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Cut points for Asthma Control Tests in Mexican children in Orange County, California

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ABSTRACT

Background: The Childhood Asthma Control Test (C-ACT) and the Asthma Control Test (ACT) are validated measures of asthma control in which a score of 19 is defined as uncontrolled according to published reports. However, different cut points may exist in different ethnic populations.
Objective: To determine the cut point for uncontrolled asthma in a Mexican descent population from Orange Country, California, compared with an age- and asthma severity–matched non-Hispanic cohort.
Methods: The C-ACT (in children 6–11 years old) and ACT (in children 12–17 years old) scores were collected from 151 children of Mexican descent and 48 non-Hispanic controls with mild-to-moderate asthma who lived in Orange County. Physicians were masked to C-ACT and ACT scores while assessing control based on National Asthma Education and Prevention program guidelines. The receiver operating characteristic method was used to examine the screening accuracy of the tests to detect uncontrolled asthma. The optimal cut points were selected by maximizing the total sensitivity and specificity.
Results: Cronbach α values for the C-ACT (0.76) and the ACT (0.80) confirmed that both tests were reliable in our study population. The C-ACT and ACT scores were statistically higher in children of Mexican descent than non-Hispanic children ($P = .008$). A cut point of 22 was optimal to detect uncontrolled asthma in children of Mexican descent 6 to 11 years old (group 1: sensitivity, 0.74; specificity, 0.86; area under the curve [AUC], 0.83) and children 12 to 17 years old (group 3: sensitivity, 0.78; specificity, 0.68; AUC, 0.79). For non-Hispanic controls, a cut point of 20 were optimal to detect uncontrolled asthma in children 6 to 11 years old (group 2: sensitivity, 0.70; specificity, 0.91; AUC, 0.86) and children 12 to 17 years old (group 4: sensitivity, 0.83; specificity, 0.87; AUC, 0.91).
Conclusion: In this cross-ethnic validation study, children of Mexican descent in Orange County seem to underreport asthma symptoms compared with a non-Hispanic population and may require higher C-ACT and ACT cut points to detect uncontrolled asthma.

Introduction

Asthma is a complex common chronic disease, and current guidelines emphasize the importance of achieving and maintaining control of symptoms.[1,2] The decision to initiate or step up therapy to achieve control in children is particularly difficult because it is generally based on a subjective clinical history, which can differ markedly between child and parent[3,4] and can also depend on income, educational level, ethnic or cultural background, and asthma severity.[5] In addition, standard spirometry results, although objective, are usually within the reference range even in children with poorly controlled symptoms.[6] Consequently, many asthmatic children are undertreated and are at risk for exacerbations.

The Childhood Asthma Control Test (C-ACT) and the Asthma Control Test (ACT) are 2 validated tools developed to assess asthma control and thus assist effective treatment, especially for primary care physicians.[7,8] C-ACT is a 7-question survey (score range, 0–27) for children ages 4 to 11 years in which the questions are completed by both the patient and parent. ACT is a patient-completed 5-question survey (score range, 5–25) designed for adults and adolescents 12 years or older. According to published reports, a C-ACT or ACT score of 19 or lower is defined as having uncontrolled asthma

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during the previous 4 weeks.[7–10] However, these studies did not include an ethnically diverse population, particularly inner-city children with a higher burden of asthma, for whom there might be the greatest need. Although some studies have shown that this cut point is accurate and reliable for white children in France, Germany, the United Kingdom, and Italy, higher optimal cut points were found in other ethnic populations.[11–14] However, the C-ACT and ACT cut points for uncontrolled asthma in children of Mexican descent have never been validated. The purpose of this cross-ethnic study was to determine the cut point for uncontrolled asthma in a population of Mexican descent from Orange Country, California, compared with an age- and asthma severity–matched non-Hispanic cohort.

Methods

Study participants

Children aged 6 to 17 years who were being actively treated for asthma at a mobile asthma clinic called the Children's Hospital of Orange County Breathmobile[15] were enrolled in the study. The Breathmobile provides comprehensive asthma care to children who have asthma or are at risk for asthma primarily in low socioeconomic status populations as defined by reduced cost or free lunch at school. Most patients (90%) treated in the Breathmobiles identify themselves as being of Mexican descent. Children were included in the study if they had a clinical diagnosis of asthma by a physician. Patients were excluded from the study if they were diagnosed as having other pulmonary or cardiac disease, had a history of smoking within 12 months of their enrollment, or were not able to perform a standard spirometry maneuver. The institutional review boards of the University of California, Irvine, and the Children's Hospital of Orange County approved the study. Written informed consent and assent were obtained from all participants and their parents or guardians.

Study protocol

All study procedures were performed in the Breathmobile. Participants received a nursing assessment to identify their health status and skin prick testing of 12 common allergens to assess atopic status. Categorization of atopic was based on a single positive wheal (3 mm greater than the negative control). For children 6 to 11 years old, C-ACT was completed by the children (4 questions) and their parents (3 questions). For children 12 years and older, all 5 questions were completed by the patients. The patients and their family had the choice of using the English or Spanish version of C-ACT or ACT. Caregivers helped the children read the questionnaire if needed but allowed the children to give the responses themselves. The answers to each question were summed to obtain the total C-ACT or ACT score. In addition, all patients and families were required to report a complete symptom history during the past 6 to 8 weeks, including daytime symptoms, nighttime symptoms, exercise symptoms, and exacerbations to a pediatrician in the Breathmobile who specialized in bronchial asthma. Although the families gave a complete symptom history of the previous 6 to 8 weeks to the physician, C-ACT and ACT instructed patients to only answer questions based on symptoms from the previous 4 weeks. Spirometry maneuvers were performed in accordance with the American Thoracic Society and European Respiratory Society standards.[16] Albuterol (2 puffs; 180 μg) was then administered from a metered-dose inhaler with a spacer to assess bronchodilator responsiveness. Ten minutes after bronchodilator administration, spirometry measurements were repeated. Asthma severity and control were assessed and a treatment plan developed by the physician using criteria defined in the National Asthma Education and Prevention Program, National Heart, Lung, and Blood Institute guidelines.[1] The physician was masked to the C-ACT and ACT results. For children aged 6 to 11 years, controlled asthma was defined as 1 episode or fewer per month of nighttime symptoms, 2 days per week or fewer of daytime symptoms or short-acting β-agonist use, no interference with normal activities, and normal spirometry results, consisting of an 80% or greater forced expiratory volume in 1 second (FEV_1) and ratio of FEV_1 to forced vital capacity (FVC).[17] For children 12 years and older, criteria for control are similar except for 2 or fewer episodes per month of nighttime symptoms.[1]

Statistical analysis

The Mann-Whitney test was used to compare baseline characteristics, spirometry results, and C-ACT and ACT scores among the different ethnic groups. Internal consistency reliabilities were evaluated for both C-ACT and ACT using the Cronbach α coefficient, and an α value of 0.7 or greater was considered to be an indicator of acceptable internal reliability.[18] Clinical validity of C-ACT and ACT was evaluated by physician assessment of control, change in patient therapy (step up, no change, and step down), and spirometry (FEV_1, forced expiratory flow between 25% and 75% [$FEF_{25\%-75\%}$], and FEV_1/FVC ratio). A general linear model was applied to test the correlation between standard spirometry measurements and C-ACT and ACT scores.

The receiver operating characteristic curve was used to assess the performances of the C-ACT and ACT scores in screening for physician-assessed uncontrolled asthma. Sensitivity, specificity, positive predictive value, negative predictive value, correctly classified ratio, and area under the curve (AUC) were calculated for various cut points of C-ACT and ACT. The optimal cut points were selected by maximizing the total of the sensitivity and specificity.[8] $P < .05$ was considered statistically significant.

Results

Study sample and spirometry

A total of 151 children of Mexican descent and 48 non-Hispanic children with mild-to-moderate asthma were approved for the study. The non-Hispanic group was composed of a mixed ethnic population of 38 white (80%), 9 Asian (19%), and 1 black (1%). Seventy-seven percent of those of Mexican descent and 62% of non-Hispanic patients were treated with inhaled corticosteroids (steps 2 to 4). Approximately half of the patients had controlled asthma based on physician assessment (50% of those of Mexican descent and 54% non-Hispanic patients). No statistical difference was detected in baseline characteristics, asthma severity, medication step, or spirometry between the 2 ethnic groups (Table 1). Seventy-eight patients (52%) in the Mexican descent cohort and 25 (48%) in the non-Hispanic cohort had previously completed ACT and C-ACT, and no difference was found between groups.

Sixty-seven of the Mexican descent population (group 1) and 21 of the non-Hispanics (group 2) were younger than 12 years and completed C-ACT, whereas 84 patients of Mexican descent (group 3) and 27 non-Hispanic patients (group 4) were 12 years and older and completed ACT. Spirometry results were compared between physician-assessed controlled and uncontrolled asthma in each of the 4 groups (Table 2). The FEV_1/FVC ratio was significantly higher for patients with controlled asthma than uncontrolled asthma in groups 1, 3, and 4. The $FEF_{25\%-75\%}$ percent predicted was significantly higher in patients with controlled asthma in groups 1 and 3. FEV_1 percent predicted revealed no difference among different control statuses. However, a larger bronchodilator response of FEV_1 from baseline was found for patients with uncontrolled asthma in groups 2 and 3.

Table 1
Summary of characteristics for the children of Mexican descent and non-Hispanic children[a]

Characteristic	Mexican descent (n = 151)	Non-Hispanic (n = 48)	*P* value
Age, y	12 (6–17)	12 (6–17)	.94
Male, No. (%)	81 (54)	25 (52)	.96
Height, cm	150 (114–180)	150 (120–175)	.99
BMI	23 (15–41)	16.7 (14.7–28.7)	.29
Atopic, %	74	83	.19
Intermittent/mild/moderate persistent asthma, %	60/38/2	65/23/12	.64
Medication step 1/2/3/4/5, %	23/44/26/5/2	38/35/21/4/2	.11
Spirometry			
FVC, % predicted	105 (66–148)	104 (81–129)	.64
FEV_1, % predicted	96 (60–126)	98 (80–135)	.47
$FEF_{25\%–75\%}$, % predicted	81 (36–126)	87 (45–168)	.10
FEV_1/FVC, %	82 (63–98)	83 (66–99)	.46
BDR, %	6 (0–24)	6 (0–25)	.93
Physician-assessed controlled asthma, No. (%)	75 (50)	26 (54)	.59
C-ACT and ACT score	22 (10–27)	20 (6–27)	.008[b]

Abbreviations: ACT, Asthma Control Test; BMI, body mass index (a measure of weight in kilograms divided by the square of height in meters); BDR, bronchodilator response; C-ACT, Childhood Asthma Control Test; $FEF_{25\%-75\%}$, forced expiratory flow between 25% and 75%; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity.
[a]Data are presented as mean (range) unless otherwise indicated. The Mann-Whitney test was used to test the difference between children of Mexican descent and non-Hispanic children.
[b]Significance level of $P < .01$.

C-ACT and ACT

Cronbach α values for C-ACT and the ACT were 0.76 and 0.80, respectively, indicating that the 2 tests are reliable in our study population. C-ACT and ACT scores were statistically higher for patients with physician-assessed controlled asthma than uncontrolled asthma in all 4 age and ethnic groups (Table 2). In addition, the mean C-ACT and ACT scores were significantly different between patients who received a step up in medication than patients who had step down or no change in medication (20 and 23, respectively; $P < .001$).

The overall mean C-ACT and ACT scores were higher for the Mexican descent children compared with the non-Hispanic children (22 vs 20; $P < .001$; Table 1). The mean C-ACT and ACT scores for uncontrolled asthma in children of Mexican descent were above the standard cut point of 19 and were significantly higher than the mean scores in the non-Hispanic children (C-ACT: 21 vs 19; $P = .04$; and ACT: 20 vs 17; $P < .001$). Similarly, for controlled asthma, Mexican descent children also had higher C-ACT and ACT scores than the non-Hispanic controls (C-ACT: 24 vs 23; $P = .03$; and ACT: 23 vs 22; $P = .04$). In addition, the choice of language and its effect in patient and parent responses were also considered during the analysis. Most C-ACT tests were answered in English (90%), and tests revealed no significant difference in mean C-ACT scores between the Spanish and English versions of the questionnaire. Only one patient took the ACT in Spanish, and so we were unable to perform a similar analysis for ACT.

Screening accuracy

In the younger age groups, the optimal C-ACT cut point for uncontrolled asthma was 22 or less (sensitivity, 74%; specificity, 86%) for children of Mexican descent (group 1). This cut point was able to correctly classify 79% of the patients with an estimated AUC of 0.83. For the non-Hispanic group (group 2), 20 or less was the best cut point for uncontrolled asthma (sensitivity, 70%; specificity, 91%), and it correctly classified 90% of the population with an AUC of 0.86 (Table 3 and Fig 1A).

In the adolescent groups, an optimal ACT cut point of 22 or less for the children of Mexican descent (group 3) correctly classified 71% of the patients (sensitivity, 78%; specificity, 68%) with an AUC of 0.79. The non-Hispanic patients (group 4) had a cut point of 20 or less, which correctly classified 79% of the patients (sensitivity, 83%; specificity, 87%) with an AUC of 0.91 (Table 3 and Fig 1B).

Spirometry measurements and C-ACT and ACT scores

General linear regression indicated that C-ACT and ACT did not correlate with FEV_1, $FEF_{25\%-75\%}$ (percent predicted), FEV_1/FVC ratio, or the bronchodilator response of FEV_1. Spirometry measurements and C-ACT and ACT scores were not always consistent in assessing asthma control status. For example, among the patients with uncontrolled asthma detected by the C-ACT and ACT cut points (≤22 in the Mexican descent cohort and ≤20 in the non-Hispanic cohort), 61% and 60% of them had a FEV_1/FVC ratio of 80% or higher (Fig 2A). In contrast, in patients with C-ACT and ACT–defined con-

Table 2
Comparison of spirometry measurements and C-ACT and ACT scores for each age and ethnic group[a]

Physician assessment	Mexican descent			Non-Hispanic		
	Controlled asthma	Uncontrolled asthma	*P* value	Controlled asthma	Uncontrolled asthma	*P* value
Patients 4–11 years old						
No. of patients	28	39		11	10	
FVC, % predicted	109 (77–145)	111 (66–148)	.25	104 (85–126)	103 (81–116)	.94
FEV_1, % predicted	98 (80–118)	96 (61–114)	.53	101 (80–135)	91 (81–110)	.12
$FEF_{25\%–75\%}$, % predicted	87 (65–126)	75 (48–124)	.002[b]	93 (53–154)	75 (45–106)	.19
FEV_1/FVC, %	85 (80–95)	79 (63–90)	<.001[b]	85 (81–91)	79 (66–93)	.07
BDR, %	4 (0–9)	7 (0–24)	.08	4 (0–13)	14 (3–25)	.002[b]
C-ACT score	24 (17–27)	21 (10–27)	<.001[b]	23 (20–27)	19 (15–23)	.005[b]
Patients ≥12 years old						
No. of patients	47	37		15	12	
FVC, % predicted	100 (80–126)	103 (70–128)	.21	104 (88–129)	106 (88–118)	.43
FEV_1, % predicted	98 (81–126)	92 (60–114)	.055	101 (85–126)	99 (84–114)	.70
$FEF_{25\%–75\%}$, % predicted	90 (63–124)	72 (36–101)	<.0001[b]	95 (68–168)	83 (54–104)	.19
FEV_1/FVC, %	86 (80–98)	79 (65–91)	<.001[b]	86 (80–99)	80 (69–90)	.01[c]
BDR, %	4 (0–14)	8 (0–21)	.002[b]	3 (0–9)	6 (0–18)	.18
ACT score	23 (19–25)	20 (10–25)	<.001[b]	22 (18–25)	17 (6–23)	<.001[b]

Abbreviations: ACT, Asthma Control Test; BDR, bronchodilator response; C-ACT, Childhood Asthma Control Test; $FEF_{25\%-75\%}$, forced expiratory flow between 25% and 75%; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity.
[a]Data are presented as mean (range) unless otherwise indicated. The Mann-Whitney test was used to test the difference between physician-assessed controlled and uncontrolled asthma in each group.
[b]Significance level of $P < .01$.
[c]Significance level of $P < .05$.

Table 3
Screening accuracy of the C-ACT and ACT cut points predicting physician-assessed uncontrolled asthma

Score	Mexican descent					Non-Hispanic				
	Sensitivity	Specificity	PPV	NPV	Accuracy	Sensitivity	Specificity	PPV	NPV	Accuracy
C-ACT score										
≤17	18	96	88	46	51	30	100	100	61	74
≤18	28	96	92	49	57	40	100	100	65	79
≤19	33	96	93	51	60	50	100	100	69	84
≤20	54	93	91	59	70	**70**	**91**	**88**	**77**	**90**
≤21	56	93	92	60	72	70	73	70	73	79
≤22	**74**	**86**	**88**	**71**	**79**	90	55	65	86	79
≤23	79	71	79	71	76	100	36	59	100	73
≤24	87	61	76	77	76	100	27	55	100	68
ACT score										
≤17	14	100	100	60	61	50	100	100	71	72
≤18	22	100	100	62	64	67	93	88	78	76
≤19	41	98	94	68	71	75	93	90	82	79
≤20	51	89	78	70	71	**83**	**87**	**84**	**86**	**79**
≤21	57	81	70	71	69	92	73	73	92	76
≤22	**78**	**68**	**66**	**80**	**71**	92	40	55	86	59
≤23	86	47	56	81	63	100	33	54	100	58
≤24	91	26	49	79	53	100	20	50	100	52

Abbreviations: ACT, Asthma Control Test; C-ACT, Childhood Asthma Control Test; NPV, negative predictive value; PPV, positive predictive value.
[a]Numbers in bold indicate the performance of the optimal cut points.

trolled asthma (>22 in the Mexican descent cohort and >20 in the non-Hispanic cohort), there was still a small proportion of them who had a FEV_1/FVC ratio less than 80% (14% and 18%, respectively; Fig 2B). However, patients with uncontrolled asthma had more abnormal FEV_1/FVC ratios (Fig 2A) compared with those with controlled asthma (Figure 2B) defined by C-ACT and ACT cut points ($P = .008$).

Discussion

Our cross-ethnic study demonstrated that C-ACT and ACT are reliable in a medically underserved Mexican descent population evaluated by pediatricians specializing in asthma and allergy care. The results showed that the overall C-ACT and ACT scores were significantly higher in Mexican descent children compared with non-Hispanic children. In addition, the optimal C-ACT and ACT cut point to detect uncontrolled asthma was 22 in the Mexican descent population, which was 3 points higher compared with published reports and also 2 points higher than the non-Hispanic cohort in our study. It is important to consider that these results are specific to patients with mild to moderate asthma of Mexican descent in Orange County and that these same results may not apply to patients with severe asthma or other geographic or socioeconomic settings. Nevertheless, these results suggest that children of Mexican descent with mild to moderate asthma and their parents in Orange Country seem to underreport asthma symptoms, and a higher C-ACT and ACT cut point is worth consideration for assessing asthma control.

Previous studies developed the asthma control tests in mixed ethnic, primarily white, populations, in which a cut point of 19 was selected to identify uncontrolled asthma for both children and adults.[7,8,10] Additional studies validated the cut point in several different ethnic groups, including Spanish, Chinese, and Greek.[19–21] However, other studies performed in Spain, Taiwan, and the Netherlands reported that higher C-ACT or ACT cut points were more accurate in determining asthma control when compared with Global Initiative for Asthma guidelines.[13,14,22] These studies suggest that different perceptions of asthma symptoms in different ethnic populations and social settings may give insight into why a higher C-ACT and ACT cut point is necessary for Mexican descent children in Orange County. Our results showed that in the children of Mex-

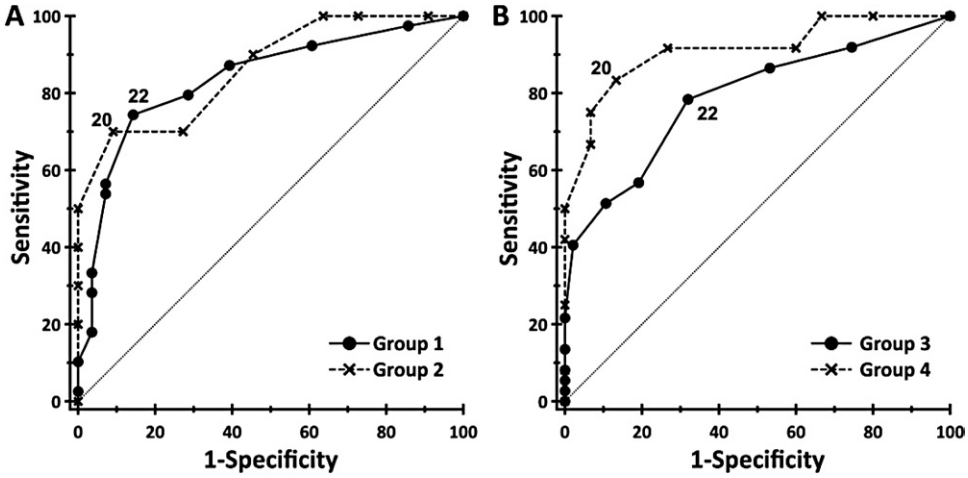

Fig. 1. Receiver operating characteristic curves of the Childhood Asthma Control Test (C-ACT) and Asthma Control Test (ACT) in predicting physician-assessed uncontrolled asthma. Optimal C-ACT cut points (A) for children of Mexican descent and non-Hispanic children were 22 (group 1; area under the curve [AUC], 0.83) and 20 (group 2; AUC, 0.86), respectively. Optimal ACT cut points (B) for children of Mexican descent and non-Hispanic children were 22 (group 3; AUC, 0.79) and 20 (group 4; AUC, 0.91), respectively.

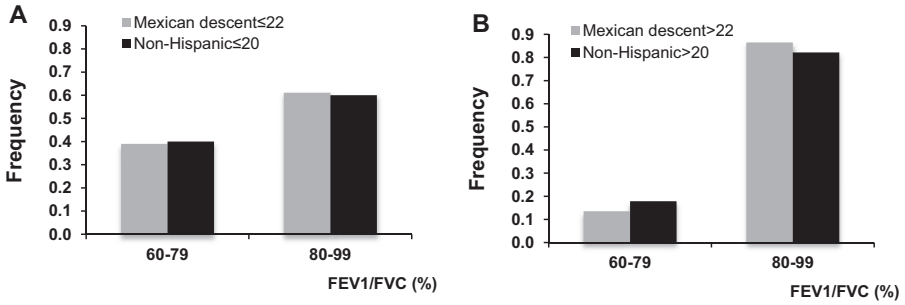

Fig. 2. A, Percentage of patients (frequency) with uncontrolled asthma (Childhood Asthma Control Test [C-ACT] and Asthma Control Test [ACT] scores of ≤22 for children of Mexican descent and C-ACT and ACT scores of ≤20 for non-Hispanic children) stratified by the ratio of forced expiratory volume in 1 second (FEV_1) to forced vital capacity (FVC). B, Percentage of patients with controlled asthma (C-ACT and ACT scores >22 for children of Mexican descent and C-ACT and ACT scores >20 for non-Hispanic children stratified by FEV_1/FVC ratio).

ican descent, the standard cut point of C-ACT and ACT of 19 or less had high specificities in predicting uncontrolled asthma, with very limited sensitivities (33% for C-ACT and 41% for ACT). By using 19 or less as the cut point in the Mexican descent population, a large proportion of children with uncontrolled asthma would be missed, thus risking the possibility of exacerbations because of undertreated asthma. On the other hand, a C-ACT and ACT score of 22 or less was found to be the optimal cut point because it achieved the highest sum of sensitivity and specificity and provided the best correctly classified ratio (79% and 71%, respectively).

Fritz et al[23] reported that Latino children with asthma were less accurate at subjectively assessing their lung function compared with non-Latino white children. In this Latino population, which was Puerto Rican, heterogeneity was also seen, and the island Puerto Ricans had less accuracy than Rhode Island Latinos, which was thought to be due to such factors as poverty and lower intelligence level.[24] Therefore, other factors than ethnicity may be playing a role in the perception of clinical asthma. However, asthma severity, access to care, trust in the medical system, insurance (Medicaid), and poverty level in the children of Mexican descent and the non-Hispanic comparators in Orange County were the same. Other factors, such as level of education and stressors, were not assessed and could be confounding factors. Furthermore, Puerto Ricans have much more severe asthma than those of Mexican descent.[24] This finding is consistent with our observation that most of the children of Mexican descent in our study had mild-to-moderate asthma (98%). Therefore, the overestimation of asthma control among our Mexican descent population might also be explained by a lower sensitivity toward asthma symptoms.

Numerous studies have previously shown poor correlations between asthma control tests and lung function measured by traditional spirometry.[13,20,22,25] In the present study, spirometry measurements did not correlate well with C-ACT and ACT scores. Previous reports have shown that although standard spirometry can provide objective information, it is not extremely useful in detecting uncontrolled asthma in children because the values are usually normal in children with mild to moderate asthma.[6,26] In our study, a large proportion of the patients, including the children of Mexican descent and the non-Hispanic children, who by C-ACT and ACT were determined to have uncontrolled asthma had normal spirometry results. On the other hand, several patients who had controlled asthma based on their C-ACT and ACT scores had abnormal spirometry. These results suggest that the 2 measurements do not reflect the same aspect of asthma. For example, spirometry captures the pulmonary function status at a single time point and thus may not adequately reflect symptoms occurring for several weeks as determined by C-ACT and ACT. Thus, C-ACT and ACT cannot simply replace traditional spirometry but provide additional information to spirometry, which is necessary to improve the assessment of asthma control in children.

In our study, the C-ACT and ACT scores were compared with the criterion standard of asthma control, which was the assessment made by 4 physicians who were a mixture of asthma specialists and pediatricians trained in allergy and asthma. The elevated C-ACT and ACT cut point in the Mexican descent cohort could be caused by the underestimation of those patients whose asthma was controlled by the small number of physicians. However, our age-matched non-Hispanic control groups argue against this possibility. The mean C-ACT and ACT scores were consistently lower in the non-Hispanic cohort than in those of Mexican descent. In addition, the optimal C-ACT and ACT cut point for uncontrolled asthma in the non-Hispanic groups was 20 or less and was very close to 19 or less as suggested by published reports. In our non-Hispanic control groups, most children were white, which was similar to the ethnicities of the early C-ACT and ACT validation studies.[7,8] These results validated our physician-assessed asthma control and suggested that the children of Mexican descent from Orange County were underreporting their symptoms in the surveys.

Another potential limitation of the study was the small sample size, especially for the non-Hispanic controls. We recognized that the sample size in this pilot study was small compared with previous works[7,8] and the accuracy of C-ACT and ACT cut points could be improved by increasing the sample size. However, our study population number was adequate to show statistical differences in C-ACT and ACT between those of Mexican descent and other ethnicities. Finally, our study investigated the cut point of C-ACT and ACT in the children of Mexican descent cross-sectionally, and there were no longitudinal data to repeatedly validate the reliability of this cut point in discriminating controlled and uncontrolled asthma.

In conclusion, our preliminary study, which evaluated C-ACT and ACT scores across different ethnic and cultural populations, demonstrated that underserved, inner-city, asthmatic children and their families generally underestimate poor control. However, children of Mexican descent living in Orange County were less sensitive in perceiving their asthma symptoms compared with non-Hispanic children and thus have an even greater underestimation of the true level of uncontrolled asthma. Health care professionals, particularly primary care physicians, need to recognize that the C-ACT and ACT cut points for uncontrolled asthma may vary in different populations. Our study reveals that in children of Mexican descent a cut point of 22 or less should be considered for uncontrolled asthma, rather than the traditional cut point of 19 or less. Finally, these data suggest the need for a better controlled, more comprehensive perspective study in a variety of geographic and socioeconomic settings.

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