Asthma Control Questionnaire in children: validation, measurement properties, interpretation

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ABSTRACT: The Asthma Control Questionnaire (ACQ) has been validated in adults to measure the primary goal of management (minimisation of symptoms, activity limitations, short-acting β_2-agonist use and airway narrowing). The present study evaluated the validity, measurement properties and interpretability of the ACQ in children aged 6–16 yrs.

35 children attended clinic on three occasions (0, 1 and 4 weeks) and completed the ACQ, Mini Paediatric Asthma Quality of Life Questionnaire and the Royal College of Physicians' "Three Questions". Parents completed the Paediatric Asthma Caregiver's Quality of Life Questionnaire. Between visits, children completed the Asthma Control Diary and measured peak expiratory flow. At weeks 1 and 4, clinicians and parents completed Global Rating of Change Questionnaires.

All patients completed the study. 19 children were stable between two assessments and provided evidence of good test–retest reliability (intraclass correlation coefficient 0.79). The ACQ was responsive to change in asthma control (p=0.026) and the mean±SD Minimal Important Difference was 0.52±0.45. Both cross-sectional and longitudinal correlations between the ACQ and the other outcomes were close to predicted and provided evidence that the ACQ measures asthma control in children.

The ACQ has strong measurement properties and is valid for use in children aged 6–16 yrs. In children aged 6–10 yrs, it must be administered by a trained interviewer.

KEYWORDS: Asthma control, measurement, outcome questionnaire, paediatric asthma

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The Asthma Control Questionnaire (ACQ) [1] was developed to measure asthma control as defined by international guidelines; namely, that the goal of management should be to minimise asthma symptoms, activity limitations, airway narrowing and rescue bronchodilator use, and thus reduce the risk of exacerbations. 91 clinicians, who were members of international asthma guideline committees [2–5] and who represented clinicians looking after both adults and children, identified the symptoms that are most important for assessing control. The five top-scoring symptoms, which were the same for both adults and children, were included in the ACQ. The sixth question asks about the number of puffs of rescue short-acting β_2-agonist used each day. The clinicians indicated that the measurement of airway calibre should be the forced expiratory volume in 1 s % predicted (FEV1 % pred) pre-bronchodilator; this is the seventh question. Patients recall their experiences during the previous week and respond to the first six questions (night-time waking, symptoms on waking, activity limitation, shortness of breath,

wheeze and rescue short-acting β_2-agonist use) on a 7-point scale (0=no impairment; 6=maximum impairment). Clinic staff score FEV1 % pred pre-bronchodilator on a similar 7-point scale. The items are equally weighted and the ACQ score is the mean of the seven items and therefore between 0 (well controlled) and 6 (extremely poorly controlled).

The ACQ has been validated for use in adults and has strong measurement properties for use in both clinical practice and clinical trials [1]. Ideally, all seven questions in the ACQ should be used. However, measurement of airway calibre and rescue bronchodilator use are sometimes not available and three shortened versions of the questionnaire have been validated (symptoms alone, symptoms plus FEV1, symptoms plus bronchodilator) [6]. The aim of the present study was to assess the measurement properties and validity of the ACQ in children aged 6–16 yrs and to determine what change in score can be considered clinically important. We used the complete seven-question ACQ but have analysed

the data using both the complete questionnaire and the three shortened versions.

In an initial cognitive debriefing study, children aged 6–16 yrs were asked to complete the self-administered version of the ACQ. Those who were able to do this task were asked to explain the meaning of each question and the concept of the 7-point scale. We found that the self-administered version was easily and accurately understood by children aged $\geqslant 11$ yrs. We worked with younger children to identify difficult concepts and to find alternative wording and instructions (table 1). The resultant interviewer-administered version of the ACQ was tested in a separate group of children aged 6–10 yrs, and was fine-tuned to ensure ease and accuracy of understanding [7]. Children themselves always respond to the questions and help from a parent/caregiver is only sought as a last resort (usually about rescue bronchodilator use). Included in the interviewer-administered version are instructions to the interviewer on how to ensure that each child understands the 7-point scale and the concept of ''during the last week'' (table 2).

The questions posed in the present study were as follows. 1) In children aged 6–16 yrs with stable asthma, what is the test–retest reliability of the ACQ? 2) In children whose asthma control changes between clinic visits, is the ACQ able to detect these changes (responsiveness)? 3) Does the ACQ measure asthma control in children aged 6–16 yrs (content and construct validity)? 4) What change in ACQ score is the smallest that can be considered clinically important (Minimal Important Difference (MID))?

METHODS
Subjects
35 children (aged 6–16 yrs) with well-established and physician-diagnosed asthma, who had current symptoms of asthma (ACQ score >0.5) were enrolled from five primary care practices across the south of England and one hospital clinic. They represented a wide range of asthma severity, age and sex (table 3). They were not permitted to require daily oral steroids, have life-threatening asthma or have any other current illness with symptoms similar to those of asthma. Both the children and their primary caregiver were informed about the study and both signed consent forms that had been approved by South West of England Multi-Centre Research Ethics Committee (Taunton, UK).

Study design
During the 4-week observational study, children and their primary caregiver (usually a parent) attended the clinic on three occasions (baseline, and after 1 and 4 weeks). At each visit the child completed the ACQ, followed by spirometry and the Mini Paediatric Asthma Quality of Life Questionnaire (MiniPAQLQ) [8, 9]. The parent completed the Paediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ) [10]. Following this, the clinician: discussed the child's clinical status with the child and the caregiver; evaluated adequacy of asthma control using the criteria in the Global Initiative for Asthma (GINA) guidelines (not using ACQ scores); and completed the Royal College of Physicians' ''Three Questions'' (RCP) [11]. At the first visit, the child and parent were shown how to measure peak expiratory flow (PEF) and complete the Asthma Control Diary (ACD) each morning and evening [12]. If the clinician considered that the inadequacy of the child's asthma control required an immediate increase in medication, this was done according to the child's own treatment plan. All other children continued on their current medication until the next visit (1 week) with the instruction to increase medication if their asthma deteriorated further.

At the second visit, all children with inadequately controlled asthma had their medication increased. At the end of each follow-up visit, clinicians and caregivers each completed a Global Rating of Change Questionnaire [13].

Outcome measures
Asthma Control Questionnaire
As discussed in the opening paragraphs of this manuscript.

Mini Paediatric Asthma Quality of Life Questionnaire [9]
The MiniPAQLQ [9] is a validated shortened version of the original Paediatric Asthma Quality of Life Questionnaire (PAQLQ) [8]. It has 13 questions and measures the physical, emotional and social problems that are experienced by children with asthma. Children are asked to recall their experiences during the previous week and respond to each question on a 7-point scale (7=no impairment; 1=severe impairment). The overall score is the mean of the 13 responses.

Asthma Control Diary [12]
The wording of the seven questions and the response options in the ACD is almost identical to that used in the ACQ. The only major difference is that PEF is recorded instead of FEV1. Before taking any medication in the morning, children made three measurements of PEF and recorded the best value (later converted to % pred in the clinic). At the same time, they scored the questions about nocturnal waking and morning symptoms. At bedtime, they scored the amount of activity limitation, shortness of breath and wheeze experienced during the day and recorded β_2-agonist use during the previous 24 h. The diary is scored by adding the responses for each of the

TABLE 1	Example of a question from the Asthma Control Questionnaire (ACQ) that required a supplement for children in the UK

First, read each question to the child using the primary wording. If the child does not fully understand the question, read it again using the secondary wording shown in brackets.

3 During the past week, how **limited were you in your activities** because of your asthma?

3a (During the past week, how **bothered were you in the things you do every day** because of your asthma?)

The supplementary wording applies only to the UK English version. Questions that require a supplement vary between languages and countries. Reproduced with permission from E.F. Juniper. Copyright of the ACQ is held by E.F. Juniper, QOL Technologies Ltd.

TABLE 2	UK English Asthma Control Questionnaire (ACQ): instructions for interviewers

Asthma Control Questionnaire (for children aged 6–10 yrs)

Please read these instructions carefully before administering the questionnaire

Parents may be present during the interview but you should encourage the child to respond and only ask the parent to help if the child is having difficulties.

Some younger children may have difficulty understanding the meaning of some questions. First, you should read each question to the child exactly as written in the text. If the child doesn't understand, read the question again using the secondary wording included in the brackets. Try not to place your own interpretation on the question.

The questionnaire will ask how the child's asthma has been during the last week (7 days). Check that the child understands this time frame. If in doubt, ask the parent to identify an event that occurred a week previously (e.g. a football match) and then ask the child to tell you how she/he has been since that event

Show the child the response card and explain the options. Explain the concept of the 7 responses. Explain that 0 means that they have not had any asthma symptoms at all and that 6 means that their symptoms have been really, really bad. Explain that the other numbers (1–5) represent levels in between. For children who can read, we suggest that you ask them to read aloud each of the responses. For younger children, start by reading to them just the 7 responses to question one (both number and words) and check that they understand the concept (then repeat at the beginning of each question).

Reassure the child that there are no right or wrong answers.

Extract from the ACQ (for children aged 6–10 yrs old). Reproduced with permission from E.F. Juniper. Copyright of the ACQ is held by E.F. Juniper, QOL Technologies Ltd.

seven questions for each of the 7 days and dividing the total score by 49 (i.e. the resultant score is between 0 (well controlled) and 6 (extremely poorly controlled)).

TABLE 3	Demographic and baseline data
Patients	35
Age yrs	10.4 ± 2.6
Sex	
Males	21
Females	14
Medications	
SABA alone	3
SABA + IS	13
SABA + IS + LABA	16
SABA + LABA + Leuk + SC	1
SABA + IS + LABA + Leuk	2
ACQ	1.76 ± 0.71
FEV1 % pred	89.4 ± 14.3
RCP	1.85 ± 0.74
MiniPAQLQ	5.09 ± 1.13
PACQLQ	5.23 ± 1.14
PEF % pred	83.1 ± 14.7
ACD	1.30 ± 0.86

Outcomes	Scores
ACQ	0=well controlled, 6=extremely poorly controlled
RCP	0=well controlled, 1, 2, 3=not controlled
MiniPAQLQ	7=no impairment, 1=severe impairment
PACQLQ	7=no impairment, 1=severe impairment
ACD	0=well controlled, 6=extremely poorly controlled

Data are presented as n or mean± SD. SABA: short-acting β_2-agonist; IS: inhaled corticosteroid; LABA: long-acting β_2-agonist; Leuk: leukotriene modifier; SC: sodium cromoglycate; FEV1: forced expiratory volume in 1 s; % pred: % predicted; RCP: Royal College of Physicians' ''Three Questions''; MiniPAQLQ: Mini Paediatric Asthma Quality of Life Questionnaire; PACQLQ: Paediatric Asthma Caregiver's Quality of Life Questionnaire; PEF: peak expiratory flow; ACD: Asthma Control Diary.

Spirometry

Pre-bronchodilator FEV1 was measured at each clinic visit and expressed as % pred normal. Short-acting β_2-agonists were not taken for at least 4 hours before each clinic visit.

Royal College of Physicians ''Three Questions'' [11]

The Royal College of Physicians has identified three asthma symptom questions (difficulty sleeping due to asthma, daytime asthma symptoms, activity limitation) with dichotomous responses (''yes'' or ''no'') that should be used by UK clinicians in the routine management of asthma patients. Patients responding positively to one or more question provide evidence of poor asthma control.

Paediatric Asthma Caregiver's Quality of Life Questionnaire [10]

The PACQLQ is a 13-item questionnaire that measures the impact that the child's asthma has on the primary caregiver's day-to-day experiences (usually a parent). Parents respond to each question on a 7-point scale (7=no impairment; 1=severe impairment). The overall score is the mean of the 13 responses. There are two domains: emotional function and activity limitation. The same parent or primary caregiver completed this questionnaire at every visit.

Parent's Global Rating of Change Questionnaire [13]

For this questionnaire, the parent was asked whether there had been any change in their child's asthma control since the previous visit (+7=a very great deal better; 0=no change; -7=a very great deal worse).

Clinician's Global Rating of Change Questionnaire [13]

For this questionnaire, the clinician was also asked whether there had been any change in the child's asthma control since the previous visit. To respond to this questionnaire, the following were used: RCP scores, ACD data, spirometry, and their clinical consultation with the child and the caregiver. ACQ data were not used. The clinician also identified whether the change was of clinical importance (i.e. justified a change in treatment).

Analysis

Content validity

The items in the ACQ were selected by paediatric asthma clinicians as being the most important for determining asthma control using the ''importance method'' for item selection [1]. Therefore, the content validity of the ACQ in children has already been established.

Testing the measurement properties
General approach

Construct validation: Since there is no gold standard for measuring asthma control in children, evidence that the ACQ truly measures asthma control has been established through ''construct validation''. This is achieved by demonstrating that it shows appropriate correlations with established health status measures [14].

Measurement properties: A health status instrument that is required to measure change over time (*e.g.* clinical trials and clinical practice) must have good evaluative properties, which are responsiveness (the ability to detect important within-patient changes, even if they are small) and longitudinal construct validity (appropriate correlations between changes in the new instrument and changes in established health status measures). An instrument that is required to distinguish between people at a single point in time (*e.g.* surveys and impairment assessment) must have good discriminative properties, which are reliability (high ratio of variance between-patients to variance within-patients) and cross-sectional construct validity (appropriate correlations between established measures and the new instrument). We tested the ACQ for both evaluative and discriminative properties.

Statistical analysis
Categorising patients

Conceptually, testing the ACQ's measurement properties required defining a group of children who remained clinically stable between consecutive clinic visits (weeks 0–1 and 1–4) and another group who experienced change in their asthma control. For each time period, we categorised each patient using the Clinician's Global Rating of Change score: stable group had scores of -1, 0 or +1; unstable group had scores of -7 to -2 and +2 to +7.

Evaluative properties

Responsiveness of the ACQ was examined in three ways. First, for patients in the unstable group, we determined whether the ACQ could detect within-patient change using a paired t-test. Secondly, we assessed whether the ACQ could detect differences between stable and unstable patients using an unpaired t-test. Thirdly, we calculated the responsiveness index ($\Delta/\Delta\mathrm{SD}$), where Δ is the change in score between visits. To ensure that the contribution of two observations by some patients did not result in an overestimation of the precision of responsiveness, we inflated the variance by the quantity $1+(n-1)\rho$, where ρ is the intraclass correlation coefficient (ICC) of the change scores and $n=2$ (no. of observations per subject). For longitudinal validity, we made *a priori* predications about the amount of correlation we should expect to observe if the ACQ truly measures change in asthma control. The predictions were based on results from previous studies in children and adults [1, 6, 8, 15, 16] and clinical experience.

The MID was calculated in two ways. First, it was calculated as the mean change in score between clinic visits in children who scored +3, +2, -2 and -3 on the Clinician's Global Rating of Change Questionnaire [13]. Symmetry of positive and negative responses allowed the data to be combined for analysis by changing the sign of the negative responses. Secondly, the change in ACQ scores that was equivalent to a change in MiniPAQLQ score of 0.5 was calculated by regressing the change in ACQ scores on change in MiniPAQLQ scores, using a geometric mean regression model [6, 17]. This method allows for measurement errors in the independent (PAQLQ) variable as well as the dependent (ACQ) variable.

Discriminative properties

Reliability of the ACQ was determined from patients in the stable group. If a patient was stable during both weeks 0–1 and weeks 1–4, a single observation was selected using a random number generator. Reliability was estimated as the within-subject SD and related to the total SD as an ICC. For cross-sectional validity, we used data from the second clinic visit (week 1) and once again made *a priori* predications about the level of correlation we should expect to observe if the ACQ truly measures asthma control.

TABLE 4 Comparison of the original Asthma Control Questionnaire (ACQ) and the shortened versions (0=well controlled; 6= extremely poorly controlled)

Questionnaire	Score at baseline	Change score between baseline and 4 weeks	Concordance between ACQ and short versions at baseline (ICC)	Difference between ACQ and short versions		Difference between change in ACQ and change in short versions between baseline and 4 weeks	
				Mean$\pm$SD	p-value	Mean$\pm$SD	p-value
ACQ all questions	1.76$\pm$0.71	-0.53$\pm$1.17					
Symptoms alone	1.88$\pm$0.81	-0.70$\pm$1.29	0.93	0.12$\pm$0.26	0.010	0.17$\pm$0.34	0.006
Symptoms plus FEV1 % pred	1.83$\pm$0.74	-0.65$\pm$1.20	0.98	0.07$\pm$0.11	<0.001	0.11$\pm$0.17	<0.001
Symptoms plus SABA use	1.79$\pm$0.77	-0.56$\pm$1.25	0.96	0.03$\pm$0.21	0.38	0.03$\pm$0.23	0.49

Data are presented as mean$\pm$SD, unless otherwise stated. ICC: intraclass correlation coefficient; FEV1: forced expiratory volume in 1 s; % pred: % predicted; SABA: short-acting β_2-agonist.

Cross-sectional construct validity[#]: visit 2

Questionnaire	MiniPAQLQ	RCP	ACD	PACQLQ
ACQ: all questions	-0.83	0.52	0.77	-0.63
Symptoms alone	-0.84	0.57	0.71	-0.56
Symptoms plus FEV1 % pred	-0.83	0.52	0.72	-0.61
Symptoms plus SABA use	-0.83	0.56	0.77	-0.58

MiniPAQLQ: Mini Paediatric Asthma Quality of Life Questionnaire; RCP: Royal College of Physicians' ''Three Questions''; ACD: Asthma Control Diary; PACQLQ: Paediatric Asthma Caregiver's Quality of Life Questionnaire; ACQ: Asthma Control Questionnaire; FEV1: forced expiratory volume in 1 s; % pred: % predicted; SABA: short-acting β_2-agonist. [#]: Pearson correlation coefficients.

RESULTS

All 35 children completed the first and second visits but two failed to attend for the third visit. Their demographic and baseline asthma data are shown in table 3. Although concordance between the ACQ and the three shortened versions was high (ICC >0.93), the symptoms alone and the symptoms plus FEV1 gave significantly higher scores (p<0.01) (table 4). In addition, changes in scores between baseline and 4 weeks were significantly greater in these two versions than the complete ACQ (p<0.006).

19 children remained stable between two consecutive clinic visits and provided evidence of good test–retest reliability with the following ICCs: ACQ 0.79, symptoms alone 0.67, symptoms plus FEV1 0.79, symptoms plus β_2-agonist 0.68. Evidence of good cross-sectional construct validity is shown in table 5 with correlations close to predicted (visit 2 was used so that ACD data could be included).

The ACQ and all three shortened versions showed good responsiveness (table 6). In children whose asthma control changed between clinic visits, the questionnaire was able to detect change (p<0.026) and it was able to distinguish between those who remained stable and those who changed. With the Global Rating of Change method (n=11), the smallest change in ACQ score that can be considered clinically important, the MID, mean±SD was 0.52±0.45 (symptoms alone 0.65, symptoms plus FEV1 0.52, symptoms plus β_2-agonist 0.63).

Longitudinal correlations with other clinical outcomes provided further evidence that the ACQ really does measure asthma control (table 7). The geometric mean regression method (n=31) gave a similar result (MID 0.50; SEM 0.05).

DISCUSSION

The present study has provided evidence that the ACQ is a valid instrument for measuring asthma control in children aged 6–16 yrs. It can be used with confidence to determine the level of control, changes in control and whether changes in control can be considered of clinical importance. Previous work has shown that the questionnaire must be administered to children aged 6–10 yrs by a trained interviewer who initially ensures that the child understands the concept of the 7-point scale and the time specification of ''during the last week'' [7].

Although only 35 children were enrolled in the present study (the same number as were enrolled in the original validation study of the Asthma Quality of Life Questionnaire [18]), they were sufficient to provide strong evidence of the validity of the instrument (e.g. there was sufficient power for expected differences to reach statistical significance). In addition, the measurement properties of the ACQ in children (reliability, responsiveness, construct validity and interpretability) found in the present study, were very similar to those observed in adults [1, 6]. The MID was estimated using two different but established methods [6, 13, 17]. The consistency of the estimates (global rating: 0.52; geometric mean regression: 0.50) provides further evidence that the sample size was adequate. To ensure generalisability, children were enrolled to represent a wide range of asthma severity, the full range of age and both sexes, and they came from primary care clinics and a hospital situated in areas of differing socioeconomic status (table 3). Children requiring regular oral steroids or those with life-threatening asthma were excluded; therefore, we cannot be certain about validity in this small group of children.

The complete ACQ and the three shortened versions each attained measurement properties that are acceptable for strong evidence of validity. The measurement properties of the three shortened versions tended not to be quite so strong as the complete ACQ. Therefore, it is best if the shortened versions are used only when either FEV1 or rescue bronchodilator use are not available. In the absence of either FEV1 or rescue bronchodilator use, either of the three shortened versions may be used. However, although concordance between each of the

TABLE 6 Responsiveness of the Asthma Control Questionnaire (ACQ) and the shortened versions

Questionnaire	Change in score between clinic visits: stable patients (A)		Change in score between clinic visits: unstable patients (B)		A versus B		Responsiveness index
	Mean±SD	p-value	Mean±SD	p-value	Mean±SD	p-value	
ACQ all questions	-0.20±0.76	0.29	-0.93±1.45	0.026	0.74±1.13	0.072	0.455
Symptoms alone	-0.26±0.90	0.24	-1.24±1.51	0.007	0.98±1.21	0.027	0.544
Symptoms plus FEV1 % pred	-0.28±0.80	0.16	-1.09±1.45	0.011	0.81±1.14	0.051	0.540
Symptoms plus SABA use	-0.17±0.85	0.42	-1.03±1.50	0.018	0.87±1.18	0.045	0.450

FEV1: forced expiratory volume in 1 s; % pred: % predicted; SABA: short-acting β_2-agonist.

TABLE 7	Longitudinal construct validity[#]: 1–4 weeks					
Questionnaire	ΔMiniPAQLQ	ΔRCP	ΔACD	ΔPACQLQ	Global Rating of Change Questionnaire	
					Clinician	Caregiver
ΔACQ all questions	-0.89	0.81	0.83	-0.79	-0.72	-0.66
Δsymptoms alone	-0.93	0.81	0.79	-0.84	-0.75	-0.69
Δsymptoms plus FEV₁ % pred	-0.91	0.81	0.82	-0.80	-0.75	-0.68
Δsymptoms plus SABA use	-0.91	0.81	0.81	-0.83	-0.71	-0.66

Δ: change; MiniPAQLQ: Mini Paediatric Asthma Quality of Life Questionnaire; RCP: Royal College of Physicians' ''Three Questions''; ACD: Asthma Control Diary; PACQLQ: Paediatric Asthma Caregiver's Quality of Life Questionnaire; ACQ: Asthma Control Questionnaire; FEV₁: forced expiratory volume in 1 s; % pred: % predicted; SABA: short-acting β_2-agonist. [#]: Pearson correlation coefficients.

shortened versions and the complete ACQ was high (ICC >0.93), there were statistically significant differences in score suggesting that although each instrument is valid in its own right, there is a bias between them and therefore the different versions should not be used interchangeably. In addition, the MID was higher when rescue bronchodilator use was omitted.

A limitation of the present study is that the clinician could not be completely blinded to the current ACQ data. To minimise the risk of this influencing the clinician's global estimate of change at the end of each clinic visit, the clinician did not have access to ACQ data from previous visits and therefore had no reference point. In addition, the ACQ was always completed at the beginning of the visit and the clinician completed the Global Rating of Change at the end of the visit (after the MiniPAQLQ, spirometry, review of diary data and PEF technique, clinical discussion with the child and parent on the child's asthma status, RCP and treatment plan).

The ACQ was only tested in children ⩾6 yrs of age because we wanted the children to respond to the questions. This is because parents are often unable to give an accurate estimate of their child's health status, as shown by their only moderately accurate estimate of change in their child's asthma control between visits (table 7) and previous studies on the accuracy of parental reporting [19]. This inaccuracy can occur for a number of reasons: the parent is not with the child 24 h a day (e.g. night-time and school); children sometimes hide how their asthma really is from their parents (e.g. to prevent missing playing with their friends/sports); and parents sometimes score how they personally would feel if they had similar asthma (e.g. activity limitation). Children <6 yrs of age have difficulty understanding the concept of ''during the last week''; they know how they are today, but for longer recall they become inaccurate. Since a single snapshot of how the child is today is not an accurate reflection of the child's asthma control, the ACQ should not be used in children <6 yrs of age.

International guidelines advocate the use of the ACQ in the clinical management of adults with asthma [20] because there is evidence that a valid instrument for assessing control (both current status and change over time) is more accurate than conventional clinical assessments [21, 22]. The construct validation in this study has provided evidence that the ACQ really does measure asthma control in children >6 yrs of age.

However, it also provides evidence, through the modest correlation between the ACQ and the Clinician's Global Rating of Change score, that the clinicians' accuracy in estimating adequacy of asthma control in children is similar to that observed in adults.

Although the primary goal of clinical asthma management must be to achieve optimum control, it is also important to ensure that the goals that are important to the children themselves (asthma-specific quality of life) are also included in the treatment plan. In the present study, the correlation between the ACQ and the MiniPAQLQ was quite high, suggesting that the two questionnaires might be measuring a similar concept. However, these results are similar to previous observations and factor analysis has shown that asthma control and quality of life are two distinct components of clinical asthma [16]. Therefore, both outcomes have to be assessed in order to set the treatment goals and follow the effectiveness of treatment. This is already occurring in the management of adults with asthma and the validation of the ACQ means that, in conjunction with either the PAQLQ (standardised version [9]) or MiniPAQLQ, a similar approach to management is possible in children.

The recent American Thoracic Society (ATS)/European Respiratory Society (ERS) statement on asthma control and exacerbations, states that ''acceptance of [ACQs] use needs to be determined in primary care'' [23]. This validation of the ACQ was conducted mainly in primary care and, following the latest GINA guidelines [19], clinicians around the world have started to use the ACQ in primary care. This has come about through individual national asthma guidelines and pharmaceutical companies promoting the GINA guidelines. The ERS/ ATS statement also suggests that the 7-point response scale is too ''complex and laborious'' [23]. However, it is the 7-point scale that gives the instrument its high degree of responsiveness, allowing it to detect accurately small but clinically important changes in asthma control (0.5 change on the 7-point scale is clinically important). Children as young as 6 yrs of age have not had any problems understanding or using a 7-point scale [15].

The present study provides evidence that the ACQ, if completed by the children themselves, is a valid instrument for measuring asthma control in children aged 6–16 yrs. The

measurement properties in this age group are strong and very similar to those observed when the questionnaire is used in adults. In children <10 yrs of age, the questionnaire should be administered to the child by a trained health professional.

SUPPORT STATEMENT

STATEMENT OF INTEREST

Statements of interest for E.F. Juniper, K. Gruffydd-Jones, and for the study itself can be found at www.erj.ersjournals.com/site/misc/statements.xhtml

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