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Hospitalizations Related to Diabetes in Pregnancy, 2008

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Introduction

Diabetes is a growing public health concern in the United States. Poorly controlled diabetes can cause severe complications including blindness, kidney damage, cardiovascular disease, and lower-limb amputations. Pre-existing diabetes (type 1 and type 2) and gestational diabetes (defined as glucose intolerance with onset or first recognition during pregnancy among women without diabetes) are associated with increased risk of serious health complications for both the mother and infant.[1] For instance, a maternal diagnosis of gestational diabetes is associated with high rates of complicated births and intensive care utilization, as well as hypoglycemia, jaundice, and macrosomia (large body size) in newborns.[2] Pre-existing diabetes in pregnancy is further associated with preterm (early) birth and higher risk of miscarriage.[3]

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on hospitalizations related to diabetes in pregnancy in 2008. Specifically, utilization, cost of hospital care, and patient characteristics of maternal hospitalizations with pre-existing diabetes complicating pregnancy and gestational diabetes are compared with maternal hospitalizations without diabetes by visit type (delivery or non-delivery). Additionally, this report provides information about the types of procedures commonly performed during these stays with deliveries. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

[1] American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 30 Suppl 1:S42-S47, 2007.
[2] National Institutes of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Gestational Diabetes. http://www.nichd.nih.gov/health/topics/gestational_diabetes.cfm (Accessed on December 09, 2010).
[3] Type1 or Type 2 Diabetes and Pregnancy. http://www.cdc.gov/NCBDDD/pregnancy_gateway/diabetes-types.html (Accessed on December 09, 2010).

Highlights

- Diabetes-related maternal stays accounted for about 6.5 percent of all maternal stays—5.4 percent of all maternal stays involved gestational diabetes and 1.1 percent involved pre-existing diabetes complicating pregnancy.
- One-third (33.9 percent) of hospital stays with pre-existing diabetes complicating pregnancy involved no delivery—hospitalization was primarily aimed at treating this maternal complication. This compares to 10.3 percent of stays without diabetes and 8.4 percent of maternal stays with gestational diabetes.
- Nearly two-thirds of women with pre-existing diabetes complicating pregnancy delivered via Cesarean section (C-section) (63.9 percent)—more than twice as high as for women without diabetes (31.7 percent). The C-section rate for women with gestational diabetes (45.6 percent) was also higher than for women without diabetes.
- From 1997 to 2007, there was a 14 percent increase in the number of stays for all deliveries. In contrast, deliveries involving gestational diabetes increased 75 percent and deliveries involving pre-existing diabetes complicating pregnancy increased 71 percent during this same time frame.
- Mean length of stay and mean costs were higher for diabetes-related stays that resulted in delivery. For women without diabetes, a delivery stay cost $3,800 for a 2.6 day hospitalization. In comparison, a delivery stay cost 55 percent more ($5,900) for a woman with pre-existing diabetes for a 4.2 day hospitalization. For women with gestational diabetes, a delivery stay cost 18 percent more ($4,500) for a 3.2 day stay.
- Total costs of hospitalization for all diabetes in pregnancy was over $1.4 billion, or 7.8 percent of all maternal hospitalization costs.

Findings

There were about 4.7 million maternal discharges in 2008. As shown in table 1, diabetes-related maternal stays—those involving delivery as well as pregnancy complications—accounted for about 6.5 percent of all maternal stays (307,400 discharges)—5.4 percent of all maternal stays were for gestational diabetes and 1.1 percent were for pre-existing diabetes complicating pregnancy.

Table 1. Number and percentage of delivery and non-delivery maternal stays associated with diabetes and pregnancy, 2008

	Pre-existing diabetes complicating pregnancy	Gestational diabetes	Maternal stays without diabetes
Total Stays (% of all maternal stays)	53,700 (1.1%)	253,700 (5.4%)	4,394,500 (93.5%)
Stays with delivery (% of total stays for each column)	35,500 (66.1%)	232,300 (91.6%)	3,942,100 (89.7%)
Vaginal (% of stays with delivery)	12,800 (36.1%)	126,300 (54.4%)	2,694,100 (68.3%)
C-Section (% of stays with delivery)	22,700 (63.9%)	106,000 (45.6%)	1,247,900 (31.7%)
Non-Delivery Stays (% of total stays for each column)	18,200 (33.9%)	21,400 (8.4%)	452,500 (10.3%)

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2008

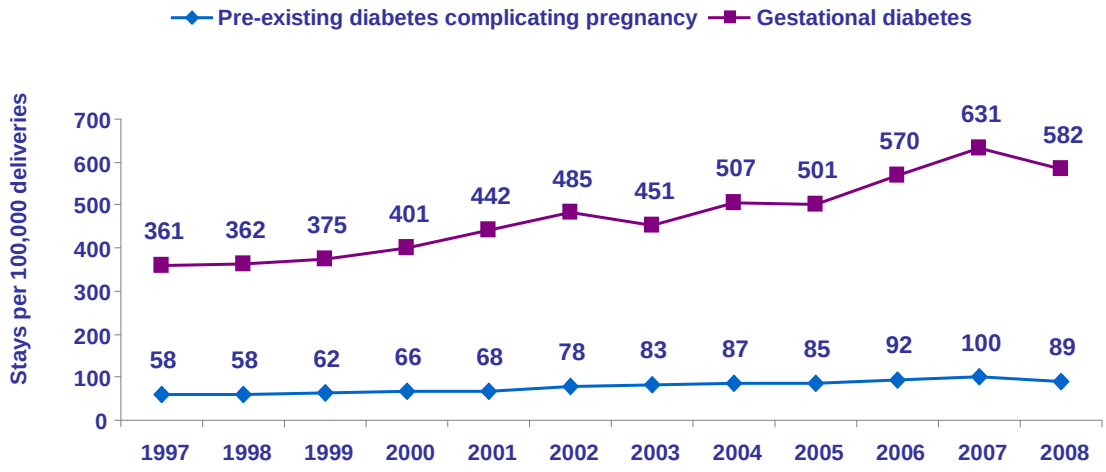
Note: Counts of hospital stays based on all-listed diagnoses. Stays with diabetes are compared to maternal stays without diabetes. All differences were statistically significant at $p<0.05$.

Roughly 9 out 10 maternal discharges without diabetes (89.7 percent) and with gestational diabetes (91.6 percent) involved the birth of an infant. In contrast, for women with pre-existing diabetes, only 66.1 percent gave birth during the stay—one out of three maternal hospitalizations involving pre-existing diabetes (33.9 percent) were for treatment of complications with no delivery.

The C-section rate for women with pre-existing diabetes complicating pregnancy was more than twice as high as for women without diabetes—63.9 percent compared to 31.7 percent. The C-section rate for women with gestational diabetes was also higher than for women without diabetes—45.6 percent.

From 1997 to 2007, the number of stays for all deliveries increased about 14 percent. In contrast, as shown in figure 1, the rate of hospital stays for gestational diabetes grew 75 percent (from 361 to 631 stays per 100,000 deliveries) and hospitalizations for pre-existing diabetes complicating pregnancy grew 72 percent (from 58 to 100 stays per 100,000 deliveries). In the one year interval from 2007 to 2008, the number of stays for all deliveries remained relatively stable and there was a slight, but not statistically significant, decline in stays for gestational diabetes and pre-existing diabetes complicating pregnancy.

Figure 1. Stays for diabetes complicating pregnancy and gestational diabetes grew rapidly from 1997 to 2008



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997–2008
Note: Stays based on all-listed diagnosis.

Utilization characteristics for diabetes and pregnancy, without delivery

Table 2 focuses on hospitalizations without delivery. There were 18,200 hospital stays with pre-existing diabetes complicating pregnancy and 21,400 stays with gestational diabetes and no delivery.[4] There were 452,500 non-delivery maternal hospitalizations without diabetes.

Table 2. Characteristics of hospital stays associated with diabetes and pregnancy, without delivery, 2008

	Pre-existing diabetes complicating pregnancy	Gestational diabetes	Pregnancy-related stays without diabetes
Total number of discharges	18,200	21,400	452,500
Mean length of stay, days	3.9	4.3	2.8
Mean hospital costs	$4,300*	$4,000*	$4,100
Aggregate costs	$78,500,000	$86,400,000	$1,872,900,000
Discharge against medical advice	4.0%	2.3%	1.5%

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2008

Note: Counts of hospital stays based on all-listed diagnoses.

* Not statistically different from pregnancy-related stays without diabetes at p<0.05.

[4] These counts may include multiple hospitalizations by the same individuals, which is common among patients with diabetes.

The mean length of hospitalizations with pre-existing diabetes and gestational diabetes was longer than the average without diabetes (3.9 and 4.3 days versus 2.8 days, respectively). Despite differences in length of stay, costs of hospitalization were the same across these three groups—all cost roughly $4,000 per stay regardless of diabetes status.

Aggregate costs for non-delivery maternal hospitalizations for pre-existing diabetes were $78 million and for gestational diabetes aggregate costs were $86 million, compared to $1.8 billion for non-diabetes maternal hospitalizations without delivery.

Discharge against medical advice was more common among stays with pre-existing diabetes complicating pregnancy (4.0 percent) and gestational diabetes (2.3 percent) compared to stays without diabetes (1.5%).

Utilization characteristics for diabetes and pregnancy, deliveries only
Table 3 focuses on deliveries and shows that there were 35,500 deliveries among women with pre-existing diabetes complicating pregnancy and 232,300 deliveries for women with gestational diabetes.[5] There were more than 3.9 million hospitalizations for deliveries without diabetes.

Table 3. Characteristics of hospital stays associated with diabetes and pregnancy, deliveries only, 2008

	Pre-existing diabetes complicating pregnancy	Gestational diabetes	All deliveries without diabetes
Total number of discharges	35,500	232,300	3,942,100
Mean length of stay, days	4.2	3.2	2.6
Mean hospital costs	$5,900	$4,500	$3,800
Aggregate costs	$210,972,000	$1,045,400,000	$14,804,800,000
Discharge to home	80.4%*	74.8%	79.5%
Discharge against medical advice	0.2%	0.1%	0.0%

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2008
Note: Counts of hospital stays based on all-listed diagnoses.
* Not statistically different from all deliveries without diabetes at p<0.05.

The mean length of hospitalization for delivery stays with pre-existing diabetes complicating pregnancy and gestational diabetes was longer than the average stay without diabetes (4.2 and 3.2 days versus 2.6 days, respectively). The average cost of a delivery hospitalization without diabetes was $3,800. Deliveries with pre-existing diabetes complicating pregnancy cost 55 percent more per stay ($5,900) and those with gestational diabetes cost 18 percent more ($4,500).

Aggregate costs for delivery-related hospitalizations for pre-existing diabetes complicating pregnancy were $211 million and for gestational diabetes aggregate costs were over $1 billion, compared to nearly $15 billion for non-diabetes deliveries. Total costs of hospitalization for all diabetes in pregnancy (including deliveries and non-delivery stays) was over $1.4 billion, or 7.8 percent of all maternal hospitalization costs.

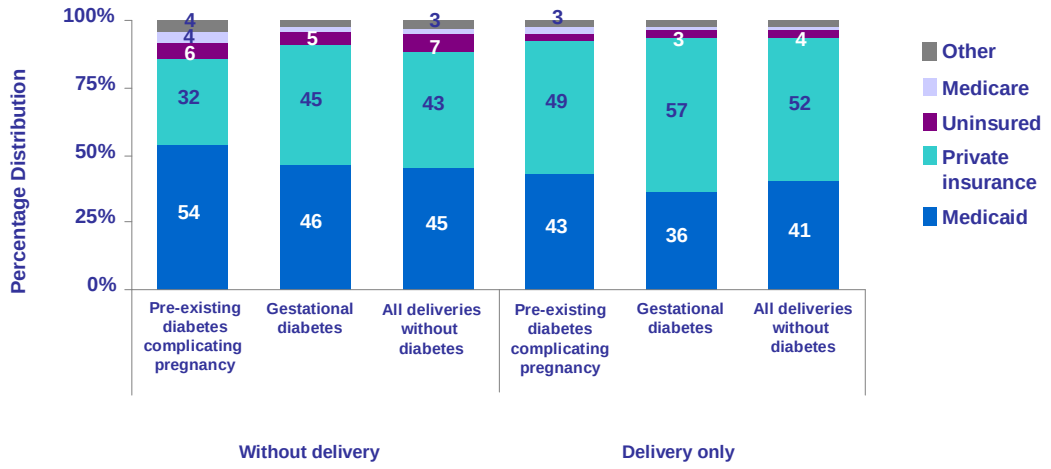
Discharge against medical advice was uncommon among all deliveries, but was slightly more frequent among delivery stays with pre-existing diabetes complicating pregnancy (0.2 percent) and gestational diabetes (0.1 percent) than among delivery stays without diabetes.

[5] These counts may include multiple hospitalizations by the same individuals, which is common among patients with diabetes.

Hospitalizations related to diabetes in pregnancy, by primary payer
Figure 2 shows that more than half (54 percent) of non-delivery maternal stays with pre-existing diabetes complicating pregnancy were billed to Medicaid, while 32 percent were billed to private insurance and 6 percent to uninsured individuals. Relative to non-delivery stays with pre-existing diabetes complicating pregnancy, hospitalizations with gestational diabetes and those without diabetes were billed more frequently to private insurance (43–45 percent) and billed less frequently to Medicaid (45–46 percent).

Among delivery stays, a larger proportion of hospitalizations with gestational diabetes (57 percent) was billed to private insurance compared to delivery stays with pre-existing diabetes complicating pregnancy (49 percent) and without diabetes (52 percent).

Figure 2. Majority of delivery and non-delivery stays were billed to private insurance and Medicaid, regardless of diabetes diagnosis



Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2008
Note: Stays based on all-listed diagnosis.
Note: Distributions less than 2 percent are not labeled.

Procedures associated with hospitalizations related to diabetes in pregnancy, deliveries only
Table 4 shows that C-section was the most frequently performed procedure during stays with pre-existing diabetes complicating pregnancy and gestational diabetes. Compared to maternal delivery stays without diabetes, C-section was twice as likely to be performed for women with pre-existing diabetes complicating pregnancy (63.9 percent of stays) and about 1.4 times more likely to be performed for women with gestational diabetes (45.6 percent of stays).

Table 4. Most frequent all-listed procedures associated with diabetes and pregnancy, deliveries only, 2008

	Pre-existing diabetes complicating pregnancy		Gestational diabetes		All deliveries without diabetes	
	Discharges (%)	**Rank**	**Discharges (%)**	**Rank**	**Discharges (%)**	**Rank**
Total number of discharges	35,500 (100.0%)	--	232,300 (100.0%)	--	3,942,100 (100.0%)	--
Cesarean section	22,700 (63.9%)	1	106,000 (45.6%)	1	1,247,900 (31.7%)	2
Repair of obstetric laceration	5,900 (16.6%)	5	61,900 (26.7%)	2	1,298,700 (32.9%)	1
Fetal monitoring	7,400 (20.9%*)	2	51,800 (22.3%*)	3	851,300 (21.6%)	4
Artificial rupture of membranes to assist delivery	5,900 (16.7%)	4	50,300 (21.6%)	4	942,200 (23.9%)	3
Ligation or occlusion of fallopian tubes	6,800 (19.1%)	3	29,500 (12.7%)	5	268,500 (6.8%)	6
Episiotomy	1,300 (3.6%)	6	14,900 (6.4%)	6	331,700 (8.4%)	5

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2008

Note: Counts of hospital stays based on all-listed diagnoses.

* Not statistically different from all deliveries without diabetes at $p<0.05$.

Repair of obstetric laceration, which ranked first among stays without diabetes (32.9 percent of stays), was the second most common procedure for gestational diabetes stays (26.7 percent of stays) and the fifth most common procedure for pre-existing diabetes complicating pregnancy stays (16.6 percent of stays).

Artificial rupture of membranes to assist delivery and episiotomy were also less commonly performed for women with pre-existing diabetes complicating pregnancy and gestational diabetes, probably a function of the higher C-section rate.

Ligation or occlusion of fallopian tubes was more commonly performed during stays with pre-existing diabetes complicating pregnancy (19.1 percent of stays) and gestational diabetes (12.7 percent of stays) than during stays without diabetes (6.8 percent of stays). There were no differences in fetal monitoring across the three groups.

Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2008 Nationwide Inpatient Sample (NIS). Historical data were drawn from the 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, and 2007 NIS.

Definitions

Diagnoses, ICD-9-CM, and Clinical Classifications Software (CCS), and Diagnosis-Related Groups (DRGs)
The principal diagnosis is that condition established after study to be chiefly responsible for the patient's admission to the hospital. Secondary diagnoses are concomitant conditions that coexist at the time of admission or that develop during the stay. All-listed diagnoses include the principal diagnosis plus these additional secondary conditions.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 13,600 ICD-9-CM diagnosis codes.

CCS categorizes ICD-9-CM diagnoses into a manageable number of clinically meaningful categories.[6] This "clinical grouper" makes it easier to quickly understand patterns of diagnoses and procedures.

DRGs comprise a patient classification system that categorizes patients into groups that are clinically coherent and homogeneous with respect to resource use. DRGs group patients according to diagnosis, type of treatment (procedures), age, and other relevant criteria. Each hospital stay has one DRG assigned to it.

Case definition
For this report, non-delivery maternal stays were identified as having an all-listed ICD-9-CM diagnosis code in the following range: 630–679. Delivery stays were identified as having a DRG code 765–768 (vaginal delivery) or 774–775 (C-section).

Pre-existing diabetes complicating pregnancy was defined as an all-listed ICD-9-CM diagnosis code (648.0x). Gestational diabetes was defined as an all-listed ICD-9 CM diagnosis code (648.8x). For the few cases that listed both codes, cases were counted as diabetes complicating pregnancy.

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. Excluded are 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).[7] 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.

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[6] HCUP CCS. Healthcare Cost and Utilization Project (HCUP). December 2009. U.S. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp

[7] HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2008. U.S. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/db/state/costtocharge.jsp.

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

- Medicare includes fee-for-service and managed care Medicare patients.
- Medicaid includes fee-for-service and managed care Medicaid patients. Patients covered by the State Children's Health Insurance Program (SCHIP) may be included here. Because most state data do not identify SCHIP patients specifically, it is not possible to present this information separately.
- Private insurance includes Blue Cross, commercial carriers, and private HMOs and PPOs.
- Other includes Workers' Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs.
- Uninsured includes an insurance status of "self-pay" and "no charge."

When more than one payer is listed for a hospital discharge, the first-listed payer is used.

Discharge status
Discharge status indicates the disposition of the patient at discharge from the hospital, and includes the following six categories: routine (to home), transfer to another short-term hospital, other transfers (including skilled nursing facility, intermediate care, and another type of facility such as a nursing home), home health care, against medical advice (AMA), or died in the hospital.

About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

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
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 and Senior Services

New Mexico Health Policy Commission
New York State Department of Health
North Carolina Department of Health and Human Services
Ohio Hospital Association
Oklahoma State Department of Health
Oregon Association of Hospitals and Health Systems
Pennsylvania Health Care Cost Containment Council
Rhode Island Department of Health
South Carolina State Budget & Control Board
South Dakota Association of Healthcare Organizations
Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health Services
Wyoming Hospital Association

About the NIS

The HCUP Nationwide Inpatient Sample (NIS) is a nationwide database of hospital inpatient stays. The NIS is nationally representative of all community hospitals (i.e., short-term, non-Federal, non-rehabilitation hospitals). The NIS is a sample of hospitals and includes all patients from each hospital, regardless of payer. It is drawn from a sampling frame that contains hospitals comprising about 95 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

For More Information

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

For additional HCUP statistics, visit HCUPnet, our interactive query system, at www.hcup.ahrq.gov.

For information on other hospitalizations in the U.S., download HCUP Facts and Figures: Statistics on Hospital-based Care in the United States in 2008, 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, 2008. Online. May 2010. U.S. Agency for Healthcare Research and Quality.
http://hcup-us.ahrq.gov/db/nation/nis/NIS_2008_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

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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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