

Asthma Prevalence Among Inner-City Asian American Schoolchildren

TED LEE, MD, MPH^a
DOUG BRUGGE, PhD, MS^b
CHARLENE FRANCIS, RN^c
OPAL FISHER, RN, MEd^c

SYNOPSIS

Objective. Though asthma has been studied in many inner-city populations in the United States, there have been no studies specifically on Asian American immigrants. The authors conducted a cross-sectional survey of the prevalence of asthma among schoolchildren at the Josiah Quincy Elementary School, located in Boston Chinatown. Roughly 62% of the students in the school are Asian American.

Methods. The authors utilized the Brief Asthma Pediatric Screen (BAPS), a five-question instrument that was validated through the Chicago public schools. The survey was administered to kindergarten through fifth grade students.

Results. Of the 606 respondents (69.9% of the students), 16% had previously diagnosed asthma and 3% had possible undiagnosed asthma. Asthma was more prevalent in boys than in girls (relative risk [RR] 1.75; 95% confidence interval [CI] 1.20, 2.56). In addition, the respondents who lived in Chinatown were less likely to have been diagnosed with asthma (RR 0.59; 95% CI 0.39, 0.90), as were those with Asian surnames (RR 0.65; 95% CI 0.44, 0.97).

Conclusion. Although this study was preliminary, our results suggest that asthma rates are substantial among inner-city Asian immigrant children, but possibly lower than for other inner-city children.

^aWest Suburban Family Practice Residency Program, Oak Park, IL

^bDepartment of Family Medicine and Community Health, Tufts University School of Medicine, Boston, MA
Josiah Quincy Elementary School, Boston, MA

Address correspondence to: Doug Brugge, PhD, MS, Dept. of Family Medicine and Community Health, Tufts Univ. School of Medicine, 136 Harrison Ave., Boston, MA 02111; tel. 617-636-0326; fax 617-636-4017; e-mail <dbrugge@aol.com>.

© 2003 Association of Schools of Public Health

Although asthma has been extensively studied in various inner-city minority populations, a literature search reveals that the magnitude of this disease among Asian Americans is largely unknown. One recent study reported abnormal spirometry in 47% of Asian children, but the Asian children made up a tiny percentage and number of students in the study.¹

Asthma is the most common chronic disease of childhood and contributes to a significant proportion of school absences each year.² In 1999, approximately 5.6% of children ages 5 through 14 in the United States had an episode of asthma or asthma attack.³ Morbidity and mortality from this disease disproportionately affects minority populations. For example, the asthma mortality rate among African Americans aged 5 through 34 years was three to five times as great as the rate among whites.⁴ Studies on asthma in large cities, such as New York and Chicago, show that asthma morbidity and mortality are highly concentrated in inner-city neighborhoods.^{5,6} In a small area analysis of Boston, high asthma hospitalization rates were found primarily in poor inner-city neighborhoods with large minority populations.⁷ Specifically, the Boston neighborhoods of Roxbury, Dorchester, and South End had greater than five hospitalizations per 1,000 persons. In Chinatown, there were about three hospitalizations per 1,000 persons.

China has been reported to have lower rates of childhood asthma than the U.S.,⁸ however rates of childhood asthma also appear to vary among different Chinese cities.^{9,10} A study of Asian immigrants in Melbourne showed that the prevalence of hay fever and asthma in this population was strongly associated with length of stay in Australia.¹¹ This suggests that the pathogenesis of asthma in Asian immigrants may be associated with exposures in a new environment or to differences in diagnosis.

Our study population was composed of the students at the Josiah Quincy Elementary School. Situated in Boston Chinatown, the students at this school are predominately of Chinese descent. The impetus for this study was concern from parents and the school nurses about the perceived increase in asthmatic children at this school. In 1998, 66 students were known by the school nurse to have asthma. Since then, more asthmatic students have been reported each year to the nurses. During the 2001–2002 school year, more than 20 of the 50 Meter Dose Inhalers retained in the school nurses' office were administered per week during the winter, but far fewer in the spring. Thus, it is possible that time spent indoors or use of heating systems is a factor in asthma seasonality at the school.

The residents of Boston Chinatown face a dispro-

portionate amount of environmental hazards, including air pollution, secondhand smoke, noise, construction, and trash. A pilot study found that adult residents reporting greater exposure to motor vehicle exhaust and construction dust had more health symptoms in the preceding month.¹² Traffic injuries are abundant in the community and a recent study has found an association between vehicle volume and rate of injuries at intersections.¹³ Residents also suffer from a lack of affordable housing and open space due to urban renewal and highway construction since the 1950s.¹⁴ Smoking prevalence is very high among male residents.

The elementary school is located at the southern border of Chinatown, adjacent to the intersection of two major highways—the Massachusetts Turnpike (I-90) and the Central Artery (I-93)—that are currently undergoing the largest transportation construction project in the U.S. Although the pathogenesis of asthma is likely multifactorial, it is possible that the air pollution that surrounds the school is contributing to the prevalence and/or morbidity at the school.

METHODS

This cross-sectional survey was accomplished through collaboration between the Josiah Quincy Elementary School and Tufts University School of Medicine (TUSM). Approval for this study was first obtained through the Institutional Review Board of TUSM. The instrument used to measure the prevalence of diagnosed asthma at this school was the Brief Pediatric Asthma Screen (BPAS) (Table 2).¹⁵ This five-question survey was validated through the Chicago public school system as a screening tool for asthma. Depending on how parents of the schoolchildren answered these five questions, the students could be placed into three categories: (1) asthma; (2) no asthma; or (3) possible asthma. Possible asthma was coded as those respondents who answered “no” to question 1 and “yes” to question 5 or two or more of the remaining questions. We adapted the BPAS for our study by translating it into Chinese and back-translating it to ensure accuracy.

Attached to the adapted version of the BPAS was a bilingual cover letter—signed by all the authors and the school principal—that explained the goals of the study. A section of the letter had space for parents to fill out the demographics: age, gender, grade, and neighborhood of residence. We informed the parents in the cover letter that responding to the survey would constitute consent for their children to participate in this study. To ensure confidentiality, the results of the BPAS were kept separate from the page with the students' names and demographics.

The nurses wrote a memo to all the teachers explaining the purpose of the study and encouraging them to remind their students to return these surveys. The surveys were then distributed to each of the homerooms and sent home to the parents via the students. Upon filling out the surveys, the parents sealed them in envelopes and had their children return them to their homeroom teachers. The teachers then returned them to the nurses. There was a two-week period between distribution and collection of most of the surveys, with a small number returned over a longer time period.

Once all the surveys were collected, the information was entered into a database using Microsoft Access.¹⁶ The information was entered twice and then checked for errors using the validation feature of Epi Info.¹⁷ The final database was then analyzed using Epi Info. Missing data was filtered out prior to analysis. We calculated frequencies of each demographic and assigned the respondents to the three categories defined by the BPAS. Cross-tabulations were then conducted between question 1 of the BPAS (previous diagnosis of asthma) and the demographic variables of sex, grade, neighborhood, and surname. We conducted chi-square analyses looking for significance in the differences.

We conducted three different additional levels of analyses to look for trends among the variables of asthma, neighborhood, and surname. First, we compared the rates of previously diagnosed asthma between the respondents living in Chinatown and those living in all other neighborhoods combined. Then we created the variable “surname” by categorizing the respondents’ names as Asian or non-Asian. Those who filled out the Chinese version of the survey were automatically put into the Asian surname category. For all other respondents, comparing the entries of two different research assistants and resolving any discrepancies determined the surname. Ambiguous names were removed, leaving 548 surveys for analysis. This new variable was then cross-tabulated with the variable “asthma” to see if there was a difference in prevalence of asthma between Asian and non-Asian respondents. Lastly, we cross-tabulated “neighborhood group” (Chinatown vs. outside of Chinatown) with “surname” (Asian vs. non-Asian) to look for trends. We also looked for trends in the 20 students who were categorized as possibly having undiagnosed asthma. For the analysis, we copied these 20 students from the main database and created a second database.

Finally, all parents were sent response letters informing them of the results of the survey for their child. The parents of those who had been previously

diagnosed with asthma were alerted to various resources available to them at the school. Those for whom it appeared unlikely that their child had asthma were so informed. The parents whose children had possible undiagnosed asthma were informed of this and a recommendation was made to have their child follow up with a physician for further diagnosis.

RESULTS

A total of 867 surveys were sent out and 606 were collected, for a response rate of 69.9%. Of those surveys with completed data, 275 (48.2%) were male and 295 (51.8%) were female. The mean age was 7.9 years (standard deviation [SD] = 1.8 years). All the grade levels had roughly an equal number of respondents. The majority of respondents lived in the two neighborhoods adjoining the school: Chinatown (36.9%) and the South End (25.8%) (Table 1).

Responses to the five questions of the BPAS are shown in Table 2. Based on the response combinations to the BPAS, respondents were placed into one

Table 1. Study population

Age	Years	
Mean	7.9	
SD	1.9	
Sex	No.	Percent
Males	275	48.2
Females	295	51.8
Grade		
Kindergarten	80	13.9
First	97	16.9
Second	102	17.7
Third	109	19
Fourth	93	16.2
Fifth	94	16.3
Neighborhood		
Chinatown	206	36.9
South End	144	25.8
Allston-Brighton	46	8.2
Dorchester	25	4.5
South Boston	26	4.7
Other	111	19.9
Asian surname		
Yes	423	69.8
No	158	26.1
Unable to determine	25	4.1

SD = standard deviation

Table 2. Brief pediatric asthma screen

Question 1	No.	Percent
Has your child ever been diagnosed by a doctor as having asthma?		
Yes	97	16
No	475	78.4
Missing	34	5.6
Question 2		
Has your child ever had episodes of wheezing (whistling in the chest) in the last 12 months?		
Yes	60	9.9
No	514	84.8
Missing	32	5.3
Question 3		
In the last 12 months, have you heard your child wheeze or cough during or after active play?		
Yes	84	13.9
No	487	80.4
Missing	35	5.8
Question 4		
Other than a cold, in the last 12 months, has your child had a dry cough at night?		
Yes	113	18.6
No	458	75.6
Missing	35	5.8
Question 5		
In the last 12 months, has your child been to a doctor, an emergency room, or a hospital for wheezing?		
Yes	39	6.4
No	534	88.1
Missing	33	5.4

SOURCE: Questionnaire adapted from reference 15.

of three categories: (1) asthma; (2) no asthma; and (3) possible asthma. A total of 97 respondents (16%) reported a previous diagnosis of asthma, 455 (75%) no evidence of asthma, and 20 (3%) had possible undiagnosed asthma.

Boys were found more likely to have asthma than girls (22.4% vs. 12.8%; relative risk [RR] 1.75; 95% confidence interval [CI] 1.20, 2.56). This difference was statistically significant with χ^2 of 8.61 ($p=0.003$). The second grade had the highest prevalence of previously diagnosed asthmatic (20.8%). However, this higher prevalence was not statistically significant

($p=0.609$). The association between asthma prevalence and neighborhood was not statistically significant ($p=0.088$). When the neighborhood of Chinatown was compared to all other neighborhoods combined, the prevalence of previously diagnosed asthma was lower in Chinatown (12.4% vs. 21%; RR 0.59; 95% CI 0.39, 0.90). This difference was also statistically significant with χ^2 of 6.22 ($p=0.012$).

For the created variable "surname," 413 (75.4%) had Asian surnames whereas 135 (24.6%) had non-Asian surnames. Those with Asian surnames were less likely than those with non-Asian surnames to have been previously diagnosed by a doctor as having asthma (14.5% vs. 22.2%; RR 0.65; 95% CI 0.44, 0.97). This difference was statistically significant with χ^2 of 4.39 ($p=0.036$). The last cross-tabulation was between place of residence (Chinatown vs. outside of Chinatown) and surname (Asian vs. non-Asian). This showed that respondents living in Chinatown were more likely than those living outside of Chinatown to have Asian surnames (93.5% vs. 57.6%; RR 1.62; 95% CI 1.47, 1.79). This difference was statistically significant with χ^2 of 78.63 ($p<0.001$).

Lastly, we looked at the 20 students who were categorized as possibly having undiagnosed asthma. Fourteen (70%) of these students had Asian surnames whereas 6 (30%) of these students had non-Asian surnames. Five (25%) of these students lived in Chinatown, 10 (50%) lived in South End, and 5 (25%) lived in all other neighborhoods combined.

DISCUSSION

The results of our study can best be compared to the results obtained during the validation of the BPAS through the Chicago public school system by Wolf et al.¹⁵ In their study of eight elementary schools, the total response rate was 43%. Of those who responded, 19% had a previous diagnosis of asthma, 71% had no evidence of asthma, and 10% had possible undiagnosed asthma. Another study that included spirometry and had a response rate of 61% found 14.3% undiagnosed asthma in Detroit school children in the third through fifth grades.¹⁸

In our study, the response rate was 69.9% with a total of 16% who had a previous diagnosis of asthma, 75% who had no evidence of asthma, and 3% who had possible undiagnosed asthma. Our survey result for previous diagnosis of asthma is close to the 15% of students registered with the school nurses as having asthma. Although the response rate in our study was higher, there were a smaller percentage of students who had possible undiagnosed asthma as compared to

the Chicago study. This may be a reflection of the actual difference between the two study populations, or there may be cultural limitations of applying the BPAS to a predominantly Cantonese population. The earlier study's lower response rate could bias results, with those who are least aware being least likely to respond.

U.S. data on asthma prevalence can be obtained through the Centers for Disease Control and Prevention (CDC) and the National Center for Health Statistics (NCHS). The definition of asthma prevalence through the National Health Interview Survey was changed in 1997 from "had asthma in the past 12 months" to "had an episode of asthma or asthma attack in the past 12 months." This definitional change resulted in about a 20% drop in apparent asthma prevalence. Data from 1999 show that among children 5 through 14 years of age, asthma prevalence was 56.4 per 1,000 (5.6%).³ However, both of these questions are narrower than ours: "Has your child ever been diagnosed by a doctor as having asthma?" The difference in wording makes direct comparison unreliable and could explain why we found higher rates.

When we compared the responses to question 1 of the BPAS by gender, more boys than girls in our survey were reported to have been previously diagnosed with asthma. This difference was statistically significant and is consistent with NCHS data showing that among children 0 through 17 years of age, males were more likely to have had an asthma episode or attack, 59 per 1,000 males vs. 41 per 1,000 females.¹⁹

When we analyzed the previous diagnosis of asthma between neighborhoods, there was no statistically significant variation. However, when we compared Chinatown with all other neighborhoods combined, there was a significantly lower asthma rate in Chinatown. We also looked at the rates of asthma based on surnames. Although those with Asian surnames made up the majority of the respondents, this group was less likely to have been previously diagnosed with asthma. The last cross-tabulation of neighborhood by surname confirms our assumption that most of the respondents living in Chinatown were Asian. This strengthens our confidence in the observed correlation that Asian children living in Chinatown were less likely to have been diagnosed with asthma.

There are a few possible explanations for this trend. Perhaps the residents living in Boston Chinatown have less access to healthcare and are thus less likely to have been diagnosed by a physician. However, that is at odds with the low finding of undiagnosed asthmatics in our survey. In an Asian population such as Chinatown, there could also be the influence of cultural

factors, including adherence to traditional medicine, as has been reported for Vietnamese refugees with asthma.²⁰ Also, newer immigrants, who make up at least half of the Chinatown residents, as measured by place of last residence being in Asia,²¹ may have less asthma since they have had a shorter exposure time to environmental factors specific to the U.S. This trend was supported by the study of asthma in Melbourne by Leung et al.¹¹ One other possibility is that the Asian immigrant children are exposed to less environmental hazards at home, but that is at odds with responses to an environmental survey of Boston Chinatown residents.¹²

If the Asian students who live in Boston Chinatown were less likely to have been diagnosed with asthma, then the flipside to this correlation would have been that this same population would have higher rates of undiagnosed asthma. The results show little difference among the 20 students with undiagnosed asthma. Seventy percent of them had Asian surnames and 75% lived in the neighborhoods closest to the school (Chinatown and South End). The breakdown in this group of students is similar to the full study population. Since there were only 20 students in the possible undiagnosed asthma category, this small number would not significantly change the results of the full study population, even if all of these 20 students had true asthma. This supports the hypothesis that the true prevalence of asthma among the Asian schoolchildren in Boston Chinatown is similar to the prevalence determined by the BPAS.

It is important to point out that this cross-sectional survey has limitations. We have drawn multiple associations but have not been able to elucidate causality. Another limitation of this study is that the BPAS is a survey-based screening tool and not one that is clinically based. Although the BPAS has a sensitivity of 75% and a specificity of 81.2%,¹⁵ it is still an imperfect tool that is less precise than clinical diagnosis using pulmonary function testing. An extension of this limitation is that the BPAS was validated in its original English format. Although the BPAS was adapted for use in our study population through translation and back-translation, we cannot exclude the possibility that cultural nuances may have been lost in the process. There are numerous questions that we would like to have included and that deserve to be on future questionnaires. Among them are: (a) length of residency in the U.S.; (b) race/ethnicity; (c) place of birth; and (d) length of residency in Chinatown. There is also a need for direct comparison to the city's African American, Hispanic, and white populations.

CONCLUSION

It is well known that asthma disproportionately affects inner-city, minority populations. However, little is known about the burden of this disease in Asian American urban enclaves such as Boston Chinatown. In fact, despite more than 30 years of nationwide surveys, the health determinants of Asian Americans and Pacific Islanders in general and with respect to the environment are at best rough estimates.^{22,23} With this pilot study, we suggest that asthma may be higher than national averages at the predominantly Asian American Josiah Quincy Elementary School. However, differences in survey questions prevent a firmer conclusion. Our findings do suggest that prevalence of asthma is lower among students at the school who reside in Chinatown and among students with Asian surnames. More studies are needed to confirm this apparent difference between Asian immigrant children and other inner-city children. We hope that this study has demonstrated the importance of studying asthma among inner-city Asian American schoolchildren.

The authors thank the teachers, children, and parents for their willingness to participate in the survey. They also thank Suzanne Lee, Principal of the Josiah Quincy Elementary School, for her support of the study and Will Rand for his assistance with the analysis. Sabine Jean-Louie and Hassanatu Blake assisted with the data entry.

REFERENCES

- Freeman NC, Schneider D, McGarvey P. School-based screening for asthma in third grade urban children: the Passaic asthma reduction effort survey. *Am J Public Health* 2002;92:45-6.
- Kemp JP, Kemp JA. Management of asthma in children. *Am Fam Physician* 2001;63:1353-4.
- Mannino DM, Homa DM, Akinbami LJ, Moorman JE, Gwynn C, Redd SC. Surveillance for asthma—United States, 1980–1999. *MMWR Morb Mortal Wkly Rep CDC Surveill Summ* 2002;51(1):1-13.
- Weiss KB, Wagener DK. Changing patterns of asthma mortality: identifying target populations at high risk. *JAMA* 1990;264:1683-7.
- Carr W, Zeitel L, Weiss K. Variations in asthma hospitalizations and deaths in New York City. *Am J Public Health* 1992;82:59-65.
- Marder D, Targonski P, Orris P, Persky V, Addington W. Effect of racial and socioeconomic factors on asthma mortality in Chicago. *Chest* 1992;101 Suppl:426S-9S.
- Gottlieb DJ, Beiser AS, O'Connor GT. Poverty, race, and medication use are correlates of asthma hospitalization rates. A small area analysis in Boston. *Chest* 1995;108:28-35.
- Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. *Lancet* 1998;351:1225-32.
- Zhao T, Wang A, Chen Y, Xiao M, Duo L, Liu G, et al. Prevalence of childhood asthma, allergic rhinitis and exzema in Urumqi and Beijing. *J Paediatr Child Health* 2000;36:128-33.
- Wong GW, Hui DS, Chan HH, Fok TF, Leung R, Zhong NS, et al. Prevalence of respiratory and atopic disorders in Chinese school children. *Clin Exp Allergy* 2001; 31:1225-31.
- Leung RC, Carlin JB, Burdon JG, Czarny D. Asthma, allergy and atopy in Asian immigrants in Melbourne. *Med J Aust* 1994;161:418-25.
- Brugge D, Leong A, Averbach A, Cheung FM. An environmental health survey of residents of Boston Chinatown. *J Immigrant Health* 2000;2:97-111.
- Brugge D, Lai Z, Hill C, Rand W. Traffic injury data, policy, and public health: lessons from Boston Chinatown. *J Urban Health* 2002;79:87-103.
- Lai Z, Leong A, Wu CC. The lessons of the Parcel C struggle: reflections on community lawyering. *Asian Pac Am Law J* 2000;6:1-43.
- Wolf RL, Berry CA, O'Connor T, Coover L. Validation of the brief pediatric asthma screen. *Chest* 1999;116: 224S-8S.
- Microsoft Corp. Microsoft Access: version 2000 for Windows. Seattle: Microsoft Corp; 2000.
- Centers for Disease Control and Prevention (US). Epi Info: version 6.04 for Windows. Atlanta: CDC; 2001.
- Joseph CL, Foxman B, Leickly FE, Peterson E, Ownby D. Prevalence of possible undiagnosed asthma and associated morbidity among urban schoolchildren. *J Pediatr* 1996;129:735-42.
- National Center for Health Statistics (US). Asthma prevalence, health care, and mortality, 2000–2001 [cited 2002 Aug 30]. Available from: URL: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm>
- Ries AL, Picchi MA, Nguyen LH, Moser RJ, Mogaard CA, Wasserman SI. Asthma in a Vietnamese refugee population. *Am J Respir Crit Care Med* 1997;155: 1895-901.
- Chinatown/South Cove Neighborhood Council. Chinatown community plan: a plan to manage growth. Boston: Boston Redevelopment Authority; 1990.
- Yu ES, Liu WT. US national health data on Asian Americans and Pacific Islanders: a research agenda for the 1990s. *Am J Public Health* 1992;82:1645-52.
- Brugge D, Leong A, Law A. Environmental health and safety in Boston Chinatown. In: Zhan L, editor. *Asian voices: vulnerable populations, model interventions, and clarifying agendas*. Boston: Jones and Bartlett; 2003. p. 43-67.