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Trends in Hospitalizations With a Red Blood Cell Transfusion, 2000–2013

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Introduction

Blood transfusion is a medical procedure to supply blood and blood components to a patient through an intravenous line in order to replace blood lost during surgery or injury, or when the body cannot make blood properly because of illness.¹ In modern practice, blood is separated into components to meet the specific needs of the patient. Red blood cells are the most commonly transfused blood component.

Although blood transfusion is recognized as crucial in treating certain diseases or conditions, published guidelines on blood utilization recommend restricting red blood cell transfusion in hospitalized patients to minimize adverse outcomes and reduce unnecessary health care costs.² National surveys have reported an overall decrease in the number of units of blood transfused in inpatient and outpatient settings.^{3,4} However, a recent brief report demonstrated an increase in blood transfusions per inpatient hospital stay.⁵

As suggested in a recent study, analyses that further describe the patient populations receiving blood transfusions will help inform and improve the use of blood transfusions, specifically red cells, and improve costs and resource use in hospitals.⁶

This Healthcare Cost and Utilization Project (HCUP) Statistical Brief presents national data on hospital inpatient stays among adults with a red blood cell transfusion from 2000 to 2013. The

Highlights

- Hospital inpatient stays with a red blood cell transfusion increased 85.8 percent from 2000 to 2013, a trend that was not driven solely by increases in the total number of inpatient stays. The percentage of all inpatient stays with a red blood cell transfusion also nearly doubled from 2000 to 2013 (80.6 percent increase).
- For all age groups, the percentage of adult inpatient stays with a red blood cell transfusion increased from 2000 to 2013. In 2013, nearly 10 percent of all stays for patients aged 65 years and older included a red blood cell transfusion.
- Septicemia was the most frequent principal condition for stays with a red blood cell transfusion in 2013, followed by gastrointestinal hemorrhage.
- Approximately 40 percent of hospital inpatient stays with a red blood cell transfusion also included a major therapeutic procedure. Treatment of a hip fracture or dislocation was the most frequent major procedure category with a red blood cell transfusion in 2013, followed by hip and knee replacement.
- Approximately 34 percent of hospital inpatient stays with a red blood cell transfusion included a minor, but no major, therapeutic procedure. Respiratory intubation and mechanical ventilation was the most frequent minor procedure category with a red blood cell transfusion in 2013, followed by hemodialysis.

¹ U.S. Department of Health & Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute. What Is a Blood Transfusion? <https://www.nhlbi.nih.gov/health/health-topics/topics/bt>. Accessed July 21, 2016.

² Carson JL, Grossman BJ, Kleinman S, Tinmouth AT, Marques MB, Fung MK, et al. Red blood cell transfusion: a clinical practice guideline from the AABB. *Annals of Internal Medicine*. 2012;157:49–58.

³ Chung K-W, Basavaraju SV, Mu Y, van Santen KL, Haass KA, Henry R, Berger J, et al. Declining blood collection and utilization in the United States. *Transfusion*. 12 May 2016. doi:10.1111/trf.13644. [epub ahead of print]

⁴ Whitaker B, Rajbhandary S, Kleinman S, Harris A, Kamani N. Trends in United States blood collection and transfusion: results from the 2013 AABB Blood Collection, Utilization, and Patient Blood Management Survey. *Transfusion*. 15 June 2016. doi:10.1111/trf.13676. [epub ahead of print]

⁵ Pathak R, Bhatt VR, Karmacharya P, Aryal MR, Alweis R. Trends in blood-product transfusion among inpatients in the United States from 2002 to 2011: data from the Nationwide Inpatient Sample. *Journal of Hospital Medicine*. 2014;9:800–1.

⁶ Ibid.

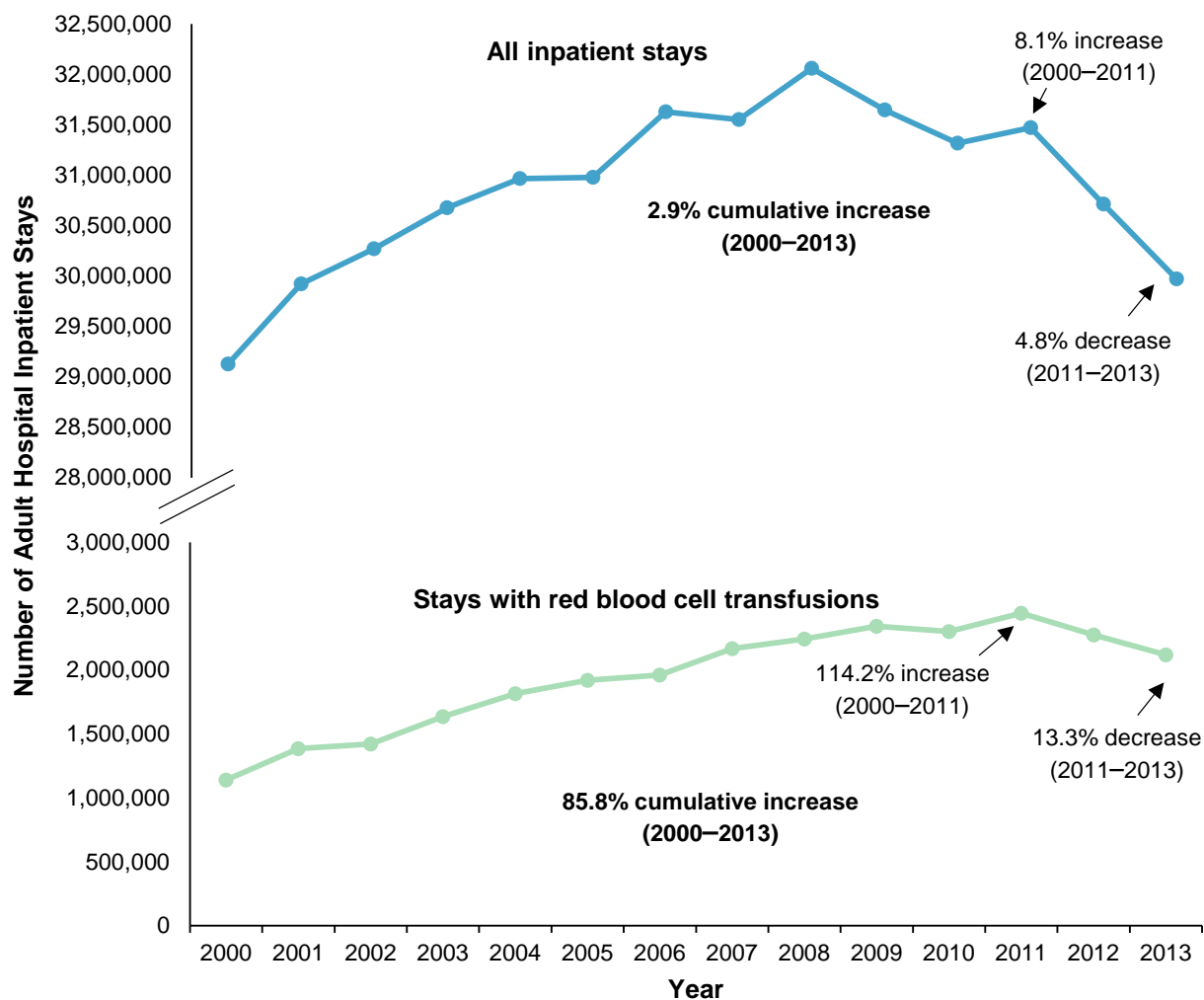
analyses focus on stays with any red blood cell transfusion, rather than on the number of blood units transfused. We present trends in stays with a red blood cell transfusion relative to the trend in all inpatient stays from 2000 to 2013 as well as an overview of characteristics of stays with a red blood cell transfusion. We also present trends in the percentage of stays with a red blood cell transfusion by age. We then focus on 2013 and present the most frequent diagnoses for stays with a red blood cell transfusion. In addition, we examine the most commonly performed procedures that occur among patients receiving a red blood cell transfusion. All differences noted in the text differ by at least 10 percent.

Findings

Trends in inpatient stays with a red blood cell transfusion, 2000–2013

Figure 1 presents the total number of adult inpatient stays and the number of stays with a red blood cell transfusion from 2000 through 2013.

Figure 1. Trends in inpatient hospitalizations and hospitalizations with a red blood cell transfusion for adults, 2000–2013



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000–2013

- **The number of hospital inpatient stays with a red blood cell transfusion increased 85.8 percent from 2000 to 2013, substantially higher than the rate of increase for all inpatient stays.**

The number of hospital inpatient stays with a red blood cell transfusion procedure among patients aged 18 years and older increased 114.2 percent between 2000 and 2011, followed by a 13.3 percent decrease between 2011 and 2013. The cumulative increase from 2000 to 2013 was 85.8 percent. The total number of hospital inpatient stays among patients aged 18 years and older also increased between 2000 and 2013 (following a somewhat similar pattern of increasing and then decreasing). However, the cumulative increase in all stays was only 2.9 percent across the 13-year period.

Characteristics of hospital inpatient stays with a red blood cell transfusion, 2000–2013

Table 1 presents patient and hospital stay characteristics for inpatient hospitalizations with a red blood cell transfusion in 2000 and 2013.

Table 1. Characteristics of adult inpatient hospitalizations with a red blood cell transfusion, 2000 and 2013

Characteristics	2000	2013
Number of stays	1,141,500	2,120,700
Percentage of total inpatient stays	3.9	7.1
Patient characteristics		
Age, years, mean	67.5	65.7
Age, years, %		
18–44	12.9	13.1
45–64	22.9	28.5
65+	64.3	58.4
Sex, %		
Female	58.0	57.2
Male	42.0	42.8
Expected primary payer, %		
Medicare	63.3	62.7
Medicaid	8.8	10.9
Private insurance	21.7	19.6
Uninsured	3.6	4.2
Other	2.1	2.5
Region, rate per 100,000 adults		
Northeast	639.8	939.8
Midwest	328.8	784.3
South	661.4	1,005.6
West	498.1	733.5
Hospital stay characteristics		
Length of stay, mean, days	8.9	8.3
Total hospital costs, mean, \$ ^a	19,000	23,300
Admissions from the ED, %	51.9	63.3

Abbreviation: ED, emergency department

^a Hospital costs in 2000 are inflation adjusted and expressed in 2013 dollars.

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **Both the number and percentage of all inpatient stays with a red blood cell transfusion nearly doubled from 2000 to 2013.**

The number of stays with a red blood cell transfusion procedure increased from approximately 1.1 million in 2000 to 2.1 million in 2013. Stays with a red blood cell transfusion as a percentage of total inpatient stays increased from 3.9 percent in 2000 to 7.1 percent in 2013.

- **Women and patients aged 65 years and older represented the highest proportion of stays with a red blood cell transfusion in both 2000 and 2013.**

Females represented a higher proportion of inpatient stays with a red blood cell transfusion in both 2000 (58.0 percent) and 2013 (57.2 percent). Patients aged 65 years and older represented around 60 percent of stays with a red blood cell transfusion in 2000 and 2013. Patients aged 45–64 years increased as a percentage of stays with a red blood cell transfusion, from 22.9 percent in 2000 to 28.5 percent in 2013.

- **The rate of inpatient stays with a red blood cell transfusion was higher in the South and the Northeast than in other regions of the country in 2000 and 2013.**

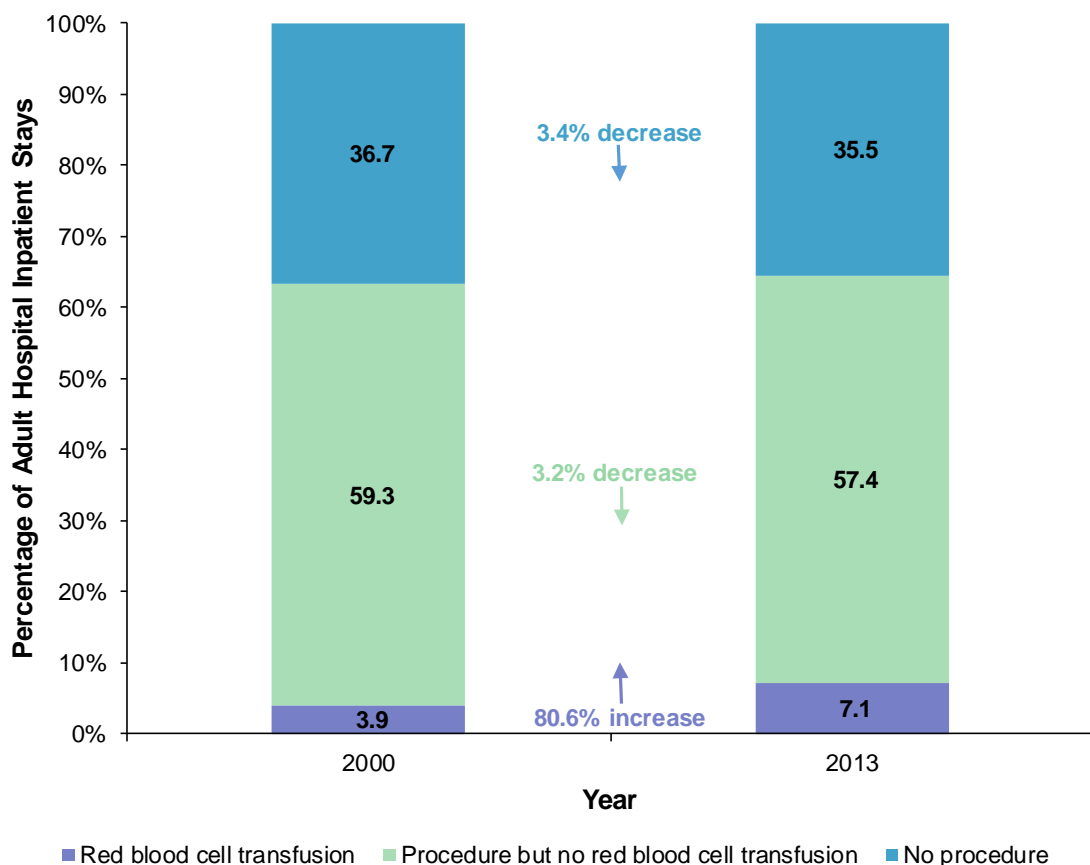
The rate of stays with a red blood cell transfusion was highest in the South and Northeast in 2000, at 661.4 and 639.8 stays per 100,000 adults, respectively. The rate of inpatient stays with a red blood cell transfusion increased from 2000 to 2013 in all regions. In 2013, the regions with the highest rate of stays with a red blood cell transfusion were still the South and Northeast, with rates of 1,005.6 and 939.8 stays per 100,000 adults, respectively. The largest cumulative increase in the rate of stays with a red blood cell transfusion between 2000 and 2013 was in the Midwest, where the rate more than doubled (a 138.6 percent increase).

- **The proportion of hospital inpatient stays with a red blood cell transfusion that were admitted through the emergency department increased over 20 percent from 2000 to 2013. Stays with a red blood cell transfusion had a mean length of stay greater than 8 days in both years.**

In 2000, 51.9 percent of hospital inpatient stays with a red blood cell transfusion were admitted through the emergency department compared with 63.3 percent in 2013, representing a 22.0 percent increase. Stays with a red blood cell transfusion had a mean length of stay of 8.9 and 8.3 days in 2000 and 2013, respectively. By comparison, the mean length of stay among all adult hospital inpatient stays was just 4.9 days in 2000 and 4.7 days in 2013 (data not shown). Despite the decrease in length of stay during this time period, inflation-adjusted mean hospital costs for hospital stays with a red blood cell transfusion increased 22.6 percent from 2000 to 2013, from \$19,000 to \$23,300.

Figure 2 presents the distribution of hospital inpatient stays with a red blood cell transfusion, with another procedure but no red blood cell transfusion, or with no procedure in 2000 and 2013.

Figure 2. Change in the percentage of adult inpatient stays by type of procedure, 2000 and 2013



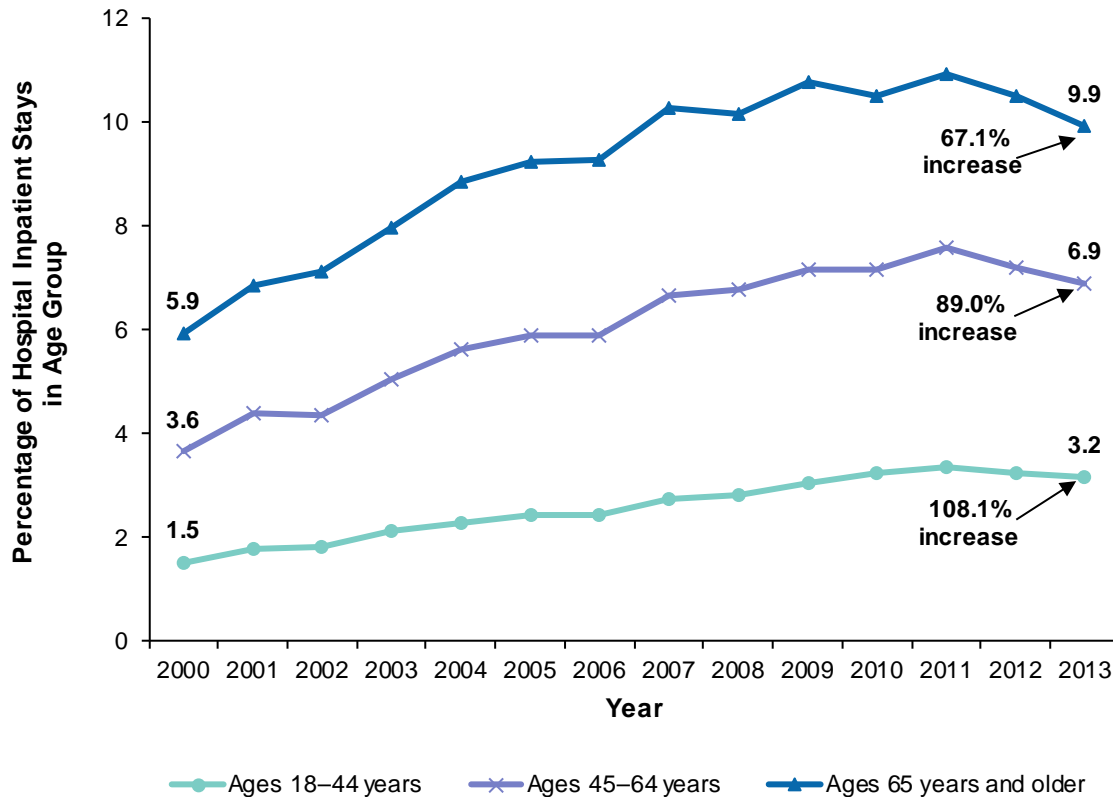
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **The proportion of hospital inpatient stays with a red blood cell transfusion increased 80.6 percent from 2000 to 2013.**

Stays with a red blood cell transfusion increased from 3.9 percent to 7.1 percent of all hospital inpatient stays between 2000 and 2013, an 80.6 percent increase. However, fewer than 10 percent of inpatient stays involved a red blood cell transfusion in either year. Inpatient stays with a procedure (either surgical or nonsurgical) without a red blood cell transfusion represented the greatest proportion of all inpatient stays, 57.4 percent in 2013. Stays without any procedure represented 35.5 percent of all inpatient stays in 2013.

Figure 3 presents trends in stays with a red blood cell transfusion as a percentage of total hospital inpatient stays, by patient age, from 2000 through 2013.

Figure 3. Trends in the percentage of adult inpatient hospitalizations with a red blood cell transfusion by patient age, 2000–2013



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000–2013

- **The increase in the percentage of adult inpatient stays with a red blood cell transfusion from 2000 to 2013 occurred across all age groups. In 2013, nearly 10 percent of all stays for patients aged 65 years and older involved a red blood cell transfusion.**

Stays with a red blood cell transfusion as a percentage of all inpatient stays grew from 2000 through 2013 across all adult age groups. The percentage of stays with a red blood cell transfusion among patients aged 18–44 years grew 108.1 percent from 2000 to 2013, from 1.5 percent to 3.2 percent of all stays. The percentage of stays with a red blood cell transfusion among patients aged 45–64 years grew 89.0 percent, from 3.6 percent to 6.9 percent of all stays. The percentage of stays with a red blood cell transfusion among patients aged 65 years and older grew 67.1 percent, from 5.9 percent to 9.9 percent of all stays.

Reasons for hospitalizations of adults with a red blood cell transfusion, 2000 and 2013

Table 2 lists the 15 most frequent principal diagnoses among hospitalizations with a red blood cell transfusion in 2013. Data on the same diagnoses also are provided for 2000 for comparison.

Table 2. Top 15 conditions with a red blood cell transfusion in 2013, compared with the frequency of each condition in 2000

Principal conditions	2000			2013		
	Stays with red blood cell transfusion		Total stays	Stays with red blood cell transfusion		Total stays
	N	%	N	N	%	N
Septicemia (except in labor)	28,603	9.3	308,638	174,740	13.7	1,276,805
Gastrointestinal hemorrhage	105,171	32.3	326,074	171,995	47.6	361,375
Hereditary, nutritional, hemolytic, and bone marrow failure anemias	68,000	51.7	131,595	141,225	73.2	192,885
Fracture of neck of femur (hip)	59,144	19.5	302,890	87,590	29.1	301,190
Complication of device; implant or graft	33,950	6.9	489,383	81,865	13.4	608,920
Osteoarthritis	36,177	8.4	430,281	79,410	7.8	1,022,945
Acute and unspecified renal failure	13,695	11.3	121,451	54,830	11.1	495,000
Complications of surgical procedures or medical care	19,859	5.6	357,398	52,205	11.7	447,230
Congestive heart failure; nonhypertensive	36,712	3.7	992,426	49,365	5.6	880,629
Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	43,914	4.1	1,061,987	48,840	5.7	862,234
Acute myocardial infarction	31,687	4.3	744,848	38,565	6.4	602,235
Diverticulosis and diverticulitis	27,189	10.3	263,459	37,885	12.8	295,955
Coronary atherosclerosis and other heart disease	40,141	3.0	1,316,200	32,440	7.1	458,295
Acute posthemorrhagic anemia	5,443	52.6	10,340	31,485	75.6	41,650
Heart valve disorders	8,339	9.9	84,139	27,800	22.8	121,825

Note: Table is sorted by the highest number of stays with a red blood cell transfusion in 2013.

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **Septicemia was the most frequent principal diagnosis for stays with a red blood cell transfusion in 2013, followed by gastrointestinal hemorrhage and hereditary, nutritional, hemolytic, and bone marrow failure anemias.**

Septicemia was the principal diagnosis for 174,740 stays with a red blood cell transfusion in 2013, up from 28,603 stays with a red blood cell transfusion in 2000. The increase in septicemia stays with a red blood cell transfusion is due to both a four-fold increase in the total number of septicemia stays from 2000 to 2013 (from 308,638 to 1,276,805 stays) and an increase in the percentage of septicemia stays with a red blood cell transfusion over the 13-year period (from 9.3 to 13.7 percent).

Gastrointestinal hemorrhage was the principal diagnosis for 171,995 stays with a red blood cell transfusion in 2013, and 141,225 stays for hereditary, nutritional, hemolytic, and bone marrow failure anemias involved a red blood cell transfusion. Among the top 15 conditions with a red blood cell transfusion in 2013, only stays for gastrointestinal hemorrhage had over 100,000 stays with a red blood cell transfusion in 2000.

- **Diagnoses such as hip fracture, complications of device or surgery, and coronary atherosclerosis had large increases in the percentage of stays with a red blood cell transfusion from 2000 to 2013.**

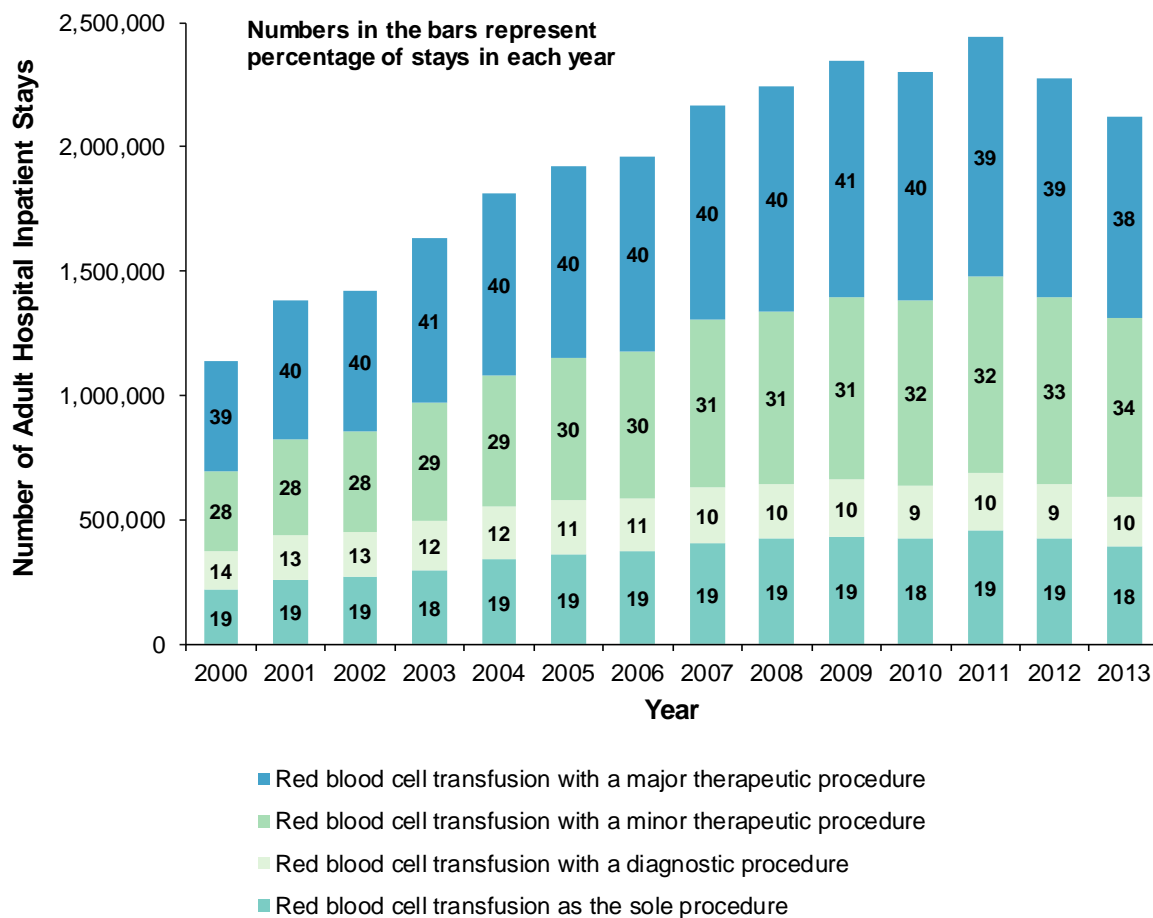
The following conditions had large increases in the percentage of stays with a red blood cell transfusion:

- The percentage of all hip fracture stays with a red blood cell transfusion increased from 19.5 percent in 2000 to 29.1 percent in 2013.
 - The percentage of all complication of device, implant or graft stays with a red blood cell transfusion increased from 6.9 percent in 2000 to 13.4 percent in 2013.
 - The percentage of all complication of surgical procedure or medical care stays with a red blood cell transfusion increased from 5.6 percent in 2000 to 11.7 percent in 2013.
 - The percentage of all coronary atherosclerosis stays with a red blood cell transfusion increased from 3.0 percent in 2000 to 7.1 percent in 2013, although the number of stays with a diagnosis of coronary atherosclerosis decreased from 1,316,200 in 2000 to 458,295 in 2013.
- **The number of osteoarthritis and renal failure stays with a red blood cell transfusion increased because of a large increase in the total number of stays for these conditions from 2000 to 2013.**

The number of osteoarthritis stays with a red blood cell transfusion increased from 36,177 in 2000 to 79,410 in 2013. This increase in osteoarthritis stays with a red blood cell transfusion resulted from an increase in the total number of osteoarthritis stays during this time period (430,281 to 1,022,945). The number of acute and unspecified renal failure stays with a red blood cell transfusion increased from 13,695 in 2000 to 54,830 in 2013, because of an increase in the total number of renal failure stays (121,451 to 495,000) with no change in the percentage of stays with a red blood cell transfusion.

Figure 4 presents the distribution of stays with a red blood cell transfusion occurring with and without another procedure performed. For stays during which another procedure occurred, the procedures are categorized into three broad categories—major therapeutic, minor therapeutic, and diagnostic.

Figure 4. Trends in adult inpatient hospitalizations with a red blood cell transfusion by type of procedure, 2000–2013



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000–2013

- **From 2000 to 2013, approximately 40 percent of hospital inpatient stays with a red blood cell transfusion also included a major therapeutic procedure.**

The percentage of stays with a major therapeutic procedure among stays with a red blood cell transfusion was fairly constant from 2000 to 2013, representing approximately 40 percent of all stays with a red blood cell transfusion. Medical transfusions (red blood cell transfusions as the sole procedure) were also fairly constant across time, representing approximately 19 percent of stays with a red blood cell transfusion.

- **Among inpatient stays with a red blood cell transfusion, the proportion with a minor therapeutic procedure increased, whereas the proportion with only a diagnostic procedure decreased over time.**

The percentage of red blood cell transfusion stays with a minor therapeutic procedure in addition to a red blood cell transfusion (and no major therapeutic procedure) grew from 28 percent in 2000 to 34 percent in 2013. At the same time, the percentage of red blood cell transfusion stays with only a diagnostic procedure decreased from 14 percent in 2000 to 10 percent in 2013.

In each year, about 19 percent of inpatient stays with a red blood cell transfusion involved no other procedure. Table 3 lists the 15 most frequent principal diagnoses among hospitalizations with a red blood cell transfusion as the sole procedure in 2013. Data on the same diagnoses also are provided for 2000 for comparison.

Table 3. Top 15 conditions with a red blood cell transfusion as the sole procedure in 2013, compared with the frequency of each condition in 2000

Principal condition	2000			2013		
	Stays with red blood cell transfusion as the sole procedure		Total stays	Stays with red blood cell transfusion as the sole procedure		Total stays
	N	%	N	N	%	N
Hereditary, nutritional, hemolytic, and bone marrow failure anemias	39,269	29.8	131,595	75,585	39.2	192,885
Septicemia (except in labor)	7,345	2.4	308,638	27,050	2.1	1,276,805
Gastrointestinal hemorrhage	16,394	5.0	326,074	19,630	5.4	361,375
Acute and unspecified renal failure	3,340	2.7	121,451	19,490	3.9	495,000
Pneumonia (except that caused by tuberculosis or sexually transmitted disease)	16,275	1.5	1,061,987	18,795	2.2	862,234
Congestive heart failure; nonhypertensive	15,306	1.5	992,426	18,715	2.1	880,629
Sickle cell anemia	6,893	12.2	56,425	17,240	24.0	71,755
Acute posthemorrhagic anemia	3,161	30.6	10,340	14,270	34.3	41,650
Urinary tract infections	5,661	1.5	378,025	8,950	1.8	490,099
Complications of surgical procedures or medical care	3,268	0.9	357,398	8,695	1.9	447,230
Fluid and electrolyte disorders	7,053	1.7	419,688	6,685	1.8	362,335
Chronic obstructive pulmonary disease and bronchiectasis	3,329	0.6	596,096	6,425	1.0	642,224
Diseases of white blood cells	3,055	8.3	36,612	6,230	12.3	50,555
Diverticulosis and diverticulitis	3,554	1.3	263,459	5,780	2.0	295,955
Acute myocardial infarction	6,383	0.9	744,848	5,050	0.8	602,235

Note: Table is sorted by the highest number of stays with a red blood cell transfusion as the sole procedure in 2013.

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **Hereditary, nutritional, hemolytic, and bone marrow failure anemias was the most frequent principal diagnosis for stays with a red blood cell transfusion without another procedure in 2013.**

Hereditary, nutritional, hemolytic, and bone marrow failure anemias was the principal diagnosis for 75,585 stays with a red blood cell transfusion as the sole procedure in 2013, representing 39.2 percent of all stays for that condition and nearly 20 percent of the 391,100 stays with a red blood cell transfusion as the sole procedure (data not shown). Hereditary, nutritional, hemolytic, and bone marrow failure anemias was also the most frequent principal diagnosis for stays with a red blood cell transfusion without another procedure in 2000, with 39,269 stays.

- **Diagnoses such as sickle cell anemia and urinary tract infections were top conditions for stays with a red blood cell transfusion as the sole procedure. These conditions did not appear in the top 15 conditions for all stays with a red blood cell transfusion.**

Sickle cell anemia was the principal diagnosis for 17,240 stays with a red blood cell transfusion as the sole procedure in 2013, more than double the number in 2000 (6,893 stays). Sickle cell anemia stays with a red blood cell transfusion as the sole procedure also doubled in percentage of stays for that condition (from 12.2 percent to 24.0 percent).

Other conditions that were unique to patients who received only a red blood cell transfusion and no other procedure in 2013 included urinary tract infections (8,950 stays), fluid and electrolyte disorders (6,685 stays), chronic obstructive pulmonary disease (6,425 stays), and diseases of white blood cells (6,230 stays).

In each year, about 40 percent of hospital inpatient stays with a red blood cell transfusion involved a major therapeutic procedure. Table 4 lists the 10 most common major therapeutic procedures in 2013 among hospitalizations with a red blood cell transfusion. Data on the same procedures also are provided for 2000 for comparison.

Table 4. Ten most frequent major therapeutic procedure categories for hospital inpatient stays with a red blood cell transfusion in 2013, compared with the frequency of each procedure in 2000

Procedure category	2000			2013		
	Stays with red blood cell transfusion		Total stays	Stays with red blood cell transfusion		Total stays
	N	%	N	N	%	N
Treatment, fracture or dislocation of hip and femur	53,472	21.5	248,765	91,835	33.9	271,195
Hip replacement, total and partial	46,587	15.6	298,351	80,405	16.3	493,360
Arthroplasty knee	25,354	8.1	312,332	56,460	7.7	731,410
Coronary artery bypass graft (CABG)	43,161	11.3	383,153	49,995	25.0	199,895
Colorectal resection	33,017	11.7	283,076	48,900	16.4	297,500
Heart valve procedures	11,158	13.3	84,047	36,945	28.6	129,185
Excision, lysis peritoneal adhesions	17,654	5.4	328,580	36,280	11.3	321,075
Partial excision bone	10,802	4.8	223,965	32,900	10.0	330,085
Amputation of lower extremity	17,190	13.2	130,202	28,285	20.8	135,705
Spinal fusion	9,336	4.0	235,775	27,740	6.3	442,610

Note: Table is sorted by highest number of stays with a red blood cell transfusion in 2013

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **Treatment of hip fracture or dislocation was the most frequent major therapeutic procedure among stays with a red blood cell transfusion in 2013.**

There were 91,835 procedures to treat a fracture or dislocation of the hip or femur that involved a red blood cell transfusion in 2013, with a substantial increase in the proportion of these procedures that involved a red blood cell transfusion (from 21.5 percent in 2000 to 33.9 percent in 2013).

- **Hip replacement and knee arthroplasty were among the most frequent major therapeutic procedures with a red blood cell transfusion in 2013, each representing over 50,000 inpatient stays.**

Red blood cell transfusion occurred during 80,405 stays with hip replacement surgery and 56,460 stays with knee arthroplasty in 2013 but at substantially lower rates compared with treatment of hip fracture or dislocation (16.3 percent and 7.7 percent, respectively, vs. 33.9 percent). Both hip and knee replacement surgeries were among the most frequent major therapeutic procedures with a red blood cell transfusion in 2013. The proportion of these procedures that involved a red blood cell transfusion did not change substantially between 2000 and 2013.

In 2013, approximately 34 percent of inpatient stays with a red blood cell transfusion involved another minor therapeutic procedure. Table 5 lists the 10 most common procedure categories for the minor therapeutic procedures in 2013 among hospitalizations with a red blood cell transfusion. Data on the same procedures also are provided for 2000 for comparison.

Table 5. Ten most frequent minor therapeutic procedures for hospital inpatient stays with a red blood cell transfusion in 2013, compared with the frequency of each procedure in 2000

Procedure category	2000			2013		
	Stays with red blood cell transfusion		Total stays	Stays with red blood cell transfusion		Total stays
	N	%	N	N	%	N
Respiratory intubation and mechanical ventilation	52,855	10.1	525,643	150,440	13.9	1,080,095
Hemodialysis	39,600	10.8	366,945	117,630	19.0	618,525
Enteral and parenteral nutrition	24,136	15.3	158,062	49,625	21.4	232,090
Incision of pleura, thoracentesis, chest drainage	17,794	7.3	243,931	42,160	13.4	315,460
Abdominal paracentesis	11,877	11.5	102,955	40,060	17.1	234,020
Cancer chemotherapy	17,343	9.2	187,991	35,540	20.4	174,430
Gastrostomy, temporary and permanent	11,842	8.8	134,495	19,340	16.3	118,345
Conversion of cardiac rhythm	8,084	5.6	145,148	19,045	9.9	191,725
Indwelling catheter	2,715	8.5	31,897	17,680	12.7	139,405
Prophylactic vaccinations and inoculations	233	1.0	23,931	16,170	5.0	320,680

Note: Table sorted by highest number of stays with a red blood cell transfusion in 2013

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), National (Nationwide) Inpatient Sample (NIS), 2000 and 2013

- **The most frequent minor therapeutic procedure during inpatient hospital stays with a red blood cell transfusion in 2013 was respiratory intubation and mechanical ventilation.**

Red blood cell transfusion occurred during 150,440 stays with a respiratory intubation and mechanical ventilation procedure in 2013, up from 52,855 stays in 2000. The total number of stays in this procedure category (over 1.0 million in 2013) as well as the percentage of stays with a red blood cell transfusion (13.9 percent in 2013) increased from 2000 to 2013.

- **Hemodialysis was among the most frequent minor therapeutic procedures with a red blood cell transfusion in 2013, representing over 115,000 inpatient stays.**

Hemodialysis was the second most frequent minor therapeutic procedure occurring with a red blood cell transfusion in 2013, involving 117,630 inpatient stays. Both the total number of stays in this procedure category and the percentage of stays with a red blood cell transfusion increased from 2000 to 2013.

Data Source

The estimates in this Statistical Brief are based upon data from the Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample (NIS), 2013. Historical data were drawn from the 2000–2012 National (Nationwide) Inpatient Sample (NIS). Supplemental sources included population denominator data for use with HCUP databases, derived from information available from Nielsen.⁷

All differences noted in the text differ by at least 10 percent.

Definitions

Diagnoses, procedures, ICD-9-CM, Procedure Classes, and Clinical Classifications Software (CCS)

The *principal diagnosis* is that condition established after study to be chiefly responsible for the patient's admission to the hospital. *Secondary diagnoses* are concomitant conditions that coexist at the time of admission or develop during the stay. *All-listed diagnoses* include the principal diagnosis plus these additional secondary conditions.

All-listed procedures include all procedures performed during the hospital stay, whether for definitive treatment or for diagnostic or exploratory purposes. The *first-listed procedure* is the procedure that is listed first on the discharge record. Inpatient data define this as the *principal procedure*—the procedure that is performed for definitive treatment rather than for diagnostic or exploratory purposes (i.e., the procedure that was necessary to take care of a complication). The term *procedure* in this Statistical Brief included surgeries as well as minor procedures.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses and procedures. There are approximately 14,000 ICD-9-CM diagnosis codes. There are approximately 4,000 ICD-9-CM procedure codes.

The Procedure Classes provide users with an easy way to categorize procedure codes into one of four broad groups: minor diagnostic, minor therapeutic, major diagnostic, and major therapeutic.⁸ The Procedure Classes are based on the ICD-9-CM codes. For this Statistical Brief, the major and minor diagnostic procedure classes were combined into one category, diagnostic. Each inpatient stay with a red blood cell transfusion was categorized into a single Procedure Class using all-listed procedures (i.e., the principal procedure and up to 14 secondary procedures). The assignment was based on a hierarchy that first looked for the presence of a major therapeutic procedure, then a minor therapeutic procedure, then diagnostic procedures, and finally stays in which red blood cell transfusion was the sole procedure.

CCS categorizes ICD-9-CM diagnosis codes and procedure codes into a manageable number of clinically meaningful categories.⁹ This clinical grouper makes it easier to quickly understand patterns of diagnoses and procedure use. CCS was used to define diagnosis conditions and procedure categories in Tables 2–5. Three categories of anemias from the CCS diagnosis categorization scheme are specifically defined below to clarify the different types of conditions included in each category.

Hereditary, nutritional, hemolytic, and bone marrow failure anemias (CCS 59 Deficiency and other anemia) includes ICD-9-CM diagnosis codes: 280.0 280.1 280.8 280.9 281.0 281.1 281.2 281.3 281.4 281.8 281.9 282.0 282.1 282.2 282.3 282.4 282.40 282.43 282.44 282.45 282.46 282.47 282.49 282.7 282.8 282.9 283.0 283.1 283.10 283.11 283.19 283.2 283.9 284.0 284.01 284.09 284.1 284.11 284.12 284.19 284.2 284.8 284.81 284.89 284.9 285.0 285.21 285.22 285.29 285.8 285.9.

⁷ Barrett M, Hickey K, Coffey R, Levit K. Population Denominator Data for Use with the HCUP Databases (Updated with 2014 Population Data). HCUP Methods Series Report #2015-07. September 1, 2015. Rockville, MD: Agency for Healthcare Research and Quality. <http://www.hcup-us.ahrq.gov/reports/methods/2015-07.pdf>. Accessed February 17, 2016.

⁸ Agency for Healthcare Research and Quality. Procedure Classes 2015. Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality. Updated February 2016. <http://hcup-us.ahrq.gov/toolssoftware/procedure/procedure.jsp>. Accessed June 8, 2016.

⁹ Agency for Healthcare Research and Quality. HCUP Clinical Classifications Software (CCS) for ICD-9-CM. Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality. Updated October 2016. <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>. Accessed October 27, 2016.

Acute posthemorrhagic anemia (CCS 60) includes ICD-9-CM diagnosis code: 285.1.

Sickle cell anemia (CCS 61) includes ICD-9-CM diagnosis codes: 282.41 282.42 282.5 282.60 282.61 282.62 282.63 282.64 282.68 282.69.

Case definition

The ICD-9-CM procedure code defining red blood cell transfusion is 99.04, Transfusion of packed cells. For the purposes of this Statistical Brief, we identify any stay with a red blood cell transfusion and do not distinguish the number of blood units used during each stay, which could be one or more than one.

Types of hospitals included in the HCUP National (Nationwide) Inpatient Sample

The National (Nationwide) Inpatient Sample (NIS) is based on data from community hospitals, which are defined as short-term, non-Federal, general, and other hospitals, excluding hospital units of other institutions (e.g., prisons). The NIS includes obstetrics and gynecology, otolaryngology, orthopedic, cancer, pediatric, public, and academic medical hospitals. Excluded are long-term care facilities such as rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals. Beginning in 2012, long-term acute care hospitals are also excluded. However, if a patient received long-term care, rehabilitation, or treatment for a psychiatric or chemical dependency condition 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 1 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).¹⁰ *Costs* 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.

Annual costs were inflation adjusted using the Gross Domestic Product (GDP) Price Index from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), with 2013 as the index base.¹¹ That is, all costs are expressed in 2013 dollars.

Payer

Payer is the expected payer for the hospital stay. To make coding uniform across all HCUP data sources, payer combines detailed categories into general groups:

- Medicare: includes patients covered by fee-for-service and managed care Medicare
- Medicaid: includes patients covered by fee-for-service and managed care Medicaid
- Private Insurance: includes Blue Cross, commercial carriers, and private health maintenance organizations (HMOs) and preferred provider organizations (PPOs)
- Uninsured: includes an insurance status of *self-pay* and *no charge*
- Other: includes Workers' Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs

Hospital stays billed to the State Children's Health Insurance Program (SCHIP) may be classified as Medicaid, Private Insurance, or Other, depending on the structure of the State program. Because most

¹⁰ Agency for Healthcare Research and Quality. HCUP Cost-to-Charge Ratio (CCR) Files. Healthcare Cost and Utilization Project (HCUP). 2001–2013. Rockville, MD: Agency for Healthcare Research and Quality. Updated November 2015. <http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp>. Accessed February 17, 2016.

¹¹ U.S. Bureau of Economic Analysis. National Income and Product Account Tables, Table 1.1.4 Price Indexes for Gross Domestic Product. <http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=1&isuri=1>. Accessed June 30, 2016.

State data do not identify patients in SCHIP specifically, it is not possible to present this information separately.

For this Statistical Brief, when more than one payer is listed for a hospital discharge, the first-listed payer is used.

Region

Region is one of the four regions defined by the U.S. Census Bureau:

- Northeast: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania
- Midwest: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas
- South: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas
- West: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii

Admission source or point of origin

Admission source (now known as the patient's point of origin) indicates where the patient was located prior to admission to the hospital. Emergency admission indicates that the patient was admitted to the hospital through the emergency department.

About HCUP

The Healthcare Cost and Utilization Project (HCUP, pronounced "H-Cup") is a family of health care databases and related software tools and products developed through a Federal-State-Industry partnership and sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP databases bring together the data collection efforts of State data organizations, hospital associations, and private data organizations (HCUP Partners) and the Federal government to create a national information resource of encounter-level health care data. HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. These databases enable research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments at the national, State, and local market levels.

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
District of Columbia 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
North Dakota (data provided by the Minnesota Hospital Association)
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Oregon Office of Health Analytics
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina Revenue and Fiscal Affairs Office
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 Statistical Briefs

HCUP Statistical Briefs are descriptive summary reports presenting statistics on hospital inpatient, ambulatory surgery, and emergency department use and costs, quality of care, access to care, medical conditions, procedures, patient populations, and other topics. The reports use HCUP administrative health care data.

About the NIS

The HCUP National (Nationwide) Inpatient Sample (NIS) is a national (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 includes all payers. 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 the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use. Over time, the sampling frame for the NIS has changed; thus, the number of States contributing to the NIS varies from year to year. The NIS is intended for national estimates only; no State-level estimates can be produced.

The 2012 NIS was redesigned to optimize national estimates. The redesign incorporates two critical changes:

- Revisions to the sample design—starting with 2012, the NIS is now a *sample of discharge records from all HCUP-participating hospitals*, rather than a sample of hospitals from which all discharges were retained (as is the case for NIS years before 2012).

- Revisions to how hospitals are defined—the NIS now uses the *definition of hospitals and discharges supplied by the statewide data organizations* that contribute to HCUP, rather than the definitions used by the American Hospital Association (AHA) Annual Survey of Hospitals.

The new sampling strategy is expected to result in more precise estimates than those that resulted from the previous NIS design by reducing sampling error: for many estimates, confidence intervals under the new design are about half the length of confidence intervals under the previous design. The change in sample design for 2012 necessitates recomputation of prior years' NIS data to enable analysis of trends that uses the same definitions of discharges and hospitals.

For More Information

For other information on specific procedures and treatments, including red blood cell transfusions, refer to the HCUP Statistical Briefs located at http://www.hcup-us.ahrq.gov/reports/statbriefs/sb_specific.jsp.

For additional HCUP statistics, visit:

- HCUP Fast Stats at <http://www.hcup-us.ahrq.gov/faststats/landing.jsp> for easy access to the latest HCUP-based statistics for health information topics
- HCUPnet, HCUP's interactive query system, at <http://hcupnet.ahrq.gov/>

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

For a detailed description of HCUP and more information on the design of the National (Nationwide) Inpatient Sample (NIS), please refer to the following database documentation:

Agency for Healthcare Research and Quality. Overview of the National (Nationwide) Inpatient Sample (NIS). Healthcare Cost and Utilization Project (HCUP). Rockville, MD: Agency for Healthcare Research and Quality. Updated November 2015. <http://www.hcup-us.ahrq.gov/nisoverview.jsp>. Accessed February 17, 2016.

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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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