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School-based asthma surveillance: A comparison of student and parental report

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This study addressed the comparability of data obtained from a student-based and parent-based asthma and respiratory health survey. Our goal was to ascertain whether there were meaningful and systematic differences in asthma classification based on symptom and diagnosis reports obtained separately from students and their parents. A brief, written survey, based on the International Study of Asthma and Allergy in Children questionnaire, was administered to 6th through 10th grade students in two schools in Oakland, CA, USA. Students who reported asthma-like indicators for the previous 12-month period were defined as positive and a more extensive questionnaire was mailed home to those parents. A more refined classification of asthma based on parent report of indicators was compared with student report. Forty-four percent of 1298 students were classified as positive for current asthma-like symptoms and 50% of parent surveys were returned. For the positive students with parent surveys, 59% were classified as 'probable' for asthma based on the parent survey. Overall, the agreement between parent and students' classification was 70%, and 83% for students with a parent report of physician diagnosis of asthma. Students who were discordant with parents for physician diagnosis of asthma were more likely to be male, and more likely to have a parent report of unscheduled Emergency Department visit for wheezing or trouble breathing. Findings indicated that with the exception of medication, students reported asthma indicators more frequently that parents, independent of classification. Student report of physician diagnosis with a 12-month report of an asthma symptom was determined to be a good indicator of probable current asthma. Inclusion of or reliance on a parental questionnaire is not likely to improve the reliability of a school-based asthma surveillance program in our population.

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The rising prevalence of pediatric asthma, particularly among low socio-economic populations (1), is of increasing concern to communities across the United States and Europe. However, research has demonstrated that patient and caretaker education (2–6), behavioral interventions (7–9), and policy changes (10) can help asthma patients better manage existing symptoms, reduce asthma-related health care expenditures, and increase patients' quality of life. To facilitate planning and implementation of asthma interventions and control programs in given communities, it is necessary to have relevant and reliable prevalence data. Such data are needed not only to estimate the magnitude of the problem but also to target and evaluate the effectiveness of interventions.

In the United States, asthma prevalence data currently available largely are based on national level survey data (11–15) or regional hospital discharge or clinical data (11). National survey data are obtained from general population health surveys, in which asthma-related questions often are limited to a few questions to establish a 'diagnosis' without additional questions related to symptoms and severity, a circumstance that limits full understanding of the spectrum of disease. Although these data can be categorized

by state or region of the country, information obtained generally does not allow for the detail necessary for program planning. Hospital discharge data only capture the most severe asthmatics. Further, these data generally do not allow a distinction between asthma hospitalizations because of severe asthma, poor asthma control, or lack of access to primary asthma care, all of which present challenges in asthma management.

The community is a key context to advance understanding of asthma epidemiology and to implement programs to reduce the burden of disease. Community-level data can provide location-specific asthma prevalence estimates, specify the spectrum of asthma severity present in a community, and be utilized as surveillance data to track population level progression of disease prevalence and severity over time (16). In addition, within and between community analyses can provide greater understanding of variation in asthma prevalence with regard to race, ethnicity, socioeconomic status, and environment.

There is a growing literature focused on best practices to obtain community-level asthma prevalence data, specifically for pediatric asthma (17–20). There is, however, a lack of a uniformly agreed upon, standardized, epidemiological definition of asthma (21–23). A 'doctor's diagnosis of asthma' in the absence of consideration of specific symptoms, often is used in epidemiological studies of asthma (24). By definition, this approach fails to identify children with undiagnosed asthma and does not provide information on disease severity. Alternatively, use of clinical criteria, such as those published by the National Heart Lung and Blood Institute (25) is too time and cost intensive to implement as part of most routine community-based surveillance.

The International Study of Asthma and Allergy in Children (ISAAC) (16, 26) developed a brief survey to identify asthma in children ages 13–14 yr. The ease of use of this survey and its wide application in many countries makes it a useful starting point for the development of a simple and easy to administer survey suitable for ongoing community-based asthma surveillance in children and adolescents. Although the ISAAC instrument has been effective in epidemiological studies, its performance properties as a surveillance tool have not been evaluated.

Previous studies of population-based, pediatric asthma have relied upon physicians, parents and children for reports of asthma symptoms (27–31). Reliability studies that compare different sources of information (32–37) and different methods of survey administration [e.g. written vs. video questionnaire (21, 38–42)] have observed that agreement between surveys is difficult to predict and is dependent on factors such as language, geographic region, and survey format. The purpose of this analysis is to assess if there are meaningful differences between student and parent reporting of student's asthma and related symptoms in a school-aged population in an urban setting. As part of the establishment of an ongoing school-based asthma surveillance system in Oakland, CA, USA, we compared student answers to a brief, in-school administered ISAAC-like survey to an extensive home-based parent survey.

Methods

We conducted a pilot study in two public schools in Oakland, CA, USA to test two surveillance tools and a protocol designed to estimate the prevalence of current asthma in a middle-school and high-school. We examined the agreement between students' and parents' report of asthma and asthma-related indicators to establish a logistically feasible school-based method for estimation of asthma prevalence and severity in children ages 11–18. All procedures were approved by the Committee for the Protection of Human Subjects of the University of California, Berkeley.

Initial asthma survey data were obtained from a 10 question, ISAAC-like school-based survey (Appendix S1, available online as supplementary material) self-administered by students in grades 6 and 7 (middle school) and grades 9 and 10 (high school) in the Oakland Unified School District (OUSD) during Spring, 2002. Parental consent forms were provided to students in class. Parents were asked to return the forms, only if they did not wish to allow their children to participate in the study. Students could refuse to participate in the survey, even if a parent did not refuse. Surveys were distributed school-wide during one period (middle school) and two classes (high school) every day over the course of 1 wk to maximize participation. A definition of 'positive for current asthma-like symptoms' was determined from student responses to survey questions about wheezing, coughing, Emergency Department (ED) visits, and medication for wheezing or chest tightness during the prior 12 months. This list, referred to as 'asthma indicators' throughout this paper, was designed to maximize sensitivity rather than specificity. A student was considered 'positive' if he/she answered 'yes' to any of the asthma indicators. In addition to this list, we also included questions

about the student's history of an asthma diagnosis. We did not want to include in the 'positive' group students who might have been diagnosed at a young age but had not been symptomatic in the previous year. Therefore, if a student reported a physician diagnosis, we defined the student as 'positive' only if he or she also reported one of the asthma indicators. This additional indicator is referred to as 'diagnosed and symptomatic'.

A more detailed respiratory health survey was sent to parents/guardian, only if students were 'positive' on the initial survey. Parents of children who did not have a valid current address on file with the OUSD were excluded.

The parental survey included sections on students' respiratory health status, health care, medication, quality of life, home characteristics, smoking, and general demographic information. A $5 bill was included as incentive for completion and return of the survey (43). A reminder notice was mailed to parents who did not return the survey within 2 wk and was followed by an additional copy of the parental survey after 1 month of the initial mailing. Funds were not available for more intensive efforts to improve the frequency of returned surveys.

Based on 10 asthma indicator questions from the parent-completed surveys, we developed an algorithm to further classify the positive students as 'probable', 'possible', or 'not likely' to have active asthma. A slightly more stringent algorithm was applied to students without a parental report of a diagnosis of asthma (see Table 2b).

Statistical analysis

All analyses were performed with STATA (version 7, College Station, TX, USA). Inter-rater reliability between parent and student report of symptoms was analyzed with the kappa statistic (44).

Parent and student pairs were classified into three groups based on answers to the physician diagnosis question on each survey: 'concordant', 'discordant 1' (parent reported physician diagnosis; student reported 'no' or 'don't know'), and 'discordant 2' (parent reported 'no' or 'don't know' for physician diagnosis; students reported 'yes'). Any combination of 'no' for one report and 'don't know' for the other report was considered unclassifiable and those children were excluded from the analysis. Because of small numbers, the two discordant categories were grouped together for the analysis. Logistic regression was then used to evaluate the association between discordance and indicators and demographics reported on the student and parent survey. Potential explanatory variables for discordance were obtained from information reported in the parent follow up surveys [race, high school vs. middle school, child's sex, smokers in the household, student smoking, nocturnal symptoms, unscheduled visits to an emergency facility or physician's office, family history of asthma, and survey respondent (mother vs. other guardian)]. Variables with p-value < 0.25 and those that, based on previous findings or hypotheses, might be related to parent-child agreement were included in the model. Backwards stepwise variable selection was used to retain variables in the model ($p < 0.15$). Likelihood ratio tests were performed to compare models.

Results

A small number of students who were considered truant or were suspended at the time of survey administration were not eligible for the study, which resulted in 590 and 865 eligible students in the middle and high school, respectively. Thirty middle school and 82 high school students were either absent or otherwise unaccounted for during the survey, or returned an adult-signed consent form that denied consent ($n = 12$), or refused to participate in the study on their own accord ($n = 6$). The final study population included 560 middle school students (95.1%) and 783 high school students (90.5%). Forty-five surveys were excluded for lack of reliable data (e.g. missing names, blank surveys returned), which resulted in 1298 students for whom complete data were available.

Based on our criteria for current asthma-like symptoms, 43.9% ($n = 571$) of students were defined as positive for asthma-like symptoms. Of these, 522 (92.4%) had current addresses available; parent follow-up surveys were sent to these homes. A total of 262 completed parent surveys were returned (50.2%).

Descriptive data from student survey

Of the 1298 students who completed the survey, 227 (17.5%) reported ever being diagnosed with asthma ('lifetime diagnosis of asthma'). Of those, however, 40 (17.6%) did not report having symptoms in the past 12 months or family history of asthma and, therefore, were not defined as having active asthma. One hundred eighty-seven students (14.4% of all students surveyed; 82.3% of those with a physician's diagnosis) who were defined as positive for asthma reported a lifetime diagnosis and

Table 1. Asthma indicators among positive screen students

	Reported physician diagnosis (n = 187)	Did not report physician diagnosis (n = 384)	Difference (95% CI)
Indicators (%)			
Wheeze	97.3	68.2	29.1 (23.9, 34.3)
Emergency Department visit	47.1	18.8	28.3 (20.2, 36.4)
Cough	44.9	43.2	1.7 (−6.9, 10.4)
Medication	74.9	14.6	60.3 (53.1, 67.4)
1 indicator	15.0	64.0	$\chi^2_{(3)} = 200.5$ $p < 0.10^{-4}$
2 indicators	26.7	28.6	
3 indicators	37.4	5.4	
4 indicators	20.9	1.8	

symptoms or a family history ('diagnosed and symptomatic'). Students who reported a physician diagnosis also reported higher percentages of all asthma indicators (Table 1). Although high school students reported a greater frequency of all symptoms (data not shown), the percentage of students with more than four indicators (i.e. a marker for asthma severity) was not different for high school vs. middle school students.

Comparison of students for whom a follow-up survey was not returned

We compared the number of indicators for the positive students with (n = 262) and without (n = 309) a parent survey and found that while students who returned a parent survey were more likely to have self-report a doctor's diagnosis of asthma (38.1% vs. 28.1%; 95% CI for difference: 2.3, 17.7), there were no meaningful differences in the frequency of each individual student-reported indicator. Among the positive students, the median number of indicators for those with and without a parent survey was the same overall (median for both groups = 2), for those with a physician diagnosis (median for both groups = 3) or without a diagnosis (median for both groups = 1).

Data from the follow-up survey

Of the 262 students with a parent survey, we classified 59% as 'probable' asthma, 7% as 'possible' asthma and 34% as 'unlikely' to have asthma (Table 2a). Forty-one percent (n = 108) of parents reported that the student had a physician diagnosis of asthma (Table 2b). Of these, 89.8% were classified as 'probable' for asthma based on parent report. In contrast, only 38% of the students whose parents did not report a physician diagnosis were considered 'probable' for asthma, and 54% (n = 83) were considered to be 'unlikely' to have asthma.

Table 2a. Asthma classification based on parent survey

Category	Number of students (%)	Median no. of indicators	Interquartile range	Range
Unlikely	89 (33.9)	0	0–1	0–1
Possible	18 (6.9)	2	1–2	1–2
Probable	155 (59.2)	5	3–6	2–10

n = 262 (number of students with parent surveys).

The median number of indicators reported by parents for all students classified as 'unlikely' was zero (range, 0–1). Students with a parent report of diagnosis had a 28% greater frequency (95% CI: 15.2, 41.0) of reporting an unscheduled visit to the ED or to a physician for trouble breathing compared with students without a parent report of physician diagnosis.

Symptom agreement between parents and students

The 10 questions from the student survey were matched and compared with the question with the most similar wording in the parent survey. The absolute agreement [number of positive and negative answers to both questionnaires divided by the total (45)] was >50% for all questions. The kappa statistic indicated 'good' agreement between parent and student report for lifetime asthma diagnosis (kappa = 0.80) and sibling diagnosis (kappa = 0.77). The agreement was 'poor' for all other questions (from 0.09 for history of parent having a diagnosis of asthma to 0.50 for use of asthma medication). The agreement between parent and student was substantially better among students with probable asthma than among the non-probable asthma group (Table 3). Agreement for wheeze, ED visit, and cough was better for the 'probable' group. There was no meaningful difference between parent and student report of physician diagnosis for either the 'probable' or the 'not probable' groups.

Parent and student agreement on physician diagnosis

Four of the 262 students with a parent returned survey were missing data for the student or parent report of physician diagnosis. Twenty-three cases were considered unclassifiable [parent responded 'no' and students responded 'don't know' to physician diagnosis (21) or vice versa (1)], which resulted in 235 parent-student pairs for the analysis (Table 4). Parent and students were concordant for physician diagnosis in

Table 2b. Asthma classification based on parent survey stratified by physician diagnosis

Category	Definition	Number of students (%)	Median	Interquartile range	Range
Students with parental report of physician diagnosis of asthma					
		n = 108	5	3–7	0–10
Unlikely	No other indicators	6 (5.6)	1	NA	NA
Possible	Only 1 other indicator	5 (4.6)	1	NA	NA
Probable	>1 other indicator	97 (89.8)	5	3–7	2–10
Students without a parental report of physician diagnosis of asthma					
		n = 154	1	0–3	0–9
Unlikely	1 indicator	83 (53.9)	0	0–1	0–1
Possible	If only 1 indicator: either unscheduled MD visit or nocturnal symptoms. If 2 indicators, did not include unscheduled MD visit or nocturnal symptoms	13 (8.4)	2	2–2	2–2
Probable	3 or more indicators, or 2 indicators, both unscheduled MD visit or nocturnal symptoms	58 (37.7)	4	3–5	2–9

Indicators included: wheezing with cold or flu, wheezing without cold or flu, cough without cold, cough first thing in the morning, wheezing/cough so severe student could not finish a sentence, nocturnal symptoms, cough when exercising, wheeze when exercising, unplanned hospital or clinic visit for trouble breathing, and any parent or sibling with a physician diagnosis of asthma.
MD, Physician; NA, Not Applicable.

Table 3. Parent and student report of asthma indicators by parent-based asthma classification

	Students reporting indicator (%)	Parents reporting indicator (%)
Category: probable (n = 155)		
Wheeze	81.6	52.5
Emergency Department visit	38.6	28.4
Cough	34.2	30.4
Medication	21.5	55.1
Physician diagnosis*	57.6	51.2
Category: not probable (n = 107)		
Wheeze	70.2	3.8
Emergency Department visit	14.0	0.0
Cough	29.8	4.8
Medication	11.5	2.9
Physician diagnosis*	14.4	10.6

*Physician diagnosis from student report is defined as 'diagnosed and symptomatic' (lifetime report of diagnosis plus current symptom; parent report reflects lifetime diagnosis).

84.6% of cases (n = 199). Of the concordant pairs, 88 parents and students (44.2%) both reported a physician diagnosis of asthma. Of the 36 discordant pairs, there were slightly more parents reporting 'yes' and students reporting 'no/don't know' (n = 20) than parents reporting 'no/don't know' and students reporting 'yes' (n = 16).

Because of small numbers in each of the discordant groups, the two categories were collapsed into one group to examine any potential relation between student-reported indicators and discordance. No indicators were significantly associated with a discordant outcome.

Next, we assessed if questions in the parent survey predicted discordance of physician diagnosis. For this analysis we combined the two discordant groups and compared them to the concordant group. Of the 235 students with full information on parent and student report of physician diagnosis, 20 (8.5% of responses) were discordant. (The remaining 16 students classified as discordant were missing some data on the independent variables used in the regressions.)

Table 4. Parent vs. student report of physician diagnosis of asthma (includes only students with completed parent survey)

MD diagnosis	Parent responses			
Student responses	Don't Know	Yes	No	Total
Don't know	0 (0.0)* (0.0)†	11 (33.3) (10.2)	22 (66.7) (15.1)‡	33 (100.0) (12.8)
Yes	3 (2.9) (75.0)	88 (84.6) (81.5)	13 (12.5) (8.9)	104 (100.0) (40.3)
No	1 (1.0) (25.0)‡	9 (7.4) (8.3)	111 (91.7) (76.0)	121 (100.0) (46.9)
Total	4 (1.6) (100.0)	108 (41.9) (100.0)	146 (59.6) (100)	258 (100.0) (100.0)

*Indicates row percentages for category.
†Indicates column percentages for category.
‡Cells were considered 'unclassifiable'.

In adjusted analyses, students with an unscheduled clinic or ED visit for wheezing or trouble breathing had more than twice the odds of having a discordant response for physician diagnosis between parent and student compared with students who did not have unscheduled visits to the clinic or ED (OR: 2.11, 95% CI: 0.84, 5.3). Male students had more than four times the odds of having a discordant response between parent and student for the asthma survey compared with female students, although the estimate was imprecise (OR: 4.51, 95% CI: 0.58, 34.7). Male students with an unscheduled visit to the ED or a clinic for trouble breathing were more likely to be discordant for a physician diagnosis of asthma compared with females without unscheduled ED visits (OR: 9.51, 95% CI: 1.04, 86.3). Grade level (middle vs. high school) was not related to discordance between parent and student report of physician diagnosis of asthma.

Asthma classification based on student survey

The student survey was carried out to evaluate its usefulness for a larger surveillance program and to determine the cost and time associated with a mailed parent survey. Although some of the symptoms asked in the more extensive parent survey did not appear on the student version, key questions to determine classification (physician diagnosis, nocturnal symptoms, and unplanned clinic or ED visit for trouble breathing) were included. We modified the asthma classification scheme used on the parent survey and applied it to the 1298 students who participated in the student survey. Based on the student surveys, 19.7% of students were classified as 'probable' (n = 256), 11.6% were 'possible,' (n = 151), and 68.6% were 'unlikely' (n = 891). Based on the modified classification scheme, we also calculated the percentage of probable students among those positive screen students who returned a parent survey (n = 262) and those positive screen students without a parent survey (n = 309). Forty-one percent of students with a parent survey were classified as 'probable', compared with 34.9% of students without a parent survey. There was not a significant different in percent probable between these two groups (risk difference: 6.3%, 95% CI: −1.7, 14.2).

The students who were defined as positive and had a parent survey returned (n = 262) were classified both by student survey information and parent survey information and compared by classification of 'probable' and 'not probable' (includes 'possible' and 'unlikely'). Based on the student survey information, 53.1% of students were classified as 'not probable', and 46.9% of students were classified as 'probable', compared with 40.8% and 59.2% as classified by the parent data, respectively. For the 262 students who were classified both by parent and student report, 183 (69.8%) students were classified in the same category using parent and student data, 92 of which were classified as 'probable'. Despite concern that younger children's report would be more unreliable, the agreement between classification based on parent and student reports was similar for the middle high and high school students (70.9% and 67.4%, respectively). For the 'probable' group, with the exception of medication, students reported a significantly greater frequency of each indicator. For the 'not probable' group, this was true for all indicators.

Among students with a parent report of physician diagnosis (n = 108), 83.3% were classified in the same category by parent and student report; of these, 91.1% were classified as 'probable'. For students without a parent report of physician diagnosis (n = 154), 60.3% of students were classified in the same category by parent and student report; of these, only 10.7% were classified as 'probable'.

Estimate of asthma prevalence

The prevalence of asthma was estimated with the student-reported data and the classification algorithm used initially with the parent-reported data. We estimate that 16.6% of the students who participated in our study with complete data (n = 1298) had 'probable' asthma. This figure includes both students with a physician diagnosis of asthma, and some undiagnosed but symptomatic students. Among the 'probable' group, 86.6% had a self-report of physician diagnosis. In contrast, 58.7% of students classified as 'probable' by parent-reported criteria had a self-report of physician diagnosis.

Discussion

This study addressed the comparability of data obtained from a student-based and parent-based asthma and respiratory health survey. Our aim was to ascertain whether there were meaningful and systematic differences in asthma classification based on surveys completed separately by students and their parents. The administration of two sets of surveys can be inefficient in both cost and time, if the surveys provide similar information or do not provide any additional information, which

one cannot obtain from the other survey. Factors other than specific knowledge about physician diagnosis and indicator that could result in different outcomes include setting of the survey, format of the survey and time required to complete. Our analysis found that parent and student agreement on report of a physician diagnosis was high (85%), independent of the asthma classification given to the student, based on either the student or parent questionnaire. Based on our algorithm to classify students into categories, the majority (54%) of positive students without a report of physician diagnosis were classified as 'unlikely', and the majority (90%) of students defined as positive with a physician diagnosis were classified as 'probable'. In aggregate, these findings indicate that: (i) student report of physician diagnosis would also be a good proxy for a physician diagnosis of asthma; (ii) student report of physician diagnosis with a 12-month report of an asthma symptom is a good indicator of probable current asthma; and (iii) inclusion of or reliance on a parental questionnaire is not likely to improve the reliability of a school-based asthma surveillance program in our population.

Parent reports of their child's asthma diagnosis and/or related symptoms have been utilized to estimate community level pediatric asthma prevalence (46–48), conduct community level case-detection (20, 49), and to compare with a physician examination or report for survey validation (18, 19, 34, 50, 51). Studies that are part of the ISAAC consortium have utilized adolescent reported asthma information to estimate asthma prevalence (17, 52), but few studies have directly compared parent and child survey reports on asthma diagnosis and symptoms. Renzoni et al. (36) reported that in a study of over 21,000 adolescents in Italy, students reported higher asthma prevalence estimates compared with their parents. Student reports were significantly higher for report of lifetime physician diagnosis, and as much as 100% higher for reports of individual symptoms (e.g. wheeze) compared with answers from parents. Redline et al. (50) found that, for a group of urban elementary school students in the United States, students and parent answers to questions on asthma symptoms showed only moderate agreement. Students tended to report asthma symptoms three times more frequently compared with their parents. Hublet et al. (53) reported that adolescent children were significantly less likely to report an asthma diagnosis, yet reported more asthma symptoms. Braun-Fahrlander et al. (45) found that adolescents' self-reported prevalence rates for asthma symptoms and lifetime asthma diagnosis were also significantly higher than parental reports.

Similar to Renzoni et al. (36) and Braun-Fahrlander et al. (45), we found that agreement between parent and student reports, as measured by kappa scores, were higher for a diagnosis of asthma compared with questions related to symptoms. The comparatively lower kappa scores found in our study were most likely the result of different wording of the symptom and diagnosis questions on the parent and student surveys. It is also likely that the ability of parents to accurately report their children's asthma symptoms decreases as children enter adolescence (45). Our comparison of parent and student agreement was performed less to obtain a high level of agreement and more to understand the types and consistency of symptom reporting by parents and students. In almost all cases, we found that students reported asthma indicators consistently more frequently than parents, which is comparable with results from previous studies.

When parent and student data were used for separate classification into probable and not probable asthma groups, the agreement of the classifications was relatively high (70%). However, there remained substantial number of students who were classified into the opposite category when using the two distinct datasets. There are two likely explanations for this difference. First, although the algorithm from the parent-based classification was adapted to the student data for classification, classification based on student data was limited to the four indicators plus a physician diagnosis, rather than the 10 questions asked on the parent survey. As classification was based on the number of indicators reported, it is not surprising that a smaller proportion of students were classified as 'not probable' when utilizing the student-based data. In addition, as classification was based on symptoms, the discordance between parent and student report of symptoms would have led to discordant classification into 'not probable' and 'probable' asthma categories.

Although there was a high level of agreement between students and parents with regard to report of physician diagnosis of asthma, there were varying levels of agreement on asthma symptoms. Eight of 10 of our indicators had poor kappa scores. However, the utility of the kappa statistic in asthma surveys has been questioned (21), and other parent/student comparison surveys (36, 45, 50, 53) have found a general lower-level agreement for symptom

question between parents and students. Independent of asthma classification, students tended to report higher prevalence of symptoms compared with parents, except in one case (report of asthma medication for students classified as not probable.) There are several possible explanations for this finding – specifically, students may not be informing parents of the extent of their symptom frequency or severity. The age of this study population might reflect a time during adolescence when students are able to better manage or control their asthma without parental assistance and are not as likely to report symptoms to their parents.

There are several limitations to this study. First, of those students who we classified as positive for asthma-like symptoms, only 50% of parent surveys mailed were returned. Although the student report of symptoms did not significantly differ for those students with and without a parent survey, those with a returned parent survey were significantly more likely to have student report of a physician diagnosis of asthma. This may indicate that students with a report of physician diagnosis may have a parent who is more aware and engaged in the management of the student's asthma would be more motivated to participate in an asthma study. Second, because of resource constraints, we did not mail parent surveys to parents of students who did not screen positive for asthma-like symptoms. Comparison of the results of student and parent answers for students who we did not suspect to have asthma would have informed our analysis as to possible other patterns of response or disagreement between the students and parents. However, in light of the relatively low rates of return for parent surveys of students who were classified as positive, there would most likely be a low rate of return for parent surveys if their child did not screen positive. This suggestion is further supported by the finding that the only significant symptom report difference between positive students with and without a parent survey was student report of a physician diagnosis.

Because this was a pilot study, the algorithm for asthma classification was designed to be overly sensitive, meaning that it is likely that there are students identified as possible or probable for asthma who do not actually have asthma. This would result in an increased prevalence estimate compared with the true prevalence. However, because asthma is both under-diagnosed and untreated among urban children, it is important that school-based interventions are designed to capture as many children as possible (20).

The administration of an in-school survey appears to be more efficient in terms of proportion of survey response, cost and time efficiency, and provides the best setting for capture of our target population, adolescents in the community (50). Schools have a vested interest to participate in asthma surveillance studies, as it has been found that asthma affects school performance (54, 55), school attendance (56) and have an impact on school funding (57).

By limiting future asthma surveillance to student-based survey data only, it is likely that there will be more misclassification of disease than if both a student an parent survey were used. The potential identification of possible cases of undiagnosed asthma is a significant outcome of in-school surveillance data. However, to capture students who potentially are undiagnosed for asthma, the classification algorithm was designed to maximize sensitivity rather than specificity. Therefore, the prevalence estimate derived from the student surveys might be viewed as an upper bound of asthma prevalence in this population.

An accurate estimate of the burden of asthma is an essential element in the development and evaluation of community-based programs to reduce asthma morbidity. Creation of an asthma surveillance program in an urban community requires the follow components: (i) a setting to capture the target population; (ii) a practical survey instrument that can provide reliable data that are necessary for prevalence estimation; and (iii) a individuals who can adequately communicate information about asthma symptoms and diagnosis and who can be sampled efficiently in terms of costs and accessibility. We found that schools can serve as the setting that meets these criteria. We also have found that our adaptation of the written ISAAC survey (see Appendix S1), when administered in a school setting can be utilized. One of the key features of this instrument used in a school setting is its utility in identifying students with diagnosed and symptomatic asthma as well as potentially undiagnosed asthma. Lastly, we conclude from our comparison between student and parent survey results that self-report of asthma symptoms, indicators, and diagnosis by adolescent students is a useful basis for prevalence estimates and program development for our community.

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Supplementary material

The following supplementary material is available for this article online:
Appendix S1: Student Health Survey.

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