2001 U.S. Department of Health and Human Services;
Public Health Reports

Public Health Rep 2001; 116: 51-57

January, 2001 / February, 2001

SECTION: RESEARCH ARTICLES

LENGTH: 3841 words

TITLE: Differences in Asthma Prevalence between Samples of American Indian and **Alaska Native Children**

AUTHOR: JAMES W. STOUT, MD, MPH na; LISA C. WHITE, MPH na; GREGORY J. REDDING, MD na; BARBARA H. MORRAY, RN, MS nb; PATRICIA E. MARTINEZ, MD nc; PETER J. GERGEN, MD, MPH nd

na Department of Pediatrics, School of Medicine, University of Washington, Seattle
nb Division of Pulmonary Medicine, Children's Hospital and Regional Medical Center, Seattle
nc Yukon-Kuskokwim Delta Regional Hospital, Bethel, AK
nd Center for Primary Care and Research, Agency for Healthcare Research and Quality, Rockville, MD

SYNOPSIS: Objectives. To better understand the prevalence of asthma among American Indian and Alaska Native (AI/AN) children and to explore the contribution of locale to asthma symptoms and diagnostic assignment, the authors surveyed AI/AN middle school students, comparing responses from metropolitan Tacoma, Washington (metro WA) and a non-metropolitan area of Alaska (non-metro AK).

Methods. Students in grades 6-9 completed an asthma screening survey. The authors compared self-reported rates of asthma symptoms, asthma diagnoses, and health care utilization for 147 children ages 11-16 self-reporting as AI/AN in metro WA and 365 in non-metro AK.

Results. The prevalences of self-reported asthma symptoms were similar for the metro WA and non-metro AK populations, but a significantly higher percentage of metro WA than of non-metro AK respondents reported having received a physician diagnosis of asthma (OR 2.33; 95% CI 1.23, 4.39). The percentages of respondents who reported having visited a medical provider for asthma-like symptoms in the previous year did not differ.

Conclusions. The difference in rates of asthma diagnosis despite similar rates of asthma symptoms and respiratory-related medical visits may reflect differences in respiratory disease patterns, diagnostic labeling practices, or environmental factors. Future attempts

to describe asthma prevalence should consider the potential contribution of non-biologic factors such as diagnostic practices.

TEXT:

The prevalence and severity of childhood asthma have increased during the last two decades. [n1-n3] Reports addressing whether residents of urban areas have higher prevalences of asthma [n4] and higher asthma mortality than those living in non-urban areas offer mixed conclusions. [n5,n6] On the other hand, it has been conclusively demonstrated that the burden of asthma is highest among low-income populations. [n7,n8] It is not clear to what extent observed variations between populations in asthma prevalence are due to differences in actual asthma prevalence or differences in the likelihood of receiving a diagnosis of asthma. Because many cases of asthma in a population may remain undiagnosed, [n9] prevalence levels based on physician diagnosis alone could vary greatly. This variation could be related to differences in geographic proximity to health care, in care-seeking behavior of patients, or in practice patterns of physicians. [n10]

For this and other reasons, determining asthma prevalence is problematic. There is no highly sensitive and specific "gold standard" for the diagnosis of asthma, as there are for some other chronic illnesses. Historically, asthma prevalence has been measured in epidemiologic surveys through asking questions about either a diagnosis of asthma, a history of wheezing, or both. Wheezing illness may be a manifestation of a condition other than asthma. And while questionnaires eliciting self-reports of physician diagnoses of asthma have been shown to be valid for both children and adults, these data are influenced by patterns of contact with medical care and diagnostic practices. [n11] Standardized laboratory methods of asthma diagnosis are also problematic. For example, the methacholine challenge test, a measure of bronchial hyper-responsiveness (BHR) used primarily in research settings, is a relatively insensitive and nonspecific tool for determining asthma prevalence. [n12] Both children and adults may demonstrate BHR without a prior history of asthma, and a diagnosis of asthma without BHR. [n13-n16]

We need to better understand the reasons for higher levels of reported asthma prevalence among some populations. There is some recent evidence that hospitalization rates for wheezing illness (asthma and bronchiolitis) for AI/AN infants are significantly higher than those for infants in the general population. [n17,n18] It is possible that host differences, viral exposures, or non-biologic factors such as likelihood of a physician diagnosis play a role in these differences for some communities. Furthermore, little is known about whether this difference between infant populations persists into later childhood as a disparity in the prevalence of either wheezing symptoms or asthma. To begin exploring this question, we conducted a prevalence study of two convenience samples of AI/AN middle school students. This study afforded us the opportunity to compare two methods of measuring asthma prevalence--self-report of a physician diagnosis and self-report of symptoms--for two samples of children.

We surveyed all middle school students at an AI/AN tribal school in Tacoma,

Washington (metro WA), and at three schools serving predominately AI/AN children in the Yukon Kuskokwim (Y-K) Delta region of southwest Alaska (non-metro AK). These locations were chosen for two reasons: 1) to represent AI/AN populations that differed in their proximity to metropolitan areas, and 2) our research group had prior working relationships with the two communities. We restricted the data analysis to responses from AI/AN students.

The 75,000-square-mile Y-K River Delta in southwest Alaska is inhabited by 21,000 people, 82% of whom are Yup'ik Eskimos, while 7% are from other indigenous groups. [n19] The Y-K Delta corresponds roughly to the traditional lands of the Yup'ik, who live primarily in remote villages. The town of Bethel has a population of 5,500 and serves as the regional hub for 56 villages. [n20] The Y-K Health Corporation, a regional tribal health corporation, operates a local hospital and clinic system that serves as the hub for a network of health aides in the surrounding area. [n20] The health aides provide front-line health care in the Y-K Delta villages, with telephone support from physicians in Bethel.

In Tacoma, Washington, an industrial port city, the Indian Health Service (IHS)-affiliated Takopid Health Center serves more than 11,000 enrolled members of AI/AN tribes (Personal communication, Cliff O'Callahan, MD PhD, Pediatrician, Takopid Health Center, October 1998). AI/AN children receive inpatient care at Tacoma's children's hospital because there is no IHS-affiliated facility available. Chief Leschi School provides public education for preschool through 12th grade AI/AN children from throughout the Tacoma area. The city of Tacoma has been designated by the Census Bureau as a Primary Metropolitan Statistical Area and is part of the larger Seattle-Tacoma-Bremerton Consolidated Metropolitan Statistical Area. [n21]

METHODS

Subjects

We surveyed all 6th through 9th grade students in one town and two Alaska coastal village schools serving predominately AI/AN children in the Y-K Delta region in the fall of 1997. We surveyed 6th through 8th grade students at the Chief Leschi School in Tacoma in the fall of 1998. For the present study, we analyzed the responses of participants who reported their ethnicity as AI/AN and their age as 11-16 years.

Permission for the study was obtained from the school principals and superintendents; the Puyallup, Emmonak, and Hooper Bay Tribal Councils; the Y-K Health Corporation Executive Board; the Northwest Portland Area Indian Board; and the Institutional Review Board at the University of Washington. Parental consent was passive; that is, parents were informed of the survey and instructed to respond to the school or investigators only if they did not wish their children to participate.

Measures

The International Study of Asthma and Allergy in Children (ISAAC) group has developed and validated a written questionnaire to assess the prevalence and severity of asthma and allergic disease in defined populations using simple standardized questions.

[n22,n23] The ISAAC questionnaire has been administered to middle school-aged students at 155 centers in 56 countries. [n23] In addition, the ISAAC group has developed and validated a videotape and accompanying questions that have been used to determine asthma prevalence among school-aged children at approximately 100 of these sites. [n23,n24]

The ISAAC videotape supplements the written questionnaire with five scenarios of school-aged children displaying asthma symptoms. The purpose of showing signs and symptoms of asthma instead of using words to describe them is to reduce or eliminate language or translation bias. [n25] We used the international version of the video survey, ISAAC 3.0, which shows children from different ethnic groups. [n25,n26]

Following several demographic questions, the questionnaire included 29 items addressing symptoms and health care utilization. The demographic questions included date of birth, gender, racial/ethnic identification (Native American/Eskimo; white; Asian/Pacific Islander; African American; Hispanic; other); and tribal affiliation.

The video was shown to accompany questions 14 through 18. The five scenarios of asthma symptomatology depicted in the video represent:

* Moderate wheezing at rest,

* Wheezing and shortness of breath after exercise,

* Nocturnal wheezing,

* Nocturnal cough,

* Severe wheezing and shortness of breath at rest.

The last scenario was designed to depict symptoms of severe respiratory distress as a proxy for severe asthma. [n25] For each scenario, respondents checked yes/no responses, indicating whether they had experienced the symptom at any time in their lives, and whether they had experienced it once or more in the previous 12 months.

The other asthma-related questionnaire items were:

* Have you *ever* had asthma?

* Did a doctor *ever* tell you that you had asthma?

* *In the last 12 months*:

-- have you had wheezing or whistling in the chest?

-- has wheezing ever been severe enough to limit your speech to only one or two words at

a time between breaths? [proxy for severe asthma]

-- how many attacks of wheezing have you had? [four or more a proxy for severe asthma]

For the present study, we added two items regarding health care utilization that had been used in a cross-sectional asthma prevalence study of Seattle middle school students by co-authors GJR and BHM.

* *In the last 12 months*:

-- approximately (best guess) how many times did you go to the doctor for wheezing, dry cough, and/or breathing difficulties?

-- *Non-metro AK sample:* approximately (best guess) how many times did you go to a village health aide or an emergency room for wheezing, dry cough, and/or breathing difficulties? *Metro WA sample:* approximately (best guess) how many times did you go to an emergency room for wheezing, dry cough, and/or breathing difficulties?

Survey administration

Study staff and teachers administered the survey during regular class time. In Alaska, students were surveyed at the local elementary school which housed the 6th graders, and at the local high school for the 7th through 9th graders. Each classroom was surveyed separately. In Tacoma, 7th and 8th grade students participated simultaneously, via schoolwide video. The 6th graders, who were in a different building on campus, completed the survey at a different time, also using central video access.

Viewing of the video and completion of the written questions took approximately 20 to 25 minutes. At both study sites, the survey team was led by researchers experienced in survey administration, including co-authors Lisa White and Barbara Morray. To reduce potential literacy bias, the research staff read the questions to all 6th grade classes. School attendance figures, ascertained on the day of the survey, were used as denominators in calculating response rates.

A total of 629 surveys were completed, 163 in metro WA and 466 in non-metro AK. Four students were eliminated from the metro WA sample because of age, and 12 because they did not self-report as AI/AN, leaving a total of 147 students, or 73.4% of those in attendance on the day of the survey. Fourteen students were eliminated from the non-metro AK sample because of age, and 87 because they did not self-report as AI/AN, leaving a total of 365 students, or 77.7% of those in attendance. Limited resources prohibited data collection from students missing on the day of the survey.

Analysis

We expressed differences between metro WA and non-metro AK students in asthma prevalence and health service utilization as odds ratios. We assessed the significance of these comparisons using 95% confidence intervals around the odds ratios.

RESULTS

Population characteristics

The two study samples were similar in age and gender. The median age of the students in the metro WA sample was 13.1 years (mean 13.0 years), and 46.9% were female. The median age of the students in the non-metro AK sample was 13.2 years (mean 13.3 years); 53.2% of the students were female.

Symptom prevalence

Symptom prevalence was assessed based on past-year symptoms to capture current asthma, to reduce recall error, and to be consistent with international ISAAC analyses. We found no differences between the metro WA and non-metro AK students in responses to four of the five video scenarios. (See Table 1.) Overall, 8.5% of participating AI/AN students reported having had moderate wheezing at rest in the previous 12 months, 10.9% reported wheezing after exercise, 7.7% reported nocturnal cough, and 5.3% reported severe wheezing at rest, the scenario used as a proxy for severe asthma. A higher percentage of metro WA students than of non-metro AK students reported nocturnal wheezing (6.2% vs. 1.7%, OR 3.9; 95% CI 1.24, 12.59).

Table 1. Prevalence of asthma symptoms over a 12-month period reported by 512 middle school students ages 11-16 years who self-identified as American Indian or Alaska Native

	Metro WA	Non-metro AK		
	n = 147	n = 365		
Symptom in previous 12 months	Percent	Percent	OR	95% CI
Video questions				
Moderate wheezing at rest	8.9	8.3	1.08	0.52, 2.23
Wheezing and shortness of breath after exercise	14.7	9.4	1.66	0.89, 3.07
Nocturnal wheezing	6.2	1.7	3.90	1.24, 12.59 a
Nocturnal cough	4.1	9.1	0.43	0.16, 1.10
Severe wheezing and shortness of breath at rest b	6.2	5.0	1.26	0.51, 3.05
Other asthma-related questionnaire items				
Wheezing or whistling in the chest	18.4	13.2	1.49	0.86, 2.56
Wheezing severe enough to limit speech b	10.2	4.7	2.33	1.07, 5.06 a
4 attacks of wheezing b	3.4	3.0	1.13	0.34, 3.61

a Significant difference between samples

b Item designed to represent severe asthma

Metro WA = metropolitan Tacoma, Washington, area
Non-metro AK = non-metropolitan Yukon-Kuskokwim (Y-K) River Delta, Alaska

There were no differences between the metro WA and non-metro AK students in responses to two of the three non-video items on the questionnaire that addressed asthma-related symptoms over a 12-month period. Overall, 14.6% of participating AI/AN students reported having experienced wheezing or whistling in the chest in the previous 12 months, and 3.1% reported four or more attacks of wheezing in the previous 12 months, a proxy for severe asthma. In response to another indicator of severe asthma, more metro WA students than non-metro AK students reported speech-limiting wheezing over a 12-month period (OR 2.33; 95% CI 1.07, 5.06).

We compared the percentage of positive responses to any of the three video scenarios showing wheezing (moderate wheezing at rest, wheezing after exercise, or nocturnal wheezing) to the percentage of positive responses to the primary non-video question regarding wheezing or whistling in the chest. [n27] We found no difference between responses to the video scenario and responses to the single non-video question. In metro WA, 17.0% answered positively to any of these three video scenarios with regard to the previous 12 months, and 18.4% reported wheezing or whistling in the chest in the previous 12 months in response to the non-video question. In non-metro AK, 14.5% reported any of these three video symptoms, and 13.2% answered yes to the non-video question.

Asthma diagnosis and respiratory visits
Children in the metro WA sample were significantly more likely to report ever having asthma and ever having been diagnosed with asthma by a doctor (Table 2). However, there was no difference between the groups in the percentages of respondents who reported having visited a medical provider or emergency department for wheezing, dry cough, and/or breathing difficulties in the previous 12 months. Among the subset of children who indicated that they had made one or more respiratory visits, those in metro WA were 4.53 times as likely as those in non-metro AK to report ever having had a diagnosis of asthma.

Table 2. Prevalence of asthma, asthma diagnosis, and respiratory-related medical visits reported by 512 middle school students ages 11-16 years who self-identified as American Indian or Alaska Native

	Metro WA n = 147	**Non-metro AK n = 365**		
Variable	**Percent**	**Percent**	**OR**	**95% CI**
Ever had asthma	17.6	10.0	1.93	1.06, 3.49 a
Ever diagnosed with asthma by physician	16.1	7.6	2.33	1.23, 4.39 a
Respiratory visit b in past 12 months	24.1	27.1	0.85	0.53, 1.35

Physician diagnosis of asthma, among subset with respiratory visit	(n = 35) 51.4	(n = 99) 18.9	4.53	1.81, 11.44	a

a Significant difference between samples

b "In the last 12 months, approximately (best guess) how many times" did you go to the doctor, emergency room, or village health aide "for wheezing, dry cough, and/or breathing difficulties?"

Metro WA = metropolitan Tacoma, Washington, area
Non-metro AK = non-metropolitan Yukon-Kuskokwim (Y-K) River Delta, Alaska

DISCUSSION

Using a validated survey instrument, we found no differences between the two samples in the prevalence of asthma symptoms reported in response to four of five video scenarios or two of three non-video questionnaire items. Although overall the prevalence of asthma symptoms appeared similar for the two samples, two differences were noted: a higher percentage of children reporting nocturnal wheezing and wheezing severe enough to limit speech among the metro WA children than among the non-metro AK children. While this may imply that a subgroup of the metro WA sample had more severe asthma than the non-metro AK group, we are unable to conclude this because of the similarities between groups in the remaining six variables. No differences were noted between the two sites in health care visits for wheezing, dry cough, and/or breathing difficulties. Yet among those children who had made a respiratory visit, those in the metro WA sample were much more likely than those in the non-metro AK sample to report ever having received a physician diagnosis of asthma.

The ISAAC video survey has been used at four other North America sites: Seattle; Chicago; Hamilton, Ontario; and Saskatoon, Saskatchewan. [n23] Our asthma prevalence results tend to be lower than those found at these sites. [n23] Because these surveys have all been conducted with convenience samples of middle school students, it is impossible to know whether there are true prevalence differences among populations.

The limitations inherent in measuring asthma prevalence make it difficult to know whether our findings represent differences in diagnostic behavior, differences in health beliefs of the affected individuals and their families, or true biologic differences between the two study groups. The findings may also reflect literacy differences between these groups of children; however, we read the survey questions to the youngest participants (6th graders) in an attempt to reduce this potential source of bias. There may also be unmeasured differences in access to health services between these groups. When we restricted our analysis of physician diagnosis to the subset of respondents who had made a respiratory visit in the previous year, the differences between the two samples were even greater. After discussing our findings with the medical communities at both study sites, we concluded that differences in diagnostic behavior on the part of medical

providers accounted for most of the difference in the likelihood of a patient receiving an asthma diagnosis.

Bronchiolitis, an infection of the small airways most commonly due to parainfluenza or respiratory syncytial viruses, is the most common cause of wheezing in infants, an age group for which diagnostic confusion with asthma is likely. [n17] The prevalence and severity of bronchiolitis in the Y-K Delta region of Alaska are orders of magnitude greater than that seen in the rest of the United States. [n28] It is possible that asthma-like symptoms are more likely to be triggered by viral respiratory illness and less likely to be triggered by airborne allergens for children in rural Alaska than for children in the rest of the country. Accordingly, children in rural Alaska may be more likely to receive diagnoses such as reactive airways disease or recurrent bronchiolitis than a diagnosis of asthma. We are not aware of any data regarding the prevalence of atopy (allergic reaction) to common indoor airborne allergens among this northern-latitude population.

Although the ISAAC survey is designed to minimize cultural differences in determining asthma prevalence, these differences may still influence symptom reporting. According to several Yup'ik health care workers with whom we spoke, the Western concept of asthma is not part of the Yup'ik health belief system. Although the non-metro AK community may be using a different label than used in other areas, the reported rates of asthma symptoms were generally similar for the two groups. While our findings from these two non-random AI/AN samples should not be generalized to other rural and urban populations, they do provide evidence that physician diagnosis of asthma may vary according to locale, even when clinicians are presented with similar clinical pictures.

Variables such as socioeconomic status, ethnicity, and urban vs. non-urban residence may prove to be more strongly associated with receiving a physician diagnosis of asthma than the prevalence of asthma symptoms. [n29] For example, Cunningham and colleagues reported that African-American children in urban Philadelphia were twice as likely to report having been diagnosed with asthma as their white counterparts, but equally likely to report persistent wheeze in analyses controlled for several social, health history, and home environment factors. [n30]

Recent reports have described increases in childhood asthma prevalence and severity, especially among low-income, urban populations. [n3,n8,n9] Our study suggests that future research should consider the influence of patients' health beliefs and patterns of health service use as well as physicians' patterns of diagnosis in explaining these trends.

SUPPLEMENTARY INFORMATION: This study was supported by NIAID/NIH grant number U01 AI39761, as an Office of Research on Minority Health (ORMH) supplement, and by a Maternal and Child Health Bureau grant, HHS/HRSA MCHB # 6T72-MC00008-09S1. The results of this study were presented in part at the meeting of the Ambulatory Pediatrics Association, May 3, 1999, San Francisco, California.

Address correspondence to: James W. Stout, MD. Childhood Asthma Study Team, 146 N. Canal St., Suite 300, Seattle, WA 98103; tel. 206-616-9410; fax 206-543-5318; e-mail

<jstout@u.washington.edu>.

REFERENCES:

[n1.] Gergen PJ, Weiss KB. Changing patterns of asthma hospitalization among children: 1979 to 1987. JAMA 1990; 264:1688-92.

[n2.] Asthma--United States, 1980-1990. MMWR Morb Mortal Wkly Rep 1992;41:733-5.

[n3.] Mannino DM, Homa DM, Pertowski CA, Ashizawa A, Nixon LL, Johnson CA, et al. Surveillance for asthma--United States, 1960-1995. MMWR CDC Surveill Summ 1998;47:1-27.

[n4.] Gergen PJ, Mullally DI, Evans R. National survey of prevalence of asthma among children in the United States, 1976 to 1980. Pediatrics 1988;81:1-7.

[n5.] Weiss KB, Wagener DK. Geographic variations in US asthma mortality: small-area analyses of excess mortality, 1981-1985. Am J Epidemiol 1990;132:S107-15.

[n6.] Ray N, Thamer M, Fadillioglu B, Gergen P. Race, income, urbanicity, and asthma hospitalization in California: a small area analysis. Chest 1998;113:1277-84.

[n7.] Halfon N, Newacheck PW. Childhood asthma and poverty: differential impacts and utilization of health services. Pediatrics 1993;91:56-61.

[n8.] Childhood asthma hospitalizations--King County, Washington, 1987-1998. MMWR Morb Mortal Wkly Rep 2000;49:929-52.

[n9.] Crain EF, Weiss KB, Bijur PE, Hersh M, Westbrook L, Stein REK. An estimate of the prevalence of asthma and wheezing among inner-city children. Pediatrics 1994;94:356-62.

[n10.] Eggleston PA. Urban children and asthma. Immunol Allergy Clin North America 1998;18:75-84.

[n11.] Samet JM. Epidemiologic approaches for the identification of asthma. Chest 1987;91:74S-78S.

[n12.] Shaw RA, Crane J, O'Donnell TV, Lewis ME, Stewart B, Beasley R. The use of a videotaped questionnaire for studying asthma prevalence: a pilot study among New Zealand adolescents. Med J Aust 1992;157:311-14.

[n13.] Enarson DA, Vedal S, Schulzer M, Dybuncio A, Chan Y-M. Asthma, asthma-like

symptoms, chronic bronchitis, and the degree of bronchial hyperresponsiveness in epidemiologic surveys. Am Rev Respir Dis 1987;136:613-7.

[n14.] Clifford RD, Radford M, Howell JB, Holgate ST. Prevalence of atopy and range of bronchial response to methacholine in 7 and 11 year old schoolchildren. Arch Dis Child 1989;64:1126-32.

[n15.] Backer V, Bach M-N, Dirksen A. Prevalence and predictors of bronchial hyperresponsiveness in children aged 7-16 years. Allergy 1989;44:214-19.

[n16.] Sears MR, Jones DT, Holdaway MD, Hewitt CJ, Flannery EM, Herbison GP, Silva PA. Prevalence of bronchial reactivity to inhaled methacholine in New Zealand children. Thorax 1986;41:283-9.

[n17.] Liu LL, Stout JW, Sullivan M, Solet D, Shay DK, Grossman DC. Asthma and bronchiolitis hospitalizations among American Indian children. Arch Pediatr Adolesc Med 2000;154:991-6.

[n18.] Lowther S, Shay D, Holman R, Clarke M, Kaufman S, Anderson L. Bronchiolitis-associated hospitalizations among American Indian and Alaska Native children. Pediatr Infect Dis J 2000;19:11-17.

[n19.] Alaska Department of Community and Economic Development. Alaska community database online [cited 2000 Mar 13]. Available from: URL: http://www.dced.state.ak.us/mra/cf_comdb.htm

[n20.] Alaska Department of Community and Economic Development. Alaska community database. Community information summaries [cited 2000 Mar 13]. Available from: URL: http://www.dced.state.ak.us/mra/cf_cis.cfm

[n21.] Census Bureau (US). About Metropolitan Areas [cited 2000 Mar 13]. Available from: URL: http://www.census.gov/population/www/estimates/aboutmetro.html

[n22.] Shaw RA, Crane J, Pearce N, Burgess CD, Bremner P, Woodman K, Beasley R. Comparison of a video questionnaire with the IUATLD written questionnaire for measuring asthma prevalence. Clin Exp Allergy 1992;22:561-8.

[n23.] ISAAC Steering Committee. Worldwide variations in the prevalence of asthma symptoms: the International Study of Asthma and Allergies in Childhood (ISAAC). Eur Respir J 1998;12:315-35.

[n24.] Beasley R, Keil U, von Mutius E, Pearce N. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: the International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. Lancet 1998;351:1225-32.

[n25.] Crane J, Beasley R, Stewart B, Shaw R, Pearce N, Burgess C. The international asthma video questionnaire for measuring asthma prevalence in different populations. Int Arch Allergy Immunol 1995;107:450-1.

[n26.] ISAAC [cited 2000 Mar 13]. Available from: URL: http://isaac.auckland.ac.nz

[n27.] Pearce N, Weilund S, Keil U. Self-reported prevalence of asthma symptoms in children in Australia, England, Germany, and New Zealand: an international comparison using the ISAAC protocol. Eur Respir J 1993;6:1455-61.

[n28.] Singleton RJ, Petersen KM, Berner JE, Schulte E, Chiu K, Lilly CM, et al. Hospitalizations for respiratory syncytial virus infection in Alaska Native children. Pediatr Infect Dis J 1995;14:26-30.

[n29.] Gergen P. Social class and asthma--distinguishing between the disease and the diagnosis [editorial]. Am J Public Health 1996;86:1361-2.

[n30.] Cunningham J, Dockery DW, Speizer FE. Race, asthma, and persistent wheeze in Philadelphia schoolchildren. Am J Public Health 1996;86:1406-9.