Pediatric Allergy and Immunology

EC

ORIGINAL ARTICLE Asthma

RHINASTHMA-Adolescents: a new quality of life tool for patients with respiratory allergy

Stefania La Grutta[1,2], Massimo Landi[3], Fulvio Braido[4], Laura Montalbano[1], Giuliana Ferrante[1,2], Velia Malizia[2], Omar Fassio[5], Giorgio W. Canonica[4] & Ilaria Baiardini[4]

[1]Institute of Biomedicine and Molecular Immunology, National Research Council, Palermo, Italy; [2]Department of Science for Health Promotion and Mother and Child, University of Palermo, Palermo, Italy; [3]National System of Pediatric Primary Care Asl TO 1, Turin, Italy; [4]Allergy & Respiratory Diseases Clinic – DIMI – University of Genoa, IRCCS AOU San Martino-IST, Genoa, Italy; [5]Department of Psychology, Turin University, Turin, Italy

To cite this article: La Grutta S, Landi M, Braido F, Montalbano L, Ferrante G, Malizia V, Fassio O, Canonica GW, Baiardini I. RHINASTHMA-Adolescents: a new quality of life tool for patients with respiratory allergy. *Pediatr Allergy Immunol* 2014: **25**: 450–455.

Keywords
adolescents; asthma; health-related quality of life; rhinitis

Correspondence
Ilaria Baiardini, Allergy & Respiratory Diseases Clinic – DIMI – University of Genoa, IRCCS AOU San Martino-IST,
Pad. Maragliano, Largo Rosanna Benzi 10, 16132 Genova, Italy
Tel/Fax: +390105553524
E-mail: ilaria.baiardini@libero.it

Accepted for publication 22 April 2014

DOI:10.1111/pai.12242

Abstract

Background: Specific instruments for health-related quality of life (HRQoL) assessment in adolescents with rhinoconjunctivitis or asthma are available. None of them evaluates rhinitis and asthma together, although they often coexist. Our aim was to validate a HRQoL questionnaire for adolescents with rhinoconjunctivitis, asthma, or both.
Methods: A pool of 38 items covering the main symptoms and problems related to respiratory allergy was generated based on literature review, clinical experience, and unstructured interviews to 54 adolescents. The items were randomly listed and presented to 88 consecutive outpatients (44 M; mean age 15.2 ± 3.1). Patients had to indicate which item they had experienced and, for each selected item, its importance on a four-point scale (1 = not at all; 4 = very much). Twelve items were excluded from the list, because of low importance. In the validation phase, 102 patients (54 M; mean age 15.36 ± 1.12) completed the KINDL, a generic HRQoL tool, and the new questionnaire (RHINASTHMA-Adolescents).
Results: Factor analysis revealed a five-dimensional structure, which explained up to 71.23% of the total variance. Association between RHINASTHMA-Adolescents and KINDL scores was all in the expected direction. Internal consistency for the extracted factors was satisfactory: Upper Airways (0.81), Lower Airways (0.89), Emotions (0.85), Social Relationship (0.79), Daily life management (0.74). Reliability was good for all factors with a Pearson coefficient ranged from 0.91 to 0.99.
Conclusions: RHINASTHMA-Adolescents is the first tool for evaluating HRQoL in patients with rhinitis and/or asthma. It provides a simple assessment and met the standards of validity, internal consistency, and reliability.

A critical aspect in the management of respiratory allergy is its burden on patient's health-related quality of life (HRQoL), defined as the impact of a disease and its treatment perceived by patients themselves (1). Health-related quality of life is now recognized as a crucial outcome measure in patients suffering from respiratory allergy. The use of questionnaires to evaluate HRQoL is recommended by international guidelines (2, 3), specific recommendations for patient reported outcomes assessment in rhinitis and asthma (4), and regulatory authorities (5, 6). Furthermore, the fundamental role of patient's perspectives is now underlined by the Grade of Recommendations, Assessment Development and Evaluation (GRADE) system (7), which represents the best option in defining the criteria for grading evidence and developing guidelines.

During the last years, several questionnaires were developed and validated for measuring HRQoL in patients with rhinitis or asthma, and some of these were specifically addressed for children and adolescents (8–11). However, no one permits to globally evaluate the burden of respiratory allergy when both conditions are present.

Asthma frequently coexists with rhinitis being seen in half to three quarter of children and teenagers with asthma in a range of studies (12, 13).

Patients with both rhinitis and asthma report a significant impairment of their physical health, comorbid rhinitis, and asthma resulting in an additional quality of life burden (14). This observation is in line with the hypothesis of a common pathogenic mechanism underlying rhinitis and asthma ('united airway disease'), suggesting that the assessment of HRQoL in patients with respiratory allergy should consider both upper and lower respiratory tract (15). The RHINASTHMA (15) is the only available questionnaire designed to assess HRQoL in comorbid asthma and allergic rhinitis, but it has been thought for adult patients. For this reason, it is not adapted to capture the impact of respiratory allergy in a transition phase like adolescence (16). The presence of a chronic disease in teenagers interferes with the physical, emotional, social, and cognitive changes that are typical of this age. In particular, the need of independence, the presence of intense emotions, the role of peer group should be taken into account.

The aim of our study was to develop and validate a HRQoL questionnaire for adolescents suffering from rhinitis and/or asthma. As the RHINASTHMA, the new questionnaire considers asthma and rhinitis as different aspects of the same disease, so that the patient is not asked to attribute specific symptoms or problems to asthma or rhinitis separately. The new instrument takes into account the burden of symptoms and problems experienced by adolescents with respiratory allergy. This questionnaire was intended to be (1) short, simple, and user-friendly, (2) psychometrically sound with good validity and reliability, and (3) useful both in research and clinical practice. The new questionnaire has been named RHINASTHMA-Adolescents.

Methods

The development and validation of the new questionnaire occurred in two separate phases (development procedure and validation procedure) involving different groups of patients. The method used for the two steps is described in detail below.

Patients

All adolescents recruited in the development and validation of the new questionnaire were drawn from two Italian allergy units. They suffered from respiratory allergy, ascertained through the routine diagnostic procedure. In detail, all patients underwent an interview for clinical and family history, clinical visit, and skin prick test for the common allergens (a RAST assay was also performed in selected cases). Rhinitis was clinically diagnosed, according to ARIA guidelines (3). The diagnosis of asthma was based on the presence of respiratory symptoms such as cough, chest tightness, wheezing, acute episodes of dyspnea, and the ascertainment of variable airway obstruction by chest examination and spirometry, in agreement with the GINA guidelines (2).

Development procedure

To ensure the inclusion of items appropriate and relevant for adolescents with respiratory allergy, the generation and selection of items, as well as item pretesting, were based on current guidelines (17).

Item generation

The first task was to identify all those symptoms and problems, which are perceived as relevant and troublesome by adolescent suffering from with rhinoconjunctivitis, asthma, or both. First, a pool of items was generated based on the following sources:

1 Recent literature review of the available HRQoL questionnaires and symptom score scales for rhinitis and asthma;
2 Discussion with expert allergists, pulmonologists, and pediatricians; as a result, 26 relevant items were indicated;
3 Preliminary unstructured interviews to 54 adolescents with respiratory allergy; an initial list of 30 expressions/items was recognized, maintaining, whenever possible, the patient's expressions.

A qualitative selection was performed by eliminating those items resulted redundant, ambiguous, difficult to understand, expressed in negative form.

Item selection

The resulted list of 38 items was randomly listed and administered to patients who had to indicate (i) which of the items they have experienced (the response options were yes/no); (ii) the importance of each selected item on a four-point scale (1 = not at all; 4 = very much).

Patients were also asked to indicate other possible aspects on which the respiratory allergy might impact and whatever they consider worthy to be added or changed in the questionnaire.

This first phase was carried out in a sample of 90 outpatients, consecutively seen at our department over a 6-month period. We subsequently calculated: (i) the percentage of patients who indicated each item as a consequence of their disease (frequency range: 0–100), (ii) the importance (mean value) attributed from the patient to each item indicated as a problem (range: 0–4), and (iii) the overall importance score of the item, defined as the product of the frequency and the mean importance divided by 100 (range: 0–4).

The result of this first phase generated a 28-item questionnaire where patients had to indicate, on a Likert scale with multiple options (1 = not at all, 5 = very much), how much they were been troubled by each problem. The questionnaire was then administered to a different patient population for validation.

Validation procedure

The questionnaire obtained from the first phase was tested and validated, in accordance with current guidelines, to assess the following psychometric properties:

1 Validity. It assesses whether an instrument actually measures that which it was designed to measure. Two validation analyses were designed: Factorial analysis was performed on RHINASTHMA-Adolescents scores to identify potential subscales in accordance with our hypotheses; the principal component method (Oblimin with Kaiser Normalization) was adopted. By means of Pearson correlation coefficients, we also assessed the relationship between

the new questionnaire and the KINDL, to evaluate the convergent validity. The KINDL (18, 19) is a generic quality of life instruments that consists of 24 Likert-scaled items associated with six dimensions: physical well-being, emotional well-being, self-esteem, family, friends, and school. The psychometric properties of this instrument in adolescents with chronic disorders have been well documented (20, 21)

2 Internal consistency. It measures the homogeneity of a scale. It was computed using Cronbach's correlation coefficient on the extracted factors. Measures with reliability of 0.50–0.70 or greater have been recommended for the purpose of comparing group (22).

3 Reliability. It refers to the degree to which an instrument yields stable scores over a short period of time, assuming there is no clinical change. Reliability was assessed by administering RHINASTHMA-Adolescents to 38 stable patients at baseline and after 1 week. Data were analyzed by *t*-test for paired samples as recommended in statistical literature (22).

4 Responsiveness. It measures the ability of the questionnaire to detect significant differences over time in patients whose status has changed. Responsiveness was evaluated in a group of 30 patients at baseline and after 15/21 days of treatment in accordance with ARIA and GINA guidelines and reporting diminished symptoms. The RHINASTHMA-Adolescents scores were compared by a nonparametric test (Wilcoxon)

5 Floor and ceiling effects. These measurements are performed to ensure that a score had the ability to cover the full range of severity for the considered scale and permits to identify the subjects at the extremes of the scale. Such effects were considered to be present if more than 15% of the patients in a sample of at least 50 patients achieved the lowest or highest possible scores, respectively (23).

The local ethics committee approved the study, and participating subjects gave their written informed consent.

Results

Development procedure

Of 90 patients, 88 completed the preliminary questionnaire, 47 females and 41 males; the mean age was 15.2 ± 3.1 with range of 12–18. On the basis of patients' answers, items included in the questionnaire were those that scored highest in impact. Where an arbitrary cutoff value of 1.5 was used for impact, 10 items were excluded. Table 1 summarizes the results of this first phase, indicating the items removed due to the low total importance.

Validation procedure

Of 105 patients, 102 filled in both RHINASTHMA-Adolescents and KINDL. The assessment of data missing from completed questionnaire was very small (1.94%). Filling in the questionnaire took, on the average, 6 min (and in no case, more than 8 min). Table 2 summarizes sample's demographic and clinic characteristics.

Table 1 Development procedure: results of item selection (88 patients)

Item	Frequency (%)	Mean importance	Overall Impact
Does asthma/rhinitis affect your school activities?	**44.2**	**2.1**	**0.9**
I felt nervous	58.4	3.1	1.8
I had difficulties in falling asleep	**31.2**	**1.9**	**0.6**
I had the feeling of not being able to control the symptoms	**39.8**	**2.3**	**0.9**
I felt stressed out by my parents	73.8	2.8	2.1
I had wheezing	61.5	3.1	1.9
I felt ashamed	**30.9**	**2.5**	**0.8**
I had difficulties in concentrating	53.4	3.1	1.6
I had difficulties in breathing	71.3	2.9	2.1
I realized I was not able to do everything that I wanted	68.4	3.3	2.3
I stayed at home	**21.9**	**2.3**	**0.5**
I had difficulties in doing sports	49.4	3.7	1.83
I had chest tightness	55.6	2.8	1.6
I had to avoid certain environments	44.7	3.8	1.7
I felt different from my peers	78.3	2.4	1.9
I felt uncomfortable	81.4	3.1	2.5
I was afraid of being sick	59.8	2.7	1.6
I made less than I wanted	**38.3**	**2.2**	**0.8**
It bothered me having to do medical checks	71.5	2.7	1.9
I had the cough	56.3	3.1	1.8
I slept badly	58.9	2.7	1.6
I felt sad	61.4	3.2	1.9
It bothered me having to take drugs	81.9	2.6	2.1
I had stuffy nose	68.2	3.4	2.3
I often had to clear my throat	**17.3**	**2.1**	**0.4**
I felt anxious when did not have medicines with me	49.3	3.3	1.6
I had red/watery eyes	53.4	2.9	1.6
I woke up in the night	**44.3**	**2.1**	**0.9**
I felt unlucky	**31.3**	**3.2**	**1**
It bothered me having to always have handkerchiefs in my pocket	59.2	2.7	1.6
I felt angry	66.3	2.4	1.6
I felt limited in my social life (parties, trips, relationships with friends)	73.2	2.3	1.7
I had sneezing	73.1	2.5	1.8
The medications that I take gave me annoying side effects	54.3	3.1	1.7
I had difficulty telling others that I suffer from asthma and/or rhinitis	**33.1**	**1.9**	**0.6**
I had shortness of breath	53.2	3.3	1.8
I had difficulty hearing odors	61.3	2.7	1.7
I had a runny nose	63.4	3.2	2

Boldfaces indicate low-important items (overall impact <1.5).

Table 2 Validation procedure: sample's demographic and clinical characteristics (n = 102)

Demographic characteristics	
Sex, n (%)	
Males	54 (52.9%)
Females	48 (47.1%)
Age, yrs (mean ± SD)	15.36 ± 1.12
Rhinitis	
Intermittent	39 (38.2%)
Persistent	63 (61.8%)
Asthma	
Intermittent	54 (59.2%)
Persistent	48 (47.15)
Smoking	
Smokers	12 (11.8%)
Non-smoker	90 (88.2%)

1 Validity. Factor analysis revealed a five-dimensional structure, which explained up to 71.23% of the total variance (Table 3). Eight items were excluded because they were not allocated in the extracted dimension (I had difficulties in concentrating; I had to avoid certain environments; I felt uncomfortable; I had the cough; I slept badly; I had red/watery eyes; It bothered me having to always have handkerchiefs in my pocket). This solution was deemed appropriate on the basis of eigenvalues. Association between RHINASTHMA-Adolescents and KINDL scores was all in the expected direction: as showed in Table 4, conceptually similar domains had higher correlations than conceptually unrelated domains.

2 Internal consistency. Internal consistency reliability for the extracted factors exceeded the minimum reliability standard of 0.50–0.70. In fact all the dimensions showed satisfactory Cronbach's alpha values: Upper Airways (0.81), Lower Airways (0.89), Emotions (0.85), Social Relationship (0.79), Daily life management (0.74).

3 Reliability. The RHINASTHMA-Adolescents was completed twice by 38 patients (20 males and 18 females) with a mean (SD) age of 41 (14.6) years. All factors showed a good stability: the Pearson coefficient ranged from 0.91 to 0.99.

4 Responsiveness. All RHINASTHMA–Adolescents factors showed a good responsiveness: Upper Airways ($p = 0.003$), Lower Airways, ($p = 0.01$), Emotions ($p = 0.006$), Social Relationship ($p = 0.02$), Daily life management ($p = 0.004$), testifying that the questionnaire is responsive in health changes.

5 Floor and ceiling effects. 7% and 9% of allergic patients reported the minimal (highest HRQoL) or maximal (lowest HRQoL) score in each of the domains in the questionnaire indicating minimal floor and ceiling effects.

Discussion

This psychometric testing of the RHINASTHMA-Adolescents provides evidence that the new questionnaire appropriately

Table 3 Factors identified using principal components analysis on full data set (bold 2 typeface shows the component upon which each item loaded most highly)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	Lower airways	Emotions	Social Relationship	Daily life management	Upper airways
I had difficulties in breathing	**0.903**	−0.218	0.178	0.318	0.371
I had shortness of breath	**0.851**	−0.243	0.173	0.436	0.345
I had wheezing	**0.844**	−0.262	0.375	0.080	0.445
I had chest tightness	**0.643**	−0.157	0.371	0.456	0.402
It bothered me having to do medical checks	0.371	**−0.913**	0.232	0.052	0.241
I felt nervous	0.046	**−0.853**	0.251	0.149	0.255
I felt angry	0.415	**−0.697**	0.336	0.086	0.325
It bothered me having to take drugs	0.059	**−0.634**	0.352	0.212	0.339
I felt different from my peers	0.165	−0.261	**0.822**	0.221	0.285
I felt limited in my social life (parties, trips, relationships with friends)	0.287	−0.171	**0.703**	0.279	0.189
The medications that I take gave me annoying side effects	0.235	−0.258	**0.653**	−0.019	0.340
I was afraid of being sick	0.025	−0.212	**0.652**	0.088	0.318
I felt sad	0.179	−0.192	0.296	**0.776**	0.157
I felt stressed out by my parents	0.338	−0.444	0.147	**0.659**	0.216
I had difficulties in doing sports	0.344	0.027	0.171	**0.602**	0.238
I realized I was not able to do everything that I wanted	0.497	−0.145	0.275	**0.553**	0.406
I had stuffy nose	0.397	−0.256	0.205	0.313	**0.804**
I had a runny nose	0.267	−0.284	0.348	0.302	**0.769**
I had sneezing	0.243	−0.293	0.317	−0.181	**0.708**
I had difficulty hearing odors	0.393	−0.078	0.436	0.071	**0.623**

Table 4 Correlation (r) of the RHINASTHMA-Adolescents with KINDL

	RHINASTHMA-Adolescents				
	Lower airways	Emotions	Social Relationship	Daily life management	Upper airways
KINDL					
Physical_well_being	−0.369(**)	−0.013	−0.059	−0.169	−0.238(*)
Emotional_well_being	−0.127	−0.323(**)	−0.091	−0.350(**)	−0.248(*)
Self_esteem	−0.012	−0.057	−0.211(*)	−0.008	−0.138
Family	−0.218(*)	−0.500(**)	−0.145	−0.301(**)	−0.131
Friends	0.108	0.092	0.013	−0.166	0.059
School	0.173	0.048	0.186	0.020	0.401(**)

*Significant at p = 0.05 and **p = 0.01, respectively.

explores HRQoL in adolescents suffering from respiratory allergy. As described in the development procedure, it includes items that have been chosen directly by the patients and are consequently relevant to them. Furthermore, the validation process shows that the questionnaire met the standards for validity, internal consistency, and reliability. The RHINASTHMA-Adolescents is a 20-item tool that is simple, easy to administer, and requires a few minutes to complete without any assistance. These psychometric characteristics make the RHINASTHMA-Adolescents useful to evaluate the specific burden of rhinitis and/or asthma on HRQoL.

The global care of patients includes clinical and instrumental parameters together with the evaluation of their HRQoL. This is especially significant in patients suffering from chronic diseases. In fact, the presence of a chronic condition results in physical, emotional, and relational problems that may impact patient's HRQoL as well as their caregivers (23). For this reason, it is particularly important to achieve a subjective description of the impact of the disease on patient's everyday life (4). It is well known that more than 50% of subjects with rhinitis also suffer from asthma and almost 90% of asthmatic patients also have allergic rhinitis (24, 25). In addition, the finding of 20% of RC prevalence (17.9% as a single condition and 2.1% in association with current asthma) was found in an epidemiologic survey on adolescents living in Southern Italy (26). Patients with both rhinitis and asthma report a significant impairment of their physical health, comorbid rhinitis, and asthma resulting in an additional quality of life burden (14). This observation is in line with the hypothesis of a common pathogenic mechanism underlying rhinitis and asthma ('united airway disease'), suggesting that the assessment of HRQoL in patients with respiratory allergy should consider both upper and lower respiratory tract. However, during past years, asthma and rhinitis were considered as distinct diseases, and their impact on quality of life has been studied by specific questionnaires addressed to one disease or the other (15).

At present, only a questionnaire, the RHINASTHMA, developed in Italian, permits to obtain an evaluation of the overall impact of these diseases on HRQoL. This tool has been validated for adults. For this reason, we developed a new questionnaire, specifically addressed to adolescents, suitable for patients suffering from respiratory allergy, independent of their disease (rhinitis or asthma) (15).

The validation of a questionnaire is an iterative process, and this study may be considered the first phase of that process. Further work is planned on the relationship of the RHINASTHMA-Adolescents to other clinical features (i.e., disease severity, atopy degree, anxiety, depression) and psychologic characteristics (coping ability, alexithymia).

The use of questionnaires to assess HRQoL is today recommended by international guidelines (2, 3) and regulatory authorities for the evaluation of new drugs (5, 6). Furthermore, the fundamental role of patient's perspectives is underlined by the GRADE system (7), which represents the best option in defining the criteria for grading evidence and developing guidelines. The RHINASTHMA-Adolescents questionnaire is able to discriminate the disease severity level, it is sensitive for individual changes, and it is simple to administer, giving an immediate idea of the burden of the disease in patient's everyday life (23). In this context, the RHINASTHMA-Adolescents could be useful as in clinical trial as in routine medical practice to better manage respiratory allergy in adolescents.

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