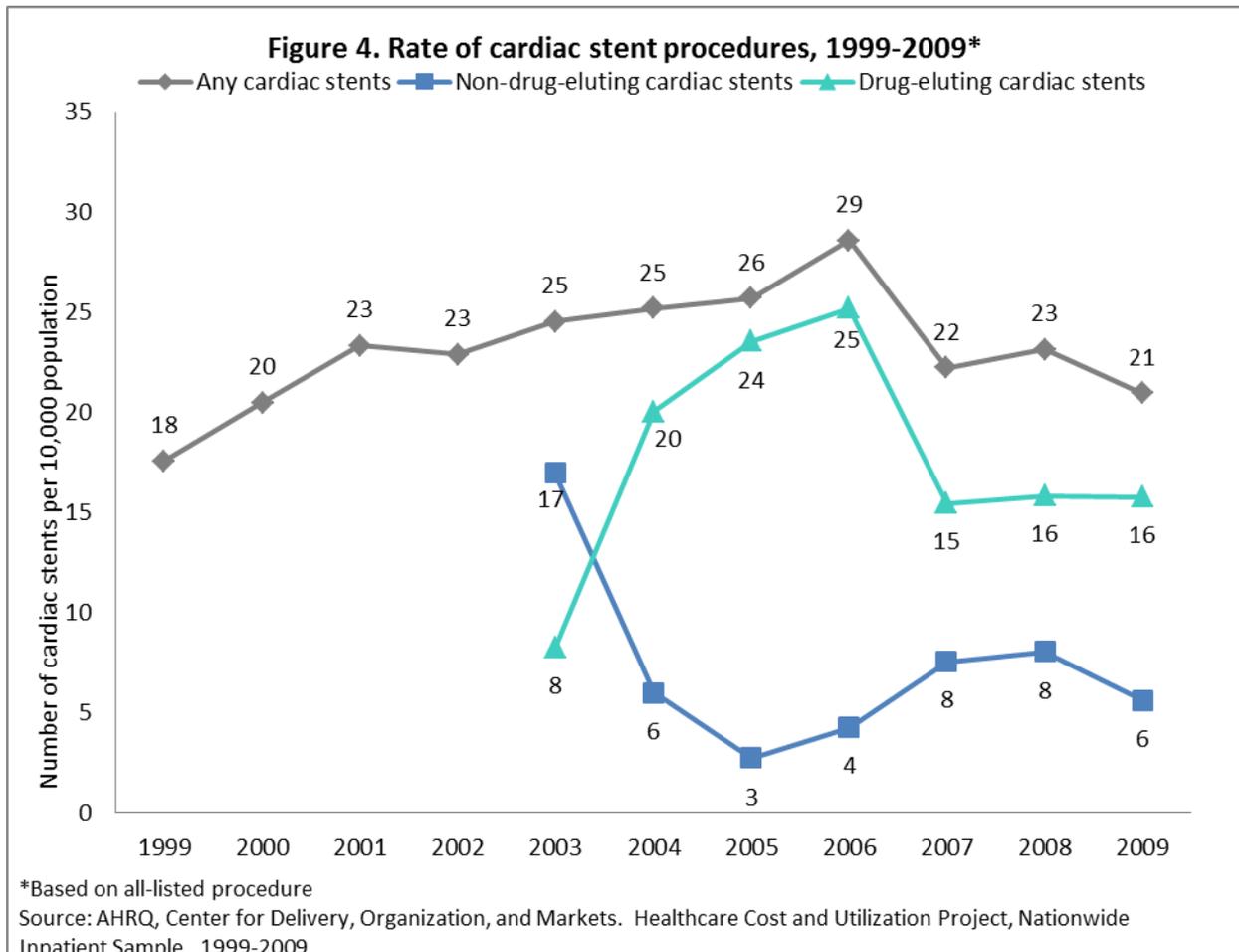
The proportion of stays with cardiac stent procedures that used drug-eluting stents as compared to non-drug-eluting stents varied by payer, as shown in figure 2. Drug-eluting stents were used in 78 percent of cardiac stent procedures for which private insurance was the primary expected payer, and only 59 percent of uninsured stays during which cardiac stents were placed.



The rate of any cardiac stent procedures was significantly lower in the West (15 stays with cardiac stent procedures per 10,000 population) than all other regions (22 to 23 stays with cardiac stent procedures per 10,000 population). The ratio of drug-eluting to non-drug-eluting stents was similar by region, with use of drug-eluting stents 2 to 3 times the rate of non-drug-eluting stents.



It was not possible to distinguish drug-eluting stents from non-drug-eluting stents until the end of 2002. The overall rate of cardiac stent procedures rose steadily from 1999 to 2006 (by 61 percent) and then declined sharply between 2006 and 2009 (by 28 percent) (figure 4). The rate of stays for any cardiac stent implantation in 2009 (21 stays per 10,000 population) was similar to the rate in 2000 (20 stays per 10,000 population).



The rate of stays with drug-eluting stent procedures rose rapidly from 2003 to 2006, while the rate of stays with non-drug-eluting stays fell. Between 2006 and 2007, however, the rate of stays with drug-eluting stents dropped sharply and then stabilized through 2009. The ratio of drug-eluting to non-drug-eluting stent procedures reached nearly 8 to 1 in 2005 before dropping back to less than 3 to 1 by 2009.

#### Data Source

The estimates in this Statistical Brief are based upon data from the HCUP Nationwide Inpatient Sample (NIS) from 1999 to 2009. Population denominators were based on the resident population for 1999 and 2000 to 2009 from the U.S. Bureau of the Census, accessed on September 6, 2011. From: <http://www.census.gov/popest/data/historical/1990s/index.html> and [http://www.census.gov/popest/data/historical/2000s/vintage\\_2009/index.html](http://www.census.gov/popest/data/historical/2000s/vintage_2009/index.html).

## Definitions

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses and procedures. Procedures on inpatient hospitalization records are coded using ICD-9-CM, while procedures on ambulatory surgery records can be coded using ICD-9-CM or the Common Procedural Terminology (CPT).

### *Case definition*

Drug-eluting stents were distinguished from non-drug-eluting stents in October 2002. We did not separate drug-eluting stents from non-drug-eluting stents until 2003 to give the coding a quarter to stabilize.

The ICD-9-CM all-listed procedure codes defining cardiac stent procedures:

- 36.06—Insertion of non-drug-eluting coronary artery stent(s)
- 36.07—Insertion of drug-eluting coronary artery stent(s)
- 36.06 and 36.07—Insertion of any cardiac stent(s)

About 2 percent of stays involving the insertion of any cardiac stent involved the insertion of both a drug-eluting and a non-drug-eluting stent. Such stays were counted once in tabulations of total stays involving a stent procedure, while in analyses of drug and non-drug-eluting stents, those stays were counted in both groups.

### *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 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 & Medicaid Services (CMS).<sup>6</sup> Costs will reflect the actual expenses incurred in the production of hospital services, such as wages, supplies, and utility costs; charges represent the amount a hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used. Hospital charges reflect the amount the hospital billed for the entire hospital stay and do not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundred.

### *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

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<sup>6</sup> HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2009. U.S. Agency for Healthcare Research and Quality. Rockville, MD. Available at [www.hcup-us.ahrq.gov/db/state/costtocharge.jsp](http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp). Updated August 2011. (Accessed March 15, 2012).

- 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
- Non-core: Nonmetropolitan and nonmicropolitan counties.

#### *Median community-level income*

Median community-level income is the median household income of the patient's ZIP Code of residence. The cut-offs for the quartile designation are determined using ZIP Code demographic data obtained from Claritas. The income quartile is missing for homeless and foreign patients.

#### *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 Workers' 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

#### **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** Health Policy Commission  
**New York** State Department of Health  
**North Carolina** Department of Health and Human Services  
**Ohio** Hospital Association  
**Oklahoma** State Department of Health  
**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 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, nonrehabilitation 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 <http://hcupnet.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>.

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, 2008*. Online. May 2010. U.S. Agency for Healthcare Research and Quality. Available at [http://hcup-us.ahrq.gov/db/nation/nis/NIS\\_2008\\_INTRODUCTION.pdf](http://hcup-us.ahrq.gov/db/nation/nis/NIS_2008_INTRODUCTION.pdf). (Accessed March 15, 2012).

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. Available at <http://www.hcup-us.ahrq.gov/reports/CalculatingNISVariances200106092005.pdf>. (March 15, 2012).

Houchens, R. L., 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/2006\\_05\\_NISTrendsReport\\_1988-2004.pdf](http://www.hcup-us.ahrq.gov/reports/2006_05_NISTrendsReport_1988-2004.pdf). (March 15, 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](mailto:hcup@ahrq.gov) or send a letter to the address below:

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