

## STATISTICAL BRIEF #82

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### Procedures with the Most Rapidly Increasing Hospital Costs, 2004–2007

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#### Introduction

Approximately one-third of the U.S. health care dollar is spent on inpatient hospital care, making hospitalizations the single most expensive component of the health care system.<sup>1</sup> Hospital costs reflect the amount of money expended by the hospital for patient care (excluding physician expenses).

In 2007, about 70 percent of the nearly 40 million hospital stays involved some type of procedure, and about 30 percent of all stays involved an operating room procedure. Some of these procedures have been associated with much more rapidly increasing hospital costs than others. Identifying the procedures that generate the most rapid increases in hospital costs may contribute to a more informed discussion of overall cost increases. The increasing costs associated with a specific procedure can be the result of several causes, including the extension of treatment to different types of patients, treating more severely ill patients, rising salaries and input costs, and the diffusion of newer technologies and more expensive equipment.

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) and identifies which ten procedures generated the most rapidly increasing hospital costs between 2004 and 2007. Specifically, it shows estimates of the portion of the cost increase resulting from greater use of procedures versus a rise in the mean cost per stay. Note that possible demographic changes, illness patterns, technology changes or other causal determinants of the increasing use of these procedures are not addressed here. Information is presented by four payer groups: Medicare, Medicaid, private insurance, and self-pay (uninsured). All differences between estimates provided in the text are statistically significant at the 0.05 level or better. Costs for 2004 were adjusted to 2007 dollars using the overall Consumer Price Index (CPI).

#### Findings

During the four-year period from 2004 to 2007, overall hospital costs grew by 6.3 percent to \$344 billion, inflation adjusted. The majority of this increase was due to a 3.9 percent rise in the mean cost per stay; a smaller portion resulted from a 2.4 percent growth in the volume of hospitalizations (figure 1). Aggregate costs for stays in which a procedure was performed grew by 7.2 percent between 2004 and 2007, totaling

#### Highlights

- From 2004 to 2007, overall hospital costs grew by 6.3 percent to \$344 billion, inflation adjusted. About two-thirds of this increase was due to a rise in the mean cost per stay and one-third due to an increase in hospitalizations.
- The 10 procedures associated with stays that generated the largest increases in costs had a combined increase in hospital costs of 32.3 percent—three-fourths due to volume increases and one-fourth due to increases in costs per stay.
- Between 2004 and 2007, hospital stays with bone marrow transplant and open prostatectomy as the principal procedures had the largest increases in hospital costs (84.9 and 68.6 percent, respectively).
- The overwhelming driver of the increasing costs of stays for incision and drainage of skin, knee arthroplasty, lobectomy, or pneumonectomy, and aortic resection was the growth in the volume of stays with these procedures.
- Increases in cost per stay contributed notably to the growth of aggregate costs of stays for cancer chemotherapy, nephrotomy and nephrostomy, and spinal fusion.

<sup>1</sup>Hartman M, Martin A, McDonnell P, Catlin A. *National Health Spending in 2007: Slower Drug Spending Contributes to Lowest Rate of Overall Growth Since 1998*. Health Affairs. 28(1): 246–261, January 2009.

\$296 billion in 2007. The rise in aggregate costs of stays with a procedure was predominantly driven by the growth in the volume of such stays (4.4 percent), while the mean cost per stay grew by 2.6 percent.

#### *Hospital stays for procedures with the most rapidly increasing hospital costs*

The ten principal procedures that generated the most rapid increases in total hospital costs from 2004 to 2007 are shown in table 1. The aggregate costs of stays for these ten procedures (\$29.1 billion) accounted for 9.8 percent of the costs of all hospital stays with procedures performed (\$296 billion) and 8.5 percent of the costs of all hospitalizations (\$344 billion) in 2007.

While the aggregate costs for these ten procedures grew by 32.3 percent overall between 2004 and 2007, cost growth varied by procedure. The procedures with the most rapidly growing costs were bone marrow transplant—aggregate costs grew by 84.9 percent to \$1.3 billion in 2007—and open prostatectomy—aggregate costs grew by 68.6 percent to \$1.0 billion in 2007. The number of stays for these two procedures grew at different rates: stays for bone marrow transplants grew by 51.3 percent and those for open prostatectomy grew by 40.8 percent.

Among the ten procedures with the most rapidly increasing hospital inpatient costs, knee arthroplasty and spinal fusion were the procedures with the highest aggregate costs in 2007 (\$9.2 billion and \$8.9 billion, respectively). Aggregate costs for these stays grew by 27.5 percent (knee arthroplasty) and 29.5 percent (spinal fusion) between 2004 and 2007.

#### *Factors accounting for growth in hospital costs among stays for procedures with the most rapidly increasing hospital costs*

As shown in figure 2, the overwhelming driver of growth in total hospital costs among these stays was growth in the volume of stays with these procedures. Among these stays, growth in the number of hospitalizations with these principal procedures accounted for about three-fourths (23.5 percent of 32.3 percent total) of the total increase.

However, factors attributing to cost growth varied considerably by procedure. For example, growth in volume drove the growth of aggregate costs among stays for incision and drainage of skin as the mean cost of these stays declined (30.8 percent change due to increase in number of stays; 2.2 percent change due to decrease in mean cost per stay). Growth in volume also drove the aggregate cost growth of stays for knee arthroplasty (26.0 percent out of 27.5 percent), lobectomy or pneumonectomy (25.7 percent out of 29.2 percent), and aortic resection (33.3 percent out of 38.5 percent). In contrast, growth in mean cost per stay—that is, greater intensity of the use of services—contributed notably to the aggregate cost increases for mastectomy (20.1 percent out of 23.8 percent), cancer chemotherapy (18.0 percent out of 33.2 percent), nephrotomy and nephrostomy (12.9 percent out of 25.3 percent), and spinal fusion (12.8 percent out of 29.5 percent).

#### *Hospital stays for procedures with the most rapidly increasing hospital costs, by payer*

Table 2 shows that the growth rates between 2004 and 2007 of the aggregate costs of stays for the top 10 procedures varied by payer. For Medicare-covered and privately-insured stays, bone marrow transplant (90.4 percent and 100.6 percent, respectively) and open prostatectomy (54.7 percent and 76.2 percent, respectively) were the procedures with the fastest growing costs among the ten procedures. Similarly, stays for open prostatectomy experienced rapid cost growth among Medicaid-covered patients (71.4 percent) and the uninsured (45.7 percent). In contrast, the cost of stays for bone marrow transplants grew by only 7.4 percent among Medicaid-covered patients, and declined by 10.0 percent among the uninsured.

For uninsured stays, the aggregate costs of stays for aortic resection grew faster (64.0 percent) than those of stays for any of the other top 10 procedures examined. The cost of these stays grew at a similar rate among Medicaid patients (63.6 percent), although the number of Medicaid-covered stays grew much less dramatically than the number of uninsured stays (34.4 percent vs. 113.4 percent). Aggregate costs of stays for aortic resection grew by 34.6 among Medicare-covered stays and 37.8 among privately-insured stays.

Figure 3 shows that the total increase in the aggregate cost of stays for the ten procedures varied by payer, as did the factors accounting for this growth. The underlying determinants of cost are different for each payer group as age, income and health status are generally different for each group. The percentage increase in aggregate costs was highest for hospitalizations paid for by private insurance, which experienced a 38.3 percent growth in total costs from 2004 to 2007. Nearly one-third (12.3 percent out of 38.3 percent) of the increase in the cost growth for the private insurance stays was driven by growth in cost per stay.

There was less growth in the aggregate costs of stays for the ten procedures among patients covered by Medicare (29.4 percent), Medicaid (24.4 percent) and among uninsured patients (20.1 percent). About one-quarter (6.9 percent out of 29.4 percent) of the change in the growth in costs for Medicare hospitalizations was due to an increase in the mean cost per stay. About one-third of the cost growth for the Medicaid stays was driven by an increase in the mean cost per stay (7.6 percent out of 24.4 percent). For uninsured stays for these procedures there was actually a decline in the mean cost per stay (-2.7 percent vs. 20.1 percent total). The increase in the aggregate costs for this group was driven by the increase in the number of stays with these procedures performed (22.8 percent).

## Data Source

The estimates in this Statistical Brief are based upon data from the HCUP Nationwide Inpatient Sample, 2004 and 2007.

## Definitions

### *Procedures and Clinical Classifications Software (CCS)*

The principal procedure is the procedure that was performed for definitive treatment rather than one performed for diagnostic or exploratory purposes (i.e., the procedure that was necessary to take care of a complication). If two procedures appear to meet this definition, the procedure most related to the principal diagnosis was selected as the principal procedure.

CCS categorizes procedure codes into clinically meaningful categories.<sup>2</sup> This "clinical grouper" makes it easier to quickly understand patterns of procedure use.

Non-operating room procedures categories as well as non-specific procedure categories were excluded from this analysis. Examples of excluded procedure categories include blood transfusions and CT scans.

### *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>3</sup> 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.

<sup>2</sup> HCUP CCS. Healthcare Cost and Utilization Project (HCUP). June 2009. 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>3</sup> HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2007. 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).

- 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.

### 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  
**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  
**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 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.

## 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 2007*, 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.

*Introduction to the HCUP Nationwide Inpatient Sample, 2007*. Online. June 16, 2009. U.S. Agency for Healthcare Research and Quality. [http://www.hcup-us.ahrq.gov/db/nation/nis/NIS\\_2007\\_INTRODUCTION.pdf](http://www.hcup-us.ahrq.gov/db/nation/nis/NIS_2007_INTRODUCTION.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

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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:

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. Commonly performed procedures with the most rapidly increasing hospital inpatient costs, 2004–2007**

Principal procedure category	Total costs (2007)	Total hospital stays (2007)	Percentage change	
			Total costs (2004–2007)	Total hospital stays (2004–2007)
Bone marrow transplant	\$1,282,645,000	15,100	84.9%	51.3%
Open prostatectomy	\$1,032,016,000	88,500	68.6%	40.8%
Aortic resection; replacement or anastomosis	\$1,872,908,000	61,600	38.5%	31.9%
Cancer chemotherapy	\$2,616,504,000	187,400	33.2%	14.2%
Spinal fusion	\$8,863,922,000	350,700	29.5%	15.6%
Lobectomy or pneumonectomy	\$1,757,748,000	81,400	29.2%	24.9%
Incision and drainage, skin and subcutaneous tissue	\$1,108,187,000	158,600	28.6%	31.5%
Arthroplasty knee	\$9,217,740,000	605,200	27.5%	25.7%
Nephrotomy and nephrostomy	\$682,609,000	38,600	25.3%	11.7%
Mastectomy	\$660,173,000	70,100	23.8%	3.6%
<b>Total for top 10 procedures**</b>	<b>\$29,094,452,000</b>	<b>1,657,100</b>	<b>32.3%</b>	<b>22.2%</b>

\*2004 costs were adjusted to 2007 dollars using the overall Consumer Price Index.  
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004 and 2007.

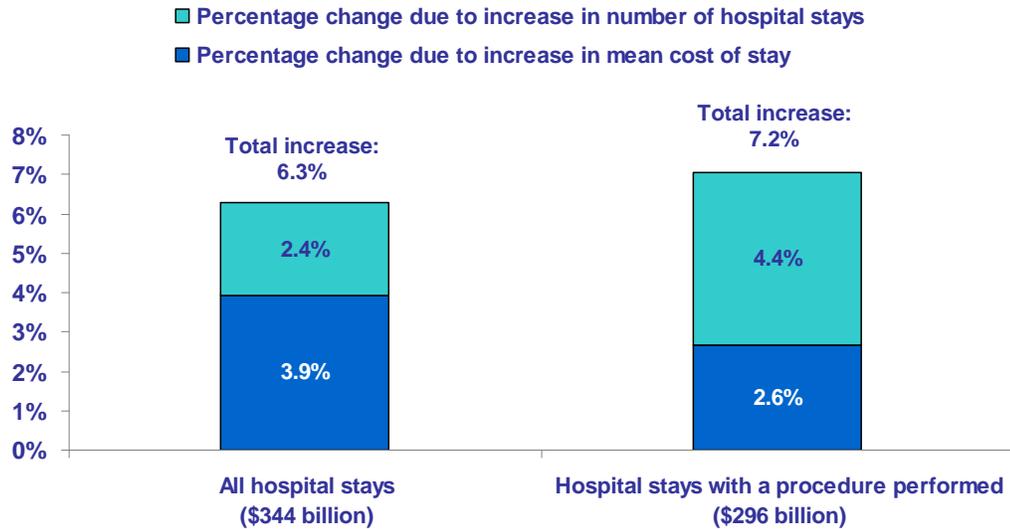
**Table 2. Commonly performed procedures with the most rapidly increasing hospital inpatient costs, by expected primary payer, 2004–2007**

Principal procedure category	Medicare-covered stays			Medicaid-covered stays			Privately insured stays			Uninsured stays		
	Total costs, 2007 (payer's share of total cost)	Percentage change		Total costs, 2007 (payer's share of total cost)	Percentage change		Total costs, 2007 (payer's share of total cost)	Percentage change		Total costs, 2007 (payer's share of total cost)	Percentage change	
		Total costs, 2004-2007*	Total hospital stays, 2004-2007		Total costs, 2004-2007*	Total hospital stays, 2004-2007		Total costs, 2004-2007*	Total hospital stays, 2004-2007		Total costs, 2004-2007*	Total hospital stays, 2004-2007
Bone marrow transplant	\$160,046,000 (12.5%)	90.4%	42.7%	\$150,478,000 (11.7%)	7.4%	-12.8%	\$837,208,000 (65.3%)	100.6%	58.3%	\$28,880,000 (2.3%)	-10.0%	25.6%
Open prostatectomy	\$326,811,000 (31.7%)	54.7%	33.1%	\$21,083,000 (2.0%)	71.4%	83.4%	\$639,632,000 (62.0%)	76.2%	42.5%	\$18,542,000 (1.8%)	45.7%	31.3%
Aortic resection, replacement or anastomosis	\$1,287,786,000 (68.8%)	34.6%	28.1%	\$93,480,000 (5.0%)	63.6%	34.4%	\$402,210,000 (21.5%)	37.8%	34.2%	\$38,269,000 (2.0%)	64.0%	113.4%
Cancer chemotherapy	\$703,654,000 (26.9%)	29.6%	14.9%	\$465,295,000 (17.8%)	21.0%	4.3%	\$1,243,500,000 (47.5%)	38.1%	14.1%	\$99,321,000 (3.8%)	17.9%	19.0%
Spinal fusion	\$2,692,303,000 (30.4%)	45.7%	30.3%	\$561,281,000 (6.3%)	25.8%	12.1%	\$4,408,876,000 (49.7%)	28.6%	13.4%	\$158,953,000 (1.8%)	10.2%	10.1%
Lobectomy or pneumonectomy	\$908,414,000 (51.7%)	28.5%	28.9%	\$127,905,000 (7.3%)	30.1%	17.8%	\$625,176,000 (35.6%)	30.0%	22.9%	\$50,702,000 (2.9%)	16.9%	-1.6%
Incision and drainage, skin and subcutaneous tissue	\$321,556,000 (29.0%)	23.3%	24.1%	\$228,495,000 (20.6%)	27.5%	33.5%	\$318,153,000 (28.7%)	28.7%	31.7%	\$163,943,000 (14.8%)	32.3%	31.8%
Arthroplasty knee	\$5,140,334,000 (55.8%)	20.9%	20.3%	\$253,098,000 (2.7%)	18.0%	14.9%	\$3,419,637,000 (37.1%)	39.2%	35.6%	\$55,437,000 (0.6%)	15.0%	16.2%
Nephrotomy and nephrostomy	\$316,755,000 (46.4%)	17.1%	9.8%	\$87,889,000 (12.9%)	37.4%	18.8%	\$221,284,000 (32.4%)	30.2%	5.3%	\$34,105,000 (5.0%)	35.1%	25.5%
Mastectomy	\$199,820,000 (30.3%)	8.6%	-5.3%	\$50,127,000 (7.6%)	16.4%	10.0%	\$385,158,000 (58.3%)	34.8%	9.9%	\$11,168,000 (1.7%)	-3.0%	-9.6%

\*2004 costs were adjusted to 2007 dollars using the overall Consumer Price Index.  
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004 and 2007



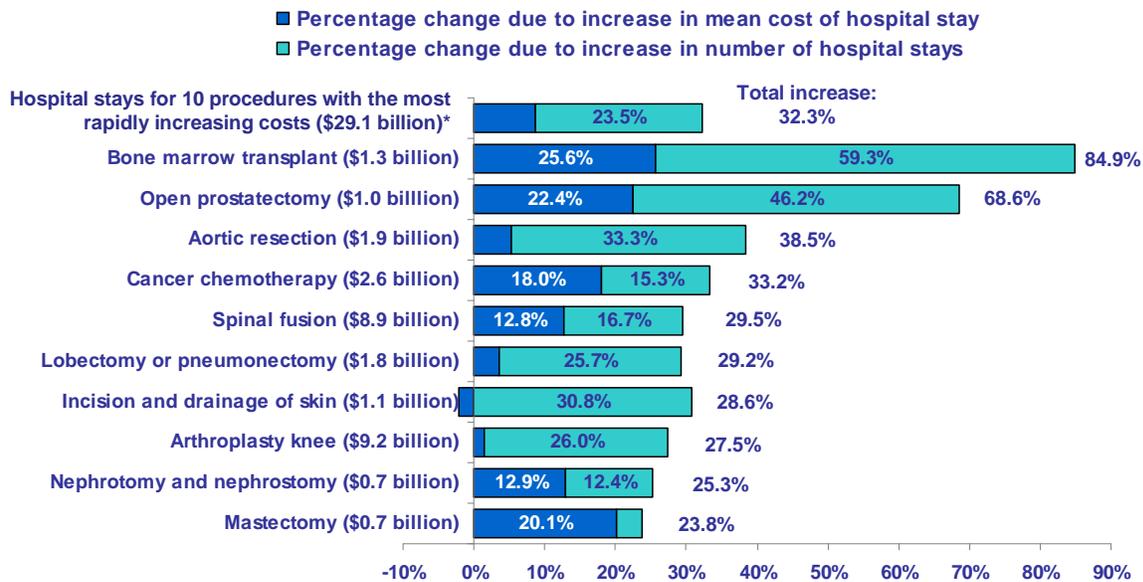
**Figure 1. Percentage change in total costs for all hospital stays and stays with a procedure, 2004–2007**



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2004 and 2007



**Figure 2. Percentage change in total costs for commonly performed procedures with the most rapidly increasing hospital inpatient costs, by procedure, 2004–2007\***

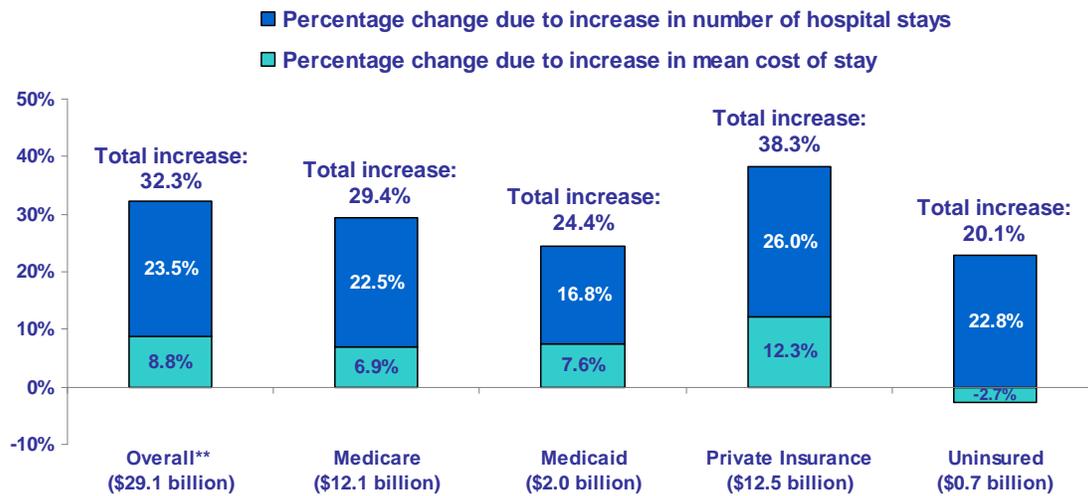


\*Leading procedures are defined as the top 10 procedures that generated the most rapid increases in total hospital costs from 2004 to 2007; 2004 costs were adjusted to 2007 dollars using the overall Consumer Price Index.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2004 and 2007



**Figure 3. Percentage change in total costs for commonly performed procedures with the most rapidly increasing hospital inpatient costs, by payer, 2004–2007\***



\*Leading procedures are defined as the top 10 procedures that generated the most rapid increases in total hospital costs from 2004 to 2007; 2004 costs were adjusted to 2007 dollars using the overall Consumer Price Index.

\*\*Overall costs include costs attributed to other payers such as Workers' Compensation, TRICARE, CHAMPUS, CHAMPVA, Title V, and other government programs as well as the payers shown here.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (NIS), 2004 and 2007