Thorax 1992;47:76–83

Evaluation of impairment of health related quality of life in asthma: development of a questionnaire for use in clinical trials

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Abstract

Background **In the past only physiological and clinical outcomes have been used to assess the effect of asthma interventions and the effect of the intervention on the lives of the patients has not been determined. The objective of this study was to assess health related impairment of quality of life in adult asthmatic patients and to develop a questionnaire for measuring quality of life in clinical trials in asthma.**

Methods **Impairment of quality of life in adults with asthma was evaluated from structured interviews in which patients were asked to identify the parts of their daily lives affected by asthma. On the basis of these results, an asthma quality of life questionnaire was developed in an interviewer and self administered form and tested for comprehension and acceptability. A total of 150 adults with asthma and with a wide range of airway hyperresponsiveness were enrolled from previous clinical trials, local asthma clinics, and notices in the media.**

Results **Areas of quality of life impairment included symptoms classically associated with asthma, responses to environmental stimuli, the need to avoid these stimuli, limitation of activities, and emotional dysfunction. Areas of impairment were similar across strata of airway hyperresponsiveness, age, and treatment requirements and between sexes, thus allowing a single questionnaire suitable for all adults with asthma to be developed. The questionnaire contains 32 items and takes 5–10 minutes to administer; in the pretesting it was shown to be acceptable to a wide range of patients.**

Conclusions **The questionnaire includes areas of quality of life impairment that are important to adult asthmatic patients. It has been designed to be responsive to within subject change and therefore may be used as a measure of outcome in clinical trials in asthma.**

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Accepted 13 November 1991

Clinical trials in asthma have focused, in general, on physiological measures of outcome such as airway calibre[1 2] and responsiveness.[3] Questionnaires on asthma symptoms[3 4] and treatment requirements[5] have been used to assess clinical severity, but they have tended to be restricted to conventional clinical symptoms and have not taken into account the impact of the symptoms and other aspects of the disease on the patients' lives.

In this study we evaluated impairment of quality of life in adult asthmatic patients, with stratification for several possible determinants of impairment (airway responsiveness, severity of clinical asthma, age, and sex). From the results of this analysis we developed an asthma quality of life questionnaire for use in clinical trials. The questionnaire was developed according to previously established principles[6] and methods.[7]

Principles of questionnaire development

The aim was to develop a questionnaire that is capable of measuring change over time within individual people.[6] The approach was guided by seven criteria and characteristics that were considered to be essential for the final questionnaire.

(1) Both physical and emotional health should be measured.

(2) Items must reflect areas of function that are important to patients with asthma.

(3) Summary scores amenable to statistical analysis must be provided.

(4) The questionnaire should be responsive to clinically important changes, even if the changes are small.

(5) The questionnaire should be valid—that is, measure subjective aspects of health state.

(6) Considerations of cost and efficiency dictate that the questionnaire be short.

(7) The questionnaire should be capable of being administered by an interviewer or being self administered.

Methods

1 ITEM SELECTION

The aim of this phase was to identify items of quality of life impairment that might be troublesome to asthmatic subjects. The items were generated through a review of Kinsman *et al*'s work in patients with severe asthma[8] and from general health related quality of life measures,[9 10] the experience of patients with chronic airflow limitation,[11] discussion with

local chest physicians, and detailed, unstructured interviews with six asthmatic patients who were judged to have good insight into their condition and to be articulate about their experiences. A list of 152 items likely to be important to patients with asthma was constructed.

2 ITEM REDUCTION

The purpose of this phase was to identify which of the 152 items generated in the item selection phase are most important to patients with asthma; to determine whether there are differences across airway responsiveness, clinical asthma severity, age, and sex; and to construct the asthma quality of life questionnaire.

Patient selection

Patients (18–70 years) were included if they gave a history of current asthma—that is, they had experienced symptoms or required treatment at least once a week for most of the previous two months and had airway hyperresponsiveness to methacholine aerosol (PC_{20} < 8·0 mg/ml).[12] Patients were excluded if they (*a*) had fixed airflow obstruction, defined as an FEV_1 of less than 70% of predicted normal values 10 minutes after inhaling 200 μg salbutamol, (*b*) were experiencing a severe exacerbation of asthma, (*c*) had any other illness thought to affect quality of life adversely, or (*d*) had an inadequate knowledge of English.

Subjects were selected to represent a wide range of airway responsiveness to methacholine and were recruited from patients participating in previous asthma clinical trials, from friends and relatives of previous subjects, from patients who had had a methacholine inhalation test in the previous six months, and through advertisements in the local media and in the university. All subjects signed an informed consent form that had been approved by the McMaster University Medical Centre Research Committee.

Study procedures

Before attending the clinic patients stopped taking inhaled bronchodilators for eight hours and theophylline products for 48 hours. If the FEV_1 was less than 70% of the predicted value the subject was given 200 μg salbutamol and spirometry was repeated after 10 minutes. If the FEV_1 rose to greater than 70% of the predicted value, thus meeting the entry criterion, the subject returned on a second occasion for the remaining investigations.

Airway responsiveness to inhaled methacholine was measured with a previously established protocol;[13] a brief asthma history was taken and current drug requirements were recorded. The item reduction questionnaire was administered to each subject by a trained interviewer. Subjects were asked which of the 152 items had been troublesome to them at any time during the past year. They were asked to indicate the importance of each of the identified items on a five point scale from "not very important" to "extremely important."

Analysis

The items have been placed in six domains: asthma symptoms, emotional problems caused by asthma, troublesome environmental stimuli, problems associated with avoidance of environmental stimuli, activities limited by asthma, and practical problems. Associated with each item are the proportion of people who labelled the item as troublesome (frequency), the mean importance score in those subjects labelling an item troublesome (mean importance), and the product of the frequency and the mean importance (overall importance)—see table 2. The maximum possible for overall importance if all 150 subjects chose an item and rated it 5 would be 5·0.

Patterns of responses were examined with respect to (*a*) airway hyperresponsiveness (mild (PC_{20} 2·0–8·0 mg/ml), moderate (PC_{20} 0·25–1·9 mg/ml), and severe (PC_{20} < 0·25 mg/ml)); (*b*) age (< 30, 30–50, and > 50); (*c*) clinical asthma severity (no drug treatment, bronchodilators only, bronchodilator and inhaled steroids); and (*d*) sex.

Results

In all, 246 subjects were considered for participation in the item reduction phase. Of these, 150 completed the protocol. Seventy were approached but refused for a variety of reasons (too far to travel (seven); too busy (20); not interested (31); other illness (eight); no transport (four)). A further 26 agreed to participate and attended the clinic but did not meet the entry criteria (FEV_1 too low (three); PC_{20} too high (18); poor English (three); pregnant (two). Of the 150 who participated, 70 had taken part in previous asthma or hayfever studies, 20 were friends or relatives of previous subjects or the investigators, 29 responded to advertisements, and 31 had had a recent airway challenge test for clinical reasons. The characteristics of the 150 participants are summarised in table 1.

The highest scoring items for all the patients together are presented in table 2. The highest scores were related to symptoms classically associated with asthma, the triggering of symptoms by environmental stimuli, and the need to avoid these environmental stimuli.

Table 1 Characteristics of 150 participants with asthma. Values are numbers of subjects unless stated otherwise

Characteristic	
Mean age (years) (SD)	39·77 (13·12)
Sex:	
Male	50
Female	100
Mean duration of asthma (years) (SD)	16·74 (14·0)
Atopic status (history):	
Atopic	127
Non-atopic	23
Drugs taken:	
None	25
β Agonists*:	
Alone	39
With inhaled steroid	86
Airway hyperresponsiveness (PC_{20} in mg/ml):	
Mild (8·0–2·0)	58
Moderate (1·9–0·25)	49
Severe (< 0·25)	43

*Theophyllines and ipatropium bromide.

Table 2 Highest scoring items of the 152 items presented to 150 patients with asthma

	*Frequency**	*Mean importance†*	*Overall importance‡*
Symptoms			
Shortness of breath	0·92	3·60	3·31
Chest tightness	0·96	3·35	3·22
Wheeze	0·87	3·15	2·73
Chest heaviness	0·81	3·22	2·60
Cough	0·86	2·83	2·43
Difficulty breathing out	0·72	3·37	2·43
Fighting for air	0·56	4·04	2·26
Heavy breathing	0·70	3·22	2·25
Difficulty getting good night's sleep	0·60	3·48	2·09
Woken during night by symptoms	0·61	3·43	2·08
Waking with symptoms in morning	0·71	2·89	2·06
Need to clear throat	0·73	2·76	2·01
Tiredness	0·57	3·19	1·81
Exhaustion	0·55	3·16	1·73
Emotions			
Afraid of not having medications when needed	0·50	3·75	1·88
Concerned about having to use medications	0·53	3·24	1·71
Concerned about having asthma	0·56	2·92	1·65
Frustrated	0·55	2·90	1·60
Uncomfortable	0·53	2·96	1·58
Afraid of getting out of breath	0·37	3·50	1·31
Impatient	0·47	2·67	1·25
Upset about having asthma	0·40	3·10	1·24
Irritable	0·42	2·94	1·23
Environment			
Exposure:			
Cigarette smoke	0·82	3·81	3·12
Dust	0·81	3·46	2·79
Air pollution	0·76	3·51	2·67
Hot humid weather	0·68	3·54	2·41
Pollen	0·61	3·84	2·35
Cold weather	0·70	3·30	2·31
Avoidance:			
Cigarette smoke	0·81	3·66	2·98
Dust	0·75	3·20	2·39
Air pollution	0·54	3·57	1·93
Hot humid weather	0·54	3·56	1·92
Cold weather	0·43	3·58	1·55
Physical activities			
Jogging/exercising	0·77	3·09	2·39
Running	0·76	2·78	2·13
Running uphill/upstairs	0·70	3·00	2·10
Playing sports	0·59	3·27	1·91
Walking uphill/upstairs	0·55	3·13	1·73
Playing with pets	0·52	2·91	1·51
Visiting friends or relatives	0·38	3·55	1·37
Shovelling snow	0·47	2·61	1·24
Practical problems			
Keeping surroundings dust free	0·51	3·96	2·03
Need to have medication available	0·41	4·11	1·70
Expense of medication	0·30	3·87	1·16

*Proportion of patients reporting item as troublesome (maximum = 1·0).
†Mean importance score in subjects who reported item as troublesome (maximum = 5·0).
‡Frequency × mean importance (maximum = 5·0).

For all domains except physical activities there was very little difference in the order of item overall importance for the four subgroupings of airway hyperresponsiveness, age, treatment requirements, and sex (tables 3 and 4). Although the order was similar, the scores tended to be higher in women than men ($p = 0{\cdot}0005$), in younger than older patients ($p = 0{\cdot}0001$), and in patients with more severe asthma (drug treatment, $p = 0{\cdot}11$; PC_{20}, $p = 0{\cdot}03$). There was no evidence of an association between any pair of subgroups (age, sex, and asthma severity), showing that differences in scores within one subgrouping could not be accounted for by differences in scores within another. As the order of overall importance of items determines inclusion in the final questionnaire, we were able to construct one questionnaire applicable to all adult asthmatic patients for symptoms, emotional function, exposure to environmental stimuli, and avoidance of environmental stimuli.

Asthma quality of life questionnaire (appendix)
In general, the items chosen most often and labelled most important were chosen for the questionnaire. Other criteria were adequate representation of both physical and emotional function and a minimum of four items per domain (symptoms (12 items), emotional function (five), activity limitation (11), and exposure to environmental stimuli (four)).

Physical activity limitations were identified and classified as being important by many

*Table 3 Order of overall importance of items by subgroup**

	Sex		Age (years)			PC_{20} (mg/ml)			Drugs		
	F	M	<30	30–50	>50	>2·0	0·25–1·9	<0·25	None	Bronchodilators only	Bronchodilators and inhaled steroids
Symptoms (n = 34)											
Shortness of breath	1	2	1	1	1	1	1	1	1	1	1
Chest tightness	2	1	2	2	2	2	1	2	2	1	2
Wheeze	3	4	5	3	4	3	4	3	4	5	3
Chest heaviness	4	3	3	5	4	5	3	7	5	5	4
Cough	5	7	6	7	6	4	6	11	3	5	6
Difficulty breathing out	6	5	4	6	9	8	5	4	18	3	5
Fighting for air	7	9	9	4	15	8	11	5	10	4	9
Heavy breathing	10	6	10	8	7	6	8	10	11	8	6
Difficulty getting good night's sleep	8	12	8	10	8	13	7	8	9	9	12
Emotions (n = 42)											
Afraid of not having medications	1	2	1	1	2	2	3	1	13	1	1
Concerned about medications	5	1	2	5	2	8	1	4	27	2	2
Concerned about having asthma	3	3	4	2	1	7	2	2	5	4	3
Frustrated	2	5	3	4	5	5	4	3	2	7	4
Physical activities (n = 44)											
Jogging/exercising	1	1	1	1	2	1	1	1	1	1	1
Running	3	2	3	3	1	2	2	3	3	2	3
Running uphill/upstairs	2	5	4	2	3	3	3	2	2	4	2
Playing sports	5	3	2	6	6	4	3	4	4	3	4
Walking uphill/upstairs	4	9	6	4	4	5	6	6	5	6	4
Playing with pets	8	10	5	9	15	8	4	8	6	5	8
Visiting friends or relatives	9	12	8	8	13	12	6	10	12	7	9
Environment											
Exposure (n = 10):											
Cigarette smoke	1	2	1	1	1	1	1	1	1	1	1
Dust	3	1	2	2	3	2	3	3	2	2	3
Air pollution	2	3	3	3	2	4	2	2	3	5	2
Avoidance (n = 10):											
Cigarette smoke	1	2	1	1	1	1	1	1	1	1	1
Dust	2	1	2	2	2	2	3	2	2	2	2
Air pollution	4	3	4	4	3	5	4	4	5	4	4

*Order in which patients identified items as being important by subgroups—for example, women identified shortness of breath as the most important symptom and chest tightness as the second; men identified chest tightness as the most important and shortness of breath as the second. Overall importance = frequency × mean importance: see table 2. Only the highest scoring items are shown.

patients (table 2). Although most patients identified activities associated with exercise as being troublesome, the remaining range of items was broad and few of the activities were relevant to a majority of respondents. The activity limitation domain of the questionnaire therefore includes five individualised questions. Thus at the first visit of a clinical trial patients are asked to list activities in which they are limited by asthma and which are important in their day to day lives. Twenty six activities are offered as probes to aid recall (see appendix). Patients are then asked to choose the five activities that are most important to them, and these constitute five of the 11 items of the activity domain (the other six being non-specific activities and avoidance of environmental stimuli) for each patient for the duration of the study.

Issues in item presentation include time specification, response option selection, and whether subjects should be shown their previous responses. Time specification refers to the fact that patients are asked to think about how they have been feeling over a well defined time period; we now use two weeks, but this could be modified according to the study. The crucial issue in selecting response options for an evaluative instrument (one designed to measure change over time) is ensuring item responsiveness: we chose a seven point scale to ensure that relatively fine gradations of change will be detected.[14 15] Data from previous trials suggest that validity, and possibly responsiveness, may be improved if, when seen at follow up, subjects are shown their previous responses[16 17]; the follow up version of the questionnaire is constructed to permit this.

The questionnaire is analysed directly from the scores recorded. First the mean scores for the items within each domain are calculated for each subject. The overall quality of life score may be estimated from the mean score for all the items. In clinical trials the effectiveness of two or more treatments may be compared by using the mean within subject change in score for each domain as well as for overall quality of life. Data meet the assumptions for parametric tests of inference.[18]

3 PRETESTING OF QUESTIONNAIRE

The aim of the pretesting phase was to ensure (*a*) that the final questionnaire was free from wording errors and easily understood by both the respondent and the interviewer; (*b*) that respondents understand the intended meaning of the questions; (*c*) that the complete range of

*Table 4 Mean overall importance by subgroup**

	Sex			Age				Drugs				PC_{20} (mg/ml)			
	F (n=100)	M (n=50)	p Value†	<30 (n=37)	30–50 (n=79)	>50 (n=34)	p Value†	None (n=25)	Bronchodilators (n=39)	Bronchodilators and inhaled steroids (n=86)	p Value†	>2·0 (n=58)	0·25–1·9 (n=49)	<0·25 (n=43)	p Value†
All items (n=152)	1·24	0·93	0·0005	1·36	1·10	0·98	0·0001	1·01	1·08	1·20	0·11	1·01	1·13	1·31	0·00
Symptoms (n=34)	1·52	1·29	0·08	1·75	1·38	1·27	0·019	1·27	1·44	1·50	0·44	1·31	1·43	1·65	0·09
Emotions (n=42)	0·98	0·60	0·004	1·16	0·82	0·59	0·012	0·77	0·78	0·91	0·61	0·67	0·85	1·10	0·03
Physical activities (n=44)	0·94	0·75	0·10	1·04	0·83	0·81	0·23	0·70	0·83	0·95	0·22	0·77	0·87	1·02	0·17
Environment:															
Exposure (n=10)	2·39	1·78	0·001	2·33	2·20	1·99	0·42	2·20	2·09	2·22	0·82	2·10	2·25	2·23	0·75
Avoidance (n=10)	1·86	1·39	0·017	1·62	1·75	1·66	0·82	1·71	1·58	1·75	0·76	1·68	1·72	1·70	0·98
Practical problems (n=12)	0·17	0·69	0·026	1·04	0·82	0·73	0·19	0·68	0·80	0·93	0·28	0·72	0·83	1·07	0·06

*Scores by domain for each of the subgroups of patients (overall importance = frequency × mean importance: see table 2).
†Probability of difference within subgroup by analysis of variance.

response options is used; (*e*) that the format of the questionnaire is suitable for data analysis.

A series of iterative interviews were conducted by two investigators. Each investigator completed the interviewer administered questionnaire in five patients with asthma, noting the time taken for administration and any errors or words that needed to be clarified or modified. After completing the questionnaire the patients were asked to describe what they understood by each question. The questionnaire was then modified and the process repeated in 10 further patients. Altogether, 30 patients were interviewed before the questionnaire was considered to be satisfactory.

This interviewer administered questionnaire was then modified for self administration. The self administered questionnaire was tested in five asthmatic patients who had not participated previously and who were unfamiliar with medical questionnaires. They were selected to represent patients who might have difficulty completing the questionnaire on their own because of their age or limited educational background. As the self administered questionnaire posed no problems in these five subjects, further modification was not necessary.

The interviewer administered questionnaire (including explanation, instructions, and identification of patient specific activities) took a maximum of 15 minutes and usually between five and 10 minutes. The self administered form took a similar amount of time. Patients did not have difficulty identifying individualised activities. The interviewer must ensure, however, that the patient intends to carry out the identified activities on a regular basis throughout the trial—for example, winter sports are inappropriate for a trial continuing into midsummer.

Discussion

This study identified items of impairment in the day to day lives of adult asthmatic patients that are important to the patients. These have been used to develop a quality of life questionnaire. The questionnaire should be applicable to all adults with asthma who do not have fixed airway obstruction. It has been designed to be responsive to within subject changes in quality of life during clinical trials.

Identified items might have been expected to vary among such a heterogeneous group of patients. For instance, patients with severe asthma might experience different limitations and types of impairment from those experienced by patients with milder asthma; sex and age might also be important determinants. Evaluating differences across strata of clinical asthma severity was difficult because the measurement of severity is still controversial.[19] In this study we examined impairment of quality of life in relation to airway responsiveness to methacholine[20] and treatment requirements,[21] but not spirometric variables as all subjects were required to have an FEV_1 above 70% of predicted values after taking a bronchodilator. Assessment of symptoms was also inappropriate as symptoms were well controlled at a minimum dose of drug. Our best estimate of the severity of clinical asthma (without the expense and inconvenience of daily peak flow measurements) was the minimum amount of drug required to keep symptoms under control.

For both a physiological and a clinical measure of asthma severity the items identified were similar for symptoms, emotional dysfunction, and response to environmental stimuli. This is not surprising perhaps as a reduction in airway calibre would be expected to produce the same sensations, symptoms, and emotions, irrespective of age, sex, or severity of asthma. What did vary was the absolute magnitude of the impact of asthma on daily life, as reflected in the product of the number of people experiencing problems and the importance they attached to these problems. The finding that the total burden of quality of life impairment was

greater in patients with more severe asthma is intuitively sensible. The finding that quality of life impairment was greater in younger asthmatic patients suggests the possibility of some temporal adaptation or acceptance of limitations with increasing age. The finding of greater impairment in women than men is less easily explained.

The physical activity domain was the only one to show large differences in items selected between patients. All the patients had an FEV_1 above 70% of predicted values after taking bronchodilator and in general they were leading full, active lives so their specific activities and expectations varied greatly. As activities were identified as being important, they need to be included, but it is important that the questionnaire should be applicable to all adult asthmatic patients irrespective of age, sex, climate, country, and culture. Five of the physical activities were therefore designed to be patient specific so that changes that are important to an individual patient can be estimated.

We had not recognised originally that exposure to and avoidance of environmental stimuli constituted two different types of impairment. This became apparent during the item identification interviews and led to inclusion of both in the final questionnaire. For instance, choosing not to go to a party because of cigarette smoke produces a different type of impairment of quality of life than choosing to attend the party and suffering the consequent symptoms and distress.

Weighting systems have been applied to some quality of life questionnaires. Although they take into account the relative importance of each item and domain in its contribution to overall quality of life, they have many limitations. As this questionnaire should be a responsive instrument for examining within subject change and analyses can be carried out separately for each domain, weighting is not so important. We have opted for a simple unweighted instrument to avoid the complexities of weighting.

Responsiveness and validity data for the questionnaire are not yet available. Despite this, we believe that there are several reasons why the questionnaire can be used with confidence as a measure of outcome in new clinical trials in asthma. Firstly, the way in which it was developed ensures content validity in that it is comprehensive and represents domains that are important to asthmatics themselves. Secondly, the process we have used to construct the questionnaire is well established[6 7] and has been used successfully in constructing specific questionnaires for patients with chronic airflow limitation,[11] rhinoconjunctivitis,[18] heart failure,[22] breast cancer being treated with chemotherapy,[23] and inflammatory bowel disease.[24] In each case the questionnaire proved responsive and valid in formal testing.

Full confidence in the questionnaire will have to wait assessment in various clinical trials. We hope that other investigators will include this outcome measure in their trials and report their findings from a variety of patient populations and cultures.

We thank the patients who participated in the study; Dr Paul O'Byrne for constructive advice throughout the study; Drs Freddy Hargreave, Michael Newhouse, Roger Haddon, and Peter Powles for input into the item selection phase; Mr Glen Randall for technical help; Mrs Jenny Whyte for data management; Drs Joel Singer and Bill McIlroy for statistical support; and Mrs Debbie Maddock for help in preparing the manuscript. This work was supported in part by a grant from Merck and Co. GHG is a career scientist of the Ontario Ministry of Health.

Appendix: Asthma quality of life questionnaire (interviewer)

The questionnaire includes 32 questions. Each has one of four sets of seven response options, identified by the colour of the card (see next page). First subjects are asked to identify activities in which they are limited by their asthma. If more than five activities are identified they are asked to choose the five most important. To ensure that all possible relevant items are considered subjects are presented with the following prompts:

- Bicycling
- Clearing snow off your car*
- Dancing
- Doing home maintenance
- Doing housework
- Gardening*
- Hurrying
- Jogging, exercising, or running
- Laughing
- Mopping or scrubbing the floor
- Mowing the lawn*
- Playing with pets
- Playing with children
- Playing sports
- Shovelling snow*
- Singing
- Doing regular social activities
- Having sexual intercourse
- Talking
- Running upstairs or uphill
- Vacuuming
- Visiting friends or relatives
- Going for a walk
- Walking upstairs or uphill
- Woodwork or carpentry
- Carrying out your activities at work

*Included only in studies conducted in the appropriate season.

When five activities have been identified subjects are asked about the extent to which they have been limited in each of the activities as follows:

1–5 Please indicate how much you have been limited by your asthma in (insert activity) during the last two weeks by choosing one of the following options. (Green card—see next page)

The remaining 27 questions are the same for all patients.

6 How much discomfort or distress have you felt over the last two weeks as a result of chest tightness? (Red card)

7 In general, how often during the last two weeks have you felt concerned about having asthma? (Blue card)

8 How often during the past two weeks did you feel short of breath as a result of your asthma? (Blue card)

9 How often during the past two weeks did you experience asthma symptoms as a result of being exposed to cigarette smoke? (Blue card)

10 How often during the past two weeks did you experience a wheeze in your chest? (Blue card)
11 How often during the past two weeks did you feel you had to avoid a situation or environment because of cigarette smoke? (Blue card)
12 How much discomfort or distress have you felt over the past two weeks as a result of coughing? (Red card)
13 How often during the past two weeks did you feel frustrated as a result of your asthma? (Blue card)
14 How often during the past two weeks did you experience a feeling of chest heaviness? (Blue card)
15 How often during the past two weeks did you feel concerned about the need to take medication for your asthma? (Blue card)
16 How often during the past two weeks did you feel the need to clear your throat? (Blue card)
17 How often during the past two weeks did you experience asthma symptoms as a result of being exposed to dust? (Blue card)
18 How often during the past two weeks did you experience difficulty breathing out as a result of your asthma? (Blue card)
19 How often during the past two weeks did you feel you had to avoid a situation or environment because of dust? (Blue card)
20 How often during the past two weeks did you wake up in the morning with asthma symptoms? (Blue card)
21 How often during the past two weeks did you feel afraid of not having your asthma medication available? (Blue card)
22 How often during the past two weeks were you bothered by heavy breathing? (Blue card)
23 How often during the past two weeks did you experience asthma symptoms as a result of the weather or air pollution outside? (Blue card)
24 How often during the past two weeks have you been woken at night by your asthma? (Blue card)
25 How often during the past two weeks have you had to avoid or limit going outside because of the weather or air pollution? (Blue card)
26 How often during the past two weeks did you experience asthma symptoms as a result of being exposed to strong smells or perfume? (Blue card)
27 How often during the past two weeks did you feel afraid of getting out of breath? (Blue card)
28 How often during the past two weeks did you feel you had to avoid a situation or environment because of strong smells or perfume? (Blue card)
29 How often during the past two weeks has your asthma interfered with getting a good night's sleep? (Blue card)
30 How often during the past two weeks have you had the feeling of fighting for air? (Blue card)
31 Think of the overall range of activities that you would have liked to have done during the past two weeks. How much has your range of activities been limited by your asthma? (Yellow card)
32 Overall, among all the activities that you have done during the past two weeks, how limited have you been by your asthma? (Green card)

RESPONSE OPTIONS

Green card
1 Totally limited, couldn't do activity at all
2 Extremely limited
3 Very limited
4 Moderate limitation
5 Some limitation
6 A little limitation
7 Not at all limited

Red card
1 A very great deal of discomfort or distress
2 A great deal of discomfort or distress
3 A good deal of discomfort or distress
4 A moderate amount of discomfort or distress
5 Some discomfort or distress
6 Very little discomfort or distress
7 No discomfort or distress

Blue card
1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 Hardly any of the time
7 None of the time

Yellow card
1 Severely limited—most activities not done
2 Very limited
3 Moderately limited—several activities not done
4 Slightly limited
5 Very slightly limited—very few activities not done
6 Hardly limited at all
7 Not limited at all—have done all activities that I wanted to do

DOMAINS

The items were grouped into four domains:
Activity limitations (items 1 to 5, 11, 19, 25, 28, 31, 32)
Symptoms (items 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 29, 30)
Emotional function (items 7, 13, 15, 21, 27)
Exposure to environmental stimuli (items 9, 17, 23, 26).

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