

## STATISTICAL BRIEF #161 -

February 2013

### Most Frequent Procedures Performed in U.S. Hospitals, 2010

Anne Pfuntner, Lauren M. Wier, M.P.H., and Carol Stocks, R.N., M.H.S.A.

#### Introduction

Most hospitalizations involve one or more procedures, which can range from simple vaccinations to complex surgical procedures. The *principal procedure* is the procedure that is performed for definitive treatment (e.g., an appendectomy), but procedures can also be performed to make a diagnosis (e.g., tissue samples or exploratory surgery). Hospitalizations usually involve more than one procedure, which together constitute the *all-listed procedures* performed during a hospital stay.

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on the most common all-listed procedures performed during hospital stays in the United States in 2010, overall and by patient age. Changes between 1997 and 2010 in the number of stays and the rate of hospitalization in the population are presented for hospital stays with the most common procedures performed in 2010. All differences between estimates noted in the text are statistically significant at the .001 level or better.

#### Findings

##### *Most frequent all-listed procedures performed during hospital stays, 2010*

Table 1 shows the most frequent all-listed procedures performed during hospital stays in 2010, as well as the change in the rate of hospitalizations with these procedures since 1997. Procedures were performed in 63 percent of the 39 million hospital stays in the United States in 2010. The rate of hospitalizations with procedures has remained relatively stable at about 800 per 10,000 population from 1997 to 2010.

Blood transfusion was the most common all-listed procedure performed during hospitalizations in 2010 (11 percent of stays with a procedure); the rate of hospitalization with blood transfusion has more than doubled since 1997.

Six of the most common procedures performed were associated with maternal and newborn hospitalizations—prophylactic vaccinations and inoculations, repair of current obstetric laceration, Cesarean section, circumcision, artificial rupture of membranes to assist delivery, and fetal monitoring. Cesarean

#### Highlights

- Medical procedures were performed in 63 percent of the 39 million U.S. hospital stays in 2010.
- The rate of hospitalization with procedures has remained relatively stable at about 800 per 10,000 population from 1997 to 2010.
- *Blood transfusion* was the most common procedure performed during hospitalizations in 2010 (11 percent of hospital stays with a procedure), and it was common among all age groups except infants.
- The most common types of procedures performed during hospitalizations in 2010 were associated with maternal and newborn stays or cardiovascular and musculoskeletal conditions.
- *Cesarean section* was the most common major operating room procedure performed and the rate of hospitalization with Cesarean section increased by 41 percent between 1997 and 2010.
- Although *diagnostic cardiac catheterization* was the fifth most common procedure in 2010, the rate of hospitalization with this procedure decreased 23 percent since 1997.
- Rates of hospitalization with *knee replacement* and *spinal fusion* approximately doubled between 1997 and 2010.
- *Indwelling catheter* was the most rapidly growing procedure between 1997 and 2010—the rate of hospitalization with this procedure more than tripled.

section was the most common major operating room procedure performed in 2010 (41 stays per 10,000 population), and the rate of hospitalization with Cesarean section increased 41 percent since 1997.

Four cardiovascular procedures—diagnostic cardiac catheterization, diagnostic ultrasound of the heart (echocardiogram), hemodialysis, and percutaneous transluminal coronary angioplasty (PTCA)—were frequently performed in 2010. Although diagnostic cardiac catheterization was the fifth most common procedure in 2010, the rate of hospitalization with this procedure decreased 23 percent since 1997.

Musculoskeletal procedures also were frequently performed during hospital stays. Rates in 2010 for hospitalizations with knee arthroplasty (24 stays per 10,000 population) and spinal fusion (16 stays per 10,000 population) approximately doubled since 1997; the rate of hospitalization with hip replacement (15 stays per 10,000 population) increased 38 percent.

**Table 1. Number of stays, stays per 10,000 population, and percentage change in rate of the most frequent all-listed procedures for hospital stays, 1997 and 2010**

All-listed CCS procedures	Number of stays with the procedure in thousands		Stays with the procedure per 10,000 population (rate)		Percentage change in rate
	1997	2010	1997	2010	1997–2010
All stays (with and without procedures)	34,681	39,008	1,272	1,261	–1%
All stays with any procedure	21,257	24,740	780	800	3%
Percentage of all stays with a procedure	61%	63%			
Blood transfusion	1,098	2,815	40	91	126%
Prophylactic vaccinations and inoculations	567	1,837	21	59	185%
Respiratory intubation and mechanical ventilation	919	1,638	34	53	57%
Repair of current obstetric laceration	1,137	1,292	42	42	0%
Diagnostic cardiac catheterization; coronary arteriography	1,461	1,283	54	41	–23%
Cesarean section	800	1,278	29	41	41%
Upper gastrointestinal endoscopy; biopsy	1,105	1,206	41	39	–4%
Circumcision	1,164	1,150	43	37	–13%
Artificial rupture of membranes to assist delivery	853*	917	31	30	–5%
Fetal monitoring	1,002	875	37	28	–23%
Diagnostic ultrasound of heart (echocardiogram)	632	858	23	28	20%
Hemodialysis	473	850	17	27	58%
Arthroplasty knee	329	730	12	24	96%
Enteral and parenteral nutrition	277	613	10	20	95%
Percutaneous transluminal coronary angioplasty (PTCA)	581	562	21	18	–15%
Laminectomy; excision intervertebral disc	425	532	16	17	10%
Colonoscopy and biopsy	531	528	19	17	–12%
Spinal fusion	202	492	7	16	115%
Incision of pleura; thoracentesis; chest drainage	349	475	13	15	20%
Hip replacement; total and partial	291	456	11	15	38%

CCS: Clinical Classifications Software

\*The number of stays in 1997 for artificial rupture of membranes to assist delivery may differ from previously reported data because of a correction that has been made to the CCS procedure code.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997 and 2010

*All-listed procedures performed during hospital stays with the most rapid growth, 1997–2010*

Although the hospitalization rate for all stays and for stays during which any procedure was performed remained stable between 1997 and 2010, the hospitalization rate for stays during which some specific procedures were performed experienced rapid growth (table 2). Seven of the most rapidly growing all-listed procedures were also among those most frequently performed during hospital stays: prophylactic vaccinations and inoculations, blood transfusion, spinal fusion, knee arthroplasty, enteral and parenteral nutrition, hemodialysis, and respiratory intubation and mechanical ventilation.

Indwelling catheter was the most rapidly growing procedure between 1997 and 2010; the rate of hospitalization with this minor procedure more than tripled during this period (from 2 to 7 stays per 10,000 population). The rate of hospitalization with prophylactic vaccinations and inoculations, blood transfusion, and spinal fusion more than doubled between 1997 and 2010.

**Table 2. Number of stays, stays per 10,000 population, and percentage change in rate for procedures with the most rapid growth, 1997 and 2010**

All-listed CCS procedures	Number of stays with the procedure in thousands		Stays with the procedure per 10,000 population (rate)		Percentage change in rate
	1997	2010	1997	2010	1997–2010
All stays (with and without procedures)	34,681	39,008	1,272	1,261	–1%
All stays with any procedure	21,257	24,740	780	800	3%
<b>Procedures with most rapid growth in stays per population*</b>					
Indwelling catheter	60	214	2	7	213%
Prophylactic vaccinations and inoculations	567	1,837	21	59	185%
Blood transfusion	1,098	2,815	40	91	126%
Spinal fusion	202	492	7	16	115%
Abdominal paracentesis	117	264	4	9	99%
Incision and drainage; skin and subcutaneous tissue	118	265	4	9	97%
Arthroplasty knee	329	730	12	24	96%
Enteral and parenteral nutrition	277	613	10	20	95%
Arterio- or venogram (not heart and head)	143	286	5	9	76%
Hemodialysis	473	850	17	27	58%
Respiratory intubation and mechanical ventilation	919	1,638	34	53	57%

CCS: Clinical Classifications Software

\* Includes only procedures with at least 100,000 stays in either 2010 or 1997

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997 and 2010

*Most frequent all-listed procedures performed during hospital stays by patient age, 2010*

Table 3 highlights the 5 most frequent procedures performed during hospitalizations in 2010 by patient age group, as well as the change in the rate of hospitalization with these procedures since 1997.

Although some procedures varied by age group, others were consistent across age groups. Blood transfusion was the most common procedure performed during hospital stays for adults ages 45–64, 65–84, and 85 and older in 2010, and the rate of hospitalization with transfusion approximately doubled from 1997 for each of these age groups. Blood transfusion also was 1 of the 5 most common procedures in 2010 among hospitalized children ages 1–17 and adults ages 18–44.

Respiratory intubation and mechanical ventilation also was a common procedure for all age groups except adults ages 18–44. The rate of hospitalization with respiratory intubation and mechanical

ventilation grew rapidly between 1997 and 2010 for adults ages 45–64 (80 percent), ages 65–84 (37 percent), and age 85 and older (44 percent).

The most common procedures performed on hospitalized infants in 2010 were routine procedures, such as vaccinations and circumcision. The rate of infant hospitalization with vaccinations increased 155 percent since 1997. The rate of hospitalization with enteral and parenteral nutrition also grew rapidly for infants (235 percent). Appendectomy was the most frequent procedure performed in 2010 during hospital stays among children ages 1–17 (13 stays per 10,000 population).

Among adults ages 18–44, 4 of the top 5 procedures were related to pregnancy and childbirth: Cesarean section, repair of current obstetric laceration, artificial rupture of membranes to assist delivery, and fetal monitoring. The rate of hospitalization with Cesarean section increased 59 percent; however, the rates of hospitalization with repair of current obstetric laceration and artificial rupture of membranes to assist delivery remained stable between 1997 and 2010.

Among adults age 45 and older, cardiovascular and musculoskeletal procedures were common. Diagnostic cardiac catheterization was the second most common procedure among hospitalized adults ages 45–64 and the third most common procedure among adults ages 65–84 in 2010. The rate of hospitalization with this procedure decreased 33 percent for both age groups since 1997. Diagnostic ultrasound of the heart (echocardiogram) was the fourth most common procedure among adults age 85 and older. In terms of musculoskeletal procedures, knee arthroplasty was the fifth most common procedure among hospitalized adults ages 65–84; the rate of hospitalization with this procedure increased 66 percent since 1997. Treatment of a fractured or dislocated hip was the fifth most common procedure among hospitalized adults age 85 and older; the rate of hospitalization for this procedure decreased 29 percent since 1997.

**Table 3. Number of stays, stays per 10,000 population, and percentage change in rate of the most frequent all-listed procedures for hospital stays by age, 1997 and 2010**

Age group and all-listed CCS procedures	Number of stays in thousands		Stays per 10,000 population		Percentage change in rate
	1997	2010	1997	2010	1997–2010
<b>All ages, total stays</b>	<b>34,681</b>	<b>39,008</b>	<b>1,272</b>	<b>1,261</b>	<b>–1%</b>
<b>&lt; 1 year, total stays</b>	<b>4,436</b>	<b>4,521</b>	<b>11,825</b>	<b>11,438</b>	<b>–3%</b>
Prophylactic vaccinations and inoculations	549	1,472	1,464	3,725	155%
Circumcision	1,159	1,147	3,090	2,902	–6%
Respiratory intubation and mechanical ventilation	164	200	436	507	16%
Enteral and parenteral nutrition	39	138	104	350	235%
Diagnostic spinal tap	147	91	392	229	–41%
<b>1–17 years, total stays</b>	<b>1,821</b>	<b>1,754</b>	<b>271</b>	<b>250</b>	<b>–8%</b>
Appendectomy	74	88	11	13	13%
Blood transfusion	26	67	4	10	144%
Cancer chemotherapy	43	52	6	7	15%
Repair of current obstetric laceration	58	48	9	7	–21%
Respiratory intubation and mechanical ventilation	30	45	4	6	42%
<b>18–44 years, total stays</b>	<b>9,444</b>	<b>9,706</b>	<b>850</b>	<b>859</b>	<b>1%</b>
Cesarean section	773	1,249	70	111	59%
Repair of current obstetric laceration	1,079	1,242	97	110	13%
Artificial rupture of membranes to assist delivery	808	886	73	78	8%
Fetal monitoring	952	845	86	75	–13%
Blood transfusion	147	346	13	31	133%
<b>45–64 years, total stays</b>	<b>6,496</b>	<b>9,755</b>	<b>1,154</b>	<b>1,193</b>	<b>3%</b>
Blood transfusion	247	797	44	97	122%
Diagnostic cardiac catheterization; coronary arteriography	578	564	103	69	–33%
Respiratory intubation and mechanical ventilation	186	488	33	60	80%
Upper gastrointestinal endoscopy; biopsy	275	400	49	49	0%
Hemodialysis	154	337	27	41	51%
<b>65–84 years, total stays</b>	<b>10,121</b>	<b>10,169</b>	<b>3,319</b>	<b>2,913</b>	<b>–12%</b>
Blood transfusion	514	1,181	169	338	101%
Respiratory intubation and mechanical ventilation	366	573	120	164	37%
Diagnostic cardiac catheterization; coronary arteriography	738	563	242	161	–33%
Upper gastrointestinal endoscopy; biopsy	530	462	174	132	–24%
Arthroplasty knee	201	382	66	109	66%
<b>85+ years, total stays</b>	<b>2,362</b>	<b>3,103</b>	<b>6,049</b>	<b>5,608</b>	<b>–7%</b>
Blood transfusion	138	373	353	675	91%
Respiratory intubation and mechanical ventilation	65	133	168	240	44%
Upper gastrointestinal endoscopy; biopsy	122	129	313	233	–26%
Diagnostic ultrasound of heart (echocardiogram)	65	90	165	162	–2%
Treatment; fracture or dislocation of hip and femur	87	87	222	157	–29%

CCS: Clinical Classifications Software

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997 and 2010

## Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2010 NIS. Historical data were drawn from the 1997 NIS. Supplemental sources included data on national population estimates from "Intercensal Estimates of the Resident Population by Single Year of Age, Sex, Race, and Hispanic Origin for the United States: April 1, 2000 to July 1, 2010," Population Division, U.S. Census Bureau, Release date: September 2011. (<http://www.census.gov/popest/data/intercensal/national/nat2010.html>).

Supplemental sources also included data on national population estimates from "Intercensal Estimates of the United States Resident Population by Age and Sex, 1990-2000: Selected Months," Population Division, U.S. Census Bureau, Release date: August 2004. (<http://www.census.gov/popest/data/intercensal/national/index.html>).

Many hypothesis tests were conducted for this Statistical Brief. Thus, to decrease the number of false-positive results, we reduced the significance level to .001 for individual tests.

## Definitions

### *Procedures, ICD-9-CM, and Clinical Classifications Software (CCS)*

The *principal procedure* is the procedure that is performed for definitive treatment rather than 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 is selected as the principal procedure. *All-listed procedures* include all procedures performed during the hospital stay whether for definitive treatment or for diagnostic or exploratory purposes.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to procedures. There are about 4,000 ICD-9-CM procedure codes.

CCS categorizes procedure codes into clinically meaningful categories.<sup>1</sup> This "clinical grouper" makes it easier to quickly understand patterns of procedure use. CCS categories identified as "Other" are typically not reported; these categories include miscellaneous, otherwise unclassifiable procedures that may be difficult to interpret as a group.

### *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.

## 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-

---

<sup>1</sup> HCUP Clinical Classifications Software (CCS). Healthcare Cost and Utilization Project (HCUP). U.S. Agency for Healthcare Research and Quality, Rockville, MD. Available at <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>. Updated March 2012. (Accessed September 18, 2012).

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** Center for Health Information and Analysis  
**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** 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 more than 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.

## About HCUPnet

HCUPnet is an online query system that offers instant access to the largest set of all-payer health care databases 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 United States. HCUPnet generates statistics using data from HCUP's Nationwide Inpatient Sample (NIS), the Kids' Inpatient Database (KID), the Nationwide Emergency Department Sample (NEDS), the State Inpatient Databases (SID), and the State Emergency Department Databases (SEDD).

## 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 United States, 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, 2010*. Online. May 2012. U.S. Agency for Healthcare Research and Quality. Available at <http://www.hcup-us.ahrq.gov/db/nation/nis/NISIntroduction2010.pdf>. (Accessed September 18, 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>. (Accessed September 18, 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](http://www.hcup-us.ahrq.gov/reports/methods/2006_05_NISTrendsReport_1988-2004.pdf). (Accessed September 18, 2012).

## Suggested Citation

Pfuntner, A (Truven Health Analytics), Wier, LM (Truven Health Analytics), Stocks, C (AHRQ). *Most Frequent Procedures Performed in U.S. Hospitals, 2010*. HCUP Statistical Brief #149. February 2013. Agency for Healthcare Research and Quality, Rockville, MD. Available at <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb149.pdf>.



## Acknowledgments

The authors would like to acknowledge the contributions of Eva Witt of Truven Health Analytics.

\* \* \*

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