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ORIGINAL ARTICLE

The prevalence of asthma risk and contributing factors in underserved Vietnamese children in Orange County, CA

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Abstract

Objectives: Vietnamese constitutes one of the fastest growing minority groups in America, with the largest concentration in Orange County (OC), CA. Yet, there are limited data on the prevalence of asthma in Vietnamese children. Our study evaluated the risk of asthma and key contributing factors among these children living in OC, CA. **Method:** Five elementary schools in OC that were predominantly Vietnamese with low socioeconomic status were selected for participation. Validated surveys were sent to parents of all students ages 3–12 in these schools with materials available in English, Vietnamese and Spanish. Surveys included questions to identify the risk of asthma and related key factors. Surveys were completed by parents and returned to schools. **Results:** There were 1530 participants eligible for analysis. Asthma risk was 30.4%, and of these, 22.6% had no prior diagnosis. Contributing factors to identification of those at risk were male gender ($p < 0.001$), preferred use of the Vietnamese language ($p = 0.004$), longer duration in the United States ($p = 0.019$), and smoker in the household ($p = 0.015$). **Conclusions:** The prevalence of asthma risk in our community of low socioeconomic status Vietnamese children was found to be higher than commonly appreciated. Furthermore, a considerable number of these children had not been previously diagnosed. Given the limited information in this population, our current findings of asthma risk and key contributing factors could affect health care policies that allow appropriate funding for programs dedicated to asthma care in this and other growing population.

Keywords

Duration in the United States, health care policies, language, low socioeconomic status, minority, prior diagnosis, smoker, surveys

History

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Introduction

Asthma is more prevalent in the general pediatric than adult population [1–3] and is a leading cause of emergency department visits, hospitalizations, and school absenteeism in children [4–10]. In addition, studies have shown that minority children have a higher asthma prevalence than the general population [11–14]. Asian Americans are one of the fastest growing groups in the United States (US), with Vietnamese Americans being the fourth largest subgroup among Asians. Out of the more than 1.5 million Vietnamese individuals living in the US, more than a third of them live in California [15,16], with Orange County (OC) serving as home to the largest Vietnamese community in America [15,16]. Yet, this population, especially children, is largely understudied for chronic diseases and their burden, in particular for asthma. There are studies looking at asthma in Asian Americans [17–21], but very few include Vietnamese children [22–25].

Generalized data and a broad definition of racial groups may lack specificity in estimating asthma prevalence. Based on the data from the California Health Interview Survey (CHIS) for 2011–2012 [25], the prevalence of ever being diagnosed with asthma in Asian-American children of all socioeconomic status (SES) levels was determined to be 19.6%. However, when disaggregated into subgroups, estimates were as low as 13.8% in Koreans or as high as 33.2% in Filipinos [25]. An estimated prevalence of 18% [25] reported for Vietnamese children of all SES levels living in California was in the range of prior reports which varied from 4.9% [22] to 22.7% [23]. This wide range of prevalence comes from only four studies with data separated by almost two decades and variation in demographic composition of study populations [22–25]. These studies which examined asthma prevalence in the Vietnamese population had several limitations, which included either few children [22], the use of non-validated surveys [24], or prevalence based only on prior physician diagnosis [25]. In addition, they present limited data regarding SES and cultural factors, such as preferred language, environmental tobacco exposure which is very high in Vietnamese men [26–29], and duration in the US, which

could influence asthma prevalence in Vietnamese children. These limitations suggested the need for a more current and comprehensive evaluation in a larger and more specific pediatric population.

Our interest in this proposal was motivated by the observation that even though we had a mobile asthma van service through the CHOC Children's Hospital of Orange County Breathmobile™ available to all underserved asthmatic children in OC communities, very few Vietnamese children came for asthma care compared to Hispanic children, which make up the other major ethnic group in the community. In order to determine factors which might influence future care of this population, the Vietnamese Children Asthma Project steering committee was formed to collaborate with community stake holders to better assess the needs of underserved Vietnamese asthmatic children [30]. The purpose of this study is to evaluate the prevalence of asthma risk and its contributing factors.

Methods

Study population

Children, age 3–12 years, in five elementary schools in OC were surveyed between June 2011 and April 2012. These schools were selected based on location in the Little Saigon area, home of the largest population of Vietnamese Americans outside of Vietnam, with more than 30% of the residents Vietnamese Americans [15]. The majority of enrolled students at participating schools were Asian-American, mostly Vietnamese, and eligible to receive free or reduced priced meals, identifying a potentially underserved population.

Study design

Validated asthma surveys [23] with letters of consent were provided by the study coordinator for distribution by teachers to each child to take home for completion by the parents. Our certified asthma educator also presented Lunch and Learn sessions for the teachers prior to the distribution of surveys. An incentive of a \$25 gift card was also offered to teachers whose classroom had >80% return rate. The study coordinator collected surveys within 2 weeks of distribution, and responses were entered into an Excel spreadsheet. In the rare instance when a parent's response was not clear, the study coordinator called the parent when consent was provided to clarify an answer. A random number generator distinguished surveys with identifying information removed from the database prior to analysis. The CHOC Children's Hospital of Orange County Institutional Review Board approved this study protocol.

Survey tools

Participants were provided a validated asthma identification tool and a survey identifying possible risk factors, available in English, Vietnamese and Spanish. Surveys included questions to help identify children at risk for asthma, environmental tobacco smoke (ETS) exposure, and duration in the US. The asthma questionnaire, based on a previously validated case detection survey in children [23], utilized an abbreviated scoring algorithm to detect children "at risk" for asthma

when any of the following criteria were met: (1) previously diagnosed with asthma by a physician, (2) repeated episodes of asthma in the past year, or (3) report of *both* exercise/play limitations (any) *and* day symptoms (≥ 2 d/week) in the past four weeks (due to cough, chest tightness, trouble breathing, or wheezing) (Appendix). The previous validation study showed specificity of 88.2% in identifying children with asthma [23]. Among children detected at risk for asthma, persistent activity was identified when any of the following was reported: (1) repeated episodes of asthma in past year (or) (2) report of *usual* exercise/play limitations due to cough, chest tightness, trouble breathing, or wheezing (or) (3) day symptoms ≥ 2 d/week in the past four weeks.

Statistical analysis

The distribution of student characteristics including gender, age, duration living in the US, ETS exposure, and insurance status was described overall and by language of survey completion. Distributional differences in defined traits between language groups were assessed for significance by the Chi-square test statistic. Asthma burden was defined in our analysis as the prevalence of asthma risk, previous physician diagnosis of asthma, and persistent disease activity in those detected at high risk for asthma. The normal approximation was utilized to model the confidence in our estimated asthma prevalence. Margin of error (ME) reported as $\pm$ percentage points within which the "true" percentage should be with 95% confidence was determined by multiplying the standard error (SE) by 1.96. Logistic regression analysis examined estimated asthma risk differentials by defined traits. Unadjusted analyses evaluated the independent contribution of each factor to increased odds of asthma risk. Multivariate analyses examined the impact of each factor after adjustment for remaining traits and significant interaction between gender and season on odds of asthma risk (all possible two-way interaction effects were examined and found to be non-significant with exception of gender $\times$ season). A Forest plot was generated to describe factors included in the final model predicting patients at high risk for asthma using Forest Plot Viewer v1.00 (U.S. National Library of Medicine, Bethesda, MD). Analyses were performed using SPSS v18.0 (SPSS Inc., Chicago, IL).

Results

School participation

A total of 2735 survey packets were distributed to enrolled students, and 2338 were returned for an overall return rate of 85.5%. Surveys returned reflected the overall student population of predominately Asian; the majority whom were of Vietnamese descent (97%). Our population reflects a disproportionate percentage of underserved children as nearly 71% of students enrolled at participating schools were eligible for free or reduced priced meals. Asthma status was determinable for 1530 Asian children whose parents provided a signed consent form.

Demographic characteristics of children surveyed

Table 1 describes characteristics of the study population overall and by language of survey completion. The majority of parents elected to complete the survey in Vietnamese

Table 1. Characteristics of Vietnamese study population described overall and by language of survey completion.

Valid column % Language of survey completion	Overall <i>n</i> = 1530	Language of survey completion		Test of between group difference ^a
		Vietnamese (<i>n</i> = 827)	English (<i>n</i> = 703)	
Male gender	50.7%	51.0%	50.5%	<i>p</i> = 0.849
Age (years): mean (Stdev)	8.1 (2.3)	8.0 (2.2)	8.2 (2.3)	<i>p</i> = 0.034
3–4	3.8%	4.0%	3.6%	
5–10	78.2%	80.3%	75.6%	
11–12 (+one 13 year old)	18.0%	15.6%	20.8%	
Parent time in U.S. ≥10 years	81.0%	74.3%	88.9%	<i>p</i> < 0.001
Smoker in household	37.0%	38.6%	35.2%	<i>p</i> = 0.178
Public health insurance	73.1%	82.8%	61.7%	<i>p</i> < 0.001
Season of survey (month):				
Winter (February)	25.4%	23.5%	27.7%	<i>p</i> = 0.122
Spring (April)	22.0%	21.3%	22.9%	
Summer (June)	18.2%	18.9%	17.4%	
Fall (September and October)	34.4%	36.4%	32.0%	

^a*p* Value based on the Chi-square test statistic (*p* < 0.05 suggests significant difference).

Table 2. Asthma prevalence and risk factors. The percentage of students detected “at risk” for asthma, previously diagnosed with asthma by a Physician, and reporting persistent disease activity, described overall, and by student characteristics.

<i>n</i> = 1530	% Asthma detected (±margin of error) ^a	% Asthma previously diagnosed with asthma by a physician (±margin of error) ^a	% with persistent disease activity (±margin of error) ^a
Overall	30.4% (±2.3%)	23.8% (±2.1)	13.3% (±1.7)
Gender	<i>p</i> < 0.001	<i>p</i> < 0.001	<i>p</i> = 0.159
Male	34.6% (±3.4%)	28.5% (±3.3)	14.5% (±2.5)
Female	25.3% (±3.2%)	18.5% (±2.9)	12.0% (±2.4)
Age (years):	<i>p</i> = 0.279	<i>p</i> = 0.610	<i>p</i> = 0.508
3–4 years	24.1% (±11.1%)	78.9% (±10.7)	12.1% (±8.5)
5–10	31.2% (±2.6%)	75.6% (±2.5)	13.9% (±2.0)
11–12	27.4% (±5.3%)	78.1% (±5.0)	11.4% (±3.8)
Language of survey completion:	<i>p</i> = 0.004	<i>p</i> < 0.001	<i>p</i> = 0.014
Vietnamese	33.5% (±3.2)	28.6% (±3.1)	15.2% (±2.5)
English	26.7% (±3.3)	18.2% (±2.9)	11.0% (±2.3)
Parent time in the U.S.	<i>p</i> = 0.019	<i>p</i> = 0.010	<i>p</i> = 0.427
<10 years	25.0% (±5.1%)	18.2% (±4.6)	12.1% (±3.9)
≥10 years	32.1% (±2.6%)	25.6% (±2.5)	14.0% (±2.0)
Smoker in household:	<i>p</i> = 0.015	<i>p</i> = 0.136	<i>p</i> = 0.002
No	27.6% (±2.9%)	22.1% (±2.7)	10.8% (±2.0)
Yes	33.6% (±4.0%)	25.6% (±3.7)	16.4% (±3.1)
Health insurance:	<i>p</i> = 0.214	<i>p</i> = 0.347	<i>p</i> = 0.147
Public	31.3% (±2.7%)	24.4% (±2.5)	14.0% (±2.0)
Private/other	28.0% (±4.3%)	22.1% (±4.0)	11.2% (±3.1)

p Value based on the Chi-square test of difference in prevalence estimates between factor levels.

^aMargin of error estimated as 1.96*SE.

(54.1%). Girls and boys were equally represented in the survey population, and participating elementary school children were predominately 5–10 years of age (78.2%). A greater percentage of older children (11–12) was represented in the group whose parents completed the English compared with Vietnamese version of survey (20.8% versus 15.6%), *p* < 0.05. The majority of participants had been in the US for 10 or more years (81.0%) with the percentage notably higher among parents who completed the English version of survey (88.9% versus 74.3%), *p* < 0.05. ETS exposure was high, with 37.0% reporting a smoker in the household. Public health insurance was reported for 73.1% of children and described more often as a form of insurance by parents who completed the Vietnamese version of survey (82.8% versus 61.7%), *p* < 0.05. Surveys were distributed during all four seasons. There was

no statistically significant differences in the seasonal distribution (*p* = 0.122).

Children “at risk” for asthma

In the 1530 elementary school age Vietnamese children surveyed, the prevalence of asthma risk was 30.4% (±margin of error = 2.3%) as seen in Table 2. Factors which contributed to asthma risks were gender, preferred language, longer duration in the US, and ETS exposure. Asthma risk was higher in males compared with females (34.6% versus 25.3%), *p* < 0.001, those whose parent chose to complete the survey in Vietnamese compared with English (33.5% versus 26.7%), *p* = 0.004, those who had been in the US for 10 or more years compared to those less than 10 years (32.1% versus 25.0%),

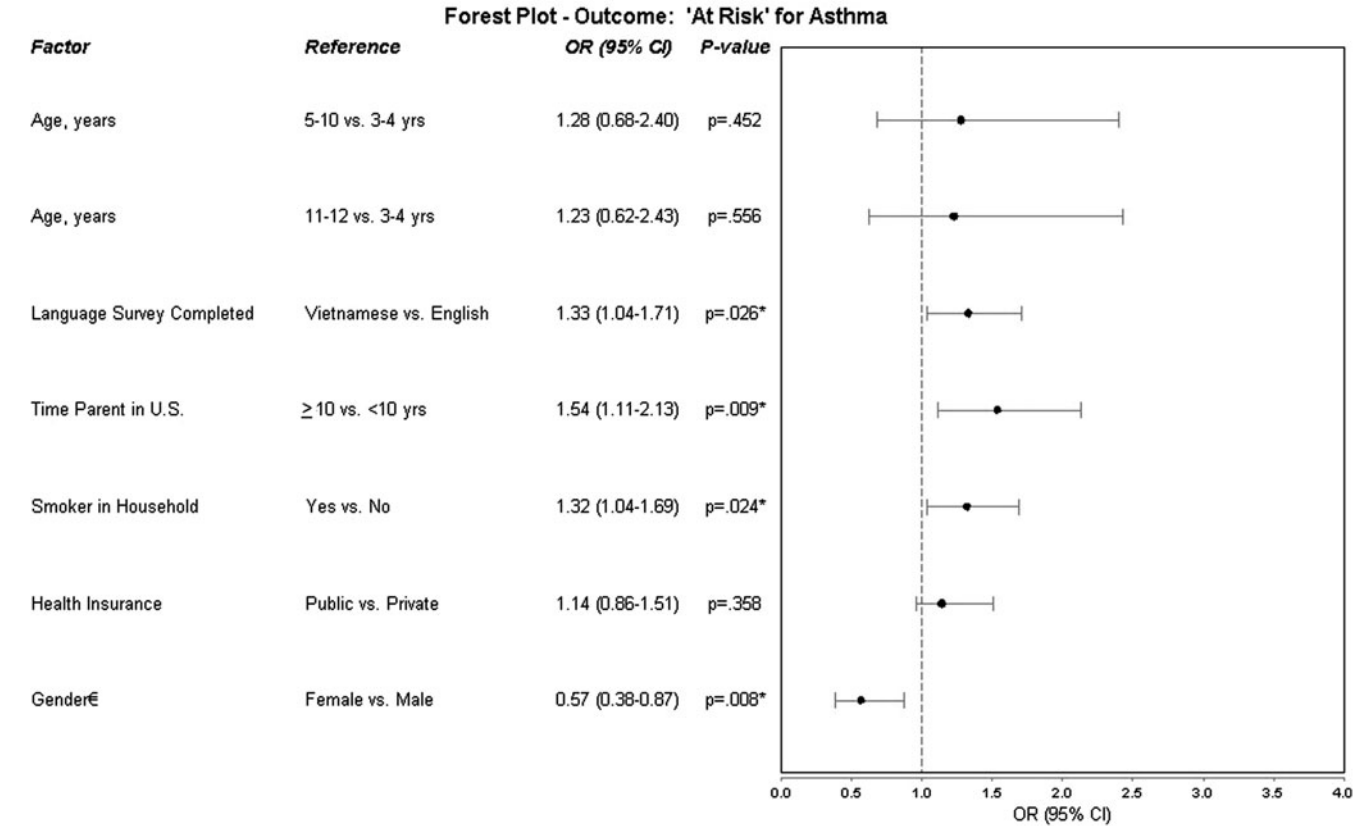


Figure 1. Forest plot displays likelihood child “at risk” for asthma for each level of characteristic compared with reference category. Odds ratios (OR) and 95% confidence intervals were calculated from adjusted model that accounted for significant interaction between gender and season (€ odds ratio presented for female versus male during fall season).

$p = 0.019$, and those with ETS exposure compared with no ETS exposure (33.6% versus 27.6%), $p \leq 0.05$. Figure 1 shows that adjustment for potential confounding factors did not alter the directional relationship of above findings. Surprisingly, public versus private health insurance was not a significant predictor of asthma “at risk” status nor does the season in which surveys were distributed.

Discussion

Our study found the burden of asthma to be high in Vietnamese children of low SES living in OC, CA. The prevalence of those at risk for asthma in the 1530 Vietnamese students evaluated across five elementary schools was 30.4%. For those detected at risk for asthma, 22.6 % had no prior diagnosis. In addition, 43.7% met criteria consistent with persistent disease severity.

Higher asthma prevalence risk was influenced by gender, ETS exposure, duration in the US, and language of survey completion. In general, male children have been found to have higher asthma prevalence than females, especially in the younger age groups [31,32]. Our study further confirms this finding. Although we did not look at specific characteristics that make males particularly at risk, previous studies have found that it might be related to physiologic growth and changes during the early stage of life and lung size and caliber [31,32]. Knowing that male children are at higher risk could help healthcare providers and caregivers alike in identifying

symptoms that could lead to early diagnosis and timely intervention.

The prevalence and the role of ETS exposure in relation to asthma prevalence found in our study were consistent with several prior studies [33,34]. ETS exposure in Vietnamese immigrants has been reported upwards of 43% [26–28] which was similar to that found in our study of 37%, compared with 13% for the general population in California [29], suggesting a much higher exposure potential in Vietnamese children. Future strategies towards smoking cessation in Vietnamese adults would be of great benefit to lessening the burden of asthma in Vietnamese children.

Longer duration in the US (≥ 10 years) also contributed to higher asthma prevalence risk (Table 2). This finding may be contributed by several reasons, including more access to care which could result in a higher likelihood of diagnosis [15,35], potential lifestyle changes in the US compared with Vietnam, environmental exposure to pollution, and the higher likelihood of developing allergic respiratory illness in children who lack early childhood exposure to microbial antigens, as proposed by the hygiene hypothesis [36–39]. This perspective is supported by a 2006 study of Vietnamese children in OC, California, showing a 13.6% asthma prevalence [24], while a 2007 study of asthma in the rural Dalat Highlands of Vietnam showed a prevalence of only 3.4% [40].

Parent-selected language of survey completion, independent of time in US and ETS exposure, also played an important role in contributing to the burden of asthma. Language has

been shown to reflect patients' view on chronic disease and treatment options [41–49]. Based on the most recent Orange County Health Needs Assessment (OCHNA) [15] report, Vietnamese have the lowest rates of English language proficiency among Asians in California. Their survey found that 82.7% preferred to answer the survey in Vietnamese compared to 54% in our study. English proficiency may have increased in this population since the OCHNA report of data collected in 2007, and the majority of our participants are likely young elementary school parents compared with the population surveyed by OCHNA. While lack of English proficiency may deter patients from seeking care and thus getting diagnosed [41–48], it was surprising that children whose parents preferred to answer the survey in Vietnamese, compared with English, had a higher prevalence risk and percentage previously diagnosed. A large number of Vietnamese-speaking physicians practicing in OC may have diminished the barrier to seeing a physician and therefore contributed to increased likelihood of prior diagnosis. On the other hand, these patients still appear to have an increased risk for persistent asthma. Previous studies have shown that non-English speaking patients are more likely to have higher rates of asthma related morbidity and mortality [41–43]. Finally, to our knowledge, there has been a lack of previous report in asthma severity in Vietnamese children. Although our study was not designed to look at severity, it highlights the need for further evaluation of this issue.

Our current findings contribute new information to the limited research data available for Vietnamese children. It is important to highlight our success of obtaining a high return rate of >80%, while an average mail survey response rate was found to be 68% in a previously published article looking at mail surveys published in medical journal [50]. Several factors that may have contributed to this success included our initial focus group study [26] performed in order to get to know the parents and school personnel, along with the dedication of the school teachers, who were rewarded with a modest gift card for achieving more than >80% of return rate. It was also attributed to the work of the committee staff members and school personnel who were involved in the education and reaching out programs to increase awareness of the study [26].

This study adds value because of its large sample size of Vietnamese children with low SES, with a questionnaire available in Vietnamese. While there are many studies evaluating asthma prevalence in the general population, few studies have focused on the Vietnamese population. To our knowledge there are only four studies to date that described data relevant to evaluating asthma prevalence in the Vietnamese pediatric population [22–25]. Asthma prevalence found in these studies ranged from 4.9%, which included both adults and children in the Ries study [22] in 1997 to 24.2% for low SES children in a more recent CHIS study [25]. This wide range may be explained by various factors including age, sample size, language used, and the type and number of questions used. Ries [22] evaluated 2536 recent Vietnamese immigrants with an age range from 4 to 70 years, but only 22 were less than 20 years. Galant et al. in 2004 [23] used similar methodology but had smaller sample size 123 children in the previous study. The

California Healthy Kids Survey (CHKS) reported by Davis et al. in 2006 [24] evaluated 4702 children, but included only teenagers and surveyed only in English. The CHIS study evaluated Californians of all ages, and the survey was conducted by phone in several languages, including Vietnamese. When looking at OC, CHIS also has a small sample size of 49 Vietnamese children which might have made the data statistically unstable, thus limiting its readiness for use and is only provided here for the purpose of comparison and perspective, as per askCHIS website [25]. The reported data on prevalence were based on one question, “Has a doctor ever told you that you have asthma?” Although a prior physician diagnosis of asthma is a valid criterion for asthma prevalence, if it is the only criterion it, may exclude low SES children who may have asthma but who have not been previously diagnosed, which was >20% in our study and thus underestimated prevalence. This is an important finding which may not have been previously emphasized, particularly in the Vietnamese population. These studies and our own illustrate that interpretation of prevalence data needs to consider factors mentioned above. Our study focused on the elementary age group with low SES, using a validated questionnaire to survey a large cohort of children in the parents preferred language of survey completion. As a result, these factors helped us to provide updated prevalence information for this growing population in a robust manner.

Limitations

One limitation of our study was that the question asking about race used the term Asian rather than specifying Vietnamese. However, the California Department of Education language census data reports 96.8% of Asian English Learners (EL) in our participating schools were Vietnamese EL (Home language survey 2010–2011). Although most Asian children in our study were Vietnamese, 3.2% may not have been Vietnamese. In future studies, for a more precise classification, the surveys could be designed to further divide the Asian subgroups into more specific categories.

Our finding of 30.4% asthma risk in this population may not reflect the true prevalence, which is usually defined by a physician diagnosis of asthma. It is possible that some of these identified children who have not been previously diagnosed do not actually have asthma but may have symptoms due to other causes, such as rhinosinusitis. However, the abbreviated algorithm utilized in our study has been previously shown to have reliability of >80% and specificity of 88.2% to detect asthma [23].

Given that this is a cross-sectional study, the effects of language were difficult to fully interpret. We believe that it can play an important role in identifying the high burden of asthma. With future studies, additional criteria can be used when surveying, to fully understand its effects.

Finally, our high asthma prevalence risk found may have also been influenced by our decision to solely focus on the communities with low SES. If the study were applied to a more general population of Vietnamese children in OC, it would give us a better overview of asthma burden for this group as a whole in the US.

Conclusions

Our data provide evidence which suggests that asthma risk is significant for Vietnamese children and their families, a fact that may not have been previously recognized by the healthcare community, as seen in the OCHNA report, which evaluated various health needs in this community [15]. In addition, our study also identified potentially undiagnosed asthma cases in Vietnamese children, which also has limited available data. Contributing to this risk is high ETS exposure and longer duration in the US. Language was an important factor in estimating asthma prevalence in this underserved community. This important factor needs to be considered in studies which evaluate other ethnic groups. Our data could result in increased awareness of asthma burden and contributing factors among low SES Vietnamese children. We suggest that this asthma identification tool could be used to screen those children at risk for asthma in all ethnic groups. Findings regarding care for the underserved, being increasingly important with the Affordable Care Act's focus on community needs assessment, could encourage public health policy makers to develop and support programs which focus on the care of the underserved Vietnamese asthmatic child in a similar way to those for other minority children.

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Declaration of interest

The authors report that they have no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Appendix

Orange County School Asthma Survey

1. Has your child ever been diagnosed with Asthma by a Physician? ☐ Yes ☐ No
2. **During the last 1 year**, has your child had *repeated* episodes of **asthma**? ☐ Yes ☐ No
3. Does your child have episodes of cough, chest tightness, trouble breathing, or wheezing when they **play or exercise**? (Select the one best answer)

Never	Rarely	Sometimes	Often	Most of the time
☐	☐	☐	☐	☐
4. In the **past 4 weeks**, how often has your child had episodes of cough, chest tightness, trouble breathing, or wheezing in the **morning or during the daytime**? (Select the one best answer)

Never	Less than two days a week	Two or more days a week but not everyday	Everyday	More than once a day on most days
☐	☐	☐	☐	☐