

## STATISTICAL BRIEF #24

January 2007

### Hospitalizations for Birth Defects, 2004

*C. Allison Russo, M.P.H. and Anne Elixhauser, Ph.D.*

#### Introduction

Each year, birth defects (or congenital anomalies) affect one out of every 33 babies born in the United States.<sup>1</sup> A birth defect occurs when the fetus is developing in the mother's body, usually within the first three months of pregnancy. Birth defects are often found within the first year of life, and their effects can range from mild to severe. Some defects result in debilitating illness or death at a very young age, while others may be successfully treated with surgery or other medical treatments. Some birth defects may not be discovered or treated until adulthood. In any case, inpatient hospital care is often necessary for persons affected by birth defects.

This Statistical Brief provides data from the Healthcare Cost and Utilization Project (HCUP) on hospital care for birth defects in 2004. Hospital utilization and costs for the treatment of birth defects are compared with hospital stays for all other non-obstetrical conditions. Additionally, the most common birth defects resulting in hospital admission are described. Finally, changes in the hospitalization rate for birth defects between 1997 and 2004 are examined. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

#### Findings

In 2004, there were more than 139,000 hospital stays principally for the treatment of birth defects. This represented a hospitalization rate of 47.4 stays per 100,000 persons and totaled \$2.6 billion in hospital costs.

##### *General characteristics of hospital stays for birth defects*

Table 1 describes the general characteristics of hospitalizations for birth defects. In general, stays principally for the treatment of birth defects were longer, more costly, occurred more often among males and younger patients, and resulted in a lower in-hospital death rate when compared with hospital stays for all other non-obstetrical conditions.

On average, birth defect hospitalizations were about 1.5 days longer than stays for all other conditions (6.3 days versus 4.9 days), while a birth defect admission was on average more than twice as costly

#### Highlights

- In 2004, birth defects accounted for more than 139,000 hospitalizations, representing 47.4 stays per 100,000 persons. Hospital costs for these conditions totaled \$2.6 billion.
- The highest aggregate costs were for stays related to cardiac and circulatory congenital anomalies, which accounted for about \$1.4 billion—more than half of all hospital costs for birth defects. Cardiac and circulatory congenital anomalies, which include conditions such as atrial and ventricular septal defects, accounted for more than one-third of all hospital stays for birth defects and had the highest in-hospital mortality rate.
- Between 1997 and 2004, hospitalization rates increased by 28.5 percent for cardiac and circulatory congenital anomalies and 25.3 percent for digestive congenital anomalies (when noted as either the principal or a coexisting condition).
- Pyloric stenosis was the most common principal reason for birth defect hospital stays, accounting for 9.0 percent of all birth defect-related hospitalizations.
- Atrial septal defect was noted during almost 86,300 hospitalizations as the principal reason for the hospital stay or as a coexisting, or secondary, condition.

<sup>1</sup>Centers for Disease Control and Prevention, National Center on Birth Defects and Developmental Disabilities. <http://www.cdc.gov/node.do/id/0900f3ec8000dffe> (Accessed on December 21, 2006)

(\$18,600 versus \$8,200). Compared with stays for all other non-obstetrical conditions, patients hospitalized principally for the treatment of birth defects were disproportionately male (53.3 percent versus 46.5 percent) and had a mean age that was more than 30 years younger (17.6 years versus 49.9 years). However, the in-hospital death rate for patients hospitalized for birth defects was lower than the in-hospital death rate for all other conditions—1.3 percent versus 2.4 percent.

#### *Birth defects causing hospitalization*

Table 2 highlights both general categories and specific birth defects that resulted in hospitalization. In 2004, cardiac and circulatory congenital anomalies accounted for 33.5 percent of birth defect hospitalizations, digestive congenital anomalies accounted for 18.5 percent of birth defect stays, and congenital genitourinary and nervous system anomalies accounted for 9.3 percent and 5.0 percent, respectively, of admissions for birth defects. All remaining birth defects accounted for about 33.8 percent of stays.

In 2004, pyloric stenosis (a narrowing of the stomach that leads to vomiting) was the most common specific congenital anomaly causing hospitalization, accounting for 9.0 percent of all stays for birth defects. This was followed by atrial septal defects (a hole between the two smaller chambers in the heart) and spondylolisthesis (a condition where one vertebra slips forward), each of which resulted in about 6 percent of all hospitalizations for birth defects. Other common birth defects included cleft lip with or without cleft palate, obstructive genitourinary defects, ventricular septal defects (a hole between the two larger chambers of the heart), congenital anomalies of the skull and facial bones, cerebrovascular anomalies (such as cerebral aneurysm), cleft palate without cleft lip, and foot deformities.

Among the most common birth defects, the longest hospital stays were for patent ductus arteriosus (a persistent connection between the aorta and the pulmonary artery that normally closes shortly after birth, 12.7 days), tetralogy of fallot (a complex heart defect that is the most common cause of “blue baby syndrome,” 11.4 days), and rectal and large intestine atresia/stenosis (absence, closure, or constriction of the large intestine or rectum, 9.1 days).

Males predominated among hospitalizations for birth defects such as coarctation of the aorta (narrowing of the aorta, 63.0 percent), pyloric stenosis (80.8 percent male), Meckel’s diverticulum (a pouch of tissue on the wall of the small intestine, 70.4 percent), and pectus excavatum (sunken or funnel chest, 79.1 percent male). Conversely, females accounted for more hospitalizations for patent ductus arteriosus (39.5 percent male), congenital hip deformities (28.6 percent male), and spondylolisthesis (38.7 percent male).

Some birth defects are discovered and treated at birth or during infancy and early childhood. Other birth defects may be discovered much later. The mean age for patients admitted for the treatment of pyloric stenosis, rectal and large intestine atresia/stenosis, cleft palate without cleft lip, and tetralogy of fallot was less than 3 years. However, for other conditions such as Meckel’s diverticulum, atrial septal defect, cerebrovascular anomalies, polycystic kidney (clusters of cysts forming on the kidneys), and spondylolisthesis, patients were, on average, 30 years or older.

The highest aggregate costs were for stays related to cardiac and circulatory congenital anomalies, which accounted for about \$1.4 billion—more than half of all hospital costs for birth defects. Similarly, the highest mean costs and the highest death rates were for cardiac and circulatory anomalies.

#### *Birth defects commonly noted during hospitalization*

Table 3 lists birth defect diagnoses commonly noted during hospitalization as the principal or secondary diagnosis. In 2004, almost 86,300 hospital stays occurred among patients with an atrial septal defect, while patients with patent ductus arteriosus accounted for 59,500 admissions. About 40,000 hospital stays occurred among patients noted to have congenital pigmentary anomaly of the skin (discolorations of skin or hair), ventricular septal defect, or Down’s syndrome. Other birth defects commonly noted as either the principal reason for admission or a coexisting condition included spina bifida (incomplete development of the brain, spinal cord, and/or their protective coverings), polycystic kidney, spondylolisthesis, undescended testicle, and obstructive genitourinary defects.

#### *Changes in hospitalizations for birth defects, 1997–2004*

Figures 1 through 4 demonstrate changes in the hospitalization rates for general categories of birth defects between 1997 and 2004. When listed as the principal reason for admission, the hospitalization

rate for cardiac and circulatory congenital anomalies remained relatively stable between 1997 and 2004 (figure 1). However, when noted as either the principal or coexisting condition (i.e., all-listed diagnoses), the hospitalization rate for these birth defects increased by 28.5 percent. Similarly, figure 2 shows that the hospitalization rate for all-listed digestive congenital anomalies increased significantly between 1997 and 2004—rising by 25.3 percent.

Between 1997 and 2004, the hospitalization rate for genitourinary congenital anomalies decreased by 17.0 percent when listed as the principal diagnosis, but increased by 13.0 percent when noted as either a principal or coexisting condition (figure 3). When noted as the principal reason for treatment, the hospitalization rate for nervous system congenital anomalies remained stable over the eight-year time period, even though all-listed diagnoses increased by 11.9 percent (figure 4).

## Data Source

The estimates in this Statistical Brief are based on data from the HCUP 2004 Nationwide Inpatient Sample (NIS). Historical data were drawn from the 1997, 1998, 1999, 2000, 2001, 2002, and 2003 NIS. Supplemental sources included data on national population estimates from Table 8: Annual Estimates of the Population for the United States, Regions, and Divisions: April 1, 2000 to July 1, 2005 (NST-EST2005-08), Population Division, U.S. Census Bureau, Release Date: December 22, 2005 (<http://www.census.gov/popest/states/tables/NST-EST2005-08.xls>) and Historical National Population Estimates: July 1, 1900 to July 1, 1999, Population Division, U.S. Census Bureau, Release Date: April 11, 2000 (<http://www.census.gov/popest/archives/1990s/popclockest.txt>).

## Definitions

### *Types of hospitals included in HCUP*

HCUP is based on data from community hospitals, defined as short-term, non-Federal, general and other hospitals, excluding hospital units of other institutions (e.g., prisons). HCUP data include OB-GYN, ENT, orthopedic, cancer, pediatric, public, and academic medical hospitals. They exclude long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals, but these types of discharges are included if they are from community hospitals.

### *Unit of analysis*

The unit of analysis is the hospital discharge (i.e., the hospital stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in one year will be counted each time as a separate "discharge" from the hospital.

### *Costs and charges*

Total hospital charges were converted to costs using HCUP cost-to-charge ratios based on hospital accounting reports from the Centers for Medicare and Medicaid Services (CMS).<sup>2</sup> Costs will tend to reflect the actual costs of production, while charges represent what the hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used because detailed charges are not available across all HCUP States. Hospital charges reflect the amount the hospital charged for the entire hospital stay and does not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundreds.

### *Diagnoses, ICD-9-CM, 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 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 12,000 ICD-9-CM diagnosis codes.

---

<sup>2</sup>HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2003. U.S. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/db/state/costtocharge.jsp](http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp).

CCS categorizes ICD-9-CM diagnoses into 260 clinically meaningful categories.<sup>3</sup> This "clinical grouper" makes it easier to quickly understand patterns of diagnoses and procedures.

#### *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 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 90 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

### 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.

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

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 & Human Services

**California** Office of Statewide Health Planning & Development

**Colorado** Health & Hospital Association

**Connecticut** Integrated Health Information (Chime, Inc.)

**Florida** Agency for Health Care Administration

**Georgia** GHA: An Association of Hospitals & Health Systems

**Hawaii** Health Information Corporation

**Illinois** Health Care Cost Containment Council and Department of Public Health

**Indiana** Hospital & Health Association

**Iowa** Hospital Association

**Kansas** Hospital Association

**Kentucky** Cabinet for Health and Family Services

**Maryland** Health Services Cost Review Commission

**Massachusetts** Division of Health Care Finance and Policy

**Michigan** Health & Hospital Association

**Minnesota** Hospital Association

**Missouri** Hospital Industry Data Institute

**Nebraska** Hospital Association

**Nevada** Division of Health Care Financing and Policy, Department of Human Resources

**New Hampshire** Department of Health & Human Services

**New Jersey** Department of Health & Senior Services

**New York** State Department of Health

---

<sup>3</sup>HCUP Clinical Classifications Software (CCS). Healthcare Cost and Utilization Project (HCUP). August 2006. U.S. Agency for Healthcare Research and Quality, Rockville, MD. [www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp](http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp)

**North Carolina** Department of Health and Human Services  
**Ohio** Hospital Association  
**Oregon** Office for Oregon Health Policy and Research and Oregon Association of Hospitals and Health Systems  
**Rhode Island** Department of Health  
**South Carolina** State Budget & Control Board  
**South Dakota** Association of Healthcare Organizations  
**Tennessee** Hospital Association  
**Texas** Department of State Health Services  
**Utah** Department of Health  
**Vermont** Association of Hospitals and Health Systems  
**Virginia** Health Information  
**Washington** State Department of Health  
**West Virginia** Health Care Authority  
**Wisconsin** Department of Health & Family Services

For additional HCUP statistics, visit HCUPnet, our interactive query system at [www.hcup.ahrq.gov](http://www.hcup.ahrq.gov).

### For More Information

For a detailed description of HCUP and 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.

*Design of the HCUP Nationwide Inpatient Sample, 2004*. Online. August 8, 2006. U.S. Agency for Healthcare Research and Quality. [http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS\\_2004\\_Design\\_Report.pdf](http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS_2004_Design_Report.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 R. L., and 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\\_NISTrendsReport1988-2004.pdf](http://www.hcup-us.ahrq.gov/reports/2006_05_NISTrendsReport1988-2004.pdf)

### Suggested Citation

Russo, C. A. (Thomson Medstat) and Elixhauser, A. (AHRQ). *Hospitalizations for Birth Defects, 2004*. HCUP Statistical Brief #24. January 2007. U.S. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb24.pdf>

\* \* \*

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 [hcp@ahrq.gov](mailto:hcp@ahrq.gov) or send a letter to the address below:

Irene Fraser, Ph.D., Director  
Center for Delivery, Organization, and Markets  
Agency for Healthcare Research and Quality  
540 Gaither Road  
Rockville, MD 20850

**Table 1. Hospitalizations for birth defects compared with hospitalizations for all other conditions, 2004\***

	Hospital stays for birth defect*	All other hospital stays†
Number of hospital stays (percentage of all hospital stays)	139,100 (0.4%)	33,759,500 (99.6%)
Mean length of stay, days	6.3	4.9
Mean hospital cost	\$18,600	\$8,200
Aggregate costs (percentage of total national cost)	\$2.6 billion (0.9%)	\$276.4 billion (99.1%)
Percent male	53.3%	46.5%
Mean age	17.6	49.9
Percent died in hospital	1.3%	2.4%

\*Based on principal diagnosis.

†Excludes stays for obstetrical conditions.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.

**Table 2. Birth defects commonly causing hospitalization, 2004\***

Principal diagnosis	Total number of hospital stays	Percentage of all stays for birth defects	Mean length of stay (days)	Mean costs (dollars)	Aggregate costs (dollars)	Percent male	Mean age	Percent died
<b>All cardiac and circulatory congenital anomalies</b>	46,500	33.5%	8.2	\$29,600	\$1,368,822,600	50.9%	19.8	2.6%
Cerebrovascular anomalies	3,500	2.5%	4.7	\$18,800	65,980,500	50.7%	39.4	1.0%
Tetralogy of fallot	2,500	1.8%	11.4	\$40,100	100,735,900	54.0%	2.7	2.2%
Ventricular septal defect	3,700	2.7%	8.1	\$27,900	104,435,100	50.8%	5.8	1.6%
Atrial septal defect	8,800	6.4%	3.1	\$15,000	132,584,700	40.7%	38.0	0.3%
Patent ductus arteriosus	2,500	1.8%	12.7	\$31,300	77,595,700	39.5%	3.5	1.6%
Coarctation of aorta	2,600	1.9%	8.7	\$29,300	75,468,300	63.0%	6.4	1.2%
<b>All digestive congenital anomalies</b>	25,800	18.5%	6.3	\$11,700	\$303,173,100	67.8%	7.5	0.4%
Pyloric stenosis	12,500	9.0%	2.5	\$4,100	\$51,256,200	80.8%	0.0	0.0%
Rectal and large intestine atresia/stenosis	2,100	1.5%	9.1	\$18,400	\$37,856,000	56.5%	0.6	0.6%
Meckel's diverticulum	2,400	1.7%	6.1	\$11,800	\$28,174,000	70.4%	31.7	0.2%
<b>All genitourinary congenital anomalies</b>	12,900	9.3%	4.1	\$8,900	\$114,709,700	52.0%	23.3	0.3%
Obstructive genitourinary defect	4,100	3.0%	3.3	\$7,400	\$30,548,200	59.4%	14.0	0.0%
Polycystic kidney	2,700	2.0%	4.8	\$11,900	\$32,434,300	51.7%	44.6	0.4%
<b>All nervous system congenital anomalies</b>	6,900	5.0%	7.5	\$16,200	\$112,164,200	44.8%	15.2	1.8%
<b>All other congenital anomalies</b>	47,000	33.8%	5.0	\$14,400	\$667,198,000	49.1%	19.8	0.7%
Cleft palate without cleft lip	2,900	2.1%	2.1	\$5,400	\$15,506,700	49.8%	2.4	0.0%
Congenital hip deformity	2,200	1.5%	3.6	\$12,500	\$26,930,200	28.6%	27.4	0.0%
Congenital anomalies of skull and facial bones	3,700	2.6%	5.5	\$16,800	\$61,329,500	60.9%	3.8	0.3%
Spondylolisthesis	8,000	5.7%	4.1	\$18,800	\$149,954,500	38.7%	56.3	0.0%
Cleft lip with or without cleft palate	4,900	3.6%	1.9	\$5,500	\$27,155,800	59.4%	4.2	0.1%
Pectus excavatum	1,700	1.2%	4.4	\$9,900	\$16,621,600	79.1%	14.8	0.0%
Congenital anomalies of larynx, trachea and bronchus	2,300	1.7%	7.5	\$13,900	\$32,646,500	58.5%	3.9	0.2%
Foot deformities	2,900	2.1%	1.8	\$5,900	\$16,873,900	56.0%	11.6	0.0%
<b>All birth defects</b>	139,100	100.0%	6.3	\$18,600	\$2,566,067,700	53.3%	17.6	1.3%

\*Based on principal diagnosis. Birth defects with less than 2,000 hospitalizations are not shown.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.

**Table 3. Birth defects commonly noted during hospitalization, 2004\***

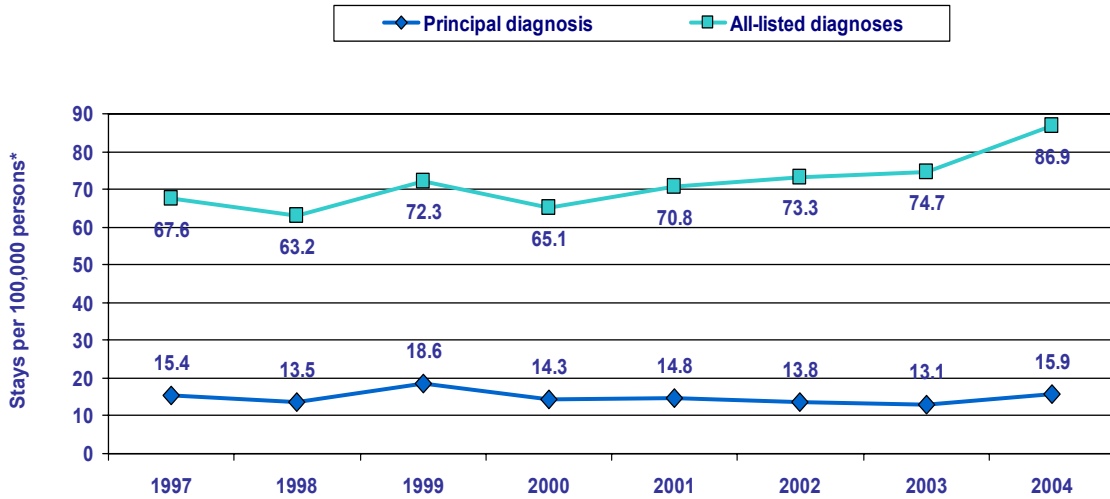
Rank	All-listed diagnoses	Total number of hospital stays
1	Atrial septal defect	86,300
2	Patent ductus arteriosus	59,500
3	Congenital pigmentary anomalies of skin	40,900
4	Ventricular septal defect	40,000
5	Down's syndrome	38,000
6	Spina bifida	28,300
7	Polycystic kidney	27,300
8	Spondylolisthesis	23,200
9	Undescended testicle	20,900
10	Obstructive genitourinary defect	20,100
11	Hypospadias and epispadias	18,100
12	Congenital anomalies of skull and facial bones	17,500
13	Foot deformities	16,700
14	Polydactyly (extra digits) and syndactyly (webbing between digits)	16,100
15	Pulmonary artery anomalies	15,700
16	Congenital hydrocephalus	13,300
17	Congenital insufficiency of aortic valve	13,200
18	Pyloric stenosis	13,200
19	Congenital anomalies of larynx, trachea and bronchus	12,900
20	Persistent fetal circulation	12,400

\*Based on all-listed diagnoses.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.



**Figure 1. Hospitalization rates for cardiac and circulatory congenital anomalies, 1997–2004**

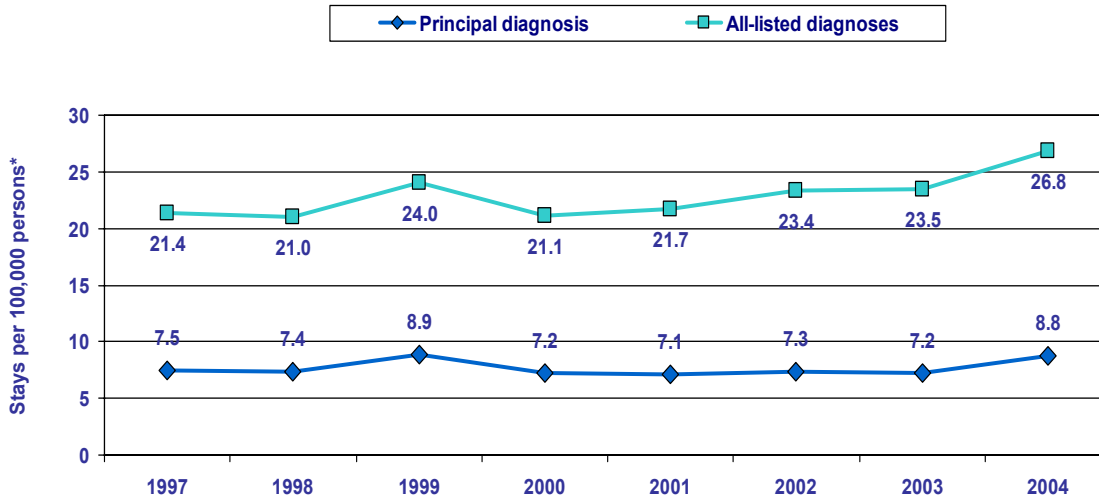


\*U.S. Census Bureau, Population Division, Census 1997–2004.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997–2004.



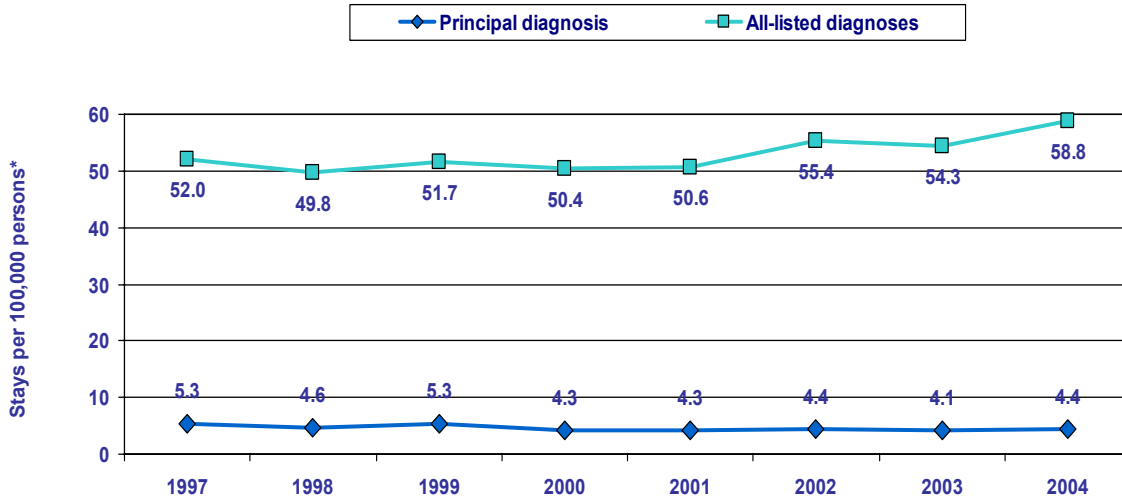
**Figure 2. Hospitalization rates for digestive congenital anomalies, 1997–2004**



\*U.S. Census Bureau, Population Division, Census 1997–2004.  
 Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997–2004.



**Figure 3. Hospitalization rates for genitourinary congenital anomalies, 1997–2004**

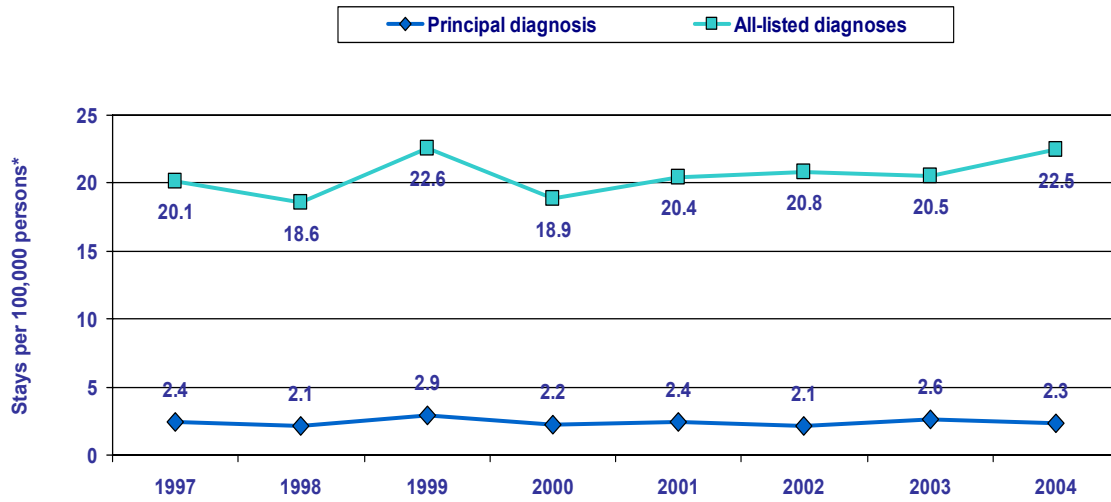


\*U.S. Census Bureau, Population Division, Census 1997–2004.  
 Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997–2004.





**Figure 4. Hospitalization rates for nervous system congenital anomalies, 1997–2004**



\*U.S. Census Bureau, Population Division, Census 1997–2004.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997–2004.