

A Comparison of Knowledge about Asthma Between Asians and Non-Asians at Two Pediatric Clinics

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Abstract Little is known about the relative knowledge of asthma in recent immigrant Asian populations in the United States (US). To comparatively assess asthma knowledge for Asian and non-Asian populations, 333 parents and children were surveyed at two geographically close urban clinics that had a large percentage of Asian patients, most of whom were Chinese. The Asian respondents scored lower compared to the non-Asian respondents on 4 of the 6 knowledge questions ($p < 0.001$). Subcategories of non-Asians (white, African-American, Hispanic) were more similar to each other than they were to Asians. In multivariate analysis we found that SES (measured as parental occupation) and being Asian were independent predictors of less asthma knowledge. Having family members with asthma did not improve knowledge scores. A single focus group of Cantonese-speaking parents of asthmatic children suggested that a combination of cultural factors and lack of knowledge contribute to lower knowledge scores in this Asian population. Asthma

education programs need to be developed, tailored to recent Asian immigrants and tested for efficacy.

Keywords Asian Americans · Asthma · Knowledge · Chinese Americans · Socio economic status

Introduction

Asthma remains a key health challenge for the pediatric population of the United States. In 2002, 30.8 million people (111 people per 1,000) had been diagnosed with asthma during their lifetime. In 2003, 12.5% of all children ages 0–17 years had a lifetime asthma diagnosis [1]. This prevalence is representative of the population of the US as a whole, but the prevalence for racial and minority groups show large differences when the data are disaggregated. Asthma prevalence among non-Hispanic African Americans and American Indians is about 30% higher than for non-Hispanic whites [2].

The prevalence of people who have had an asthma attack in the last year is an approximation of the prevalence of uncontrolled asthma and may be an indicator of access to or adherence to proper clinical regimens and allergen avoidance. In 2002, 60% of people surveyed who had asthma, had an attack within the previous year. That same year, children ages 0–17 years had five million asthma outpatient visits to private physician offices and hospitals (687 per 10,000 people) [3].

Researchers have mostly studied the condition of asthma in a white/African American paradigm. Non-Hispanic African-Americans experience higher rates for asthma-related use of emergency departments, hospitalizations and death than non-Hispanic whites; trends that are not entirely

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explained by higher asthma prevalence [1]. The few studies that included Asian Americans found lower prevalence of diagnosed asthma for Asians than in comparable populations [4–6].

Asthma prevalence also varies by ethnic sub-populations within race. For example, a substantially higher prevalence of asthma was found in Puerto Rican children, as compared to Mexican children [7, 8]. An unresolved question is the extent to which variation in asthma prevalence is real and the degree to which it represents differential diagnosis due to language, culture and education among patients and variation in practice among health care providers.

Patient education and knowledge is an important starting point in controlling asthma. Studies show that children of parents with more knowledge about and better understanding of the condition have better health outcomes including less coughing and wheezing and ultimately, a lower mortality rate [9]. In a study examining ethnicity and language in relation to asthma, knowledge about asthma was especially low among Latinos from Spanish-speaking homes, as compared to whites. Latinos from English-speaking homes were more knowledgeable than Latinos from Spanish-speaking homes, but significantly less likely than Whites to answer knowledge questions correctly. The same study showed that African Americans demonstrated a similar level of knowledge about asthma as whites [9].

To date, there are no studies of knowledge of asthma among Asian Americans. The study presented here was conducted to compare knowledge of symptoms and treatment of asthma among Asians and non-Asians through a survey of patients at two pediatric clinics in Boston, Massachusetts.

Methods

Sample

A sample of 410 children ages 0–18 was recruited in the waiting rooms of the pediatrics departments of two health centers located in Boston Chinatown, Massachusetts from June 22–July 25, 2005. These two health centers were chosen because of the high number of Asian patients they serve and their convenient location. We enrolled 187 children at South Cove Community Health Center, which specializes in care for non-English speaking low-income Asian immigrants. The remaining 223 children were enrolled at Tufts-New England Medical Center, which has an Asian clinic, but also treats a more general urban population. Patients who spoke neither English nor Cantonese or who had previously taken the screening test were excluded from the study.

Procedures

The Tufts-New England Medical Center Institutional Review Board and the South Cove Community Health Center Board of Directors approved the study protocol. Consent was given verbally at time of entry from parents/grandparents/guardians of children less than 11 years of age and the child him/herself for years thereafter. Families were provided with a written description of the study in their choice of English or Cantonese. Data collected were anonymous and de-identified, which precluded collection of town or neighborhood of residence.

Survey Instrument

A written questionnaire was orally administered to all participants in the study as a tool for assessing asthma status. Parents/grandparents/guardians served as proxies for children younger than 11 years of age. It is unlikely that children under the age of 11 would be able to accurately convey all pertinent information regarding their health history, health status and beliefs. Conversely, parents may be unreliable reporters after the child reaches the age of 11 as their children become more independent. The survey was written in English and translated into Chinese by one translator using traditional Chinese characters. A second translator then translated back to English to ensure accuracy. Staff bilingual in Cantonese and English reviewed the original English questionnaire, the Cantonese translation and the second English translation to finalize both versions of the survey instrument.

Respondents chose to take the survey in either Cantonese or English. A bilingual English/Cantonese speaker (author ACL) verbally administered most of the questionnaires and answered questions when prompted by participants. ACL received training on proper methodology of translation and administration of the survey instrument to study participants. She also had worked with the same type of questionnaire and information gathering format in a previously published study [10]. An English speaker (author LP) verbally administered a fraction ($n = 71$) of the questionnaires in English.

The questionnaire consisted of 26 questions. Literacy of the study population was not an issue because the questionnaire was orally administered. In addition, authors ACL and LP answered questions when prompted by study participants. Most of the questionnaire had been used previously in a study of the same nature, except for some modifications and additions of the knowledge statements [10].

Basic demographics were determined via questions regarding the child's sex, age, race, place of birth and age of immigration to the United States if born outside the U.S.

Preferred language was inferred from choice of Chinese or English surveys. For children under 11, the preferred language reflects the choice of his/her parents. For children ages 11 and older, the language is the child's preferred language.

Additional questions relate to exposure to smoking in the home, diagnosed allergies and family history of asthma. Parental employment status was asked as an open-ended question and was used as a proxy for assigning socioeconomic status (SES).

Five questions from the Brief Pediatric Asthma Screen were used to assess asthmatic status. [11]. The questions were as follows:

1. Have you/your child ever been diagnosed by a doctor as having asthma?
2. Have you/your child ever had episodes of wheezing in the last 12 months?
3. In the last 12 months, have you had/heard your child wheeze or cough during or after active play?
4. Other than a cold, in the last 12 months, have you/your child had a dry cough at night?
5. In the last 12 months, have you/your child been to the doctor, the emergency room or the hospital for wheezing?

This study used multiple Cantonese translations for the word “wheeze”, a word that is critical for assessing possible undiagnosed asthma, but that does not affect the diagnosed asthma determination. A previous investigation showed that the word “wheeze”, which is central to several of the questions in the BPAS, has four possible translations into Chinese. In that study, also conducted in Boston Chinatown, there was no clear consensus among Cantonese-speaking respondents in terms of preference for terms [10].

In that study, four commonly used Chinese terms for “wheeze” were generated. (1) 喉喘聲 literally means a sound from the throat, (2) 喘鳴聲 literally means a sound from difficulty breathing, (3) 喘鳴音 literally means a special sound from asthma and is the more professional expression used in medical books, and (4) 咽鳴聲 which literally means a gasping sound made after crying. To maximize capture of possible undiagnosed asthma, respondents were told all four translations any time the word “wheeze” was used in a question in surveys conducted in Cantonese.

Categorization of Asthmatic Status

The Brief Pediatric Asthma Screen (BPAS) has been validated for use as a means to screen for asthma without using clinical methods such as looking at patient history, physical examination or spirometry. The asthma screen

demonstrated a sensitivity of 75% and a specificity of 81% for the presence of asthma among those who were unaware of the diagnosis. All completed questionnaires were categorized for asthmatic status using the BPAS as described in Wolf et al. (1999). An affirmative answer to the first question was taken as confirmation of “diagnosed asthma”. An affirmative answer to the last question or any two of questions 2 through 4 warranted categorization as “possible undiagnosed asthma”. All other responses were categorized as “probably not asthmatic”.

The remaining six statements on the survey instrument assessed knowledge about asthma. These were adapted from statements provided by Sandra R. Wilson of the Palo Alto Medical Foundation (personal communication, 2005). Respondents were asked to assess each statement as either true or false. Only six knowledge statements were used because of the necessity of keeping the survey instrument short as the questionnaire was administered while patients were waiting to see their doctors. The authors acknowledge that the statements are open to some interpretation, however, we feel that the answers gave a general indication of asthma knowledge. It was rare for the respondents to challenge the content of the statements, with the exception of statement number five, which elicited requests for clarification. The six statements were:

1. Coughing is frequently a symptom of asthma.
2. Asthma medications have no side effects.
3. Asthma is a reversible disease because it can be completely cured by taking medication.
4. It is only necessary for a child to see a physician for asthma at times when the child is having a severe episode.
5. An inhaler will deliver a useful dose of medication any way that it is used.
6. It is very rare for a child with asthma to be able to exercise as vigorously as a child who does not have asthma.

Data Management and Analysis

Only 12 potential subjects declined to participate in the questionnaire (response rate = 97%). Questionnaires that were partially answered ($n = 4$), or questionnaires completed for children under the age of 1 were discarded ($n = 10$). The data for respondents who self-identified as “other” under the race category ($n = 10$), were also discarded due to insufficient numbers for data analysis. After discarding these categories of patients our database was 386 respondents.

In analyzing the responses for the knowledge statements, the questionnaires of parents with more than one child under 11 who completed multiple surveys (one for

each child) were reduced to a single entry because the knowledge answers were the same for each parent regardless of how many children they responded for. After discarding questionnaires of parents who answered surveys for multiple children, our database was 333 completed questionnaires.

Socioeconomic Status Classification

Parental occupation was used as a proxy for SES in this study. Previous work with this study population and questionnaire format indicated that using parental education level as a proxy for SES was ineffective as many of the child respondents did not know their parents' education level. In our survey, the occupations of both parents were recorded at the time of administering the questionnaire. Lack of recall of parental occupation was still a minor problem as we lacked occupational information on some respondents ($n = 21$).

Each occupation was classified as either low SES or high SES. The classification of most jobs was clearly one category or the other. For example, jobs involving manual labor or less education were categorized as low SES, whereas office-type jobs requiring more education were classified as high SES. Examples of low SES occupations included restaurant wait staff or factory workers. Examples of high SES occupations included teacher or engineer. However, there were a handful of occupations that were difficult to classify ($n = 8$). Examples included a pilates instructor and a bodyguard. In order to produce a dichotomous variable, families that had one parent categorized as low SES and one parent categorized as high SES were assigned to the high SES category.

Statistical Analysis

Data were double entered into SPSS version 12.0. Non-matching entries were identified as mistakes and then corrected using the original hardcopy version of the questionnaire. All variables were examined with standard descriptive statistics. Where appropriate, normality was assessed and outlying values analyzed. In general, no major outliers or significant departures from normality were detected and analysis proceeded to tabular and predictive models. The outcome variable of interest was SCORE, which ranged from 0 to 6 in increments of 1. SCORE was a composite variable the value of which was derived from answers on asthma knowledge questions (above). A score of 0 indicated low knowledge of asthma while a score of 6 indicated relatively high knowledge about this condition. A variety of predictor variables were examined for association with SCORE using chi-square and univariate linear

regression. Variables that showed no significant impact on SCORE in either chi-square analysis or when analyzed in univariate linear regression models were dropped from future analyses. Finally, a multivariable linear regression model was built using variables remaining from the univariate analyses. The multivariable model was constructed by entering variables one at a time while watching for confounding or multicollinearity effects (a situation where more than one variable in a model is describing essentially the same linear effect).

Focus Group

We conducted a single focus group with nine Cantonese-speaking parents (8 female, 1 male) of asthmatic children recruited from the South Cove Community Health Center. The purpose of the focus group was to gather qualitative data that would complement the quantitative survey data. Participants for the Asian focus group were selected by convenience sample. Parents of asthmatic children were asked if they would participate in a focus group to learn more about knowledge, attitudes and beliefs about asthma. The first nine parents who agreed to do so were accepted into the study.

Participants were provided with childcare, a small stipend and a meal in return for participation. The focus group was facilitated by one of us (author ACL) in Cantonese. The focus group script included introductory questions and then the following expanded list of knowledge questions to encourage discussion:

- (1) Is coughing a frequent symptom of asthma? Why or why not?
- (2) Do asthma medications have side effects? If yes, what kind?
- (3) Do you think asthma is a reversible condition that can be cured by taking medication? Why or why not? What have you been told by medical professionals?
- (4) How do you know when a child has asthma?
- (5) Is it true that asthma is only a condition during asthmatic attacks and otherwise, treatment is unnecessary? Why or why not?
- (6) Do you think it is only necessary for a child to see a physician for asthma at times when the child is having a severe episode? Why or why not?
- (7) What are some effective ways (you've used) to treat asthma?
- (8) What is the biggest disadvantage for a child who has asthma?
- (9) An inhaler will deliver a useful dose of medication any way that it is used. Is this true or false and why?
- (10) Is vigorous physical exercise harmful for a child with asthma? Why or why not?

The focus group was audio taped and the recording was translated and transcribed into English. Two of the authors (ACL, LP) conducted independent content analysis, recording main themes that were raised.

Results

Descriptive Statistics

Table 1 presents the characteristics of the Asian and non-Asian respondents. Respondents from South Cove Community Health Center were almost entirely Asian, whereas those from New England Medical Center were a mix of Asians and non-Asians ($p < 0.001$). All (100%) of the non-Asian respondents took the survey in English, while 44% of the Asian respondents took the survey in Cantonese ($p < 0.001$). Asian and non-Asian respondents did not differ statistically in terms of age, being a family with an asthmatic child or a family with a child diagnosed with

allergies. There was a slight, but statistically non-significant difference in possible undiagnosed asthma, with non-Asian respondents reporting more (12.4 vs. 7.1%; $p = 0.116$). Non-Asian respondents were more likely to report that they/their child had other family members who had asthma (33.9 vs. 11.7%, $p < 0.001$). Asian respondents were more likely to report smoking in the home (41.7 vs. 25.2%, $p < 0.05$). Asian respondents were also more likely to have been classified as low SES based on parental occupation (86.1 vs. 45.2%, $p < 0.001$).

Knowledge Statements

Table 2 summarizes responses to the six knowledge statements for Asian and non-Asian respondents. For the total sample, the percentage of correct answers to each question ranged from 31.2 to 60.7%. Asian respondents scored significantly lower than non-Asian respondents in assessing correctness of the four statements: medication side effects (52.3 vs. 76.5%, $p < 0.001$), reversibility of

Table 1 Characteristics of Asian, non-Asian and total participants in the survey

	Non-Asian ($n = 115$)	Asian ($n = 218$)	<i>P</i> value	Total ($n = 333$)
Site			<0.001	
South Cove	0.9% ($n = 1$)	72.5% ($n = 158$)		47.7% ($n = 159$)
New England medical Ctr.	99.1% ($n = 114$)	27.5% ($n = 60$)		52.3% ($n = 174$)
Language of respondent			<0.001	
Chinese	0% ($n = 0$)	44.0% ($n = 96$)		28.8% ($n = 96$)
English	100% ($n = 115$)	56.0% ($n = 122$)		71.2% ($n = 237$)
Age of respondent			0.636	
Answered by parent/guardian	50.4% ($n = 58$)	47.7% ($n = 104$)		48.6% ($n = 162$)
Answered by child > 11	49.6% ($n = 57$)	52.3% ($n = 114$)		51.4% ($n = 171$)
Family with asthmatic child ($n = 330$)			0.340	
No	66.1% ($n = 76$)	71.2% ($n = 153$)		69.4% ($n = 229$)
Yes	33.9% ($n = 39$)	28.8% ($n = 62$)		30.6% ($n = 101$)
Family with child with possible undiag. Asthma ($n = 323$)			0.116	
No	87.6% ($n = 99$)	92.9% ($n = 195$)		91.0% ($n = 294$)
Yes	12.4% ($n = 14$)	7.1% ($n = 15$)		9.0% ($n = 29$)
Family with child with diag. Allergies ($n = 329$)			0.699	
No	73.0% ($n = 84$)	71.0% ($n = 152$)		71.7% ($n = 236$)
Yes	27.0% ($n = 31$)	29.0% ($n = 62$)		28.3% ($n = 93$)
Child with family members who have asthma			<0.001	
No	66.1% ($n = 76$)	88.3% ($n = 189$)		80.5% ($n = 265$)
Yes	33.9% ($n = 39$)	11.7% ($n = 25$)		19.5% ($n = 64$)
Home smoking			0.003	
No	74.8% ($n = 86$)	58.3% ($n = 127$)		64.0% ($n = 213$)
Yes	25.2% ($n = 29$)	41.7% ($n = 91$)		36.0% ($n = 120$)
Family SES ($n = 312$)			<.001	
Low SES	45.2% ($n = 47$)	86.1% ($n = 179$)		72.4% ($n = 226$)
High SES	54.8% ($n = 57$)	13.9% ($n = 29$)		27.6% ($n = 86$)

Table 2 Response to knowledge questions about asthma for Asian, non-Asian and total respondents to the survey

Statements:	Non- Asians (<i>n</i> = 115)	Asians (<i>n</i> = 218)	<i>P</i> -Value	Total (<i>n</i> = 333)
Coughing is frequently a symptom of asthma.			0.501	
True/Correct answer	34.8% (<i>n</i> = 40)	38.5% (<i>n</i> = 84)		37.2% (<i>n</i> = 124)
False/Unsure/Incorrect answer	65.2% (<i>n</i> = 75)	61.5% (<i>n</i> = 134)		62.8% (<i>n</i> = 209)
Asthma medications have no side effects.			<0.001	
True/Unsure/Incorrect answer	23.5% (<i>n</i> = 27)	47.7% (<i>n</i> = 104)		39.3% (<i>n</i> = 131)
False/Correct answer	76.5% (<i>n</i> = 88)	52.3% (<i>n</i> = 114)		60.7% (<i>n</i> = 202)
Asthma is a reversible disease because it can be completely cured by taking medication.			<0.001	
True/Unsure/Incorrect answer	28.7% (<i>n</i> = 33)	54.6% (<i>n</i> = 119)		45.6% (<i>n</i> = 152)
False/Correct answer	71.3% (<i>n</i> = 82)	45.4% (<i>n</i> = 99)		54.4% (<i>n</i> = 181)
It's only necessary to see a physician for asthma at times when the child is have a severe episode.			0.770	
True/Unsure/Incorrect answer	38.3% (<i>n</i> = 44)	39.9% (<i>n</i> = 87)		39.3% (<i>n</i> = 131)
False/Correct answer	61.7% (<i>n</i> = 71)	60.1% (<i>n</i> = 131)		60.7% (<i>n</i> = 202)
An inhaler will deliver a useful dose of medication any way that it is used.			<0.001	
True/Unsure/Incorrect answer	52.2% (<i>n</i> = 60)	77.5% (<i>n</i> = 169)		68.8% (<i>n</i> = 229)
False/Correct answer	47.8% (<i>n</i> = 55)	22.5% (<i>n</i> = 49)		31.2% (<i>n</i> = 104)
It is very rare for a child with asthma to be able to exercise as vigorously as a child who does not have asthma.			<0.001	
True/Unsure/Incorrect answer	42.9% (<i>n</i> = 49)	66.1% (<i>n</i> = 144)		58.0% (<i>n</i> = 193)
False/Correct answer	57.4% (<i>n</i> = 66)	33.9% (<i>n</i> = 74)		42.0% (<i>n</i> = 140)

asthma (45.4 vs. 71.3%, $p < 0.001$), proper use of an inhaler (22.5 vs. 47.8%, $p < 0.001$), and whether asthmatic children are able to exercise (33.9 vs. 57.4%, $p < 0.001$). For the remaining two statements, which dealt with coughing as a symptom of asthma and when asthmatics need to see a physician, there were no statistical differences between the Asian and non-Asian respondents.

Figure 1 shows that when the total correct answers were summed (SCORE) for each respondent the resulting scores were shifted substantially toward lower values for the Asian respondents as compared to the non-Asian respondents.

Multivariate Analysis

A correlation matrix showed significant correlations between many of the variables. In the multivariate model, all the variables in Table 1 were tested and only race and SES were strong, statistically significant predictors of SCORE. Race and SES were strongly correlated but the Tolerance statistic of 0.796 was well above commonly used cutoff points of 0.10 or 0.20. Race was changed to a categorical variable to reflect its possible values of Asian, white, African American, Hispanic, or other. Figure 2 shows the general distribution of SCORE by Race. Examining the mean scores and their 95% confidence intervals (CIs) for

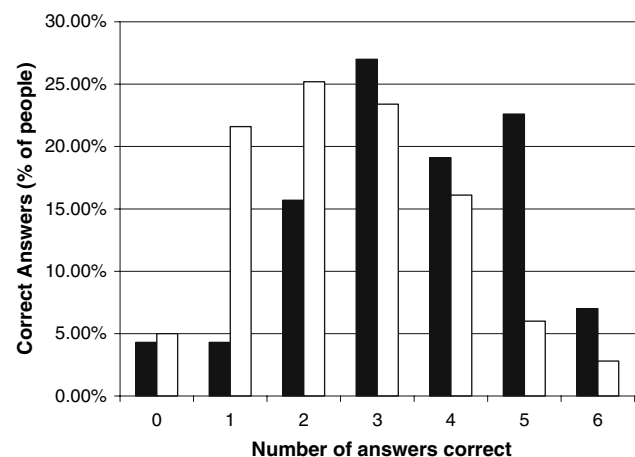


Fig. 1 Percent correct answers for Asian (open bars) and non-Asian respondents to the survey

each group showed that Asians had significantly lower score values compared to any other racial category. For any other comparison, the 95% CI of the mean score value overlapped. Therefore, in the linear modeling, we used ASIAN (1 = Asian, 0 = non-Asian) as our race variable. We found that SES was the strongest predictor of SCORE. No difference was observed in the scores of males versus females as shown in Fig. 3.

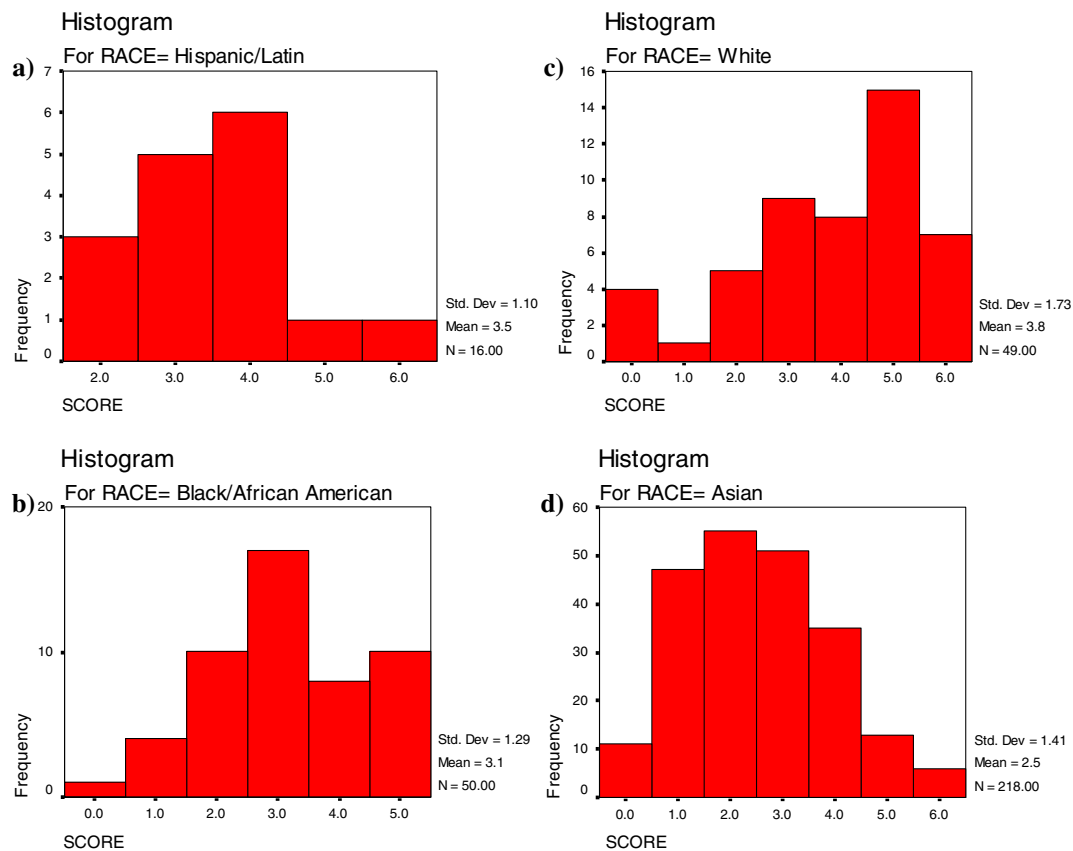


Fig. 2 SCORE for (a) Hispanic respondents; (b) Black/African American respondents; (c) White respondents; (d) Asian respondents

Many variable combinations were tested in the linear regression model building process. We included a multicollinearity statistic (Tolerance) because of the comparatively high degree of correlation between many of the variables. The best-fitting model is shown in Table 3. Only SES and ASIAN are included. Subjects classified as high SES score about three-quarters of a point higher on SCORE controlling for confounding by race (Asian/non-Asian). Asians score about three-quarters of a point lower on SCORE compared to all other groups controlling for confounding by SES (high/low). The Tolerance statistic is well above commonly accepted minimums of 0.10 or 0.20. We examined the effect of having family members with asthma on SCORE and found virtually no effect in either univariate or multivariate linear models.

One potential criticism of the analysis is that children 11–18 who responded for themselves may be a different subpopulation from parents of children younger than 11. To address this, we divided respondents into two groups, parents and children, to examine whether there was a significant difference in asthma knowledge comparing these two groups. We found no significant difference using tabular analysis (chi squared > 0.10) and, in our multivariate model, a variable for parent/child respondent was not a significant predictor of asthma knowledge.

Focus Group

Discussion within the focus group included instances in which participants showed concordance with Western medical interpretation of asthma, instances in which they did not understand Western medical views of asthma and instances in which they considered traditional Chinese medicine to be of value. For example, answers to the question, “Do asthma medications have side effects?” revealed inconsistencies with Western medical views. Answers ranged from being unsure to a belief that medications do not have side effects. However, the questions, “Is it necessary to use medication only when you have an asthma attack or should you take it on a routine basis?” And, “Do you think it is only necessary for a child to see a doctor for asthma at times of a severe episode or do you think the child should go routinely?” illustrated stronger knowledge within the group. The general consensus was for the child to see a doctor routinely. The question “What are some effective ways to treat asthma?” led to diverse answers. Some people said they followed doctor recommendations such as engaging in swimming, others believed that cooking with crocodile meat or herbs was helpful, while still others were uncertain.

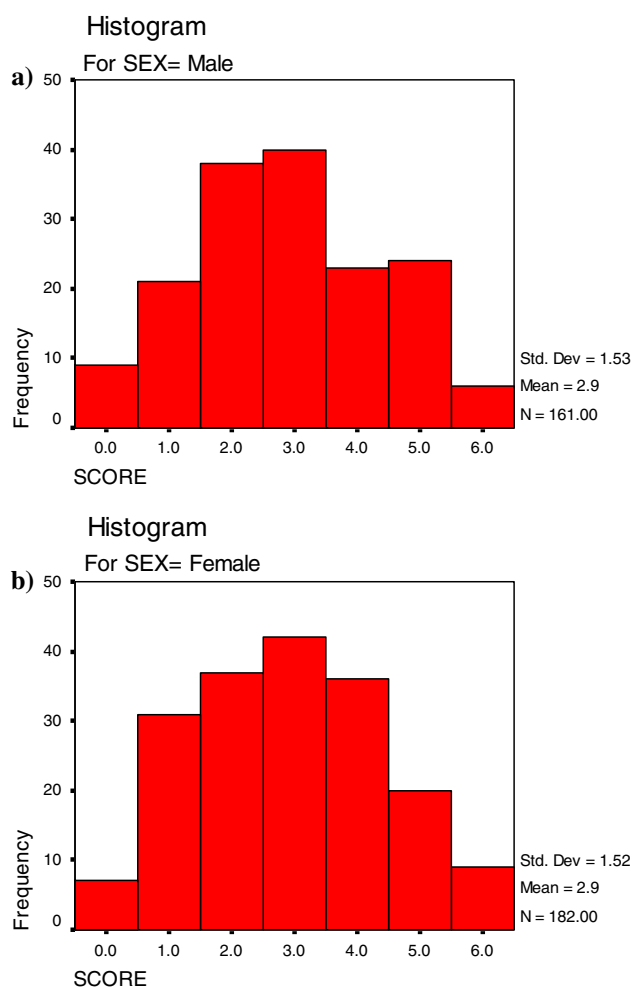


Fig. 3 SCORE for (a) Male respondents; (b) Female respondents

Table 3 Final regression model for dependent variable SCORE

	B	Std. Error	t-value	p-value	Tolerance
ASIAN	−0.773	0.182	−4.252	<0.001	0.832
SES	0.738	0.195	3.789	<0.001	0.832

Other themes that emerged from the focus group concerned food allergies and the temperature of foods. Some parents noted that their children are highly allergic to seafood and that their allergic reaction induces asthma due to a constriction of their throat or chest. There was confusion that the allergic response and asthma were related. Also, parents noted that eating foods too cold or too hot develops into “yeet hay” [熱氣] or the Chinese belief that hot air accumulates inside the body.

Discussion

The results from our investigation should be assessed in relation to the research method and our success in

implementing it. In any case, because this is apparently the first evaluation of asthma knowledge among Asian Americans, it should be seen as a starting point. We present first the strengths and limitations of our study and then offer an interpretation and recommendations for future research.

Strengths

This survey had numerous strengths. We wanted to investigate the knowledge of recent immigrant Chinese families. Our Asian comparison group was drawn from clinics that disproportionately serve Chinese-speaking patients. Our sample size gave us considerable statistical power, we had an excellent response rate (97%), and there was a low percentage of missing data, with the most missing information being for parental occupation, our proxy for SES.

We had substantial representation of both Asians and non-Asians in our sample. Importantly, Asians and non-Asians were similar across most demographic variables, including the percentage of children diagnosed with asthma. It also proved possible to pool the data of non-Asians, despite ethnic diversity, because non-Asian groups were much more similar to each other than to Asians in terms of knowledge scores and SES, simplifying the analysis. Presence of pests and smoking in the home, possible confounders in the analysis did not show associations with SCORE (data not shown). Finally, the focus group added qualitative information about the nature of misperceptions about asthma among Cantonese-speaking parents.

Limitations

Our data are not fully generalizable because the study population was drawn from clinical populations, which would likely have a higher prevalence of asthma and other health problems than a representative population. The sample may therefore be biased toward families of more severe and uncontrolled asthmatics that needed to see a physician more frequently. It is unclear how this would affect asthma knowledge. Families with more severe cases of asthma might gain greater knowledge of the disease through frequent contact with the health care system. Conversely, one might expect families with lower knowledge of asthma to be less able to control their asthma. Further, the clinical population was limited to a community health center and a major teaching hospital, which limits the generalizability to non-urban and small hospital settings.

Because of the clinical sites chosen, application of our findings may be most meaningfully made to low-income Cantonese-speaking and other Chinese immigrants from Mainland China or Hong Kong, but not the wide range of

Asian Americans in the US nor other Asian countries. Also limited by the sites was the socioeconomic cross-section that we surveyed. Because one site predominantly serves lower income Asian immigrants, while the other serves both low and high income Asians and non-Asians, there was considerable confounding between SES and Asian.

Our survey was cross-sectional which means that we cannot assess how knowledge about asthma might be changing over time. Of particular interest would have been to follow a cohort of recent Asian immigrants over time to see how much, if at all, their knowledge changed with length of stay in the US.

An additional limitation was that we asked participants only 6 statements pertaining to knowledge about asthma. Furthermore, of these 6, the structure of two might have been confusing. Some of the respondents chuckled when statement number five was read to them; because they thought about the different ways in which an inhaler could be inserted into the mouth. For example, they knew that if an inhaler were inserted with the wrong end in the mouth, this would not deliver a useful dose of medication. What the authors meant to gauge was whether or not patients knew that proper use includes specific inhalation and breathing techniques. The statement about coughing as a symptom of asthma could have been misconstrued to mean that coughing is always a sign of asthma. The statement about proper use of an inhaler might also have missed the finer point that, obviously, an inhaler that is not sprayed into the mouth will have no benefit. However, when we compared Asian and non-Asian responses to the knowledge, as assessed by the number of correct answers to the statements, leaving out the responses to these two statements we found a similar deficit in knowledge among Asian respondents (not shown).

In our analysis language, one of many probable indicators of acculturation was a significant predictor of SCORE when tested alone, but it was too correlated with both SES and ASIAN to include in the multivariate model. Additional research aimed at more fully separating the relationship of language, race and SES is warranted. Finally, we were only able to complete a single focus group with Cantonese-speaking parents of asthmatic children. It would have been instructive to compare the discussion among those parents to a focus group drawn from non-Asian parents.

Interpretation

The deficit of knowledge in both the Asian and non-Asian populations, as indicated by the number of unsure and incorrect answers for the knowledge questions on our survey, is substantial. Education about asthma that addresses underlying knowledge is a critical component of effective

asthma disease management [12], but is not sufficient by itself [13]. Further, our focus group discussion suggests that both alternative cultural interpretations of asthma combined with incorrect or missing knowledge about Western medical interpretation of asthma contribute to incorrect answers to knowledge questions.

It is important to note that the R^2 value of 0.147 reported in the multivariable linear regression model suggests that only about 15% of the variability of SCORE is explained by the combination of SES and ASIAN. This means that factors other than SES and race are important in determining asthma knowledge. We were unable to assess the role of language, which could be an additional factor. It is likely that our measure of SES allowed us only to measure a fraction of the effect of SES on knowledge. Additional factors worth exploring include health beliefs, participation in health education programs, and factors associated with visits to health care providers (e.g., education during doctor visits and effectiveness of communication during such visits).

Interestingly, having a family member with asthma did not affect respondents' knowledge score. One might expect that having a family member with asthma would contribute to greater knowledge about asthma. While we cannot say with certainty why respondents who had family members with asthma did not score higher on our questions, one possibility is that transmission of asthma knowledge within families in our study was limited.

Future Steps

Taken together, our findings suggest that it is reasonable to conclude that asthma education targeted to recent Asian immigrant populations is justified and that tailoring such education on domains of language, culture, and literacy should be addressed.

Adherence is an issue in clinical settings and is especially important when working with patients of a cultural background different from that of the provider. Doctors need to take time in their diagnosis and recommendations for treatment of asthma to address any concerns parents and families may have and thoroughly explain the symptoms, condition and treatment. This would improve understanding of asthma and boost patient adherence to recommendations. Most importantly this study indicates a need to conduct additional research focused on how asthma fits into the health framework for Asian immigrants.

Focus group information indicated that misunderstandings between doctors and patients, dislike by patients of the asthma label as a chronic condition, and doubts about effectiveness of medication affected self-management behaviors. The authors speculate a need to frame a diagnosis of asthma in a different light in order to increase acceptance

of the condition among Chinese immigrant families. Further study is needed to develop educational programs for asthma targeted to Chinese immigrant populations. Once developed, these interventions should be assessed in clinical trials.

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Works Cited

1. CDC (a). QuickStats: Percentage of Children Aged < 18 years Who Have Ever Had Asthma Diagnosed, by Age Group. United States, 2003. Centers for Disease Control and Prevention: Morbidity and Mortality Weekly Reports 29 April 2005; 54(16):412
2. CDC. Asthma Prevalence, Health Care Use and Mortality. Centers for Disease Control and Prevention: National Center for Health Statistics 2002
3. "Asthma Prevalence, Healthcare Use and Mortality, 2002." National Center for Health Statistics. 2002. U.S. Department of Health and Human Services. 12 Oct 2005 <<http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm>>
4. CDC (b). Summary Health Statistics for U.S. Children: National Health Interview Survey, 2003. Centers for Disease Control and Prevention: National Center for Health Statistics. Series 10, Number 223. March 2005
5. Chen C, Brugge D, Leung A, Finkelman A, Lu W, Rand W. Preferred language and asthma among Asian Americans. *aapi nexus: Asian Am Pac Islanders Policy, Prac Commun* 2005; 3:31–43
6. Lee T, Brugge D, Francis C, Fisher O. Asthma prevalence among inner-city Asian American school children. *Public Health Reports* 2003; 118:215–20
7. Carter-Pokras OD, Gergen PJ. Reported asthma among Puerto Rican, Mexican-American, and Cuban children, 1982 through 1984. *Am J Public Health* 1993; 83:580–82
8. Beckett WS, Belanger K, Gent JF, Holford TR, Leaderer BP. Asthma among Puerto Rican Hispanics: a multi-ethnic comparison study of risk factors. *Am J Resp Crit Care* 1996; 154:894–99
9. Chan KS, Keeler E, Schonlau M, Rosen M, Mangione-Smith R. How do ethnicity and primary language spoken at home affect management practices and outcomes in children and adolescents with asthma? *Arch Pediatr Adolesc Med* 2005; 159:283–89
10. Greenfield R, Lee AC, Tang R, Brugge D. Screening for asthma in Cantonese-speaking immigrant children. *Biomed Central* 2005; 5:48
11. Wolf RL, Berry CA, O'Connor T, Cover L. Validation of the brief pediatric asthma screen. *Chest* 1999; 116(4):224S–8S
12. Cabana MD, Le TT. Challenges in asthma patient education. *J Allergy Clin Immunol* 2005; 115:1225–1227
13. Zimmerman BJ, Bonner S, Evans D, Mellins RB. Self-regulating childhood asthma: a developmental model of family change. *Health Edu Behav* 1999; 26:55–71