Status of Asthma Control in Pediatric Primary Care: Results from the Pediatric Asthma Control Characteristics and Prevalence Survey Study (ACCESS)

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Objective To estimate the prevalence of uncontrolled asthma in pediatric patients with asthma visiting their primary care provider for any medical reason.

Study design This was a cross-sectional survey conducted at 29 pediatric care sites across the United States. Children age 4-17 years with self- or caregiver-reported asthma completed the Childhood Asthma Control Test (C-ACT) or the Asthma Control Test (ACT) and responded to demographic and health-related questions. Uncontrolled asthma was defined as a C-ACT or ACT score ≤19.

Results A total of 2429 children with a diagnosis of asthma (or caregivers) completed the survey. The prevalence of uncontrolled asthma was 46%. The prevalence of uncontrolled asthma was 35% in patients seen for a nonrespiratory complaint versus 54% in those seen for a respiratory complaint. Children seen for a non–respiratory-related complaint with uncontrolled asthma were more likely to have missed 1 or more school days in the previous 4 weeks compared with children with controlled asthma (53% vs 24%).

Conclusions These findings highlight the impact of uncontrolled asthma not only in children seen for respiratory complaints, but also in those seen for nonrespiratory complaints. Pediatric care providers should consider evaluating asthma control on a regular basis regardless of the reason for the visit. *(J Pediatr 2010;157:276-81)*.

Asthma is a prevalent chronic medical condition and is the most frequent cause of hospitalization in children.[1] Recent surveys estimate that 9% (6.5 million) of US children age <17 years have current asthma and 5% (3.8 million) experienced at least one asthma attack in the past year. In 2003, approximately 750 000 emergency department visits, 198 000 hospitalizations, 7 million ambulatory care visits, and 186 deaths in children and adolescents were considered asthma-related.[1] In addition, asthma is responsible for an estimated 12.8 million missed school days annually.[1]

The National Asthma Education and Prevention Program (NAEPP) emphasizes the importance of asthma control and the domains of impairment and future risk.[2] Management guidelines recommend assessing asthma control on a regular basis. For children age 12-17 years, the NAEPP recommends the use of clinically valid patient-centric questionnaires, such as the Asthma Control Test (ACT),[3] Asthma Control Questionnaire,[4] and Asthma Therapy Assessment Questionnaire,[5] to assess asthma control. For younger children, several validated tools for measuring asthma control have been developed, including the Childhood Asthma Control Test (C-ACT),[6] the Asthma Quiz for Kidz,[7] the Asthma Therapy Questionnaire for children and adolescents,[8] and the Test for Respiratory and Asthma Control in Kids (TRACK) for children under age 5 years.[9]

Despite efforts to characterize the prevalence of uncontrolled asthma in the pediatric population, studies focusing on pediatric patients seen in outpatient clinics and using validated instruments are lacking. Previous studies have used various instruments and definitions to determine "suboptimal asthma control" or "inadequately controlled" asthma and have reported prevalences of 37%-64% depending on the definition and measure of asthma control used and the population studied.[10-13] The objective of the present study was to determine the prevalence of uncontrolled asthma in a representative sample of pediatric primary care offices at the point of care using a validated instrument. We also examined the burden of uncontrolled asthma stratified by respiratory-related and non–respiratory-related health provider visits.

Methods

This was a multi-site, cross-sectional study in patients with asthma who visited a pediatric health care provider for any reason between January and May 2008

ACT	Asthma Control Test
CDC	Centers for Disease Control and Prevention
C-ACT	Childhood Asthma Control Test
CI	Confidence interval
NAEPP	National Asthma Education and Prevention Program

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(study #ADA111119). The primary measure, "uncontrolled asthma," was defined as a binary variable and based on a total C-ACT (in patients age 4-11 years) or ACT (in patients age 12-17 years) score ≤19.[3,6] The 29 participating sites were identified using a publicly available list of physicians (online Yellow Pages) within geographic regions throughout the United States. To increase the likelihood of choosing practices that reflect general practice health care, sample sites were excluded from the study if they (1) specialized in asthma treatment or had an asthma specialist on staff; (2) had participated in a respiratory-related clinical research study in the previous 3 years; or (3) used the C-ACT or ACT regularly to monitor their patients with asthma. Each site had to be able to generate a list and accurate count of all patients with asthma seen in the office during the study period to determine eligible patients that would volunteer to be screened for participation in the study and to identify a sample for inclusion in the chart abstraction to assess volunteer bias. In addition, each site was required to have at least one pediatric health care provider on staff willing to serve as the principal investigator.

An initial inquiry was sent to 1130 pediatric offices across the United States announcing the study. Of these, 119 offices responded; 43 stated that they were not interested. Of the 76 interested sites, 2 never completed the eligibility screening, 45 were determined to be ineligible (21 because they had an asthma specialist, 8 because they frequently used the ACT or C-ACT, 10 because of low patient volume, 4 because they had participated in asthma-related research in the previous 3 years, 1 who could not generate a list of patients, and 5 because they did not have an eligible principal investigator or could not defer to a central institutional review board).

Target enrollment at each site was set at 85 patients; however, sites were allowed to enroll up to 150 patients, for a total study target sample size of 2400-3000 patients recruited over 3 months. Trained site staff screened patients who voluntarily expressed interest in the study after seeing posted advertisements in the HCP's office, and obtained written informed consent from the legal guardians and assent from the children. The study protocol was approved by a central institutional review board.

Selection and Description of Participants

Eligible patients were age 4-17 years at the time of screening, had a history (self- or caregiver-reported) of health care provider-diagnosed asthma, used an asthma medication in the previous year, and was able to (or had a caregiver able to) read, write, and comprehend English (or Spanish at selected sites). Eligible children also had to cognitively give assent before study participation and to have a legal guardian available, willing, and able to provide informed consent before study participation. Patients were deemed ineligible to participate if they (1) reported a history of chronic bronchitis or cystic fibrosis; (2) were currently participanting in a respiratory-related research study; or (3) reported no use of any asthma medications, including albuterol, in the previous year.

Questionnaires

Before seeing the health care provider, patients age 4-11 years were asked to complete (with help from their custodial caregiver) the C-ACT, and those age 12-17 were asked to complete the ACT while in the office. Both of these self-administered tests are clinically validated age-specific assessments of asthma control that can be completed quickly. The C-ACT is a 7-question, 2-part questionnaire, with one part to be completed by the child with caregiver assistance and the other part to be completed by the caregiver (**Appendix 1**; available at www.jpeds.com). The ACT is a self-administered 5-item survey completed by the patient only (**Appendix 2**; available at www.jpeds.com).

The custodial caregivers of patients age 4-11 also were asked about the reason for the visit. Each visit was classified as either respiratory-related (eg, routine visit for asthma, visit for an asthma attack or worsening asthma, visit for another respiratory condition, including bronchitis, upper respiratory tract infection, cold, flu, pneumonia, allergies, ear infection, and sinus infection) or nonrespiratory-related (eg, annual physical examination, visit for another medical condition). Other questions elicted information on demographics, history of asthma exacerbations (defined as use of an oral steroid burst in the previous 12 months, an emergency department or urgent care center visit due to asthma in the previous 12 months, or hospitalization due to asthma in the previous 12 months), health behaviors (eg, exposure to second-hand smoke at home), school productivity, and current asthma medication use (eg, controller medications, rescue medications).

Patients age 12-17 years also were asked to answer questions related to demographics, asthma exacerbations, health behaviors, school/work productivity, and current asthma medications. Their custodial caregivers were asked to complete a questionnaire eliciting general demographic information and information concerning reasons for visits and missed days of school or work.

Evaluation of Volunteer Bias

To assess any possible differences between eligible patients enrolled in the study and those not enrolled, study sites were asked to identify all patients seen in the practice during the data collection period who had a history of asthma and to randomly select a sample for medical chart abstraction. This chart abstraction included limited nonidentifying variables that could be used to assess the potential for volunteer bias, including reason for visit, age category, sex, asthma medication use in the previous 12 months, and documentation of all asthma-related emergency department visits, specialist visits, and hospital visits.

Statistical Analysis

Overall prevalence estimates summarized across the geographic regions were estimated by a weighted-average approach, with the weights proportional to the number of self-reported cases of asthma published by the Centers for Disease Control and Prevention (CDC) by geographic region.[14] First, the regional-specific prevalence estimates were generated

by summing the number of patients identified with uncontrolled asthma across all included practices in the region divided by the total number of survey participants in that region. Weights were then generated that described the proportion of nationwide self-reported cases of uncontrolled asthma occurring in each region. The regional-specific prevalence estimates were multiplied by these weights, then summed across all regions, to obtain an overall weighted estimate,

$$p_{\text{overall}} = p_1 \cdot w_1 + p_2 \cdot w_2 + ... + p_k \cdot w_k,$$

where p_k is the prevalence estimate for region k and w_k is the weight for that same region.

Two-sided 95% confidence intervals (CIs) of the prevalences were calculated using the normal approximation based on the central limit theorem. The prevalence of uncontrolled asthma stratified by specific characteristics was estimated using the same method as for the overall prevalence, under the assumption that the ratio across the strata is similar across the geographic regions. In addition, differences between asthma control groups were assessed for each category of self-reported medical history using P values produced by the Pearson χ^2 test.

Volunteer bias was accounted for when using the data from the chart review, with an adjustment coefficient calculated for each characteristic assessed. If the overall adjustment coefficient for each characteristic was >1.05 or <0.95, then the prevalence estimate was adjusted by multiplying the adjustment coefficient by the original prevalence estimate. The specific methods for calculating the adjustment coefficient are detailed in **Appendix 3** (available at www.jpeds.com).

Missing values were excluded from the analysis. All data analyses were performed using SAS version 9.1.3 (SAS Institute, Cary, North Carolina).

Results

Based on number of subjects provided by participating HCPs, approximately 5219 children age 4-17 with a history of asthma were seen during the data collection period. Of these, 2572 patients expressed interest in the study and were screened. After screening, 104 patients were ineligible and 21 declined to participate, leaving a total of 2447 patients age 4-17 years with asthma enrolled in the study. Eighteen of these patients were excluded from the analysis (12 who were outside the age range and 6 who had incomplete C-ACT or ACT questionnaires). The final sample size was 2429, or 47% of the total eligible patients with asthma. Nearly three-fourths of the children were age 4-11 years. The reason for the health provider visit was a respiratory complaint in 53% of the cases and a nonrespiratory complaint, including "well-child" visit (n = 380), and "other medical condition, illness, or injury" (n = 686), in 47% of the cases.

The mean patient age was 9.2 ± 3.7 years. Approximately 40% of the participants were Caucasian, 30% were Hispanic, and 22% were African American. The majority (86%) of

Table I. General participant characteristics by age group and reason for visit

Demographic characteristic	Overall (n = 2429)	Age		Reason for visit*	
		4-11 years (n = 1739)	12-17 years (n = 690)	Nonrespiratory (n = 1066)	Respiratory (n = 1216)
Age, years, mean (standard deviation)	9.2 (3.7)	7.3 (2.3)	14.1 (1.6)	9.4 (3.8)	9.1 (3.7)
Males, n (%)	1353 (56.2%)	1011 (58.7%)	342 (49.9%)	597 (56.3%)	684 (56.5%)
Race/ethnicity, n (%)					
Caucasian	938 (39.3%)	638 (37.5%)	300 (43.7%)	431 (40.9%)	478 (39.9%)
African American	524 (21.9%)	392 (23.0%)	132 (19.2%)	231 (21.9%)	269 (22.5%)
Hispanic	720 (30.2%)	532 (31.3%)	188 (27.4%)	310 (29.4%)	347 (29.0%)
Other	206 (8.6%)	140 (8.2%)	66 (9.6%)	82 (7.8%)	103 (8.6%)
Region, n (%)					
West	317 (13.1%)	225 (12.9%)	92 (13.3%)	121 (11.4%)	168 (13.8%)
Midwest	221 (9.1%)	137 (7.9%)	84 (12.2%)	103 (9.7%)	112 (9.2%)
Northeast	737 (30.3%)	527 (30.3%)	210 (30.4%)	329 (30.9%)	370 (30.4%)
South central	817 (33.6%)	604 (34.7%)	213 (30.9%)	345 (32.4%)	404 (33.2%)
Southeast	337 (13.9%)	246 (14.1%)	91 (13.2%)	168 (15.8%)	162 (13.3%)
Education, n (%)					
No high school diploma	345 (14.5%)	250 (14.6%)	95 (14.0%)	152 (14.4%)	176 (14.8%)
High school graduate or equivalent	1038 (43.5%)	748 (43.8%)	290 (42.7%)	460 (43.6%)	496 (41.6%)
More than high school	1003 (42.1%)	709 (41.6%)	294 (43.3%)	444 (42.0%)	519 (43.5%)
Insurance, n (%)					
No health insurance	34 (1.4%)	23 (1.3%)	11 (1.6%)	8 (0.8%)	23 (1.9%)
Private health insurance	1081 (45.1%)	755 (44.0%)	326 (47.7%)	481 (45.4%)	551 (45.8%)
Medicaid, SCHIP	1113 (46.4%)	814 (47.5%)	299 (43.8%)	504 (47.6%)	537 (44.7%)
Other	197 (8.2%)	145 (8.6%)	52 (7.6%)	82 (7.7%)	96 (8.2%)
Exposed to second-hand smoke at home, n (%)	358 (14.9%)	232 (13.4%)	126 (18.4%)	168 (15.8%)	162 (13.4%)
BMI percentile, median	75	75	75	75	75
BMI ≥85th percentile and <95th percentile (overweight), n (%)	333 (16.7%)	212 (15.6%)	121 (18.8%)	170 (15.8%)	146 (17.7%)
BMI ≥95th percentile (obese), n (%)	570 (28.5%)	415 (30.6%)	155 (24.1%)	303 (28.2%)	234 (28.3%)

BMI, body mass index; *SCHIP*, State Children's Health Insurance Program.
For each individual characteristic percentage, the denominator excludes the number missing.
*Excludes 147 respondents that did not provide a reason for visit.

caregivers had at least a high school education. Only 1.4% of children had no private or government insurance. General characteristics of the overall study population and by age group and reason for visit are summarized in Table I.

Prevalence and Overall Burden of Uncontrolled Asthma

The overall weighted prevalence for uncontrolled asthma in this pediatric population with a history of asthma was 46% (95% CI, 43%-48%) (Table II). Uncontrolled asthma was present in 54% of the patients seen for a respiratory complaint (95% CI, 50%-57%) and in 35% (95% CI, 32%-38%) of those seen for a nonrespiratory complaint. Table II presents estimated weighted prevalences of uncontrolled asthma by demographic characteristics and history of cold, flu, or sinus infection in the previous 4 weeks.

The occurrence of one or more asthma exacerbations (marked by the use of an oral corticosteroid or an asthma-related emergency department or urgent care visit or hospitalization) in the previous 12 months was higher in children with uncontrolled asthma compared with children with controlled asthma (50% vs 33%; P <.0001) (Table III). More children with uncontrolled asthma had missed 1 or more school days in the previous 4 weeks (67% vs 29%; P <.0001). More custodial caregivers of children with uncontrolled asthma had missed at least 1 day of work in the previous 4 weeks (49% vs 17%; P <.0001). More children with uncontrolled asthma (or their caregivers) rated their asthma as worse than "mild" (67% vs 30%; P <.0001).

Burden of Uncontrolled Asthma in Patients Seen for a Nonrespiratory Complaint

The Figure illustrates health care utilization based on asthma control status in those patients seen for a nonrespiratory complaint. The occurrence of at least one asthma exacerbation in the previous 12 months was more common in children with uncontrolled asthma compared with children with controlled asthma (50% vs 31%; P <.0001) (Table III). More children with uncontrolled controlled asthma had missed 1 or more school days due to asthma in the previous 4 weeks (53% vs. 24%; P <.0001). More custodial caregivers of patients with uncontrolled asthma had missed at least 1 day of work in the previous 4 weeks (39% vs. 14%; P <.0001).

Similar trends for asthma exacerbations, missed school days, and missed work days were observed in patients seen for a respiratory complaint; however, the magnitude of the difference between the patients with uncontrolled asthma and those with controlled asthma was much higher for missed school days and missed work days in these patients compared with patients seen for a nonrespiratory reason. In contrast, the percentage of exacerbations was relatively similar in patients seen for a respiratory reason and those seen for a nonrespiratory reason (Table III).

Table II. Weighted estimate of the prevalence of uncontrolled asthma stratified by patient characteristics*

Patient characteristic	Prevalence, % (95% CI)†		
	Overall	Respiratory	Nonrespiratory
Overall	46 (43-48)	54 (50-57)	35 (32-38)
Sex			
Male	44 (41-47)	53 (49-57)	33 (29-37)
Female	49 (45-52)	55 (50-61)	38 (33-43)
Race/ethnicity			
Caucasian	43 (40-47)	53 (48-58)	31 (26-36)
African American	55 (49-61)	60 (52-69)	44 (35-53)
Hispanic	41 (36-46)	51 (44-59)	32 (24-40)
Other	51 (43-60)	61 (49-73)	38 (25-51)
Cold, flu, or sinus infection in previous 4 weeks			
Yes	50 (48-53)	56 (52-60)	41 (37-45)
No	35 (31-39)	47 (40-53)	24 (19-30)

*The percentage in each category represents the level of uncontrolled asthma for each specific characteristic, and thus should not add up to 100% for that specific category.
†Weighted estimate of prevalence, with weights proportional to the number of self-reported cases of asthma published by the Centers for Disease Control and Prevention by geographic region.

Evaluation of Potential Volunteer Bias

Chart abstraction was completed on a random sample of 319 study participants and 285 eligible (but not screened) nonparticipants. Demographic and general characteristics were similar in the 2 groups. Adjustment coefficients were within the range 0.991-1.006; thus, the weighted prevalence estimates for potential volunteer bias did not require adjustment (Appendix 3).

Discussion

Our data indicate that 46% of the children with asthma visiting a pediatrician for both respiratory and nonrespiratory reasons had uncontrolled asthma symptoms. This finding is are consistent with previously reported rates of uncontrolled asthma in children in primary care settings (37%-64%);[10-13] however, this is the first study with a large sample size to quantify the prevalence of uncontrolled asthma using a clinically validated asthma control assessment tool (ACT or C-ACT) in a population of patients seeking care for both respiratory and nonrespiratory reasons.

Although the high rate of uncontrolled asthma (54%) in patients seen for a respiratory-related reason was not surprising, the 35% rate in patients seen for a nonrespiratory reason was somewhat unexpected. In terms of the overall burden of uncontrolled asthma, the utilization of asthma-related health care services in the previous year was higher in patients with uncontrolled asthma than in those with controlled asthma, and the rate did not vary appreciably by reason for the visit. These findings support the premise that all children with asthma should be screened for asthma control at every primary care visit, because many who come in for a nonrespiratory-related visit may be uncontrolled and can benefit from an asthma evaluation.

Previous and current exacerbations are important components of "future risk" assessment for optimizing asthma control.[2] Our finding that 50% of patients with uncontrolled asthma and 31% of those with controlled asthma seen for a non–respiratory-related reason had experienced at least

Table III. Summary of self-reported medical history by reason for visit and asthma control*

Category of self-reported medical history	Overall (n = 2429)		Nonrespiratory (n = 1066)		Respiratory (n = 1216)	
	Controlled (n = 1222)	Uncontrolled (n = 1207)	Controlled (n = 664)	Uncontrolled (n = 402)	Controlled (n = 510)	Uncontrolled (n = 706)
Asthma exacerbation†	400 (32.9%)	606 (50.4%)**	207 (31.2%)	199 (49.6%)**	182 (35.8%)	368 (52.1%)**
Oral or injected steroid for asthma†	341 (28.5%)	491 (41.6%)**	175 (26.6%)	158 (40.2%)**	158 (31.6%)	301 (43.3%)**
Asthma-related emergency department or urgent care visit†	122 (10.1%)	287 (24.0%)**	61 (9.2%)	88 (22.1%)**	57 (11.2%)	180 (25.6%)**
Asthma-related hospital visit†	26 (2.1%)	66 (5.5%)**	11 (1.7%)	16 (4.0%)††	15 (3.0%)	47 (6.7%)‡‡
Seen an asthma specialist†	246 (20.3%)	275 (23.1%)**	130 (19.6%)	98 (24.6%)**	110 (21.8%)	158 (22.6%)**
Self-reported asthma severity‡						
Mild	847 (70.2%)	387 (32.5%)	472 (71.4%)	140 (35.0%)	342 (68.0%)	221 (31.6%)
Moderate	333 (27.6%)	679 (57.0%)	177 (26.8%)	231 (57.8%)	148 (29.4%)	395 (56.5%)
Severe	26 (2.2%)	126 (10.6%)	12 (1.8%)	29 (7.3%)	13 (2.6%)	83 (11.9%)
Missed at least 1 day of school§	314 (29.4%)	719 (66.6%)**	138 (23.9%)	194 (53.2%)**	160 (35.0%)	462 (73.3%)**
Caregiver missed at least 1 day of work‡	136 (17.2%)	349 (49.0%)**	61 (14.0%)	90 (38.5%)**	73 (22.3%)	231 (55.0%)**

*For each characteristic, the denominator excludes the number missing.
†Events reported in the previous 12 months.
‡*P* values are testing for the self-reported asthma severity groups combined, not at each severity level.
§In the previous 4 weeks in those attending school or employed.
***P* <.0001.
††*P* <.05
‡‡*P* <.01

one asthma exacerbation in the previous 12 months illustrates the variable nature of asthma. It also underscores the fact that even patients with asthma currently under control may be at risk for future events. Periodic assessment of asthma control and modification of treatment plans as outlined in the NAEPP asthma guidelines may help mitigate this risk.

In US school-age children, in 2003, uncontrolled asthma led to an estimated annual loss of 12.8 million school days, or approximately 3.2 missed days of school for each student with asthma.[1] Our survey found the highest rate of school absences in the previous 4 weeks in patients with uncontrolled asthma at the time of assessment. It also found that caregivers of patients with uncontrolled asthma missed more days of work because of their child's asthma compared with caregivers of patients with controlled asthma.

A comparison of self- (or caregiver-) assessed severity of asthma and asthma control defined by the C-ACT or ACT found that 31% of the caregivers of patients age 4-11 years with uncontrolled asthma rated their child's asthma as "mild" and that 36% of patients age 12-17 years with uncontrolled asthma rated their asthma as "mild." This disconnect may represent a significant underestimation of disease control by patients or caregivers and is similar to what has been reported in some previous studies. For example, Smith et al[10] reported that 60% of parents rated their child's asthma control as "good," "very good," or "excellent," even if their child had asthma symptoms 2 days a week. This finding might have been related to the fact that 27% of the parents had low expectations for their child's functioning with asthma.[10] Overall, asthma control is often overestimated, especially when asthma control is assessed with only a single

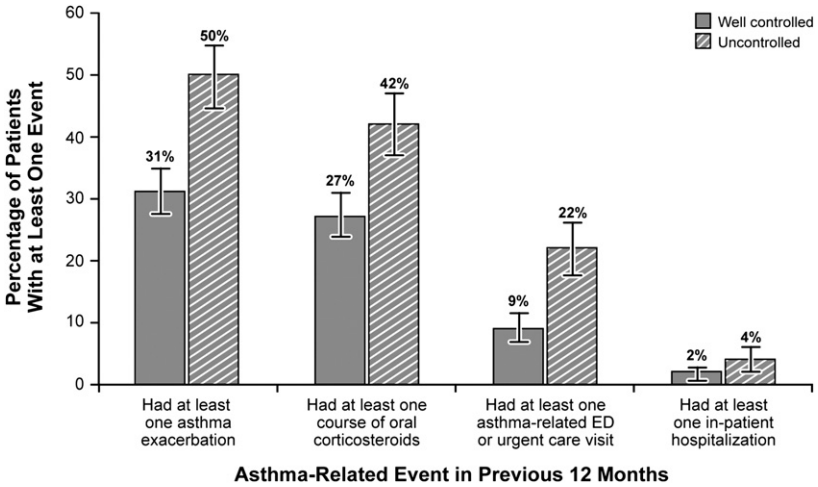

Figure. History of exacerbations and health care utilization in the previous year by asthma control status in patients with asthma seen for non–respiratory-related illness. Values in brackets are 95% CIs.

question. Asthma control might be better measured by physicians and patients using validated multi-item tools.[9,15,16]

Our study has some limitations. We assessed the prevalence of asthma controls over a 12-week period from late January to early May, when uncontrolled asthma might be more prevalent due to seasonal variations, and this might not reflect the prevalence of asthma control in other seasons. Because this study excluded sites specializing in asthma or with an asthma specialist on staff, the estimate of uncontrolled asthma among all potential pediatric primary care offices might be overestimated. The estimates likely accurately represent general pediatric care practices, however. In addition, the study population comprised patients with asthma seen by primary care providers, not patients with asthma in the general population; therefore, the prevalence of uncontrolled asthma might not be generalizable to those who are not actively seeking care. In addition, even though the primary care population in this study was dispersed geographically throughout urban and suburban centers, it is a convenience sample that might not represent all primary care practices. But because asthma control was assessed using a validated survey instrument with no lung function testing, the prevalence of uncontrolled asthma during this period actually might have been underestimated, because the addition of lung function testing possibly could have identified more patients with uncontrolled asthma.[3,17]

This study demonstrates the high prevalence of uncontrolled symptoms in children with a history of asthma in the primary care setting. Even in those visiting their physician for a nonrespiratory reason, 1 out of 3 (35%) had poor control. Thus, assessment of asthma status using a validated instrument as part of an integrated asthma management plan and performed at every visit regardless of the reason for the visit might improve asthma outcomes and facilitate partnerships between patients/caregivers and health care providers. ■

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Physician's Name: _____ Today's Date: _____

Patient's Name: _____

Childhood Asthma Control Test for children 4 to 11 years.

This test will provide a score that may help the doctor determine if your child's asthma treatment plan is working or if it might be time for a change.

How to take the Childhood Asthma Control Test

Step 1 Let your child respond to **the first four questions (1 to 4)** If your child needs help reading or understanding the question, you may help, but let your child select the response. Complete the remaining **three questions (5 to 7)** on your own and without letting your child's response influence your answers. There are no right or wrong answers.

Step 2 Write the number of each answer in the score box provided.

Step 3 Please give this test to the study coordinator.

Have your child complete these questions.

1. How is your asthma today?

0	1	2	3	SCORE
Very bad	Bad	Good	Very good	

2. How much of a problem is your asthma when you run, exercise or play sports?

0	1	2	3	
It's a big problem, I can't do what I want to do.	It's a problem and I don't like it.	It's a little problem but it's okay.	It's not a problem.	

3. Do you cough because of your asthma?

0	1	2	3	
Yes, all of the time.	Yes, most of the time.	Yes, some of the time.	No, none of the time.	

4. Do you wake up during the night because of your asthma?

0	1	2	3	
Yes, all of the time.	Yes, most of the time.	Yes, some of the time.	No, none of the time.	

Please complete the following questions on your own.

5. During the last 4 weeks, how many days did your child have any daytime asthma symptoms?

5	4	3	2	1	0	
Not at all	1-3 days	4-10 days	11-18 days	19-24 day	Everyday	

6. During the last 4 weeks, how many days did your child wheeze during the day because of asthma?

5	4	3	2	1	0	
Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday	

7. During the last 4 weeks, how many days did your child wake up during the night because of asthma?

5	4	3	2	1	0	
Not at all	1-3 days	4-10 days	11-18 days	19-24 days	Everyday	TOTAL

19 or less **If your child's score is 19 or less, it may be a sign that your child's asthma is not controlled as well as it should be. Please talk to your doctor.**

Study ID _____

Appendix 1. Childhood Asthma Control Test

Physician's Name: Today's Date:

Patient's Name:

FOR PATIENTS:

Take the Asthma Control Test™ (ACT) for people 12 yrs and older.

Know your score. Share your results with your doctor.

Write the number of each answer in the score box provided.
Please give this test to the study coordinator.

									SCORE
1. In the past **4 weeks**, how much of the time did your **asthma** keep you from getting as much done at work, school or at home?	All of the time	1	Most of the time	2	Some of the time	3	A little of the time	4	None of the time	5	
2. During the past **4 weeks**, how often have you had shortness of breath?	More than once a day	1	Once a day	2	3 to 6 times a week	3	Once or twice a week	4	Not at all	5	
3. During the past **4 weeks**, how often did your **asthma** symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?	4 or more nights a week	1	2 or 3 nights a week	2	Once a week	3	Once or twice	4	Not at all	5	
4. During the past **4 weeks**, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?	3 or more times per day	1	1 or 2 times per day	2	2 or 3 times per week	3	Once a week or less	4	Not at all	5	
5. How would you rate your **asthma** control during the **past 4 weeks**?	Not controlled at all	1	Poorly controlled	2	Somewhat controlled	3	Well controlled	4	Completely controlled	5	
									TOTAL		

If your score is 19 or less, your asthma may not be controlled as well as it could be. Talk to your doctor.

FOR PHYSICIANS:

The ACT is:

- A simple, 5-question tool that is self-administered by the patient
- Clinically validated by specialist assessment and spirometry[1]
- Recognized by the National Institutes of Health

Reference: 1. Nathan RA et al. *J Allergy Clin Immunol*. 2004;113:59-65

Study ID

Appendix 2. Asthma Control Test

Appendix 3

As described in the Methods, 29 factors collected during the limited chart abstraction of participants and nonparticipants were considered as potential indicators of volunteer bias. Each factor was compared between the participant and nonparticipant samples using a Chi-squared test. The following factors had were statistically significant ($P < .05$) (**Appendix 4**; available at www.jpeds.com).

For each of these factors a coefficient was calculated that could be multiplied by the overall estimate of prevalence to adjust for any potential bias. However, if the coefficient was between 0.95 and 1.05 then an adjustment was considered unnecessary.

For categorical indicators, the calculation of the adjustment coefficient is shown using the controller medication use as an example (**Appendix 5**; available at www.jpeds.com). We observed uncontrolled asthma in 60% (190/319) of all participants with chart abstractions. The number of patients with uncontrolled asthma among the nonparticipants with chart abstractions was estimated by multiplying the number of nonparticipants (n=285) by the prevalence among participants, stratifying by each factor. This step was based on the assumption that the prevalence of uncontrolled asthma among participants with the characteristic of interest was the same as the prevalence among nonparticipants. The expected total number of patients with uncontrolled asthma was derived as the sum observed among participants and an estimated number for cases that could not be observed among nonparticipants. Finally, the adjustment coefficient was calculated as the ratio of the expected to observed proportion of patients with uncontrolled asthma, i.e. the proportion expected among participants plus nonparticipants divided by the proportion observed among participants only. For continuous indicators, the adjustment coefficient was estimated using logistic regression based using similar assumptions between the participants and nonparticipants.

Among the four factors that were identified as potential sources of volunteer bias the adjustment coefficients (**Appendix 6**; available at www.jpeds.com) ranged from 0.991 to 1.006; and this provided evidence that no adjustment to the overall estimate of prevalence was needed.

Appendix 4. Factors considered as potential indicators of volunteer bias

Factor	Participants (n=319)	Nonparticipants (n=285)	*P* value
1. Height (inches)	53.6 (8.27)	51.8 (8.95)	.025
2. Breathing condition other than asthma as reason for visit	91 (28.5%)	56 (19.6%)	.011
3. Total number of asthma visits during the past 12 months?			
0	58 (18.2%)	49 (17.2%)	.011
1	62 (19.4%)	91 (31.9%)	
2	69 (21.6%)	54 (18.9%)	
3	45 (14.1%)	33 (11.6%)	
4 or more	85 (26.6%)	58 (20.4%)	
4. Controller medication use	248 (77.7%)	184 (64.6%)	<.001

Continuous variables are displayed as mean (SD) and categorical variables are displayed as n (%).

Appendix 5. Adjustment coefficient for controller medication use in the last 12 months

Sample with chart abstractions	Controller Use in Last 12 Months	Patients with Uncontrolled Asthma not using controller	Patients with Uncontrolled Asthma using controller	Patients with Uncontrolled Asthma
Participants (n=319)	No=71 Yes=248	58% (41/71)	60% (149/248)	Observed = 41+149=190
Nonparticipants (n=285)	No=101 Yes=184	58.58 (estimated as 58% of 101)	110.40 (estimated as 60% of 184)	Unobserved= 58.58 + 110.40=168.98
Total n=604				Expected = observed + unobserved = 190+168.98=358.98 Adjustment coefficient = (358.98/604) / (190/319) = 0.998

Appendix 6. Adjustment coefficients for factors considered as potential indicators of volunteer bias

Factor	Adjustment Coefficient
1. Height (inches)	1.003
2. Breathing condition other than asthma as reason for visit	1.006
3. Total number of asthma visits during the past 12 months?	0.991
4. Controller medication use	0.998