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Asthma Prevalence Among US Children in Underrepresented Minority Populations: American Indian/Alaska Native, Chinese, Filipino, and Asian Indian

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What's Known on This Subject

Studies have demonstrated that asthma prevalence varies widely among children with different social, economic, racial, and ethnic backgrounds. Previous studies among children have shown higher asthma prevalence among black children and among children from certain Hispanic ethnic subgroups.

What This Study Adds

We describe the national prevalence of asthma in Asian American and American Indian/Alaska Native children, including prevalences in specific Asian American subpopulations, groups for which national asthma prevalences are lacking.

ABSTRACT

OBJECTIVES. The purpose of this work was to estimate asthma prevalence among US children in racial minority subgroups who have been historically underrepresented in the pediatric asthma literature. These subgroups include American Indian/Alaska Native, Chinese, Filipino, and Asian Indian children. We also explored the association between these race categories and asthma after adjusting for demographic and sociodemographic characteristics and explored the effect of place of birth as it relates to current asthma.

PATIENTS AND METHODS. Data on all 51 944 children aged 2 to 17 years from the 2001–2005 National Health Interview Survey were aggregated and analyzed to estimate the prevalence of current asthma, lifetime asthma, and asthma attacks according to race and place of birth. Logistic regression was used to determine adjusted odds ratios for current asthma according to race and place of birth while controlling for other demographic and sociodemographic variables.

RESULTS. National estimates of current asthma prevalence among the children in the selected minority subgroups ranged from 4.4% in Asian Indian children to 13.0% in American Indian/Alaska Native children. Overall, children born in the United States had greater adjusted odds of reporting current asthma than did children born outside of the United States.

CONCLUSIONS. Smaller racial and ethnic minority groups are often excluded from asthma studies. This study reveals that, among children from different Asian American subgroups, wide variation may occur in asthma prevalence. We also found that children born in the United States were more likely than children born outside of the United States to have current asthma. *Pediatrics* 2008;122:e217–e222

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Key Words

asthma, racial disparities, Asian American, American Indian, prevalence

Abbreviations

AI/AN—American Indian/Alaskan Native
NHIS—National Health Interview Survey
OR—odds ratio
CI—confidence interval
ETS—environmental tobacco smoke

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IN 2005, 8.9% of children in the United States aged 2 to 17 years were reported to have current asthma.¹ The impact of asthma on children's health is substantial and reaches across all segments of the population. As with other diseases with an environmental component, however, that impact is felt more keenly in certain subgroups. Several studies have demonstrated that asthma prevalence varies widely among children with different social, economic, racial, and ethnic backgrounds.^{2–9} Specifically, as compared with other children, studies have shown higher asthma prevalence among black children and among children from certain Hispanic ethnic subgroups.^{2–5} Yet, very little is known about the national prevalence of asthma in Asian American and American Indian/Alaska Native (AI/AN) children, and even less is known about asthma prevalence among children in specific Asian American subpopulations. Because race and ethnicity can be important as risk markers for medical conditions, their analysis is necessary to ascertain adequately and to address appropriately disparities in medical conditions and health outcomes among different segments of the US population.

Moreover, the elimination of disparities in health is an overall goal of *Healthy People 2010*. To reach this goal as a nation, we must be aware of the health disparities that exist among our smaller minority groups.¹⁰

Data on smaller racial and ethnic subpopulations in the United States are typically either not collected, or, if collected, are broadly aggregated, a process that masks any potentially discernible differences among disparate subgroups.¹¹ For instance, studies have shown a relatively low prevalence of asthma in Hispanic children as a group, but when asthma prevalence in Hispanic children has been assessed according to ethnic subgroups, studies have shown that Puerto Rican children have the highest asthma prevalence compared with children in all other racial and ethnic groups.^{2,6} Similarly, a previous analysis of asthma in Asian American children found a low prevalence compared with other children.⁷ Nevertheless, a recent study based on responses to the California Healthy Kids Survey that allowed children to identify themselves on the basis of Asian American subgroups found that Filipino American children reported the second highest prevalence of lifetime asthma compared with all of the other racial and ethnic groups identified in the survey.⁶

The Asian American and AI/AN populations of the United States together make up 5.7% of the total population and are growing at a higher rate than is the total population.^{12,13} The 2000 US census reported 11.9 million persons identified as Asian and 4.1 million identified as AI/AN. The 3 largest Asian American subgroups were Chinese, Filipino, and Asian Indian, and together they constituted 58% of the total Asian American population.¹² The US AI/AN population is extremely diverse; AI/AN persons may identify themselves with any of 554 distinct federally recognized tribes (as well as numerous tribes that are not federally recognized).¹⁴ Although Asian Americans and AI/ANs are substantial and growing components of the US population, children in these groups have been historically underrepresented in the pediatric asthma literature.^{15,16} This is in part because these minority populations, if they are represented at all, are not represented in national surveys or in studies in sufficient numbers for meaningful analyses.^{14,15}

The National Health Interview Survey (NHIS) is a multipurpose survey that does report data on Asian subgroups, although its sample sizes for these groups are relatively small. Still, by combining 5 years of data from the NHIS (2001–2005), we obtained adequate statistical power to analyze the prevalence of current asthma, lifetime asthma, and asthma attacks for AI/AN, Chinese, Filipino, and Asian Indian children.¹⁷ With these aggregate data, we were, after adjustment for demographic and sociodemographic confounders, also able to calculate odds ratios (ORs) for current asthma in these subgroups. In addition, because of the relatively high numbers of immigrant children in the Asian American population and because place of birth has been shown to relate to asthma prevalence, this study also explored the effect of place of birth in relation to current asthma.^{2,18,19}

METHODS

The NHIS is a cross-sectional, continuously conducted household interview survey of the civilian, noninstitutionalized population of the United States. During the survey, a knowledgeable adult family member who resides in the same household provides information about 1 randomly selected child from each sampled family. The NHIS is a complex sampling design involving stratification, clustering, and oversampling of certain population subgroups and is weighted to represent the civilian noninstitutional population of the United States. To obtain adequate sample sizes for our analysis, we merged data files from the 2001–2005 NHIS. In total, information on 55 740 children aged 2–17 years was collected during the NHIS for the years 2001–2005. Surveys that were missing responses to questions of interest or that had a “don’t know” or “refused” response were excluded from the analysis.

The prevalence of lifetime and current asthma and the prevalence of 12-month asthma attacks were both calculated by using responses to questions about the presence or absence of asthma in a sample child. Lifetime asthma was estimated from responses to the question, “Has a doctor or other health professional ever told you that [child] had asthma?” Current asthma and asthma-attack prevalences were obtained from responses to 2 follow-up questions that were asked if respondents answered “yes” to lifetime asthma: “Does [child] still have asthma?” and “During the past 12 months, has [child] had an episode of asthma or an asthma attack?” Weighted estimates and SEs were calculated for the race categories “white,” “black/African American,” “American Indian/Alaska Native,” “Chinese,” “Filipino,” “Asian Indian,” and “other or multiple race.” In addition, estimates were calculated according to place of birth: “born in the United States (excluding US territories)” and “born outside the United States (including US territories).” The significance of differences in asthma prevalence among race categories was examined by using either a Pearson-type or a Cochran-Mantel-Haenszel-type χ^2 statistic for complex survey design.

The association of current asthma prevalence with race and place of birth was analyzed by using logistic regression to control for confounding demographic and sociodemographic variables. The confounding variables of interest were chosen on the basis of the review of recent population-based studies of asthma and the availability of NHIS data. The selected variables of interest included gender, age, Hispanic origin (Hispanic versus non-Hispanic), geographic region of residence (Northeast, Midwest, South, or West), annual household income (less than \$20 000 vs \$20 000 or more), highest level of education in household (less than high school diploma, high school diploma/General Educational Development, or beyond high school diploma), health insurance coverage (insured versus not insured), and having a usual place for health care when child is sick (≥ 1 place versus no place).

Crude and adjusted ORs for current asthma were calculated by using PROC RLOGIST in SUDAAN software.²⁰ Adjusted ORs were obtained after logistic regres-

TABLE 1 Sample Demographic and Sociodemographic Characteristics According to Race for Children Aged 2–17 Years: United States (NHIS 2001–2005)

Variable	Race Category								χ^2 P
	Total	White	Black	AI/AN	Chinese	Filipino	Asian Indian	Other or Multiple "Race"	
Sample size, n ^a	55 562	39 551	9031	489	372	351	365	5403	
Place of birth: born outside US, %	5.4	4.2	2.8	3.2	24.7	22.8	28.9	17.0	<.0001
Demographics, %									
Male	51.2	51.2	51.0	49.1	45.6	47.5	51.8	52.4	.2414
2–5 y old	24.6	24.4	23.9	22.9	26.1	21.8	30.5	27.3	.0003
Hispanic origin	18.0	16.7	2.3	17.9	1.7 ^b	5.9	1.8 ^b	67.7	<.0001
Region of residence, %									
Northeast	18.1	18.5	15.7	7.3	26.6	10.0	31.2	19.0	<.0001
Midwest	23.6	25.6	20.2	23.2	15.4	10.2	15.0	13.4	
South	36.3	33.9	56.0	34.7	18.7	12.0	30.8	23.2	
West	22.1	22.0	8.1	34.9	39.3	67.8	23.0	44.5	
Sociodemographics, %									
Household income less than \$20 000	16.9	12.9	32.8	25.0	10.1	6.6	11.4	26.1	<.0001
No high school diploma	11.3	9.4	13.5	13.0	8.3	3.8	6.1	26.7	<.0001
Access to health care, %									
No health insurance	10.1	9.3	9.1	28.5	7.7	7.4	11.4	17.8	<.0001
No usual place for sick care	5.3	4.7	5.5	6.3	6.6	6.5	8.4	10.7	<.0001

^a Data show the sample of children with a "yes" or "no" response to questions about lifetime and current asthma.

^b Data show 0.30 < relative SE < 0.50; estimate is unreliable.

sion model building, with potential confounders added to the model. Before the models were built, interactions of the variables of interest with race and place of birth were analyzed. They were considered effect modifiers if they were significant in the model at the .10 level (Wald χ^2 P value) and if the ORs of the interacting variable differed appreciably between strata. Only the interaction of race and place of birth was found to be an effect modifier. Small cell sizes, however, precluded that interaction from inclusion in the model. We built the main-effects model for current asthma starting with the primary variables of race and place of birth and with the demographic variables of gender, age, and Hispanic origin. We then evaluated models that included all of the possible combinations of the remaining confounding variables (ie, income, education, region, health insurance coverage, and having a usual place for sick care). The final model was chosen by selecting the most parsimonious variant that allowed for <10% change in the ORs of current asthma for our primary variables (race and place of birth) as compared with the full model, had the smallest SEs associated with those ORs, and had an adequate goodness-of-fit (measured by Hosmer-Lemeshow Satterthwaite statistic, $P > .10$). Model checking was performed through visual examination of the residual plots and testing for collinearity.²¹

RESULTS

After excluding surveys with nonresponses to the question about current asthma, surveys from a total of 55 562 children remained in the initial prevalence calculations. For the logistic regression modeling, the majority of the nonresponse exclusions came from the question concerning family income, for which 6.1% of

the responses were missing, refused, or unknown. The final sample size for the logistic regression analysis was, after excluding all of the nonresponses, 51 944, for a total reduction of 6.8%.

Our initial analysis showed baseline differences in several of the demographic, socioeconomic, and access-to-health-care variables among children in the different race categories (Table 1). As compared with children in the other categories, a higher percentage of children were born outside the United States in the 3 Asian American subgroups of Chinese, Filipino, and Asian Indian. Filipino children were least likely (and black children were most likely) to be part of a family with an annual household income of less than \$20 000 or with a highest level of education in the family less than a high school diploma. AI/AN children had much lower rates of health insurance coverage than did children in the other race categories.

Estimates of asthma prevalence according to race and place of birth are presented in Table 2. Current asthma prevalence ranged from 4.4% for Asian Indian children to 13.3% for black children, with estimates of 13.0% for AI/AN children, 10.7% for Filipino children, 8.4% for white children, and 5.1% for Chinese children. Estimates of lifetime asthma prevalence varied in a pattern similar to estimates of current asthma among the race categories. Children born in the United States had a higher prevalence of both current and lifetime asthma than did children born outside the United States (9.4% vs 4.3% [$P < .0001$] and 13.6% vs 7.3% [$P < .0001$], respectively). The prevalence of asthma attack in the past 12 months among children with current asthma did not vary considerably among race categories or according to place of birth ($P = .759$ and $.111$, respectively).

TABLE 2 Current and Lifetime Asthma Prevalence and Recent Asthma-Attack Prevalence According to Race or Place of Birth Among Children Aged 2–17 Years: United States (NHIS 2001–2005)

Asthma Status	Race, % (SE)							Place of Birth, % (SE)		
	Total	White	Black	AI/AN	Chinese	Filipino	Asian Indian	Other or Multiple Race	Born in the US	Born Outside the US
Current asthma	9.2 (0.2)	8.4 (0.2)	13.3 (0.4)	13.0 (1.7)	5.1 (1.3)	10.7 (2.2)	4.4 (1.2)	8.1 (0.5)	9.4 (0.2)	4.3 (0.5)
Lifetime asthma	13.2 (0.2)	12.3 (0.2)	18.1 (0.5)	18.0 (2.0)	9.0 (1.8)	15.7 (2.4)	9.4 (1.9)	12.4 (0.5)	13.6 (0.2)	7.3 (0.6)
Asthma attack or episode in the past 12 mo ^a	60.7 (0.9)	61.3 (1.1)	59.1 (1.6)	67.3 (7.0)	47.1 (13.4)	61.2 (11.1)	59.8 (12.3)	59.6 (2.7)	60.9 (0.9)	53.2 (4.8)

^a Data are based on sample of all of the children with current asthma.

Because of small sample sizes, estimates for individual race categories of asthma prevalence according to birth inside or outside of the United States could only be obtained for children of white, black, and other/multiple race. For these categories, children born in the United States had significantly higher rates of current asthma than did children born outside of the United States (white: 8.6% vs 3.6% [$P < .0001$]; black: 13.5% vs 5.9% [$P < .0001$]; other/multiple race: 8.6% vs 5.5% [$P =$

.006]). Current asthma prevalence for children of AI/AN, Filipino, and Asian Indian races born in the United States were 13.3%, 13.2%, and 4.8%, respectively. Table 3 presents the crude and adjusted ORs for all of the variables included in the main-effects model. After controlling for place of birth, gender, age, ethnicity, region, household income, and health insurance coverage, the adjusted ORs show that black (OR: 1.57 [confidence interval (CI): 1.43–1.73]), AI/AN (OR: 1.82 [CI: 1.33–2.49]), and Filipino (OR: 1.64 [CI: 1.04–2.58]) children had higher odds of reporting current asthma compared with white children. In addition, children born in the United States had, after controlling for the other demographic and sociodemographic factors, approximately twice the odds of reporting current asthma relative to children born outside of the United States.

TABLE 3 Crude and Adjusted ORs for Current Asthma Among Children Aged 2–17 Years: United States (NHIS 2001–2005)

Variable	Crude OR (95% CI)	Adjusted OR (95% CI) ^a
Race category		
White	Reference	Reference
Black	1.67 (1.54–1.82)	1.57 (1.43–1.73)
AI/AN	1.62 (1.20–2.21)	1.82 (1.33–2.49)
Chinese	0.59 (0.34–1.01)	0.70 (0.41–1.22)
Filipino	1.30 (0.83–2.04)	1.64 (1.04–2.58)
Asian Indian	0.50 (0.84–1.08)	0.62 (0.35–1.08)
Other or multiple race	0.95 (0.84–1.08)	1.07 (0.93–1.23)
Place of birth		
Born in the US (excluding territories)	2.30 (1.86–2.84)	2.07 (1.66–2.58)
Born outside the US	Reference	Reference
Gender		
Male	1.40 (1.31–1.50)	1.42 (1.32–1.53)
Female	Reference	Reference
Age, y		
2–5	0.78 (0.71–0.87)	0.76 (0.69–0.85)
6–9	0.94 (0.86–1.04)	0.93 (0.84–1.03)
10–13	1.05 (0.96–1.14)	1.02 (0.93–1.12)
14–17	Reference	Reference
Ethnicity		
Hispanic	0.80 (0.73–0.88)	0.97 (0.86–1.08)
Non-Hispanic	Reference	Reference
Region		
Northeast	1.37 (1.21–1.55)	1.29 (1.14–1.47)
Midwest	1.21 (1.07–1.36)	1.11 (0.97–1.27)
South	1.16 (1.04–1.29)	1.04 (0.93–1.16)
West	Reference	Reference
Household income		
Less than \$20 000 per y	1.45 (1.33–1.58)	1.43 (1.31–1.56)
\$20 000 or more per y	Reference	Reference
Health insurance coverage		
Not insured	0.63 (0.55–0.73)	0.68 (0.59–0.79)
Insured	Reference	Reference

^a The adjusted ORs are the results after entering all of the covariates listed in the crude OR column into the logistic regression model.

DISCUSSION

The results of this study support previous findings of disproportionately high lifetime asthma prevalence in black, AI/AN, and Filipino children in the United States.^{1,3–6} The results of this study also add to the growing body of evidence that, among persons living in the United States, those born in the United States are more likely to report asthma than are those born elsewhere.^{2,18,19}

The finding that black children have a higher prevalence of asthma compared with white children has been well established through multiple analytic studies that control for possible confounding factors, and multiple studies further explore differences in emergency department visits, hospitalizations, and disease outcomes among these children.^{1,3–5,9,22,23} Although some previous studies have shown high asthma prevalence estimates among AI/AN and Filipino American children, this study is unique in that it provides a national rather than regional estimate of asthma prevalence among Filipino children; it controls for basic demographic, socioeconomic, and access to health care-related confounding factors; and it uses as the outcome measure current asthma as opposed to lifetime asthma.^{1,6}

It is worth noting that, in this study, children without health insurance were found to have a lower prevalence of current asthma than children with health insurance. This finding has been noted in other childhood asthma studies by using NHIS data, and it is likely explained by decreased contact with health professionals among children without health insurance. This decreased contact

would result in fewer children without health insurance having a “yes” response to the asthma prevalence question asking if a “doctor or other health professional has ever told you that [child] has asthma.”² Although this study adjusted for health insurance status, it is still interesting to note that AI/AN children had both the highest prevalence of current asthma and the highest prevalence of “no health insurance.”

Another study finding is that children born in the United States are more likely to report current asthma than are children now in the United States but were born elsewhere. This finding is consistent with the results seen in previous studies of lifetime asthma prevalence in US- and in foreign-born children and adults.^{1,18,19} Although this study was unable to compare estimates for children of all race categories according to place of birth, it does highlight that Filipino children born in the United States have similar rates of current asthma compared with children of black and AI/AN races, whereas Asian Indian children born in the United States have much lower asthma rates.

This study is subject to several limitations, and 3 are of particular relevance. First, sparse national data are currently available that include smaller minority groups, such as AI/AN and Asian American subgroups. This paucity constrained our study design and provided relatively small sample sizes for the AI/AN, Chinese, Filipino, and Asian Indian groups. It also limited the statistical power of the study and decreased the precision of our estimates; because of relatively small sample sizes in some race and place birth categories, several of the OR CIs are very wide. To enable this study and to further increase the sample sizes, we used the largest source of national data we know of that includes AI/AN and Asian American subgroups, and we aggregated 5 years of data. Second, a potential source of selection bias is that the NHIS is conducted only in English or Spanish. If a household does not include an adult who speaks either of those languages, the household will not be included in the survey. Moreover, if English speaking in the household is considered a proxy for acculturation level, then our NHIS sample might be biased against “low acculturation” respondents. Third, we were not able to include at least 2 established risk factors for asthma in our analysis: BMI and environmental tobacco smoke (ETS) exposure. Previous studies have shown that BMI >95th percentile in children and exposure to ETS are risk factors for asthma.^{5,24–26} Because the 2001–2005 NHIS did not have heights and weights of the sample children available, we were unable to calculate BMI. Although the NHIS does ask the sample adult from each household if he or she smokes cigarettes, no question exists concerning the general presence of smokers in the household.

The results from previous studies show that AI/AN children and US-born children, when compared with white children and with foreign-born children, respectively, have a higher obesity prevalence.^{27,28} The results from previous studies of BMI in Filipino children are, however, not consistent.^{28,29} Previous studies on smoking prevalence in adults have shown high rates of smoking in AI/AN and foreign-born adults and have shown

mixed results for Filipino adults, with some studies showing high smoking rates and some showing relatively low smoking rates.^{30,31} Several studies have shown marked differences in smoking rates between men and women from various racial and ethnic backgrounds, and because for a child only 1 smoker in the household can result in ETS exposure, these differences should be taken into account when assessing potential ETS exposures.^{30–32}

We do not mean to suggest that race is itself a risk factor for current asthma. Rather, we intend to point out the importance in certain populations of race as an asthma risk marker.¹¹ The causes for these differences could be environmental, social, cultural, or bias in physician diagnosis or in parental reporting of asthma. Nevertheless, elucidating differences among different racial and ethnic groups is still important by helping to ensure that underrepresented minority groups are not marginalized or neglected in medical and public health research and practice. By identifying disparities such as these, health care professionals can plan tailored and culturally competent interventions for communities and populations with high asthma rates. Additional study of risk markers for asthma in minority subpopulations will also help to pinpoint and to highlight possible environmental and cultural causes for increased asthma prevalence. To enable this research in the future, minority populations need to be included in national surveys and studies in numbers adequate for data analysis. Many researchers have called for oversampling of Asian Americans and AI/ANs in national surveys as a method for generating better data sources.^{15,33–35} Responding to this need, the NHIS has initiated the oversampling of Asian populations beginning with the 2006 survey.³⁶

CONCLUSIONS

This study reveals that, among children from different Asian American subgroups, wide variation may occur in asthma prevalence. As more data on these populations become available, research into explanations for the elevated asthma prevalence found in AI/AN and Filipino children will allow for the exploration of both existing and novel hypotheses concerning social, cultural, and environmental contributors to asthma. This could include expanded research of place of birth, obesity, and ETS exposure in addition to research on early child rearing habits and potential childhood environmental exposures. Most importantly, this research will identify populations vulnerable to and burdened by asthma, and such research will also assist in tailoring interventional programs that meet their needs.

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