Measuring Health-Related Quality of Life in Adults During an Acute Asthma Exacerbation*

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Background: Acute severe asthma can be distressing for patients. It is important to be able to identify the causes of the distress so that these can receive attention in conjunction with the conventional treatment of the airways.

Study objective: To modify the Asthma Quality of Life Questionnaire (AQLQ) for evaluating patients with acute severe asthma and to test the measurement properties of the Acute Asthma Quality of Life Questionnaire (Acute AQLQ).

Methods: The Acute AQLQ contains the symptom and emotional function items of the AQLQ (n = 11), which are capable of changing over short periods of time. The measurement properties were tested during a clinical trial to compare formoterol and salbutamol in the treatment of acute severe asthma in hospital emergency departments.

Results: The 88 patients in the clinical trial provided evidence that the Acute AQLQ has high internal consistency (Cronbach α = 0.90) and is very responsive to change in status (p < 0.00001) with a responsiveness index of 2.5. Correlations between the Acute AQLQ and other measures of clinical status provided evidence of the validity of the instrument.

Conclusion: The Acute AQLQ has strong measurement properties and can be used with confidence to identify the problems that are distressing to patients during an acute asthma exacerbation and to evaluate the effectiveness of interventions. (CHEST 2004; 125:93–97)

Key words: asthma; health status; measurement; quality of life; questionnaires

Abbreviation: Acute AQLQ = Acute Asthma Quality of Life Questionnaire; AQLQ = Asthma Quality of Life Questionnaire

When patients have an acute severe exacerbation of their asthma, not only are they troubled by their symptoms, the experience also can be emotionally distressing. Although we now recognize the importance of including patients’ health-related quality of life in asthma assessments, all the currently available validated questionnaires focus on the things that are troublesome to asthma patients during their day-to-day lives in the community, and they ask patients to recall their experiences during the previous days or weeks. Therefore, they are not suitable for capturing the rapidly changing experiences that occur during acute severe asthma.

The original Asthma Quality of Life Questionnaire (AQLQ) was developed to measure patients’ functional experiences over a 2-week period, and it has been validated in a number of community settings. In this study, we have modified the AQLQ to focus on the problems that are distressing to patients when they experience acute severe asthma that requires treatment in the hospital and that can be expected to respond within hours to therapy. Such a questionnaire is needed not only to identify the causes of distress, but to measure the degree of distress and to evaluate the effectiveness of interventions. The measurement properties of the Acute AQLQ have been assessed using data collected during a clinical trial.

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QUESTIONNAIRE DEVELOPMENT

Acute AQLQ Specifications

1. Include the symptoms and emotions that are most distressing for adults during an acute exacerbation of asthma treated in hospital.
2. Include only symptoms and emotions that can change over short periods of time (hours).
3. Reliable (ie, gives consistent results on repeated administration when the clinical state is stable).
4. Responsive (ie, sensitive to clinically important changes even if the changes are small).
5. Valid (ie, measures the symptomatic and emotional problems associated with an acute asthma exacerbation).
6. Short and easily understood by patients.

Item Selection

The AQLQ has 32 items in four domains (symptoms, 12 items; emotions, 5 items; activity limitations, 11 items; and environmental stimuli, 4 items). Items that were thought unlikely to change during the initial hours of hospital treatment were excluded. These included all items in the activity domain (ie, physical, social, and occupational) and all items in the environmental domain (ie, problems on exposure to pollutants, dust, and strong smells). These two domains were removed because patients do not participate in activities in an emergency department, and the environment of the hospital would be constant. In addition, six items in the symptom domain that were unlikely to change were excluded (eg, waking at night with symptoms). The resultant Acute AQLQ has 11 items in two domains (symptoms, 6 items; and emotions, 5 items). The questionnaire is in an interviewer-administered format, asks patients to recall how they have felt during the previous half hour, and patients respond to each question on a 7-point scale (1/11005 maximum impairment; 7/11005 no impairment). The overall score is calculated as the mean of all 11 responses, and the domain scores are calculated as the mean of the items in each domain. The format of the Acute AQLQ was tested in 10 asthma patients to ensure ease and accuracy of understanding and completion.

VALIDATION STUDY

Although the original AQLQ, the Standardised AQLQ, and the Mini AQLQ have all been validated,16,7 it was considered important to evaluate the performance of the Acute AQLQ in the clinical trial setting. This validation study was appended to a multicenter clinical trial that compared the efficacy of the formoterol turbuhaler (Oxis; AstraZeneca; Lund, Sweden) and salbutamol metered-dose inhaler plus spacer (Ventolin; GlaxoSmithKline; London, UK) in the treatment of adults with acute severe bronchoconstriction. Complete details of the study have been reported elsewhere.8

Patients

Eighty-eight adults (age range, 18 to 70 years) presenting to the emergency department with acute severe bronchoconstriction (ie, FEV1, 30 to 60% predicted) were enrolled in the study.

Study Design

In a double blind, double-dummy manner, patients were randomized to receive either 54 µg formoterol inhalation powder via turbuhaler (n = 44) or 2,400 µg salbutamol via metered-dose inhaler plus spacer (n = 44) at baseline (0 min) and at 30 and 60 min. Outcomes were measured immediately before treatment and at 75 and 240 min.

Outcome Measures

Acute AQLQ: The Acute AQLQ (see “Appendix”) was administered to patients by a trained interviewer.

FEV1: Spirometry was performed three times at each assessment, and the highest FEV1 value recorded. All centers used spirometers that met American Thoracic Society standards.

Asthma Symptom Severity: Patients were asked the question “How is your asthma now?” They responded by making a mark on a 10-cm-long visual analog scale (0 = no symptoms; 10 = severe symptoms).

Patients’ Global Rating of Symptom Change: At each follow-up assessment (at 75 and 240 min), patients were asked whether there had been any change in their overall well-being since they had received the first dose of the study drug. They responded on a 15-point scale (−7 = a very great deal worse; 0, no change; +7 = a very great deal better).

Statistical Analysis

The reliability (internal consistency) of the Acute AQLQ was estimated with the Cronbach α using data from the baseline visit. Responsiveness was estimated by the ability of the questionnaire to detect within-subject changes between baseline and
both 75 and 240 min using a paired \( t \) test. In addition, the responsiveness index was calculated \((\Delta/\text{SDA})\). Cross-sectional and longitudinal construct validity was evaluated by correlating Acute AQLQ scores with the scores from the other measures of clinical status using Pearson correlation coefficients. We considered that if relationships were similar to those observed in other validation studies of the AQLQ, this would be strong evidence that the Acute AQLQ was truly measuring health-related quality of life in patients with an acute severe exacerbation of their asthma.

### Results

The characteristics of the patients who participated in the study are shown in Table 1. Patients in both treatment groups showed quite severely impaired asthma-specific quality of life at baseline (formoterol = 2.67; salbutamol = 2.49 [not significant]). Clinicians reported that the administration of the Acute AQLQ took between 3 and 5 min.

### Reliability

The internal consistency of the Acute AQLQ overall was high with a Cronbach \( \alpha \) of 0.90. The value for the symptom domain was 0.82, and for the emotional function domain the value was 0.86.

### Responsiveness

Seventy-five minutes after the start of treatment, the Acute AQLQ was able to detect improvements in both treatment groups with a high degree of statistical significance \((p < 0.00001)\) [change on formoterol = 2.46; change on salbutamol = 2.57], but the difference between the two treatments was not significant \((p = 0.31)\). A similar pattern in overall score was seen at 240 min. At both 75 and 240 min, both the symptom domain and the emotional function domain showed a similar pattern of response to the overall score (Table 2). The lack of difference between the two treatment groups was consistent with the majority of other clinical outcomes. The responsiveness index for the Acute AQLQ was 2.5.

### Validity

For both cross-sectional and longitudinal validity, the correlations observed between the Acute AQLQ and other measures of clinical status (Tables 3 and 4) were similar to those observed in other validation studies and also in clinical trials in which the AQLQ was measured. These relationships support the validity of the Acute AQLQ.

### Discussion

The results of this study have provided evidence that the Acute AQLQ is valid for measuring the problems that are important and troublesome to patients with asthma during an acute severe exacerbation who are treated in the hospital. The instrument has high internal consistency, good responsiveness, and strong construct validity, which are the properties required for confident use of the questionnaire in both clinical trials and clinical practice.

### Table 1—Patient Characteristics*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Formoterol (n = 44)</th>
<th>Salbutamol (n = 44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>30</td>
</tr>
<tr>
<td>Age, yr</td>
<td>45 (18–67)</td>
<td>43 (18–61)</td>
</tr>
<tr>
<td>Current treatment</td>
<td>Inhaled short-acting</td>
<td>β2-agonist</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Oral short-acting</td>
<td>β2-agonist</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Inhaled corticosteroid</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Oral corticosteroid</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>FEV1, % predicted</td>
<td>44 (17–60)</td>
<td>44 (21–59)</td>
</tr>
<tr>
<td>SaO2</td>
<td>96 (91–100)</td>
<td>97 (91–100)</td>
</tr>
<tr>
<td>Acute AQLQ</td>
<td>2.67 (1.46–6.00)</td>
<td>2.49 (1.00–6.36)</td>
</tr>
</tbody>
</table>

*Values given as No. (range). SaO2 = arterial oxygen saturation.

### Table 2—Acute AQLQ Scores*

<table>
<thead>
<tr>
<th></th>
<th>Acute AQLQ</th>
<th>Baseline</th>
<th>75 min</th>
<th>240 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall score</td>
<td>Formoterol</td>
<td>2.67 ± 0.96</td>
<td>5.13 ± 1.10</td>
<td>5.88 ± 0.55</td>
</tr>
<tr>
<td>Symptom domain</td>
<td>Formoterol</td>
<td>2.65 ± 0.96</td>
<td>5.17 ± 1.05</td>
<td>5.90 ± 0.55</td>
</tr>
<tr>
<td>Emotional function</td>
<td>Formoterol</td>
<td>2.70 ± 1.18</td>
<td>5.07 ± 1.33</td>
<td>5.86 ± 0.99</td>
</tr>
</tbody>
</table>

*Values given as mean ± SD.

### Table 3—Cross-Sectional Correlations at Baseline*

<table>
<thead>
<tr>
<th></th>
<th>Acute AQLQ</th>
<th>FEV1%, Asthma Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% predicted</td>
<td>Severity</td>
</tr>
<tr>
<td>Overall score</td>
<td>0.031</td>
<td>0.37</td>
</tr>
<tr>
<td>Symptom domain</td>
<td>0.045</td>
<td>0.39</td>
</tr>
<tr>
<td>Emotional function</td>
<td>0.015</td>
<td>0.31</td>
</tr>
</tbody>
</table>

*Values given as Pearson correlation coefficient.
The scores observed at baseline in both the symptom and emotional function domains (range, 2.4 to 2.7 [1 = severely impaired; 7 = no impairment]) are considerably lower than those that have been observed in outpatients.14–7 These data demonstrate that patients who experience exacerbations are not only very troubled by their symptoms, but they experience considerable emotional distress. Since emotional distress itself may exacerbate symptoms,10 the identification of the cause of the distress and emotional support by clinicians may not only help patients cope with the experience but also may enhance the recovery of the Airways. The lack of correlation between the Acute AQLQ and FEV₁ (r = 0.03) [Table 3], and the modest correlation between the Acute AQLQ and symptom severity (r = 0.39), are consistent with observations in less severe asthma1–7 and emphasize that clinicians cannot estimate how much patients are troubled by their asthma from the clinical indices. They must obtain this information directly from the patient.

Similar correlations were observed between the change in the clinical indices and the change in Acute AQLQ (Table 4), and between the change in FEV₁ and the change in asthma symptom severity (r = 0.17). All of these poor but consistent correlations1–7 raise the question of the relationship between various measures of clinical asthma. A recent factor analysis has suggested that clinical asthma is composed of the following four distinct components: airway caliber; daytime symptoms and β₂-agonist use; nighttime symptoms and β₂-agonist use; and asthma-specific quality of life.11 Clinical trials12 have suggested that clinically important improvements can occur in one component, with no evidence of change occurring in others. Clearly, further studies are required to understand the mechanisms linking the various components of clinical asthma.

Ideally, test-retest reliability is evaluated by administering the instrument to patients on two separate occasions, usually separated by at least a day, when they are in a stable clinical state.14–7 However, the nature of this study meant that all patients received treatment for acute severe asthma at base-

### Table 4—Longitudinal Correlations (Baseline to 240 min)*

<table>
<thead>
<tr>
<th>Acute AQLQ</th>
<th>ΔFEV₁ % predicted</th>
<th>ΔAsthma Symptom Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ Overall score</td>
<td>0.46</td>
<td>0.37</td>
</tr>
<tr>
<td>Δ Symptom domain</td>
<td>0.43</td>
<td>0.41</td>
</tr>
<tr>
<td>Δ Emotional function domain</td>
<td>0.45</td>
<td>0.30</td>
</tr>
</tbody>
</table>

*Values given as Pearson correlation coefficient.

Although the Acute AQLQ was developed for use in clinical trials, is there a place for it in a busy emergency department where the majority of patients recover in a few hours? If patients’ overall well-being and recovery are helped by the identification of the causes and degree of distress, the few minutes required to obtain this information may be considered worthwhile. Although the original AQLQ was designed for clinical trials, its use in clinical practice is growing.13,14 It may be that as clinicians use the Acute AQLQ in trials, they also will find it to be a quick and easy way to identify the needs of their patients.

This study has highlighted the fact that, although it is obviously very important to focus treatment on the Airways during an acute severe exacerbation of asthma, clinicians also should be aware of how distressing the experience is for patients not only from the perspective of the symptoms, but also from their emotional experiences. The validation of the Acute AQLQ means that not only can patients’ experiences be measured during clinical trials, but clinicians can use the questionnaire to identify the degree and causes of their patients’ distress.

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### APPENDIX

**Acute Asthma Quality of Life Questionnaire**

The Acute Asthma Quality of Life Questionnaire is copyrighted. It may not be altered, sold (paper or electronic), translated or adapted for another medium without the permission of Elizabeth Juniper.

1. How bothered have you been by **shortness of breath** during the last half hour? (Red Card)
2. How bothered have you been by **coughing** during the last half hour? (Red Card)
3. How much of the time have you felt **afraid of not having your asthma medications available** during the last half hour? (Yellow Card)
4. How much of the time have you experienced a feeling of **fighting for air** during the last half hour? (Yellow Card)
5. How much of the time have you felt **frustrated** as a result of your asthma during the last half hour? (Yellow Card)
6. How much of the time have you felt concerned about the need to use medications for your asthma during the last half hour? (Yellow Card)
7. How bothered have you been by chest tightness or chest heaviness during the last half hour? (Red Card)
8. How bothered have you been by wheezing during the last half hour? (Red Card)
9. How much of the time have you felt difficult breathing out during the last half hour? (Red Card)
10. How much of the time have you felt afraid of getting out of breath during the last half hour? (Yellow Card)
11. How much of the time have you felt concerned about having asthma during the last half hour? (Yellow Card)

**Red Card**

1. Extremely Bothered
2. Very Bothered
3. Quite Bothered
4. Somewhat Bothered
5. Bothered a bit
6. Hardly Bothered at all
7. Not bothered

**Yellow Card**

1. All of the time
2. Most of the time
3. Quite often
4. Some of the time
5. Once in a while
6. Hardly any of the time
7. None of the time

**REFERENCES**

8. Charoenratanakul S, Boonsawat W, Pothiratana C, et al. Formoterol (Oxis) turbuhaler as a rescue therapy was as effective and safe as salbutamol by pMDI plus spacer in patients with acute severe asthma [abstract]. Eur Respir J 2002; 20(suppl):52s
14. Bawden RHF, Price D, Zheng X. Impact of having a patient’s quality of life scores on nurse management of patients with chronic asthma [abstract]. International Primary Respiratory Care Group Conference 2002; Amsterdam, the Netherlands