


Pediatric Asthma Among Small Racial/ Ethnic Minority Groups: An Analysis of the 2006-2015 National Health Interview Survey

Public Health Reports
2019, Vol. 134(4) 338-343
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DOI: 10.1177/0033354919849943
journals.sagepub.com/home/phr



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Abstract

Few studies have examined the asthma burden among small racial/ethnic minority groups such as Asian children. We examined asthma disparities among children aged 4-17 in 6 small non-Hispanic racial/ethnic minority groups (American Indian/Alaska Native [AI/AN], Asian Indian, Chinese, Filipino, other Asian, and multiple race) by using the 2006-2015 National Health Interview Survey. These small minority groups represented a weighted 6.1% of the study population (6770 of 88049). The prevalence of current asthma ranged from 5.5% (95% confidence interval [CI], 3.5%-7.5%) among Chinese children to 13.8% (95% CI, 10.4%-17.2%) among multiple-race children and 14.6% (95% CI, 10.8%-18.4%) among AI/AN children. Compared with non-Hispanic white children, AI/AN (adjusted odds ratio [aOR] = 1.6; 95% CI, 1.2-2.2) and multiple-race (aOR = 1.4; 95% CI, 1.0-2.0) children had higher odds for current asthma. Several small racial/ethnic minority groups are at heightened risk of asthma-associated outcomes, highlighting the need for further research on these populations.

Keywords

pediatrics, population surveillance, Asian American, American Indian, Native American

Studies of disparities in pediatric asthma in the United States have mainly focused on non-Hispanic black children,¹⁻⁴ and little is known about the burden of asthma among other, smaller minority groups such as Asian children. This burden is not usually described in national studies because of small sample sizes.⁵ Only 1 study described the burden of asthma among smaller minority groups; it used data from the 2001-2005 National Health Interview Survey (NHIS) to show that asthma prevalence ranged from 4.4% among Asian Indian children to 13.0% among American Indian/Alaska Native (AI/AN) children.⁶ We used the most recent NHIS data (2006-2015), which began oversampling Asians in 2006,^{6,7} to update population estimates of asthma disparities among Asian and other non-Hispanic white, non-Hispanic black, and small non-Hispanic racial/ethnic minority groups.

Methods

The NHIS is a cross-sectional household interview survey of the civilian noninstitutionalized US population that is conducted by the National Center for Health Statistics using a complex, multistage sample design.⁷ The NHIS oversamples

black and Hispanic persons and started oversampling Asians in 2006.^{6,7} To our knowledge, this study is the first to use updated NHIS data to study asthma burden primarily focusing on Asian subgroups.

Our analysis focused on children aged 4-17 (N = 88049). We excluded children aged ≤ 3 because of uncertainties about asthma diagnosis in this age group.^{8,9} We focused on 3 asthma outcomes: current asthma, asthma attack/episode, and asthma emergency department (ED) visit.^{3,6,10,11} Survey questions about the child's asthma outcomes were answered by a parent or adult who was knowledgeable about and

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responsible for the sample child. We defined those who answered “yes” to the screening question, “Has a doctor or other health professional ever told you that [child] had asthma?” and “yes” to the question, “Does [child] still have asthma?” as having current asthma. We defined children with current asthma who also answered “yes” to the question, “During the past 12 months, has [child] had an episode of asthma or an asthma attack?” as having had at least 1 asthma attack/episode. Subsequently, we defined only children who had current asthma and answered “yes” to the question, “During the past 12 months, did [child] have to visit an emergency room or urgent care center because of his/her asthma?” as having at least 1 asthma ED visit.

We excluded from analysis children with missing responses ($n = 97$) or with answers such as “refused” ($n = 83$), “not ascertained” ($n = 13$), and “don’t know” ($n = 7$) for each asthma question. We also excluded 320 children whose primary race was not available in the public use data. The total study population ($N = 88\,049$) was used as the denominator to define current asthma, and the count of children with current asthma ($n = 9452$) was used as the denominator to define asthma attack/episode and asthma ED visits when estimating the weighted prevalence of these 2 asthma outcomes.

We used 9 racial/ethnic groups according to Hispanic origin and race variables from NHIS: non-Hispanic white, non-Hispanic black, Hispanic, AI/AN, Asian Indian, Chinese, Filipino, other Asian, and multiple race.¹¹ Other Asian included Korean, Vietnamese, Japanese, and other Asian subgroups. Multiple race refers to self-identifying with >1 race and no primary race selected. Although we focused on comparing the 6 small minority groups with non-Hispanic white children, we kept the results for non-Hispanic black and Hispanic children as a point of reference and for completeness of reporting. We considered the following covariates: age (4-8, 9-13, 14-17); sex (male, female); place of birth (US-born, non-US-born); region of residence (Northeast, Midwest, South, West); household highest education level (<high school, high school/general educational development, >high school); health insurance (insured, uninsured); having a usual place for health care (≥ 1 , none)⁶; self-reported food, respiratory, or skin allergy (yes, no)²; and survey year to account for the secular trend.¹¹ We used the ratio of family income to the applicable federal poverty level (FPL) thresholds from the imputed income data (imputation file 1) and categorized it as <100% FPL, 100%-249% FPL, and $\geq 250\%$ FPL.¹² None of the covariates had more than 1% missing values.

We conducted all analyses by using SAS version 9.4¹³ survey procedures, and we applied sampling strata, cluster, and weights to account for the NHIS design.^{7,14} We summarized and compared population-weighted prevalence according to race/ethnicity by using the Rao-Scott χ^2 test. We used survey logistic regression analysis to assess the association between dichotomized asthma outcomes and racial/ethnic groups after adjusting for the

aforementioned covariates. We conducted sensitivity analyses on a subset of data excluding Hispanic children, and we tested for a nonlinear effect of time by including the quadratic term of the survey years. We considered $P < .05$ to be significant.

Results

Racial/ethnic groups other than non-Hispanic white (56.8%), non-Hispanic black (14.9%), or Hispanic (22.2%) children composed approximately 6.1% of the total weighted study population (Table 1). Among these 6 small minority groups, the prevalence of current asthma was highest among AI/AN children (14.6%; 95% confidence interval [CI], 10.8%-18.4%) and lowest among Chinese children (5.5%; 95% CI, 3.5%-7.5%). Among children with current asthma, the prevalence of asthma ED visits was highest among AI/AN children (26.5%; 95% CI, 11.0%-42.0%) and lowest among Asian Indian children (10.1%; 95% CI, 1.5%-18.8%). The prevalence of all asthma outcomes, except for asthma attack/episode, varied significantly across the 9 racial/ethnic groups (Table 1), with non-Hispanic black children having the highest prevalence of current asthma (16.4%; 95% CI, 15.7%-17.2%) and asthma ED visits (29.0%; 95% CI, 26.2%-31.7%), followed by AI/AN children. All covariates except for sex were significantly different across all 9 racial/ethnic groups.

Compared with non-Hispanic white children, non-Hispanic black, Hispanic, AI/AN, and multiple-race children had significantly higher odds of current asthma (Table 2). Compared with non-Hispanic white children, other Asian children had lower odds of current asthma (adjusted odds ratio [aOR] = 0.8; 95% CI, 0.6-1.0), and both non-Hispanic black (aOR = 2.3; 95% CI, 1.9-2.8) and Hispanic (aOR = 1.7; 95% CI, 1.4-2.1) children had higher odds of asthma ED visits. These results did not change in the sensitivity analysis among non-Hispanic children and when the quadratic term of survey year was used.

Discussion

Our study augments a previous study⁶ by confirming a heterogeneous pattern of asthma prevalence among small racial/ethnic minority groups. Compared with non-Hispanic white children, AI/AN and multiple-race children had higher odds of current asthma. Although most pediatric asthma research has focused on non-Hispanic black children because of the high prevalence of asthma in that group, our study showed that multiple-race, AI/AN, and Filipino children also bore a disproportionately high asthma burden, similar to that seen among non-Hispanic black children. Our results are consistent with the results of a study on pediatric asthma that was based on NHIS data from 2008-2010 that found the highest prevalence of asthma among the multiple-race group, followed by non-Hispanic black and AI/AN children; however, that study did not differentiate among Asian subgroups.¹⁵

Table 1. Characteristics of children aged 4-17, with weighted prevalence by racial/ethnic group, National Health Interview Survey, 2006-2015^a

Characteristics	Crude No. (N = 88 049)	Non-Hispanic White, % (n = 40 968)	Non-Hispanic Black, % (n = 14 668)	Hispanic, % (n = 25 643)	American Indian/ Alaska Native, % (n = 758)	Chinese, % (n = 1062)	Filipino, % (n = 1171)	Asian Indian, % (n = 1102)	Other Asian, ^b % (n = 1929)	Multiple Races, ^c % (n = 748)	P Value ^d
Total	88049	56.8	14.9	22.2	0.9	0.8	1.0	1.0	1.7	0.7	
US-born ^e											<.001
Yes	88000	98.3	96.7	88.5	99.7	73.4	79.7	75.5	75.6	98.0	
No											
Sex											.57
Male	45410	51.2	50.8	51.0	51.9	47.3	50.4	49.7	51.5	47.2	
Female											
Age group, y											<.001
4-8	29654	34.4	35.2	38.8	32.1	37.0	31.8	46.0	35.7	42.6	
9-13	30087	35.8	35.7	34.6	40.4	34.1	38.9	32.9	37.1	34.5	
14-17	28308	29.8	29.2	26.6	27.5	28.9	29.4	21.1	27.1	22.8	
Geographic region											<.001
Northeast	14212	18.1	16.1	12.7	3.9	25.1	15.0	26.0	16.8	14.3	
Midwest	17629	30.0	20.4	10.1	18.9	15.3	10.4	20.7	17.9	27.2	
South	31976	33.7	55.4	35.3	30.1	18.3	19.8	29.4	25.0	23.1	
West	24232	18.2	8.1	41.9	47.1	41.3	54.7	23.9	40.3	35.4	
Poverty status											<.001
<100% FPL	17774	11.1	35.4	33.4	35.6	11.8	7.1	10.2	17.9	14.8	
100%-249% FPL	29025	27.4	36.2	42.1	36.6	21.2	28.8	18.4	34.7	30.9	
≥250% FPL	41250	61.4	28.4	24.5	27.9	67.1	64.0	71.4	47.4	54.3	
Highest education level in household											<.001
<High school	10137	3.6	11.6	28.2	6.7	4.9	1.4	2.3	9.0	3.7	
High school/general educational development	18398	16.9	25.4	25.9	29.6	12.4	10.0	6.5	16.8	14.4	
>High school	59278	79.4	63.0	45.9	63.7	82.6	88.6	91.2	74.3	81.8	
No health insurance ^e	7786	5.7	5.8	14.7	17.3	6.4	6.2	5.8	9.2	4.6	<.001
No usual place for health care ^e	4792	3.4	4.2	8.5	5.5	5.5	6.1	4.1	7.4	4.5	<.001
Respiratory allergy ^e	10496	13.3	11.4	9.1	13.4	9.3	10.5	9.1	7.8	17.0	<.001
Food/digestive allergy ^e	4500	5.1	5.4	4.0	7.2	5.4	6.4	5.9	5.1	7.9	<.001
Eczema/skin allergy ^e	9736	10.8	14.9	9.1	10.1	11.4	12.5	10.0	10.8	16.8	<.001
Current asthma	9452	9.2	16.4	9.5	14.6	5.5	10.1	6.0	6.0	13.8	<.001
≥1 Asthma attack/episode in past 12 months ^f	4898	54.9	51.3	50.9	49.6 ^g	67.0 ^h	52.6	59.8	49.1	62.2	.17
≥1 Asthma ED visit in past 12 months ^f	1573	14.5	29.0	23.1	26.5	15.0	12.9	10.1	20.3	22.8	<.001

Abbreviations: ED, emergency department; FPL, federal poverty level.

^aData source: Centers for Disease Control and Prevention.⁷ The standard error (SE) of weighted prevalence ranged from 0.4% to 9.4%.

^bOther Asian includes Korean, Vietnamese, Japanese, and other Asian subgroups.

^cMultiple race indicates self-identifying with >1 race and not selecting a primary race.

^dRao-Scott χ^2 test to compare the weighted prevalence of characteristics by race/ethnicity. $P < .05$ indicates significant associations between race/ethnicity and the corresponding covariate.

^eThe proportions of missing data for the following variables were: nativity, 0.06%; education, 0.03%; health insurance status, 0.04%; usual place for care, 0.02%; respiratory allergy, 0.02%; food/digestive allergy, 0.01%; eczema/skin allergy, 0.01%.

^fAmong children with current asthma. Weighted prevalence that took into account the survey design was summarized according to racial/ethnic groups and compared by using the Rao-Scott χ^2 test. Percentages may not total to 100.0 because of rounding.

^gFor American Indian/Alaska Native children, the SE was >9%.

^hFor Chinese children, the SE was >8% but <9%.

Data on small minority groups such as AI/ANs or Asian subgroups have not typically been reported in studies of national asthma trends.^{5,6,16} Because of the oversampling of Asian groups in NHIS since 2006 and because we used 10 years of these data, our study may improve the precision

of estimates of small minority groups, particularly Asian subgroups. However, our study had several limitations. First, we did not adjust for family history of asthma, environmental smoke exposure, and other potential confounders. Second, data on asthma outcomes and allergy status were based on

Table 2. Factors associated with asthma outcomes^a among children aged 4-17 (N = 88 049), National Health Interview Survey, 2006-2015^b

Variable	Current Asthma		≥1 Asthma Attack/Episode in Past 12 Months		≥1 Asthma ED Visit in Past 12 Months	
	Weighted Prevalence (95% CI)	aOR (95% CI)	Weighted Prevalence (95%CI)	aOR (95% CI)	Weighted Prevalence (95% CI)	aOR (95% CI)
Race/ethnicity						
Non-Hispanic white	9.2 (8.8-9.7)	1.0 [Reference]	54.9 (52.8-57.1)	1.0 [Reference]	14.5 (13.0-16.1)	1.0 [Reference]
Non-Hispanic black	16.4 (15.7-17.2)	1.9 (1.8-2.1)	51.3 (48.8-53.8)	0.9 (0.8-1.0)	29.0 (26.2-31.7)	2.3 (1.9-2.8)
Hispanic	9.5 (9.0-9.9)	1.2 (1.1-1.3)	50.9 (48.4-53.4)	0.8 (0.7-0.9)	23.1 (20.7-25.5)	1.7 (1.4-2.1)
American Indian/Alaska Native	14.6 (10.8-18.4)	1.6 (1.2-2.2)	49.6 (31.2-68.0) ^c	0.8 (0.4-1.6)	26.5 (11.0-42.0)	2.2 (0.9-5.4)
Chinese	5.5 (3.5-7.5)	0.7 (0.5-1.1)	67.0 (49.9-84.2) ^d	1.4 (0.7-3.1)	15.0 (0.0-30.7)	0.9 (0.3-3.3)
Filipino	10.1 (7.5-12.6)	1.3 (1.0-1.8)	52.6 (38.4-66.9)	0.8 (0.5-1.5)	12.9 (5.7-20.2)	0.9 (0.4-1.9)
Asian Indian	6.0 (4.0-8.0)	0.8 (0.6-1.1)	59.8 (45.6-74.0)	1.1 (0.6-2.1)	10.1 (1.5-18.8)	0.8 (0.3-2.1)
Other Asian ^e	6.0 (4.7-7.3)	0.8 (0.6-1.0)	49.1 (38.5-59.7)	0.8 (0.5-1.4)	20.3 (11.1-29.6)	1.8 (1.0-3.5)
Multiple race ^f	13.8 (10.4-17.2)	1.4 (1.0-2.0)	62.2 (50.8-73.6)	1.3 (0.8-2.2)	22.8 (8.3-37.2)	1.6 (0.6-4.0)
US-born						
No	4.8 (4.0-5.5)	1.0 [Reference]	52.5 (44.7-60.4)	1.0 [Reference]	19.8 (12.7-26.8)	1.0 [Reference]
Yes	10.6 (10.3-10.9)	2.0 (1.6-2.3)	53.3 (51.8-54.7)	0.9 (0.6-1.2)	20.0 (18.7-21.2)	0.9 (0.5-1.5)
Sex						
Female	8.9 (8.5-9.3)	1.0 [Reference]	53.1 (50.9-55.3)	1.0 [Reference]	18.2 (16.4-20.0)	1.0 [Reference]
Male	11.7 (11.3-12.1)	1.3 (1.2-1.4)	53.3 (51.4-55.3)	1.0 (0.9-1.1)	21.2 (19.7-22.7)	1.2 (1.0-1.3)
Age group, y						
4-8	9.8 (9.4-10.3)	1.0 [Reference]	60.4 (58.1-62.6)	1.0 [Reference]	28.5 (26.3-30.8)	1.0 [Reference]
9-13	10.8 (10.3-11.2)	1.1 (1.1-1.2)	51.9 (49.5-54.3)	0.7 (0.6-0.8)	16.8 (15.1-18.5)	0.5 (0.5-0.6)
14-17	10.4 (9.9-10.9)	1.2 (1.1-1.3)	46.6 (44.2-49.0)	0.6 (0.5-0.7)	13.4 (11.4-15.5)	0.4 (0.4-0.5)
Geographic region						
West	8.9 (8.5-9.4)	1.0 [Reference]	55.0 (51.8-58.1)	1.0 [Reference]	17.6 (15.4-19.7)	1.0 [Reference]
Northeast	11.7 (11.0-12.5)	1.3 (1.2-1.4)	50.4 (46.9-53.8)	0.8 (0.7-1.0)	20.4 (17.6-23.3)	1.2 (0.9-1.5)
Midwest	10.3 (9.6-11.0)	1.1 (1.0-1.2)	51.8 (48.7-55.0)	0.8 (0.7-1.0)	19.3 (16.4-22.3)	1.1 (0.9-1.5)
South	10.6 (10.2-11.1)	1.0 (0.9-1.1)	54.6 (52.3-57.0)	0.9 (0.8-1.1)	21.4 (19.4-23.3)	1.1 (0.9-1.3)
Poverty status						
≥250% FPL	9.0 (8.7-9.4)	1.0 [Reference]	52.8 (50.6-55.1)	1.0 [Reference]	15.2 (13.5-16.9)	1.0 [Reference]
100%-249% FPL	10.3 (9.8-10.8)	1.2 (1.1-1.3)	53.0 (50.5-55.4)	1.1 (1.0-1.3)	22.0 (19.8-24.3)	1.4 (1.1-1.8)
<100% FPL	13.5 (12.8-14.1)	1.6 (1.4-1.7)	54.2 (51.5-57.0)	1.3 (1.1-1.5)	24.8 (22.4-27.3)	1.5 (1.2-1.9)
Highest level of education in household						
>High school	10.2 (9.8-10.5)	1.0 [Reference]	55.3 (53.5-57.0)	1.0 [Reference]	18.8 (17.4-20.3)	1.0 [Reference]
High school/general educational development	11.1 (10.5-11.8)	1.1 (1.0-1.2)	48.5 (45.5-51.5)	0.8 (0.7-0.9)	21.9 (19.4-24.4)	1.0 (0.9-1.2)
<High school	10.0 (9.2-10.8)	1.0 (0.9-1.1)	49.8 (45.2-54.4)	0.8 (0.6-1.0)	23.4 (19.7-27.0)	1.0 (0.8-1.3)
Health insurance						
Yes	10.6 (10.3-10.9)	1.0 [Reference]	53.2 (51.7-54.7)	1.0 [Reference]	19.8 (18.6-21.1)	1.0 [Reference]
No	7.2 (6.4-8.0)	0.8 (0.7-0.9)	54.4 (48.8-60.0)	1.1 (0.9-1.5)	21.7 (16.9-26.6)	1.1 (0.8-1.5)
Usual place for health care						
No	5.3 (4.4-6.2)	1.0 [Reference]	45.3 (37.2-53.5)	1.0 [Reference]	14.6 (8.0-21.2)	1.0 [Reference]
Yes	10.6 (10.3-10.9)	1.7 (1.4-2.0)	53.5 (52.0-54.9)	1.3 (1.0-1.8)	20.1 (18.9-21.3)	1.5 (0.8-2.7)
Respiratory allergy						
No	7.2 (7.0-7.5)	1.0 [Reference]	46.3 (44.4-48.1)	1.0 [Reference]	16.8 (15.3-18.3)	1.0 [Reference]
Yes	32.8 (31.6-34.0)	5.6 (5.2-6.0)	64.2 (62.1-66.4)	1.9 (1.7-2.1)	24.4 (22.4-26.4)	1.7 (1.5-2.0)
Food/digestive allergy						
No	9.5 (9.2-9.8)	1.0 [Reference]	51.6 (50.0-53.2)	1.0 [Reference]	19.3 (18.0-20.5)	1.0 [Reference]
Yes	26.0 (24.2-27.8)	2.0 (1.8-2.3)	64.4 (60.6-68.3)	1.4 (1.1-1.7)	24.3 (20.3-28.3)	1.2 (0.9-1.5)
Eczema/skin allergy						

(continued)

Table 2. (continued)

Variable	Current Asthma		≥1 Asthma Attack/Episode in Past 12 Months		≥1 Asthma ED Visit in Past 12 Months	
	Weighted Prevalence (95% CI)	aOR (95% CI)	Weighted Prevalence (95%CI)	aOR (95% CI)	Weighted Prevalence (95% CI)	aOR (95% CI)
No	9.0 (8.7-9.2)	1.0 [Reference]	50.6 (48.9-52.2)	1.00 [Reference]	18.6 (17.2-20.0)	1.00 [Reference]
Yes	21.3 (20.2-22.4)	1.8 (1.7-2.0)	62.2 (59.6-64.9)	1.3 (1.1-1.5)	24.2 (21.9-26.5)	1.1 (0.9-1.3)
Survey year (2006-2015)		1.0 (1.0-1.0)		1.0 (1.0-1.0)		0.9 (0.9-0.9)

Abbreviations: aOR, adjusted odds ratio; ED, emergency department; FPL, federal poverty level.

^aSurvey logistic regression analysis was used to assess the association between dichotomized asthma outcomes and race/ethnicity after adjusting for all listed covariates. The listwise deletion method was used to handle missing data in the model. The total sample sizes were 86 942 for current asthma, 93 14 for asthma attack/episode, and 7835 for asthma ED visits in models. The percentages of missing values were 1.3% for current asthma, 1.8% for asthma attack/episode, and 2.0% for asthma ED visits. The denominator used to define asthma attack/episode and asthma ED visit was children with current asthma.

^bData source: Centers for Disease Control and Prevention.⁷

^cFor American Indian/Alaska Native children, the standard error (SE) was >9%.

^dFor Chinese children, the SE was >8% but <9%.

^eOther Asian includes Korean, Vietnamese, Japanese, and other Asian subgroups.

^fMultiple race indicates self-identifying with >1 race and not selecting a primary race.

self-reported answers that were not validated against clinically defined outcomes; as such, they may be subject to information and recall bias. Third, although we adjusted for sample year in the main model and tested quadratic terms of the sample year in the sensitivity analysis, other nonlinear time trends may exist. Finally, although we compared the prevalence of asthma among groups defined by race/ethnicity, the results may not be directly comparable with results of studies that use race alone to define subgroups.^{3,6,15}

We found that some racial/ethnic minority groups, such as AI/AN, Filipino, and multiple races, had a prevalence of asthma that was higher than the reported national level, which ranged from 7.3% in 2001 to 8.4% in 2010.¹⁵ Other studies also found a higher burden of asthma among AI/AN and/or Filipino children, with multiple underlying socioeconomic and health access factors, such as high hospitalization costs, inadequate asthma knowledge, and poor asthma management.¹⁷⁻²³ Our study suggests the need for further studies of these small minority groups to understand and intervene on asthma outcomes in diverse racial/ethnic groups.


Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The work of Dr. Sheffield was supported by the National Institutes of Health grants K23ES024127.

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