

# Disparities by Race/Ethnicity and Sex: Asthma Hospitalizations and Emergency Department Visit Rates In Rhode Island and Healthy People 2010 Goals

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In this issue *Health by Numbers* explores asthma hospitalizations and emergency department (ED) visit rates in relation to Healthy People 2010 (HP2010) goals.<sup>1</sup>

Two HP2010 objectives for asthma are specific to hospitalizations and ED visits. Objective 24-2 sets the following targets for asthma hospitalizations by age group: (1) an age-specific rate of 25 per 10,000 children under age 5 years, (2) an age-standardized rate of 7.7 per 10,000 children and adults aged 5-64 years, and (3) an age-standardized rate of 11 per 10,000 adults ages 65 years and older. Objective 24-3 seeks to lower asthma-related ED visits from an age-specific rate of 150.0 per 10,000 in 1998 to 80 per 10,000 among children under the age of 5 in 2010; from an age-standardized rate of 71.1 per 10,000 in 1998 to 50 per 10,000 for children and adults aged 5-64 years in 2010; and from an age-standardized rate of 29.5 per 10,000 in 1998 to 15 per 10,000 among adults aged 65 and older in 2010.

National hospitalization and ED visit rates for asthma vary by population subgroups. Asthma-related hospitalizations are 2 times greater in the 65+ age group compared to the those aged 18 to 44.<sup>2</sup> Hispanic adults have asthma hospitalization rates twice that of non-Hispanic white adults<sup>3</sup> and African Americans are three times more likely to be hospitalized for asthma than their non-Hispanic white peers.<sup>4</sup> There are also sex disparities in asthma prevalence by age, as reflected in national hospitalization and ED visit rates.<sup>5</sup>

This article examines whether progress toward RI's HP2010 targets for asthma-related hospitalizations and ED visit varied by patients' age, sex, race/ethnicity, and neighborhood-level poverty.

## METHODS

For hospitalization analyses, all inpatient hospitalizations were selected from the 2000 to 2008 Rhode Island Hospitalization Discharge Data. ED visit

data came from the 2005 to 2008 Rhode Island Emergency Department Data. Contained within these two datasets are de-identified health record level details on patient demographics, diagnoses, procedures, discharge status, residence location by census tract, and charges for every ED visit and hospitalization in Rhode Island to a non-federal hospital facility. These data sets represent the number of in-patient hospitalizations and ED visits for asthma, not the number of individual people hospitalized for asthma.

Asthma hospitalizations and ED visits were defined as a principal diagnosis using ICD-9-CM diagnosis code 493 (ICD-9-CM codes 493.XX). Only data on hospital discharges and ED visits for Rhode Island residents receiving treatment in one of Rhode Island's 11 acute care hospitals were included; out-of-state patients hospitalized for asthma in a Rhode Island hospital were excluded. This paper followed the HP2010 convention of calculating age-specific rates for children aged 0-4 and age-adjusted rates for those aged 5-64 and 65+ in order to compare

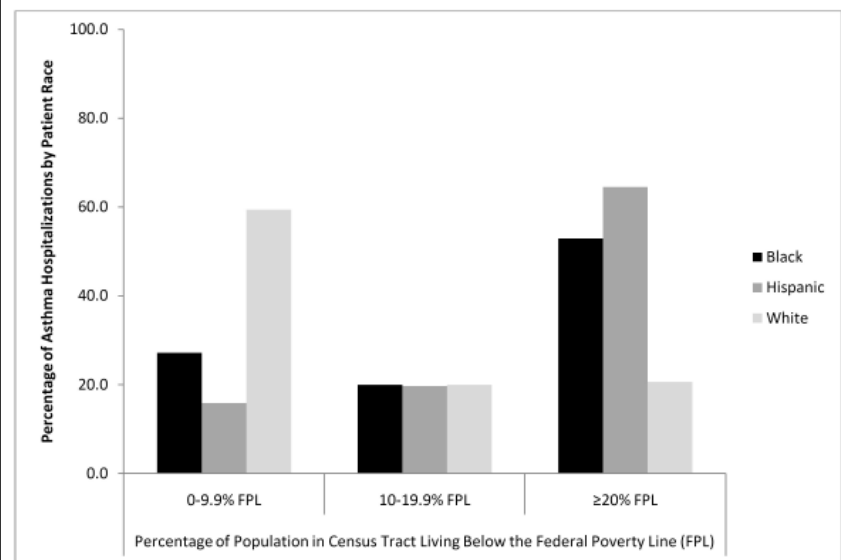
Rhode Island data with HP2010 targets. The age-specific rates of hospitalization and ED visits were multiplied by age-specific weights to calculate the age-adjusted rates. The proportion of the 2000 US population within each age group (e.g., ages 5-64 and ages 65+) were the weights used in the age-adjustment of asthma data. The weighted rates were then summed across the age groups to give the age-adjusted rate.<sup>6</sup> Because of small number issues, three-year aggregated data are presented for asthma hospitalizations and two-year aggregated data for ED visits for asthma when rates were stratified by sex and race/ethnicity within age groups. Rates based on 30 to 50 events in the numerator are considered statistically unreliable and are shown as shaded numbers. Rates based on < 30 events in the numerator are not presented.

## RESULTS

### Asthma Hospitalizations (2000-2008)

Over a nine-year period (2000 - 2008), women had consistently higher

Figure 1. Percentage of Hospitalizations by Neighborhood-Level Poverty and Race/Ethnicity, RI Hospital Discharge Data, 2008



hospitalization rates compared to men. (Table 1) However, when stratifying data by sex and age, the highest asthma hospitalization rates were found for boys aged 0-4. For boys younger than age 5, the asthma hospitalization rate ranged from an average 52.6 per 10,000 population between 2000-2002 to 57.7 per 10,000 population in 2006-2008. This sex and age disparity was reversed in the oldest

age group. Between 2000 and 2008, women 65 and older had two to three times greater age-adjusted hospitalization rates compared to men 65 and older. In this same time period, the age-adjusted rate for men 65+ was at or below the *HP2010* target.

Asthma hospitalization rates indicate persistent disparities among racial and ethnic groups. Across all time periods, non-

Hispanic blacks under age 65 had hospitalization rates two to more than three times that of non-Hispanic whites younger than age 65. In 2006-2008, for example, the asthma hospitalization rate for non-Hispanic black children aged 0-4 was 89.5 per 10,000 population, but only 38.4 for non-Hispanic white children under age 5. For the population aged 5-64, the asthma hospitalization rate for non-Hispanic blacks was 30.4 per 10,000 population, but was only 8.3 per 10,000 population for non-Hispanic whites. (Table 1) Between 2000 and 2008, asthma hospitalization rates for Hispanics were approximately 1.5 to 2.0 times the rate of non-Hispanic whites. In fact, Hispanics 65 and older had the highest age-adjusted asthma hospitalization rates among their white and black peers (2006-2008: Hispanics—55.9 per 10,000; non-Hispanic blacks—36.6 per 10,000; non-Hispanic whites—18.9 per 10,000). Only hospital discharges for asthma among non-Hispanic whites aged 5-64 were close to *HP2010* targets as measured in the period from 2006-2008.

### Emergency Department (ED) Visits for Asthma (2005-2008)

Over the four-year period from 2005-2008, ED visit rates for asthma were four to five times and nearly three times greater for non-Hispanic blacks and Hispanics, respectively, than those for non-Hispanic whites, in which there were only 38.2 ED visits for asthma per 10,000 population.

Within age groups, the asthma ED visit rates for non-Hispanic whites aged 5-64 and aged 65+ were below *HP2010* targets for all time periods. In 2005-2006 and 2007-2008, the asthma ED visit rate for non-Hispanic white children under aged 0-4 was only slightly higher than the *HP2010* target of 80 per 10,000 population (84.6 and 94.5 per 10,000 population, respectively).

The asthma ED visit rates from 2005-2008 for non-Hispanic blacks and Hispanics aged 0-4 and 5-64 far exceeded the *HP2010* goals. In particular, from 2007-2008, non-Hispanic black children aged 0-4 had 324.3 asthma ED visits rates per 10,000 children (*HP2010* Goal: 80), with Hispanic children having 149.7 asthma ED visits per 10,000 children.

**Table 1. Rhode Island Hospital Discharge Rates per 10,000 population, 2000-2008 by Age, Sex, and Race/Ethnicity**

	Hospital Discharge Year										Healthy People 2010 Goal
	2000	2001	2002	2003	2004	2005	2006	2007	2008		
<b>Sex</b>											
Male	8.30	9.83	10.37	10.58	9.51	10.60	9.63	10.31	12.64	N/A	
Female	13.21	14.99	15.05	16.84	15.81	17.61	17.26	16.93	17.64	N/A	
<b>Race/Ethnicity</b>											
White	9.08	10.45	10.67	11.31	11.26	12.43	11.76	11.59	12.29	N/A	
Black	23.62	30.60	31.36	37.34	28.94	32.98	32.70	34.30	40.67	N/A	
Hispanic	14.18	15.51	19.17	19.25	16.37	17.02	16.99	19.90	23.98	N/A	
<b>Race/Ethnicity by Age</b>											
<b>White</b>										Healthy People 2010 Goal	
0-4	2000-2002		2003-2005			2006-2008				25	
5-64*	7.93		8.35			8.30				7.7	
65+*	12.35		17.23			18.88				11	
<b>Black</b>										Healthy People 2010 Goal	
0-4	61.93		70.16			89.45				25	
5-64*	25.28		29.13			30.37				7.7	
65+*	32.05		36.20			36.64				11	
<b>Hispanic</b>										Healthy People 2010 Goal	
0-4	49.65		59.31			58.50				25	
5-64*	12.34		12.03			15.24				7.7	
65+*	40.48		42.55			55.85				11	
<b>Sex by Age</b>											
<b>Male</b>										Healthy People 2010 Goal	
0-4	2000-2002		2003-2005			2006-2008				25	
5-64*	6.60		6.47			7.24				7.7	
65+*	6.53		10.92			11.87				11	
<b>Females</b>										Healthy People 2010 Goal	
0-4	27.08		37.33			35.68				25	
5-64*	12.34		13.19			12.93				7.7	
65+*	18.97		24.54			27.81				11	

cells values between 30 and 50 events

\* Age-Specific Rate  
† Age-Adjusted Rate

Data Source: 2000-2008 Rhode Island Hospital Discharge Data, Rhode Island Department of Health, Center for Health Data and Analysis.

Overall, women had higher rates of ED visits than men, but the difference was relatively small. However, when broken down by age group, boys aged 0-4 had a much higher two-year average age-specific ED visit rate (181.0 per 10,000 in 2007-2008) compared to girls aged 0-4 (98.8 per 10,000 in 2007-2008). In 2007-2008, males aged 5-64 and 65+ had age-adjusted asthma ED visit rates that were well below the *HP2010* goals of 50 per 10,000 population for ages 5-64 and 15 per 10,000 population, respectively (males

ages 5-64: 41.5 per 10,000 population; males ages 65+: 8.4 per 10,000 population). Females aged 5-64 and 65+ had age-adjusted ED visit rates that were slightly above the *HP2010* goals (females ages 5-64: 60.0; females ages 65+: 16.1).

To understand the potential relationship between neighborhood factors and asthma-related hospitalizations or ED visits, 2000 US census data were linked to the RI hospital discharge and ED files at the census-tract level. The analysis defined poverty as the percentage of residents living below the **Federal Poverty Level (FPL)**, which depends on family size and income and was categorized as 0%-9.9%, 10.0%-19.9%, and  $\geq 20.0\%$ .<sup>7</sup> In 2008, 20.6% of hospitalizations among non-Hispanic whites were from census tracts with  $\geq 20\%$  of residents living below the FPL, while 52.9% of non-Hispanic blacks and 64.5% of Hispanics hospitalized for asthma came from impoverished census tracts. (Figure 2) Similarly, in 2008, 22.2% of non-Hispanic whites with ED visits came from census tracts that had greater than or equal to 20% of residents living below the FPL. (Figure 2) However, in 2008, 52.0% of asthma ED visits for non-Hispanic blacks and 61.3% of Hispanics came from impoverished census tracts.

goals for hospitalization rates (*HP2010* target: 7.7 hospitalizations per 10,000). Among those aged 65 and older, only males met the *HP2010* target of 11.0 hospitalizations per 10,000.

Rhode Island met the *HP2010* ED visit rates goals for five population groups: (1) males in the 5-64 year age group, (2) females aged 5-64, (3) males aged 65 and older, (4) females over age 65, and (5) whites aged 65 and older.

Despite these encouraging results, Rhode Island's asthma hospitalization and ED visit rates for non-Hispanic Blacks and Hispanics are moving away from *HP2010* goals. Equally disturbing, asthma hospitalization rates among children in the 0-4 age category far exceeded the rates of other age groups. Boys aged 0-4 with asthma seem to be particularly at risk for severe asthma exacerbations that require either an ED visit or an inpatient hospitalization. The asthma hospitalization rate for boys aged 0-4 years was 2.3 times higher than the *HP2010* target of 25 per 10,000. For girls in this age group the hospital discharge rate was 1.4 times higher than the target. In the 5-64 year old age group and the 65 and older age group, RI data show that females have asthma-related ED visit or hospitalization rates that exceed those of men.

Men and women may experience asthma differently.<sup>8,9</sup> The risk of developing asthma in childhood is significantly higher in boys than girls, with a reversal of the sex ratio after puberty.<sup>8</sup> Not surprisingly, in other studies boys under age 10 have asthma hospitalization rates nearly twice that of girls the same age, but hospital discharge rates for asthma are nearly equal in women and men.<sup>8,10,11</sup> While no clear explanation has been found for sex differences in asthma-related ED visit and hospitalization rates, several hypotheses have been proposed; e.g., differences in symptom perception, sex differences in immune responses, hormonal changes, and increased bronchial hyperresponsiveness among women.<sup>8</sup>

Our findings confirm persistent disparities in pediatric and adult asthma hospitalizations and ED visits across racial and ethnic groups.<sup>12-17</sup> Black-white hospitalization and ED visit rate ratios continue to broaden both on a national level<sup>18</sup> as well as here in Rhode Island.

## DISCUSSION

Rhode Island has reached some *HP2010* goals. For hospitalizations in the 5-64-year age group, non-Hispanic whites and males met or were near *HP2010*

**Table 2. Rhode Island Emergency Department Rates per 10,000 population, 2005-2008, by Age, Sex, and Race/Ethnicity**

	Emergency Department Year				Healthy People 2010 Goal
	2005	2006	2007	2008	
<b>Sex</b>					
Male	44.41	43.33	42.81	47.10	N/A
Female	54.40	54.17	53.16	55.38	N/A
<b>Race/Ethnicity</b>					
White	39.17	37.04	36.54	38.24	N/A
Black	133.27	139.72	149.73	151.50	N/A
Hispanic	78.97	88.17	82.22	92.55	N/A
<b>Race/Ethnicity by Age</b>					
	2005-2006		2007-2008		
<b>White</b>					
0-4				94.50	80
5-64*	84.63	41.90		41.24	50
65+*	13.21		10.61		15
<b>Black</b>					
0-4		261.99	324.27		80
5-64*		127.95	140.71		50
65+*		33.23	34.36		15
<b>Hispanic</b>					
0-4		133.27	149.73		80
5-64*		167.13	174.77		50
65+*		64.63	94.50		15
<b>Sex by Age</b>					
<b>Male</b>					
0-4		164.02	180.99		80
5-64*		40.57	41.50		50
65+*		11.82	8.42		15
<b>Female</b>					
0-4		90.95	98.75		80
5-64*		59.74	59.97		50
65+*		18.86	16.14		15

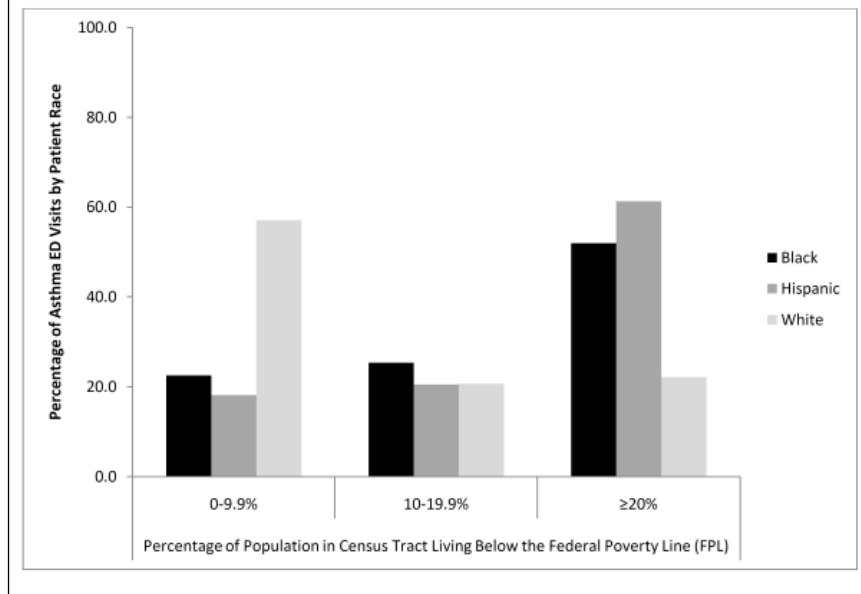
▨ = cells values between 30 and 50 events

\* Age-Specific Rate

† Age-Adjusted Rate

Data Source: 2005-2008 Rhode Island Emergency Department Data, Rhode Island Department of Health, Center for Health Data and Analysis.

Figure 2. Percentage of Emergency Department Visits by Neighborhood-Level Poverty and Race/Ethnicity, RI Emergency Department Data, 2008



Similar increases and disparities in hospitalization and ED visit rates have been found in Hispanic children and adults nationally<sup>3</sup> as well as Rhode Island.

Racial and ethnic disparities in asthma hospitalizations and ED visits are unlikely to be affected only by health-care access factors. Neighborhood characteristics frequently associated with the development of asthma and its severity include poverty, lower-quality and more-crowded housing, elevated levels of community violence, residential racial segregation, and greater exposure to indoor and outdoor asthma-related allergens.<sup>19</sup> In our own data, those living in neighborhoods with a high percentage of families living below the FPL have much higher ED visit and hospitalization rates. Effective long-term interventions for reducing asthma hospitalizations and ED visits will require: 1. policies that reduce neighborhood-level disparities associated with poor asthma outcomes; and 2. strengthened community resiliency and social cohesion, shown to decrease asthma-inducing risk factors, such as social isolation and stress.<sup>20,21</sup>

Programs that take into account neighborhood factors to lower asthma hospitalizations and ED visits are needed. The Guide to Community Preventive Services' Task Force found that multi-component interventions that link asthma management in primary care with strategies to eliminate asthma triggers in the

indoor home environment may result in improvement in symptom-free asthma days in addition to savings from averted costs of asthma care in the hospital.<sup>22</sup> Therefore, integrating these environmental changes, along with the use of evidenced-based asthma standards of care,<sup>23</sup> should be utilized in tandem to lower Rhode Island's asthma hospitalization and ED visit rates. A tool for implementing these changes may be the use of home-based education and home assessment provided by Certified Asthma Educators or trained providers who specialize in asthma care.

There are limitations to our study. While hospitals must report all ED and hospitalization data to the Rhode Island Department of Health, some data may not be complete and/or may be incorrect. Hospital staff enter racial/ethnic data: little is known about the accuracy of that data. Disease ascertainment and correct coding of asthma may prove difficult, especially in younger children. Finally, it is not possible to compare Rhode Island hospital and ED rates for asthma with national rates given that Rhode Island rates were calculated using *HP2010* methodology for age-specific and age adjusted-rates. The most recent national data on asthma hospitalization rates show that in 2005 there were 10.3 hospitalizations per 10,000 adults<sup>11</sup> and in 2006 there were 19.0 hospitalizations per 10,000 children.<sup>10</sup>

Most of our efforts have focused on the clinical management of this disease. The challenge now is to understand what affects the development and severity of asthma beyond the health care system. Addressing neighborhood-level factors external to the health care system may be critical to reducing the burden of asthma in Rhode Island.

\*All age-standardized rates were standardized to the year 2000 standard population.

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