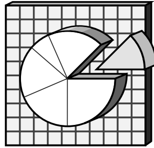

Health By Numbers

RHODE ISLAND DEPARTMENT OF HEALTH • DAVID GIFFORD, MD, MPH, DIRECTOR OF HEALTH

EDITED BY JAY S. BUECHNER, PHD

Hospitalizations and Associated Costs for Principal versus Additional Diagnoses of Asthma: Implications for Monitoring Children's Health

Deborah N. Pearlman, PhD, Nancy Sutton, RD, MS, Sze Liu, MPH, Janice Fontes, MS, and Jay S. Buechner, PhD

Asthma is the most common chronic disease of childhood in the **United States** (**US**).[1] Much of the health care cost of asthma is for treatment in the hospital. Hospitalizations for pediatric asthma increased in the US over the past decade, but recently plateaued at historically high levels.[2] In 2004, pediatric asthma hospitalizations in the US were responsible for $330 million in incurred charges.[3]

Surveillance of pediatric asthma hospitalization rates is essential to track trends over time, to identify children likely to be hospitalized due to asthma, and to quantify the burden of disease borne by population subgroups, in particular, children residing in poverty areas. Much of our knowledge about hospitalizations for childhood asthma comes from studies that define an asthma hospitalization as one with a principal diagnosis of asthma. A retrospective study of 2003 National Hospital Discharge Survey data found that 75% of all admissions for childhood asthma were assigned a principal discharge diagnosis of asthma.[4] Of the remaining asthma discharges, most were assigned a principal diagnosis of respiratory illness and an additional diagnosis of asthma.[4] This report explores the implications of using different case definitions of asthma-related hospitalizations, focusing on average length of stay and hospital charges in analyses stratified by neighborhood poverty.

METHODS

Under licensure regulations, acute-care hospitals in Rhode Island have reported to the Department of Health's Center for Health Data and Analysis a defined set of data (demographic and clinical) on each inpatient discharge beginning January 1, 1989. This analysis covers inpatient discharges ages 0 – 17 years occurring January 1, 2001 – December 31, 2005. Rate estimates were not adjusted for repeated hospital admissions of the same child during this period.

Two mutually exclusive groups of pediatric asthma discharges were established: (1) all discharges with a principal diagnosis of asthma (ICD-9-CM diagnosis code 493), and (2) discharges with a principal diagnosis of a respiratory illness (ICD-9-CM codes 460 through 496) plus an additional (secondary or tertiary) diagnosis of asthma.

Patient characteristics included: age (0 to 4, 5- 11, 12-17), sex (male vs. female), race and ethnicity (black, Hispanic, white, other race), type of health coverage (public, including RIte Care and fee-for-service Medicaid, commercial/other self-pay), and census tract of residence, (poverty or non-poverty). Records of hospital admissions (2001-2005) were matched with census tract level variables from the US Census 2000 Summary File 3 (SF 3) – Sample Data.[5] A poverty census tract was defined as a census tract where 20% or more of the residents live at or below the federal poverty level, as determined in the 2000 US Census.[6]

Rates per 10,000 children aged 0 to 17 years were calculated using Rhode Island population for the years 2001-2005 from the US Census Bureau.[7] Analyses of hospital charges and length of stay were stratified by poverty and non-poverty census tracts. To calculate changes in rates over time, the baseline rate was subtracted from the rate in a subsequent year, and the difference was divided by the baseline rate and expressed as a percentage.

Table 1.
Hospital inpatient discharges with a diagnosis of asthma, by position of asthma diagnosis and selected patient characteristics, ages 0 – 17, Rhode Island, 2001 –2005.

Characteristic		Position of Asthma Diagnosis	
		Principal N (%)	Additional* N (%)
Age	0 to 4 years	1645 (62.5)	769 (78.5)
	5 to 11 years	668 (25.4)	156 (15.9)
	12 to 17 years	320 (12.1)	55 (5.6)
Sex	Male	1616 (61.4)	569 (58.1)
	Female	1017 (38.6)	411 (41.9)
Race	Black	315 (13.1)	95 (10.8)
	Hispanic	534 (22.3)	190 (21.6)
	White	1551 (64.6)	595 (67.6)
Payer type	Medicaid/RIte Care	1363 (51.9)	492 (50.7)
	Commercial/Other	1211 (46.1)	464 (47.8)
	Self-pay	51 (2.0)	14 (1.5)
Census tract of residence	Poverty	954 (41.4)	325 (38.9)
	Non-poverty	1351 (58.6)	510 (61.1)
Total discharges**		2633 (100.0)	980 (100.0)

*Discharges with a principal diagnosis of respiratory illness only.
**Items may not add to totals due to missing data.

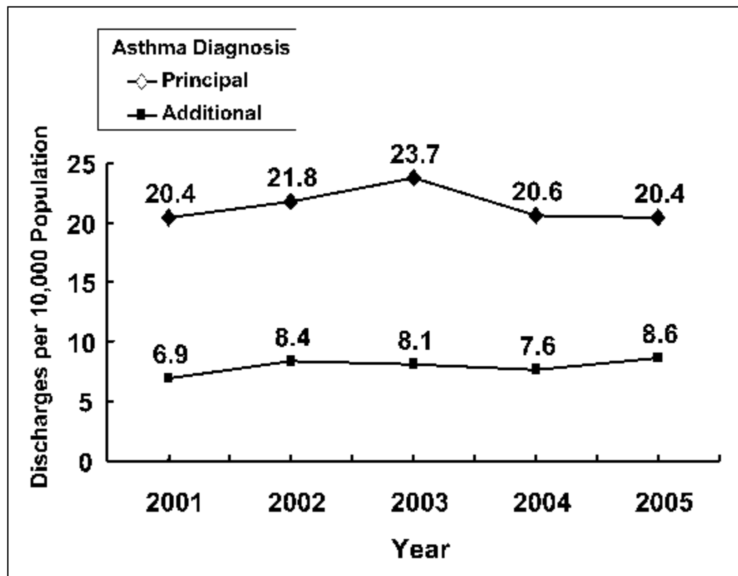

Figure 1. Hospital inpatient discharges with a diagnosis of asthma per 10,000 population, by position of asthma diagnosis and year of discharge, ages 0 – 17, Rhode Island, 2001 –2005.

Table 2.
Mean total charges and mean length of stay for hospital inpatient discharges with a diagnosis of asthma, by position of asthma diagnosis and poverty / non-poverty census tract of patient residence, ages 0 – 17, Rhode Island, 2001 –2005.

Position of Asthma Diagnosis / Measure	All census tracts	Poverty census tracts	Non-poverty census tracts
Principal			
Mean total charges	$19,427	$25,065	$14,579
Mean length of stay	6.0 days	7.4 days	4.9 days
Additional*			
Mean total charges	$23,045	$23,713	$22,369
Mean length of stay	7.4 days	7.8 days	7.3 days

*Discharges with a principal diagnosis of respiratory illness only.

Results

Over the period 2001-2005, there were 2,633 pediatric discharges with a principal diagnosis of asthma, and 980 discharges with a principal diagnosis of respiratory illness and an additional diagnosis of asthma. (Table 1) Children in both groups were more likely to be younger than age five, boys, non-Hispanic white, and live in non-poverty census tracts. Children hospitalized for a respiratory illness with asthma as an additional diagnosis were also significantly more likely to be younger than age five than children with a principal diagnosis of asthma. For both groups, slight majorities were enrolled in publicly-funded insurance. Nearly all had coverage to pay for their care.

Between 2001 and 2003, the rate of discharges per 10,000 children where asthma was the principal diagnosis increased by 16%, then declined in 2004 and 2005, returning to the same level as in 2001. (Figure 1) The rate for discharges where respiratory illnesses were the principal diagnosis and asthma an additional diagnosis increased by 25% between 2001 and 2005.

The average total charge for a pediatric asthma hospitalization with a principal diagnosis of asthma during 2001-2005 was $19,427, with a mean length of stay of 6.0 days. (Table 2) For hospitalizations with a principal diagnosis of respiratory illness and an additional diagnosis of asthma, average charges ($23,045) and length of stay (7.4 days) were both significantly higher than the average charges and length of stay when asthma was the principal diagnosis. Average charges and length of stay for a hospitalization with a principal diagnosis of asthma were significantly higher for children living in poverty neighborhoods ($25,065 and 7.4 days, respectively), than for children in non-poor communities ($14,579 and 4.9 days, respectively).

Discussion

Ongoing surveillance of childhood asthma is necessary to understand changes and patterns in prevalence and to evaluate the impact of practice guidelines and interventions. One impediment to pediatric asthma surveillance is the lack of a "gold standard" definition for hospitalization for childhood asthma. In this analysis, the addition of pediatric hospital discharges with a principal diagnosis of respiratory disease and an additional diagnosis of asthma increased the number of discharges by 37% over the number of discharges with a principal diagnosis of asthma. Furthermore, the age distribution, mean total charges, and mean length of stay for the additional hospitalizations differed significantly from the corresponding measures for hospitalizations with a principal diagnosis of asthma. Most surveillance systems for pediatric asthma in the US capture only hospitalizations with a principal diagnosis of asthma. The findings from this report suggest that asthma surveillance systems designed to inform community- and clinical-based initiatives to decrease hospitalizations for childhood asthma should consider tracking discharges where respiratory illnesses are the principal diagnosis and asthma is the secondary or tertiary diagnosis.

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Disclosure of Financial Interests

The authors have no financial interests to disclose.

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