

## STATISTICAL BRIEF #36

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# Trends in Potentially Preventable Hospitalizations among Adults and Children, 1997-2004

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### Introduction

Because of major concerns with both the cost and quality of health care, a priority of policy makers and health care providers is to identify areas where quality improvement and lower costs coincide. Potentially preventable admissions—inpatient stays that could be prevented with high quality primary and preventive care—are one area where higher quality care can cost less. Higher rates of these “preventable hospitalizations” identify areas where potential improvements in the health care delivery system could be made to improve patient outcomes and decrease costs. Changes in these rates over time may signal an improvement or worsening in the quality of ambulatory care, in access to timely and effective treatment of certain conditions for specific populations, or in patient adoption of healthy behaviors.

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on changes in the rates of potentially preventable hospitalizations. The Agency for Healthcare Research and Quality (AHRQ)’s Prevention Quality Indicators (PQIs) are used to develop hospitalization rates<sup>1</sup> for selected chronic and acute conditions in adults and children for 1997, 2000, and 2004. This brief also evaluates trends in total hospital costs associated with these potentially preventable hospitalizations. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

### Findings

In 2004, approximately 4.4 million hospitalizations for potentially preventable conditions totaled about \$29 billion in hospital costs—10 percent of total hospital expenditures. Overall, total hospital costs for potentially preventable admissions increased by 31 percent between 1997 and 2004 (from \$22.0 billion to \$28.9 billion), while the number of admissions increased by only 3 percent (from 4.2 million stays to 4.4 million stays). Figures 1 and 2 demonstrate that total hospital costs increased for preventable admissions

<sup>1</sup>Rates are adjusted by age and gender using the total U.S. population for 2000 as the standard population.

### Highlights

- In 2004, hospital costs for potentially preventable conditions totaled nearly \$29 billion—one out of every 10 dollars of total hospital expenditures. As many as 4.4 million hospital stays could possibly be prevented with better ambulatory care, improved access to effective treatment, or patient adoption of healthy behaviors.
- From 1997 to 2004, total hospital costs for potentially preventable admissions increased by 31 percent (adjusted for inflation), while the number of admissions rose by only 3 percent.
- Costs increased for preventable admissions related to diabetes (44 percent), circulatory diseases (26 percent), chronic respiratory diseases (16 percent), and acute conditions (38 percent), even though admissions declined from 1997 to 2004.
- Admission rates for congestive heart failure, chronic obstructive pulmonary disease, and dehydration among adults declined between 1997 and 2004, but the total costs associated with these stays increased, suggesting more complex cases or greater intensity of treatment.
- Despite stable hospitalization rates for diabetes-related amputations, asthma, and bacterial pneumonia in adults, total hospital costs for these admissions increased by 30 percent or more. A similar pattern was seen for short-term diabetes complications in children.
- The admission rate for hypertension increased by 20 percent; however, the total hospital costs for this condition rose by almost 90 percent.
- Total hospital costs for short-term diabetes complications and urinary tract infections in adults rose by more than 50 percent.

related to diabetes, circulatory diseases, chronic respiratory diseases, and acute conditions, even in instances where the number of admissions declined between 1997 and 2004.<sup>2</sup>

#### *Changes in preventable hospitalizations among adults for diabetes*

Changes in hospitalization rates among adults for diabetes and its associated complications varied between 1997 and 2004 (table 1). Rates for uncontrolled diabetes without complications decreased by more than 30 percent between 1997 and 2004. In contrast, hospitalization rates for short-term diabetes complications (i.e., diabetic ketoacidosis, hyperosmolarity, and coma) increased from 46.0 to 55.2 admissions per 100,000 adults during the same period. Similarly, admission rates for long-term diabetes complications (i.e., renal, visual, neurological, and circulatory disorders) increased from 111.8 to 124.9 admissions per 100,000 adults. The rate of hospitalizations involving diabetes-related lower extremity amputations declined between 2000 and 2004 (from 41.8 to 38.3 admissions per 100,000 adults).

Table 2 shows that total hospital costs (controlling for inflation) associated with short-term diabetes complications increased by nearly 60 percent (from \$482 million to \$764 million), while total hospital costs for long-term diabetes complications increased by close to 50 percent (from \$1,778 million to \$2,617 million). Between 1997 and 2004, the total hospital costs associated with diabetes-related lower extremity amputations increased by almost 30 percent (from \$1,193 million to \$1,545 million).

#### *Changes in preventable hospitalizations among adults for circulatory diseases*

Between 1997 and 2004, hospitalization rates and total hospital costs for potentially preventable stays related to specific circulatory diseases in adults also varied (tables 1 and 2). For hypertension, the hospitalization rate increased by 20 percent, and the total hospital costs rose by almost 90 percent (from \$270 million to \$509 million). In contrast, the admission rates for angina without procedure decreased by more than 60 percent, and the total hospital costs decreased by over 40 percent (from \$772 million to \$435 million). Although the hospitalization rate for congestive heart failure decreased (from 536.5 to 476.4 admissions per 100,000 adults), the total hospital costs associated with these stays increased by more than 30 percent, from \$6,206 million in 1997 to \$8,281 million in 2004, suggesting more complex cases or greater intensity of treatment.

#### *Changes in preventable hospitalizations among adults for respiratory diseases*

The hospitalization rate among adults for asthma remained relatively stable between 1997 and 2004, while the hospitalization rate for chronic obstructive pulmonary disease (COPD) decreased from 266.8 admissions per 100,000 adults in 1997 to 226.9 admissions per 100,000 adults in 2004 (table 1). Total hospital costs remained relatively stable for asthma between 1997 and 2000; however, these costs increased by nearly a third between 2000 and 2004 (from \$1,081 million to \$1,423 million). Hospital costs for COPD increased from 1997 to 2000 (from \$3,029 million to \$3,627 million), declined between 2000 and 2004 (from \$3,627 million to \$3,362), yet still resulted in an overall upward trend from 1997 to 2004.

#### *Changes in preventable hospitalizations among adults for acute conditions*

Changes in hospitalization rates for potentially preventable stays among adults related to bacterial pneumonia, dehydration, and urinary tract infections varied widely between 1997 and 2004 (table 1). The rate for bacterial pneumonia in 2004 was not significantly different from 1997, remaining around 400 admissions per 100,000 adults; however, these rates increased between 1997 and 2000, then decreased between 2000 and 2004. The hospitalization rate for dehydration declined from 136.9 admissions per 100,000 adults in 1997 to 124.6 admissions per 100,000 adults in 2004. In contrast, the rate of hospitalization for urinary tract infections rose from 159.0 admissions per 100,000 adults in 1997 to 174.9 admissions per 100,000 adults in 2004.

Despite these mixed trends, the total hospital costs for all three of these acute conditions increased during the same time period. Between 1997 and 2004, total hospital costs rose by over 50 percent for urinary tract infections (from \$1,365 million to \$2,090 million), and by nearly 40 percent for bacterial pneumonia (from \$5,089 million to \$7,050 million). The total hospital costs associated with dehydration also increased by almost 30 percent (from \$1,120 million to \$1,436 million).

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<sup>2</sup>Total number of stays and total hospital costs for diabetes include 1) uncontrolled diabetes without complications, 2) short-term diabetes complications, and 3) long-term diabetes complications. Diabetes-related lower extremity amputations are excluded from these totals because of potential double-counting of records with long-term diabetes complications.

### *Changes in preventable hospitalizations among children for select conditions*

Overall, the rates of hospitalization as well as the number of admissions for potentially preventable hospitalizations among children decreased or remained stable from 1997 to 2004 (table 1). The hospitalization rate for pediatric asthma decreased by over 20 percent between 1997 and 2000 (from 206.9 to 163.2 admissions per 100,000 children), then remained stable between 2000 and 2004. Similarly, the admission rate for pediatric gastroenteritis also declined from 201.1 admissions per 100,000 children in 1997 to 172.8 admissions per 100,000 children in 2000, but the overall change in admission rates between 1997 and 2004 was not significantly different. There were no significant changes in the hospitalization rates among children for short-term diabetes complications or for urinary tract infections from 1997 to 2004.

Despite no significant changes in the rate and number of hospitalizations for short-term diabetes complications among children, the total hospital costs for these conditions rose by more than 50 percent between 1997 and 2004 (from \$40 million to \$61 million) (table 2). Similarly, the total hospital costs for pediatric gastroenteritis and for urinary tract infections also increased during the same time period (from \$219 million to \$241 million and from \$86 million to \$109 million, respectively). The total hospital costs for pediatric asthma remained around \$330 million in both 1997 and 2004, even though the admission rate and number of hospitalizations declined.

### **Data Source**

The estimates in this Statistical Brief are based upon data from the HCUP 2004 Nationwide Inpatient Sample (NIS). Historical data were drawn from the 1997 and 2000 NIS. The population bases for rates were obtained from Claritas, a vendor that compiles data from the U.S. Census Bureau (Claritas, Inc., 2002).

### **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.

#### *Prevention Quality Indicators*

The Prevention Quality Indicators (PQIs) are part of a set of AHRQ Quality Indicators (QIs) developed by investigators at Stanford University and the University of California under a contract with AHRQ. The PQIs are a set of measures that can be used with hospital inpatient discharge data to identify quality of care for "ambulatory care-sensitive conditions." These are conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease. PQI rates can also be affected by other factors, such as disease prevalence.

Further information on the AHRQ QIs, including documentation and free software downloads, is available at <http://www.qualityindicators.ahrq.gov/index.htm>. This Web site includes information on the new version of the PQIs, Version 3.1. It also includes information on the new Pediatric Quality Indicators (PDIs), which includes the hospital admission rate measures for pediatric asthma and pediatric gastroenteritis.

#### *Costs and charges*

Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare and Medicaid Services (CMS).<sup>3</sup> Costs will tend to reflect

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<sup>3</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)

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 adjusted to 2004 dollars using the overall Consumer Price Index and reported to the nearest million.

#### *Diagnoses and ICD-9-CM*

PQI admission rates are based on principal diagnosis for all measures except diabetes-related lower-extremity amputations. For this PQI, counts are included in the numerator if the condition of interest is indicated in any diagnosis field. 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.

#### *Populations for calculating admission rates*

The populations used to calculate admission rates vary by type of condition. PQIs for adult diabetes, circulatory diseases, chronic respiratory diseases, and acute diseases include individuals 18 years and older. Pediatric short-term diabetes complications include children between 6 and 17 years of age; pediatric asthma includes children between 2 and 17 years of age; and pediatric gastroenteritis and bacterial pneumonia include children ages 4 months to 17 years. Denominator populations for all PQIs in this brief are derived from year-specific U.S. population data. All PQIs are adjusted for age and gender using the total U.S. population for the year 2000 as the standard population

### **About the NIS**

The HCUP Nationwide Inpatient Sample (NIS) is a nationwide database of hospital inpatient stays. The NIS is nationally representative of all community hospitals (i.e., short-term, non-Federal, non-rehabilitation hospitals). The NIS is a sample of hospitals and includes all patients from each hospital, regardless of payer. It is drawn from a sampling frame that contains hospitals comprising about 90 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

### **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  
**North Carolina** Department of Health and Human Services  
**Ohio** Hospital Association  
**Oklahoma** Health Care Information Center for Health Statistics  
**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., Elixhauser, A. *Using the HCUP Nationwide Inpatient Sample to Estimate Trends*. (Updated for 1988-2004). HCUP Methods Series Report #2006-05 Online. August 18, 2006. U.S. Agency for Healthcare Research and Quality. [http://www.hcup-us.ahrq.gov/reports/2006\\_05\\_NISTrendsReport\\_1988-2004.pdf](http://www.hcup-us.ahrq.gov/reports/2006_05_NISTrendsReport_1988-2004.pdf)

For more information on the AHRQ Quality Indicators and preventable hospitalizations, see the following publications:

*AHRQ Quality Indicators—Guide to Prevention Quality Indicators: Hospital Admissions for Ambulatory Care Sensitive Conditions*. Online. March 12, 2007. U.S. Agency for Healthcare Research and Quality [http://www.qualityindicators.ahrq.gov/downloads/pqi/pqi\\_guide\\_v31.pdf](http://www.qualityindicators.ahrq.gov/downloads/pqi/pqi_guide_v31.pdf)

Kruzikas D. T., Jiang H. J., Remus D., et al. *Preventable Hospitalizations. Window Into Primary and Preventive Care, 2000*. HCUP Fact Book No. 5. Online. September 2004. U.S. Agency for Healthcare Research and Quality. <http://www.ahrq.gov/data/hcup/factbk5/factbk5.pdf>

### **Suggested Citation**

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at [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. Hospitalization rates for preventable conditions, 1997, 2000, and 2004**

Preventable conditions	Number of admissions per 100,000 population			Comparison between 1997-2004 (percent change)*
	1997	2000	2004	
<b>Adults</b>				
<i>Diabetes</i>				
Uncontrolled diabetes without complications	32.5	28.5	22.0	↓ (32.1%)
Short-term diabetes complications	46.0	51.2	55.2	↑ (19.9%)
Long-term diabetes complications	111.8	120.8	124.9	↑ (11.7%)
Diabetes-related lower extremity amputations	40.9	41.8	38.3	NS
<i>Circulatory Diseases</i>				
Angina without procedure	115.2	77.4	45.0	↓ (61.0%)
Congestive heart failure	536.5	510.0	476.4	↓ (11.2%)
Hypertension	40.8	45.1	49.0	↑ (20.0%)
<i>Chronic Respiratory Diseases</i>				
Asthma	124.5	113.3	120.0	NS
Chronic obstructive pulmonary disease	266.8	279.6	226.9	↓ (15.0%)
<i>Acute Conditions</i>				
Bacterial pneumonia	399.2	444.6	408.9	NS
Dehydration	136.9	140.5	124.6	↓ (9.0%)
Urinary tract infection	159.0	163.0	174.9	↑ (10.0%)
<b>Children</b>				
Short-term diabetes complications (age 6 years to 17 years)	27.6	26.3	31.5	NS
Pediatric asthma (age 2 years to 17 years)	206.9	163.2	155.5	↓ (24.8%)
Pediatric gastroenteritis (age 4 months to 17 years)	201.1	172.8	178.7	NS
Urinary tract infection (age 4 months to 17 years)	47.3	50.3	48.9	NS

\*Significant at  $p \leq 0.05$ ; "NS" indicates non-significant changes.

Source: AHRQ, Center for Delivery, Organization, and Markets. Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997, 2000, and 2004.

**Table 2. Total hospital costs for preventable conditions, 1997, 2000, and 2004**

Preventable conditions	Total hospital costs* (in millions)			Comparison between 1997-2004 (percent change) <sup>†</sup>
	1997	2000	2004	
<b>Adults</b>				
<i>Diabetes</i>				
Uncontrolled diabetes without complications	\$191	\$204	\$201	NS
Short-term diabetes complications	\$482	\$647	\$764	↑ (58.5%)
Long-term diabetes complications	\$1,778	\$2,207	\$2,617	↑ (47.2%)
Diabetes-related lower extremity amputations	\$1,193	\$1,412	\$1,545	↑ (29.5%)
<i>Circulatory Diseases</i>				
Angina without procedure	\$772	\$614	\$435	↓ (43.7%)
Congestive heart failure	\$6,206	\$7,098	\$8,281	↑ (33.4%)
Hypertension	\$270	\$372	\$509	↑ (88.4%)
<i>Chronic Respiratory Diseases</i>				
Asthma	\$1,011	\$1,081	\$1,423	↑ (40.7%)
Chronic obstructive pulmonary disease	\$3,029	\$3,627	\$3,362	↑ (11.0%)
<i>Acute Conditions</i>				
Bacterial pneumonia	\$5,089	\$6,630	\$7,050	↑ (38.5%)
Dehydration	\$1,120	\$1,380	\$1,436	↑ (28.2%)
Urinary tract infection	\$1,365	\$1,671	\$2,090	↑ (53.1%)
<b>Children</b>				
Short-term diabetes complications (age 6 years to 17 years)	\$40	\$46	\$61	↑ (52.5%)
Pediatric asthma (age 2 years to 17 years)	\$330	\$302	\$326	NS
Pediatric gastroenteritis (age 4 months to 17 years)	\$219	\$217	\$241	↑ (10.0%)
Urinary tract infection (age 4 months to 17 years)	\$86	\$104	\$109	↑ (26.7%)

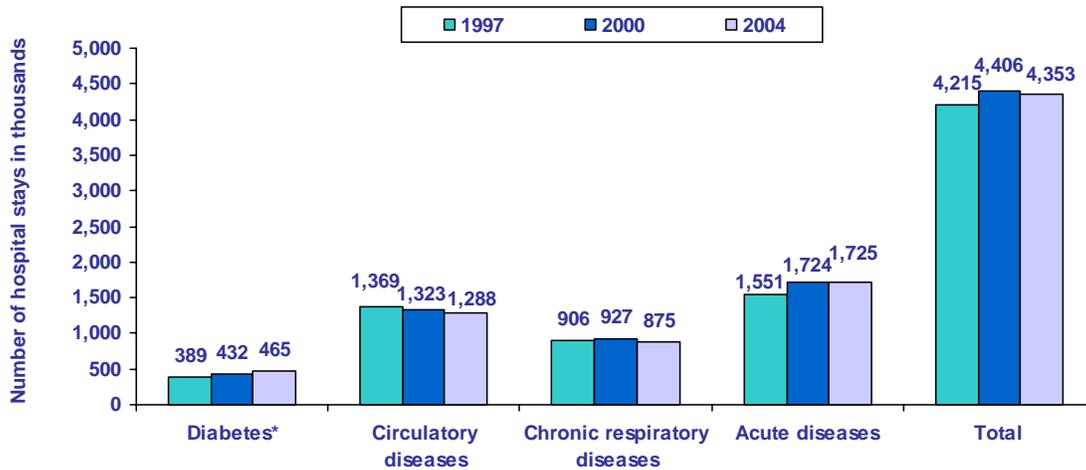
\*All costs are adjusted to 2004 dollars using the overall Consumer Price Index.

<sup>†</sup>Significant at  $p \leq 0.05$ ; "NS" indicates non-significant changes.

Source: AHRQ, Center for Delivery, Organization, and Markets. Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997, 2000, and 2004.



**Figure 1. Trends of total hospital stays for potentially preventable conditions, 1997-2004**

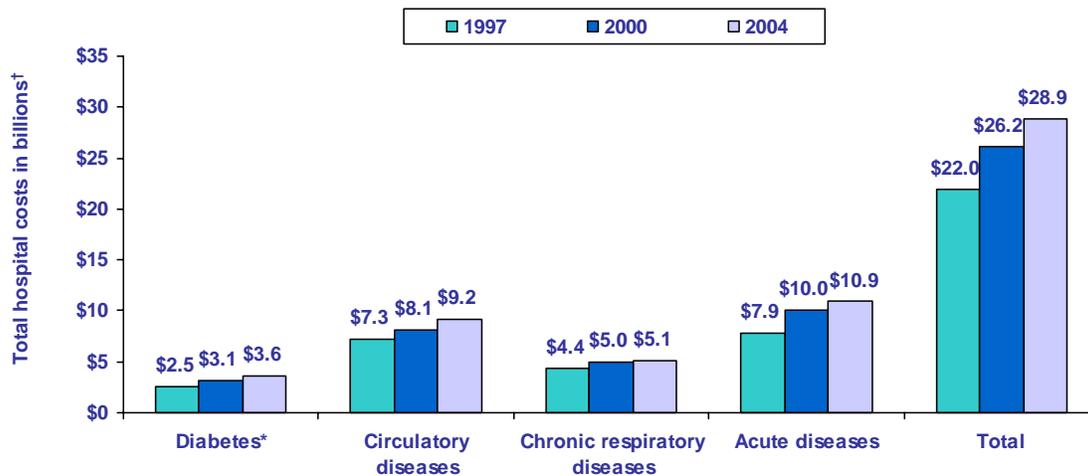


\*The diabetes category includes hospital stays for uncontrolled diabetes without complications, short-term diabetes complications, and long-term diabetes complications.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997, 2000, and 2004.



**Figure 2. Trends of total hospital costs for potentially preventable conditions, 1997-2004**



\*The diabetes category includes hospital stays for uncontrolled diabetes without complications, short-term diabetes complications, and long-term diabetes complications.

†All costs are adjusted to 2004 dollars using the overall Consumer Price Index.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997, 2000, and 2004.