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Validation of the Spanish Version of the Childhood Asthma Control Test (cACT) in a population of hispanic children

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Abstract

Background—There is a critical need for additional validation studies of questionnaires designed to assess the level of control of asthma in pediatric patients.

Objective—To validate the Spanish version of the Childhood Asthma Control Test (cACT) in children aged between 4 and 11 years with physician-diagnosed asthma

Methods—In a prospective cohort validation study, asthmatic children aged between 4 and 11 years and their parents, attended both a baseline and a follow-up visit 2 to 6 weeks later. In these two visits, they completed the information required to assess the criterion validity, construct validity, test-retest reliability, sensitivity to change, internal consistency, and usability of the cACT.

Results—At baseline, cACT scores were significantly different between patients with controlled, partly controlled, and uncontrolled asthma [24.0 (23.0-26.0), 18.0 (18.0-22.0), and 17.5 (13.0-20.0) respectively, $p < 0.001$], and also between patients for whom this visit resulted in a step-up, no change, or step-down in therapy [18.0 (15.0-21.0), 24.0 (23.0-24.0), and 26.0 (23.5-26.0) respectively, $p < 0.001$]. The score of the cACT correlated positively and significantly

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with the score of the Pediatric Asthma Caregivers Quality of life Questionnaire - PACQLQ (Spearman's $\rho = 0.50$, $p < 0.001$). The intraclass correlation coefficient of the measurements in patients with no change in clinical status was 0.849 (95% CI: 0.752-0.908). There were statistical significant differences between baseline and follow-up cACT scores in patients with an improvement in clinical status [19.0 (18.0-22.0) vs. 24.5 (24.0-25.0), $p < 0.001$]. Cronbach's α was 0.8276 for the questionnaire as a whole.

Conclusion—The Spanish version of the cACT has adequate criterion validity, adequate construct validity, adequate sensitivity to change, good internal consistency, good test-retest reliability, and excellent usability when administered to asthmatic children aged between 4 and 11 years.

Keywords

Asthma control; child; validation studies; reliability; validity

INTRODUCTION

Childhood asthma is the most common chronic disease among children and is a major public health problem in the United States as well as in many other countries, such as Colombia, which has a prevalence estimated at 10-12% (1, 2). Childhood asthma causes considerable morbidity, interference with normal daily activities, and a burden for the health care systems and for the whole family, especially during periods when it is inadequately controlled (3). Over the past decade, the concept of asthma control as the degree to which manifestations of the disease are reduced or removed by therapy has been clearly defined and has been incorporated into current asthma guidelines (4, 5). Asthma control has been considered a key therapeutic goal and an outcome measure in clinical research studies, and its regular assessment has been recommended as a guide to a stepwise (step-up if necessary and step-down when possible) approach to asthma therapy (6).

Several composite score instruments have been developed to measure asthma control in children (7-10). These asthma control composite score instruments typically assess nocturnal symptoms or interference with sleep, frequency of asthma symptoms, rescue therapy use, and limitation of activity (interference with daily activities, exercise, and school attendance), and some of them also include information about the history of exacerbations and pulmonary function parameters (11, 12). The most common recall windows for these instruments are 1 and 4 weeks, and when interpreting their summary scores, some of them have established cutoff values for uncontrolled versus controlled asthma (9-11). The Childhood Asthma Control Test (cACT) is one of the most commonly used composite score instruments for measuring asthma control in children aged 4 to 11 years, and is the instrument with more validation data than any other instrument for children of this age group. Additionally, the cACT is considered to meet the minimum standard as a core measure for participant characterization and observational studies (6). However, there is a critical need for additional validation studies of the instrument performed in different population subgroups (e.g., race/ethnicity, socioeconomic status, health literacy), assessing either its responsiveness over time or responsiveness to a specific therapy and performed in more languages (6). Additionally, these studies should determine the degree to which the

measurement of the instrument corresponds to other measures related to the construct of control of asthma, such as the Pediatric Asthma Caregivers Quality of life Questionnaire (PACQLQ) (6). In this context, validating the Spanish version of the questionnaire is important, because Spanish is the third most spoken language in the world by number of native speakers and as a second language, behind Mandarin Chinese and English, with over 416 million native speakers (13).

The aim of the present study was to validate the Spanish version of the cACT questionnaire in a population of pediatric patients with physician-diagnosed asthma living in urban Bogota, Colombia.

METHODS

Study population

The study was undertaken in The Fundacion Hospital La Misericordia, a tertiary care, university-based children's hospital located in the metropolitan area of Bogota. Parents of children between 4 and 11 years old who were on a routine visit to our outpatient clinic under the Respiratory Service from March 2013 to February 2014 with a history of physician-diagnosed asthma were invited to participate in the study. Parents of participating children were native Spanish speakers, with widely varied educational background (at least 5 years of elementary school) and socioeconomic status, but with an acceptable reading speed and ability. Children who had any other type of disease not consistent with asthma that might affect the cardiopulmonary status (e.g. chronic lung disease or congenital heart disease) and those with other significant chronic disorders or congenital abnormalities were excluded from the study.

cACT Questionnaire

The cACT is a seven-item assessment questionnaire, completed by the child and parent/caregiver, useful in assessing and monitoring asthma control in children 4–11 years of age in the preceding four weeks, and is divided into two parts. The first part is filled in by the child, and consists of four items, each with picture of a sad to smiling face with a score from 0 to 3 representing child's mood, to assess perception of asthma control, limitation of activities, coughing, and awakenings at night. The second part is filled in by the parent or caregiver and consists of three items that assess daytime complaints, daytime wheezing, and awakenings at night during the previous 4 weeks. These three items are scored on a five-point Likert-type rating. The scores for the individual items are added to obtain the total cACT questionnaire score, with the possible total score ranging from 0 to 27, a higher score indicating better asthma control and a score of 19 or less indicating an inadequately controlled asthma. This questionnaire has been translated and culturally adapted into Spanish following internationally accepted guidelines (the Spanish version is available on request) (14). (Figure 1).

Study design and procedures

We conducted a prospective cohort validation study by following a convenience sample of children aged between 4 and 11 years who fulfilled the eligibility criteria based on the

inclusion and exclusion criteria and whose parents agreed to participate. All parents/caregivers had an initial visit (baseline) and were scheduled for a follow-up visit 2 to 6 weeks later. At baseline, we used standardized forms to collect demographic data of the children (age, gender) and their respective parents/caregivers (age, highest level of education), and assessed all the children with the Spanish version of the cACT questionnaire and a validated Spanish version of the PACQLQ (15). The PACQLQ is a self-administered questionnaire useful in measuring the impact of childhood asthma on caregivers' quality of life, which includes 13 items in two domains (limitation of activity and emotional function), with a possible total score ranging from 13 to 91, a higher score indicating better quality of life. In addition, at baseline, separately and blinded to the caregivers' responses to the questionnaire, we collected the following clinical information about the respiratory status of all included children: the level of asthma control based on the Global Initiative for Asthma (GINA) guideline recommendations (16) and whether the baseline visit resulted in a step-up in therapy, no change, or step-down in therapy. During the follow-up visit, we determined the level of asthma control based on the GINA guidelines and assessed all children using the Spanish version of the cACT questionnaire and the PACQLQ. In order to determine the level of asthma control based on the GINA guideline recommendations, we completed five specific questions that assess daytime symptoms, limitation of activities, nocturnal symptoms/awakenings, need for reliever rescue treatment, and lung function when available (not available for children 5 years old and younger). Each question was scored on a 2-point Likert-type scale (1, controlled; 2, partly controlled). The scoring of these questions were used to stratify the sample into categories of controlled asthma (if a score of 1 was selected for all questions), partly controlled asthma (if a score of 2 was selected for 1 or 2 questions), or uncontrolled asthma (if a score of 2 was selected for 3 or more questions) (Table 1).

Study methods were approved by the hospital Ethics Committee.

Assessment of the psychometric characteristics of the cACT questionnaire

To assess the cACT's criterion validity (i.e., the degree to which the measurement correlates with some other measure of the specific construct of control of asthma, such as another validated severity instrument or another "gold standard" for the control of asthma), at baseline we compared cACT scores across the three categories of the GINA guideline criteria of asthma control (uncontrolled, partly controlled, and controlled asthma).

To assess the cACT's construct validity (i.e., the degree to which the measurement corresponds to other variables and measures that are not identical to the construct of control of asthma but to which the construct of control of asthma should be related), at baseline we compared cACT scores across the three categories of therapeutic decision (a step-up in therapy, no change, or a step-down in therapy). Additionally, at baseline and in the follow-up visit, we determined the correlation between the score of the cACT questionnaire and the score of the PACQLQ.

To assess the cACT's test-retest reliability (i.e., the consistency of the instrument's results measured on 2 occasions with no change in asthma control in between), we compared cACT scores in patients classified as controlled at baseline, in whom no change or a step-down in therapy occurred, and who were classified in the same manner during the follow-up visit.

To assess the cACT's sensitivity to change (i.e., the ability of a score to detect a clinically important change over time), we compared cACT scores in patients classified as uncontrolled or partly controlled at baseline, in whom the baseline visit resulted in a step-up in therapy, and who were classified as controlled in the follow-up visit.

To assess the cACT's internal consistency reliability (i.e. the degree of correlation between a scale's items), we used the responses given for all the parents/caregivers at baseline.

To assess the cACT's usability (i.e. the speed, understandability, and subjective experience when completing the questionnaire), parents/caregivers were requested to qualify the ease of scoring of the cACT questionnaire as easy to score, moderately easy to score, or difficult to score. Additionally, the time to complete the questionnaire was reported.

Statistical analysis

To assess the cACT's criterion validity, we used the one-way analysis of variance (ANOVA) or the Kruskal- Wallis non-parametric method, as appropriate, in order to compare cACT scores across the three categories of the GINA guideline criteria of asthma control (uncontrolled, partly controlled, and controlled). To assess the cACT's construct validity, we used the independent samples t-test or the non parametric Mann-Whitney U test, as appropriate, to compare cACT scores across two predefined categories of therapeutic decision (a step-up in therapy vs. no change or a step-down in therapy). Additionally, in order to determine the correlation between the score of the cACT questionnaire and the score of the PACQLQ, we used the Spearman's correlation coefficient. Test-retest reliability was assessed with the intraclass correlation coefficient (ICC) and Lin's concordance correlation coefficient (17), and through the construction of the Bland and Altman plot (18). The cACT's sensitivity to change was determined by using the paired Student's t-test or the Wilcoxon signed-rank test, as appropriate, to compare cACT scores at baseline and at follow-up. Internal consistency reliability was assessed using Cronbach's alpha coefficient (19). The use of the method proposed by Walter and colleagues to calculate the required number of subjects in a reliability study, where reliability is measured (20) yielded a sample size of 64 patients, two methods to be reported in the diagnosis, a kappa for the null hypothesis of 0.5, a kappa for the alternative hypothesis of 0.7, a statistical significance level of 0.05, and a power of 80%. Statistical analysis was done with Stata 12.0 (Stata Corporation, College Station, TX).

RESULTS

Of the total number of patients who fulfilled the eligibility criteria (n=147), four were excluded because the parents refused to participate in the study, so 143 (97.3%) were enrolled in the study. The mean (standard deviation) of the age of the 143 patients included in the study was 7.1 (1.9) years. The age group distribution was: 30 (21.0%) ≤ 5 years, 98 (68.5%) between 6 and 10 years, and the remaining 15 (10.5%) > 10 years old. Seventy-three (51.0%) of the patients were female and 70 (49.0%) were male. At baseline, the level of asthma control based on the GINA guideline recommendations was controlled asthma in 80 (55.9%) patients, partly controlled asthma in 15 (10.5%) patients, and uncontrolled asthma in 48 (33.6%) patients. In relation to the therapeutic decision, for 60 (42.0%) patients

the baseline visit resulted in a step-up in therapy, for 55 (38.5%) no change in therapy, and for 28 (19.6%) a step-down in therapy. At baseline, the median (interquartile range [IQR]) of the cACT scores and the PACQLQ scores of the 143 patients included in the study was 23.0 (18.0-25.0) and 61.0 (50.7-83.0) points, respectively. Out of the total of patients, 64 (44.7%) were eligible for being assessed for test-retest reliability (patients classified as controlled at baseline, in whom no change or a step-down in therapy occurred, and who were classified in the same manner during the follow-up visit), and 50 (34.9%) for being assessed for sensitivity to change (patients classified as uncontrolled or partly controlled at baseline, in whom the baseline visit resulted in a step-up in therapy, and who were classified as controlled in the follow-up visit).

Criterion validity

At baseline, cACT scores were significantly different between patients with controlled asthma, partly controlled asthma, and uncontrolled asthma [24.0 (23.0-26.0), 18.0 (18.0-22.0), and 17.5 (13.0-20.0) respectively, $p<0.001$]. Frequencies of responses for each item of the cACT, according to the level of asthma control, are presented in table 2.

Construct validity

The scores of the cACT questionnaire were significantly different between patients whose baseline visit resulted in a step-up in therapy, in no change, and in a step-down in therapy [18.0 (15.0-21.0), 24.0 (23.0-24.0), and 26.0 (23.5-26.0) respectively, $p<0.001$]. Likewise, the score of the cACT correlated positively and significantly with the score of the PACQLQ (Spearman's $\rho = 0.50$, $p<0.001$). Frequencies of responses for each item of the cACT, according to the three categories of therapeutic decision, are presented in table 3.

Test-test reliability

There was no statistically significant difference between baseline and follow-up medians (IQR) of the cACT scores in patients classified as controlled at baseline, in whom no change or a step-down in therapy occurred, and who were classified in the same manner in the follow-up visit. [24.0 (23.0-26.0) vs. 25.0 (23.25-26.0), $p=0.18$]. The intraclass correlation coefficient (ICC) and Lin's concordance correlation coefficient of the measurements of the cACT scores in these patients were 0.849 (95% CI: 0.752-0.908) and 0.735 (95% CI: 0.624-0.846), respectively. The Bland and Altman plot shows the agreement of cACT scores between baseline and follow-up visits. Figure 2 shows that the mean difference in the cACT score between the two visits was -0.2 , and their corresponding 95% limit of agreement was -2.2 to 1.8 . Four outliers were found, and the points in the plot show random distribution.

Sensitivity to change

There was a statistically significant difference between baseline and follow-up medians (IQR) of the cACT scores for patients classified as uncontrolled or partly controlled at baseline, in whom the baseline visit resulted in a step-up in therapy, and who were classified as controlled in the follow-up visit [19.0 (18.0-22.0) vs. 24.5 (24.0-25.0), $p<0.001$].

Internal consistency

Cronbach's alpha coefficient was 0.8276 for the questionnaire as a whole. For the individual items this statistic ranged from 0.7683 to 0.8326 (Table 4).

Usability

All patients/parents qualified the cACT as easy to score, and the time required to complete the questionnaire ranged from 1 to 2 minutes.

DISCUSSION

The present study shows that the Spanish version of the cACT questionnaire has adequate psychometric characteristics when tested in children aged between 4 and 11 years with physician-diagnosed asthma. It showed an adequate criterion validity when we compared cACT scores across the three categories of the GINA guideline criteria of asthma control, and an adequate construct validity when we compared cACT scores across the three categories of therapeutic decision and when we determined the correlation between the score of the cACT questionnaire and the score of the PACQLQ. It also showed good internal consistency, and excellent usability when patients/parents evaluated its ease of scoring and the time to complete the questionnaire. Likewise, the Spanish version of the cACT questionnaire showed good test-retest reliability and an adequate sensitivity to change when we compared baseline and follow-up scores in Hispanic children with asthma diagnosis.

The findings of this study are important because they will give confidence to Colombian and probably other Spanish-speaking physicians in the use the cACT questionnaire to assess the level of asthma control in school-aged children, not only for clinical decision-making purposes (to guide the stepwise approach for managing asthma), but also in a research context as a useful outcome in observational studies and clinical trials. Our results with respect to criterion validity, construct validity, sensitivity to change and internal consistency of the cACT are consistent with those reported by Sekerel, B.E. et al.(21), who found a significant correlation between cACT at first visit and physician's assessment of asthma control, significant differences in cACT scores according to physician's decision for asthma treatment, a significant difference in mean cACT score changes among categories of change in physician's assessment, and similar values for Cronbach's alpha coefficient. Similarly, Chen, H.H. et al.(22) also found that mean scores of the cACT questionnaire differed significantly in the expected direction for levels of physician's assessment of asthma control and physician's decision for asthma treatment, and in agreement with our results they also found good internal consistency when calculating the Cronbach's alpha coefficient of the cACT. In the same manner, Liu, A.H. et al. (10) found that the sum of the scores of the cACT discriminated between groups of patients differing in the specialists' rating of asthma control and the need for change in patients' therapy, supporting the criterion and construct validity of the cACT. When comparing cACT scores with pulmonary function measurements, Muiño, A. et al. (23) found that children with a cACT score ≥ 19 had a greater probability of having airflow obstruction by spirometry and a significant response to a bronchodilator, supporting the construct validity of the cACT. Likewise, in two of the aforementioned studies (10,21), the authors found that mean cACT scores discriminated

between groups of patients differing in the predicted percentage of the forced expiratory volume in the 1st second (FEV1%) values. On the other hand, Chen, H.H. et al. (22) found that the correlation between the predicted percentage of the peak expiratory flow rate (PEFR %) values and cACT scores were poor and not statistically significant. In contrast to these studies, we did not use pulmonary function measurements as comparators to validate the cACT due to the age of some participants in the study. With respect to cACT's test-retest reliability, we found greater values of the ICC than those reported in the studies by Sekerel, B.E. et al. and Chen, H.H. et al. (21,22). This higher value of ICC in our study is probably due to the fact that the time period between the baseline and follow-up visits in our study was shorter than that used in the other two studies, increasing the likelihood of a greater consistency of the questionnaire results between the baseline and follow-up visits.

The main limitations of our study comprise the small number of patients included (especially few patients with extremes of age: children < 5 and > 10 years old), that the study was performed in a unique clinical setting (outpatients) in a single center, and that we did not use pulmonary function measurements as comparators to validate the cACT. However, although our sample is not representative of the entire Spanish-speaking population of asthmatic children, we consider that our sample represents a wide spectrum of both patient demographics and asthma severity, hence increasing the external validity of our results. Additionally, despite the fact that in previous validation studies authors used pulmonary function measurements as comparators to validate the cACT, we consider that the omission of pulmonary function measurements had minimal effect on measurement properties and validity of the Spanish version of the cACT for several reasons. First, most asthmatic children have FEV1 in the normal range even when they are markedly symptomatic (24). Second, in asthmatic children there is a lack of correlation between pulmonary function measurements and a variety of asthma morbidity indicators, such as symptoms (24), quality of life (25), and airway inflammation. Third, pulmonary function measurements can be infeasible and unreliable in younger children (26).

The main strength of our study is the assessment of all of the recommended psychometric characteristics in the validation process of severity scores and other outcome measures of the cACT questionnaire in its Spanish version, one of the most widely spoken languages in the world.

CONCLUSIONS/KEY FINDINGS

In summary, our results suggest that the Spanish version of the cACT questionnaire has adequate criterion validity, adequate construct validity, adequate sensitivity to change, good internal consistency, good test-retest reliability, and excellent usability when employed in children aged between 4 and 11 years with physician-diagnosed asthma. Additional research is needed in different populations based on a larger number of patients and in different settings with a more representative sample of the general population of school-aged children with physician-diagnosed asthma.

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1. ¿Cémo está tu asma hoy?
0 Muy mala	1 Mala	2 Bueno	3 Muy buena
2. ¿Qué tan problemática es tu asma cuando corres, haces ejercicio o practicas algún deporte?
0 Es un problema grande, no puedo hacer lo que quiero hacer.	1 Es un problema y no me siento bien.	2 Es un problema pequeño pero está bien.	3 No es un problema.
3. ¿Sientes too débil a tu asma?
0 Sí, siempre.	1 Sí, la mayoría del tiempo.	2 Sí, algo del tiempo.	3 No, nunca.
4. ¿Te despiertas durante la noche debido a tu asma?
0 Sí, siempre.	1 Sí, la mayoría del tiempo.	2 Sí, algo del tiempo.	3 No, nunca.
Por favor contésteme usted las siguientes preguntas.			
5. Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a síntomas de asma durante el día?
0 Nunca	4 De 1 a 3 días	3 De 4 a 10 días	2 De 11 a 18 días
			1 De 19 a 24 días
			0 Todos los días
6. Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a respiración silbante (un silbido en el pecho) durante el día debido al asma?
5 Nunca	4 De 1 a 3 días	3 De 4 a 10 días	2 De 11 a 18 días
			1 De 19 a 24 días
			0 Todos los días
7. Durante las últimas 4 semanas, ¿cuántos días se despertó su niño/a durante la noche debido al asma?
5 Nunca	4 De 1 a 3 días	3 De 4 a 10 días	2 De 11 a 18 días
			1 De 19 a 24 días
			0 Todos los días

Figure 1.
Spanish version of the Childhood Asthma Control Test (cACT)

Figure 2.

Bland and Altman plot displaying the difference in cACT scores plotted against the mean cACT scores *

* Horizontal lines are drawn at the mean difference and at the mean difference ± 1.96 s.d. of the differences.

Table 1Levels of asthma control based on the GINA guidelines^a

Characteristic	Controlled (All the following)	Partly controlled (Any measure present)	Uncontrolled
Daytime symptoms	None (twice or less/week)	More than twice/week	Three or more features of partly controlled asthma ^b
Limitation of activities	None	Any	
Nocturnal symptoms/awakening	None	Any	
Need for reliever/ rescue treatment	None (twice or less/week)	More than twice/week	
Lung function (PEF or FEV1) ^c	Normal	<80% predicted or personal best (if known)	

^aGINA: Global Initiative for Asthma^bBy definition, an exacerbation in any week makes that an uncontrolled asthma week^cWithout administration of bronchodilator. Lung function is not a reliable test for children 5 years and younger

Table 2

Frequency of responses for each item of the cACT questionnaire at baseline, according to the level of asthma control based on GINA guidelines *

	Uncontrolled asthma n=48 (33.6%)	Partly controlled asthma n=15 (10.5%)	Controlled asthma n=80 (55.9%)
Item 1			
Very bad	3 (6.3%)	0 (0.0%)	0 (0.0%)
Bad	8 (16.7%)	3 (20.0%)	0 (0.0%)
Good	23 (47.9%)	5 (33.3%)	33 (41.3%)
Very good	14 (29.2%)	7 (46.7%)	47 (58.8%)
Item 2	5 (10.4%)	0 (0.0%)	0 (0.0%)
It's a big problem, I can't do what I want to do	10 (20.8%)	3 (20.0%)	9 (11.3%)
It's a problem and I don't like it	22 (45.8%)	7 (46.7%)	26 (32.5%)
It's a little problem, but it's okay	11 (22.9%)	5 (33.3%)	45 (56.3%)
It's not a problem			
Item 3	7 (14.6%)	3 (20.0%)	0 (0.0%)
Yes, all of the time	16 (33.3%)	2 (13.3%)	3 (3.8%)
Yes, most of the time	24 (50.0%)	10 (66.7%)	52 (65.0%)
Yes, some of the time	1 (2.1%)	0 (0.0%)	25 (31.3%)
No, none of the time			
Item 4	4 (8.3%)	0 (0.0%)	0 (0.0%)
Yes, all of the time	9 (18.8%)	0 (0.0%)	0 (0.0%)
Yes, most of the time	23 (47.9%)	9 (60.0%)	25 (31.3%)
Yes, some of the time	12 (25.0%)	6 (40.0%)	55 (68.8%)
No, none of the time			
Item 5	3 (6.3%)	1 (6.7%)	51 (63.8%)
Not at all	11 (22.9%)	0 (0.0%)	22 (27.5%)
1-3 days/mo	13 (27.1%)	14 (93.3%)	4 (5.0%)
4-10 days/mo	10 (20.8%)	0 (0.0%)	3 (3.8%)
11-18 days/mo	10 (20.8%)	0 (0.0%)	0 (0.0%)
19-24 days/mo	1 (2.1%)	0 (0.0%)	0 (0.0%)
Everyday			
Item 6	15 (31.3%)	9 (60.0%)	56 (70.0%)
Not at all	21 (43.8%)	0 (0.0%)	21 (26.3%)
1-3 days/mo	2 (4.2%)	6 (40.0%)	3 (3.8%)
4-10 days/mo	7 (14.6%)	0 (0.0%)	0 (0.0%)
11-18 days/mo	0 (0.0%)	0 (0.0%)	0 (0.0%)
19-24 days/mo	3 (6.3%)	0 (0.0%)	0 (0.0%)
Everyday			
Item 7	9 (18.8%)	4 (26.7%)	67 (83.8%)

	Uncontrolled asthma n=48 (33.6%)	Partly controlled asthma n=15 (10.5%)	Controlled asthma n=80 (55.9%)
Not at all	15 (31.3%)	2 (13.3%)	10 (12.5%)
1-3 days/mo	9 (18.8%)	9 (60.0%)	0 (0.0%)
4-10 days/mo	4 (8.3%)	0 (0.0%)	3 (3.8%)
11-18 days/mo	6 (12.5%)	0 (0.0%)	0 (0.0%)
19-24 days/mo	5 (10.4%)	0 (0.0%)	0 (0.0%)
Everyday			

* Item 1: ¿How is your asthma today? (¿Cómo está tu asma hoy?); ítem 2: ¿How much of a problem is your asthma when you run, exercise or play sports? (¿Qué tan problemática es tu asma cuando corres, haces ejercicio o practicas algún deporte?); ítem 3: ¿Do you cough because of your asthma? (¿Tienes tos debido a tu asma?); ítem 4: ¿Do you wake up during the night because of your asthma? (¿Te despiertas durante la noche debido a tu asma?); ítem 5: During the last 4 weeks, ¿how many days did your child have any daytime asthma symptoms? (Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a síntomas de asma durante el día?); ítem 6: During the last 4 weeks, ¿how many days did your child wheeze during the days because of asthma? (Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a respiración sibilante (un silbido en el pecho) durante el día debido al asma?); ítem 7: During the last 4 weeks, how many days did your child wake up during the night because of asthma? (Durante las últimas 4 semanas, ¿cuántos días se despertó su niño/a durante la noche debido al asma?)

Table 3

Frequency of responses for each item of the cACT questionnaire at baseline, according to the therapeutic decision at baseline *

	No change in therapy n=55 (38.5%)	Set-up in therapy n=60 (42.0%)	Step-down in therapy n=28 (19.6%)
Item 1			
Very bad	0 (0.0%)	3 (5.0%)	0 (0.0%)
Bad	3 (5.5%)	8 (13.3%)	0 (0.0%)
Good	28 (50.9%)	25 (41.7%)	8 (28.6%)
Very good	24 (43.6%)	24 (40.0%)	20 (71.4%)
Item 2			
It's a big problem, I can't do what I want to do	1 (1.8%)	4 (6.7%)	0 (0.0%)
It's a problem and I don't like it	12 (21.8%)	10 (16.7%)	0 (0.0%)
It's a little problem, but it's okay	24 (43.6%)	31 (51.7%)	0 (0.0%)
It's a little problem, but it's okay It's not a problem	18 (32.7%)	15 (25.0%)	28 (100.0%)
Item 3	0 (0.0%)	10 (16.7%)	0 (0.0%)
Yes, all of the time	7 (12.7%)	14 (23.3%)	0 (0.0%)
Yes, most of the time	26 (47.3%)	35 (58.3%)	25 (89.3%)
Yes, some of the time	22 (40.0%)	1 (1.7%)	3 (10.7%)
No, none of the time			
Item 4	0 (0.0%)	4 (6.7%)	0 (0.0%)
Yes, all of the time	0 (0.0%)	9 (15.0%)	0 (0.0%)
Yes, most of the time	25 (45.5%)	26 (43.3%)	6 (21.4%)
Yes, some of the time	30 (54.5%)	21 (35.0%)	22 (78.6%)
No, none of the time			
Item 5	29 (52.7%)	4 (6.7%)	22 (78.6%)
Not at all	17 (30.9%)	10 (16.7%)	6 (21.4%)
1-3 days/mo	3 (5.5%)	28 (46.7%)	0 (0.0%)
4-10 days/mo	3 (5.5%)	10 (16.7%)	0 (0.0%)
11-18 days/mo	3 (5.5%)	7 (11.7%)	0 (0.0%)
19-24 days/mo	0 (0.0%)	1 (1.7%)	0 (0.0%)
Everyday	33 (60.0%)	22 (36.7%)	25 (89.3%)
Item 6	15 (27.3%)	24 (40.0%)	3 (10.7%)
Not at all	4 (7.3%)	7 (11.7%)	0 (0.0%)
1-3 days/mo	3 (5.5%)	4 (6.7%)	0 (0.0%)
4-10 days/mo	0 (0.0%)	0 (0.0%)	0 (0.0%)
11-18 days/mo	0 (0.0%)	3 (5.0%)	0 (0.0%)
19-24 days/mo			
Everyday	38 (69.1%)	16 (26.7%)	26 (92.9%)

	No change in therapy n=55 (38.5%)	Set-up in therapy n=60 (42.0%)	Step-down in therapy n=28 (19.6%)
Item 7	14 (25.5%)	11 (18.3%)	2 (7.1%)
Not at all	0 (0.0%)	18 (30.0%)	0 (0.0%)
1-3 days/mo	3 (5.5%)	4 (6.7%)	0 (0.0%)
4-10 days/mo	0 (0.0%)	6 (10.0%)	0 (0.0%)
11-18 days/mo	0 (0.0%)	5 (8.3%)	0 (0.0%)
19-24 days/mo			
Everyday			

* Item 1: ¿How is your asthma today? (¿Cómo está tu asma hoy?); ítem 2: ¿How much of a problem is your asthma when you run, exercise or play sports? (¿Qué tan problemática es tu asma cuando corres, haces ejercicio o practicas algún deporte?); ítem 3: ¿Do you cough because of your asthma? (¿Tienes tos debido a tu asma?); ítem 4: ¿Do you wake up during the night because of your asthma? (¿Te despiertas durante la noche debido a tu asma?); ítem 5: During the last 4 weeks, ¿how many days did your child have any daytime asthma symptoms? (Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a síntomas de asma durante el día?); ítem 6: During the last 4 weeks, ¿how many days did your child wheeze during the days because of asthma? (Durante las últimas 4 semanas, ¿cuántos días tuvo su niño/a respiración sibilante (un silbido en el pecho) durante el día debido al asma?); ítem 7: During the last 4 weeks, how many days did your child wake up during the night because of asthma? (Durante las últimas 4 semanas, ¿cuántos días se despertó su niño/a durante la noche debido al asma?)

Table 4

Values of Cronbach's α for each item and for the cACT as a whole.

Item	Value of Cronbach's α
1	0.7939
2	0.8326
3	0.8066
4	0.8019
5	0.7881
6	0.8317
7	0.7683
cACT as a whole	0.8276