

Validation of an Asthma Knowledge Questionnaire for Use With Parents or Guardians of Children With Asthma

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OBJECTIVE: Interventions to increase asthma knowledge enable children and/or their parents to acquire skills needed for the prevention and/or appropriate management of crises. Periods of illness caused by the disease can thereby be reduced. However, no validated instrument for quantifying knowledge of asthma is available in Spanish. The aim of the present study was to develop and validate an asthma knowledge questionnaire that could be self-administered by parents and/or persons charged with caring for asthmatic children.

MATERIAL AND METHODS: The 17 items that make up the questionnaire were obtained on the basis of a review of the literature, focus group discussions, the professional experience of the researchers, and pilot studies. We evaluated the instrument's face, content, and concurrent validity and analyzed its factorial structure. The test-retest reliability of the questionnaire and its sensitivity to change were also assessed.

RESULTS: A total of 120 pediatric patients with a mean (SD) age of 4.5 (3.7) years participated. Factor analysis demonstrated a probable structure of 3 factors that together explained 85% of the total variance in results. The opinion of an interdisciplinary group of experts on asthma confirmed the face validity of the instrument. The questionnaire's ability to distinguish between parents with high and low asthma knowledge demonstrated its concurrent validity. Test-retest reliability was demonstrated, as was sensitivity to change between 2 different testing moments.

CONCLUSIONS: The asthma knowledge questionnaire developed is useful and reliable for quantifying the baseline level of asthma knowledge of parents of asthmatic children as well as to assess the efficacy of an educational intervention aiming to increase knowledge and understanding of the disease.

Key words: *Asthma. Asthma knowledge. Questionnaire. Validation.*

Validación de un cuestionario de conocimientos acerca del asma entre padres o tutores de niños asmáticos

OBJETIVO: Una intervención educativa destinada a aumentar el conocimiento acerca del asma permite a los niños y/o sus padres adquirir habilidades que les permitan prevenir y/o manejar adecuadamente las crisis asmáticas, disminuyendo la morbilidad producida por la enfermedad. Sin embargo, en nuestro medio no contamos con un instrumento validado que nos permita cuantificar el nivel de conocimiento de asma. El objetivo del presente estudio ha sido desarrollar y validar un cuestionario de conocimientos acerca del asma para ser cumplimentado por los padres y/o personas encargadas del cuidado de pacientes pediátricos asmáticos.

MATERIAL Y MÉTODOS: Los 17 ítems que conforman el cuestionario se obtuvieron de la revisión de la bibliografía, la realización de grupos focales, la experiencia profesional de los investigadores y la realización de pruebas piloto. Se evaluó la validez de apariencia, de contenido y de criterio concurrente del instrumento; asimismo se determinaron la estructura factorial, la fiabilidad test-retest y la sensibilidad al cambio del cuestionario.

RESULTADOS: Se incluyó a 120 pacientes pediátricos con una edad promedio (\pm desviación estándar) de 4,5 \pm 3,7 años. El análisis factorial demostró una estructura probable de 3 factores, que en conjunto explican el 85% de la varianza total de los resultados. La validez de apariencia y de contenido se basó en el concepto de un grupo multidisciplinario de expertos en el tema. La validez de criterio concurrente se demostró mediante la habilidad del cuestionario para distinguir a los padres con alto y con bajo conocimiento acerca del asma. Se demostraron además una adecuada fiabilidad test-retest y una adecuada sensibilidad al cambio al comparar la puntuación del cuestionario administrado en 2 ocasiones distintas.

CONCLUSIONES: El cuestionario de conocimientos de asma desarrollado en el estudio es una herramienta útil y fiable para cuantificar el nivel basal de conocimiento acerca del asma en padres de niños asmáticos, así como para determinar la eficacia de una intervención educativa destinada a aumentar el conocimiento y la comprensión de la enfermedad.

Palabras clave: *Asma. Conocimiento en asma. Cuestionario. Validación.*

Introduction

Children and/or their parents need a basic understanding of the pathophysiology of asthma and its treatment if they are to acquire the skills to manage the

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disease independently—for such understanding has been associated with better disease control.¹⁻³ This is the case because the main factors implicated in illness due to asthma,⁴ namely underlying treatment with anti-inflammatory drugs, overconfidence in the use of bronchodilators, and delay in seeking medical help during an asthmatic crisis, can in fact be modified if disease awareness is raised. For this reason, increasing knowledge is a common objective of educational programs for asthma self management.⁵

An educational intervention that seeks to increase knowledge of asthma should allow children and/or their parents to understand the nature of the disease and the factors that can cause an attack. It should also provide information on adequate monitoring of disease status, on medications and on how they should be used in case a crisis develops. This is to say, it must promote the acquisition of skills that let children and/or parents prevent or adequately manage an asthma attack.^{6,7}

However, a validated, reliable instrument that is sensitive to change in knowledge of asthma is needed before such change can be attributed to an educational intervention rather than be considered an artifact of measurement error.⁸ In spite of the importance of having an instrument with the aforementioned psychometric properties, none has been available for our Spanish language clinical setting.

The aim of this study was to develop and validate such questionnaire an asthma knowledge to be self-administered by parents and/or guardians of pediatric patients with asthma.

Material and Methods

Questionnaire

Items on the questionnaire developed for this study were derived from 3 sources: the literature,⁹⁻¹³ responses and comments made by parents of asthmatic children during focus groups, and the professional experience of the researchers. Face and content validity were assessed by an interdisciplinary group with extensive experience in treating asthmatic children: 4 pediatric pneumologists, a physical therapist, a nurse supervisor, and a clinical psychologist. Each member of the team was asked to evaluate the questionnaire by assigning to each item a number from 0 to 2, 0 indicating the item had no importance and 2 indicating it had great importance and needed to be kept on the final instrument. Later, each item's average score was calculated and items were ranked. Those with the lowest scores were considered candidates for removal.

Next the questionnaire was piloted in 4 groups of parents of asthmatic children. Each group consisted of the parents of 10 to 15 asthmatic children; the population was a convenience sample enrolled sequentially in a single facility where the study was carried out so that subjects would have a similar educational and cultural level. The pilot studies evaluated item comprehension and ambiguity, the presence of questions with affective loading, response frequency, range of

responses, and time needed to complete the questionnaire.^{8,14} Items with responses in a certain direction more than 95% of the time were considered candidates for removal. Items were added, modified, or removed based on information collected until the final questionnaire had the 17 items shown in Table 1. The parents responded to each item on a Likert-type scale of 5 points with answers ranging from "strongly disagree" to "strongly agree." Responses to each item were thus graded from 1 to 5 and greater weight was assigned to correct answers. That is, if a true statement obtained a correct response of "strongly agree," a score of 5 was assigned. Scoring gradually decreased until a score of 1 was reached when that item received a response of "strongly disagree." In the same way, if an affirmation that was false received a response of "strongly disagree" a score of 5 was assigned. Scoring gradually decreased until only 1 point was given for a response of "strongly agree." Item scores were then added for a total score ranging from 17 to 85, with higher scores indicating greater knowledge of asthma.

Data recorded in addition to asthma knowledge were age, sex, time since diagnosis, and parents' educational level.

TABLE 1
Asthma Knowledge Questionnaire

1. Inhaler use can lead to dependence or addiction.
2. Inhalers can have an affect on the heart or damage it.
3. It's not good for children to use the inhaler for too long.
4. After a child's asthma attack, once the coughing is over, use of the inhaler and medications should stop.
5. Children with asthma should use asthma medications only when they have symptoms (coughing, congestion, or wheezing).
6. It's better to use inhalers directly, without a holding chamber, so the medication can go more directly to the lungs.
7. The main cause of asthma is airway inflammation.
8. Parents should ask a doctor to tell the school that an asthmatic child shouldn't exercise or participate in physical education classes.
9. Children who have asthma shouldn't participate in sports that make them run too much.
10. When a child has an asthma attack it's best to go to the emergency room even if symptoms are mild.
11. Asthma attacks can be prevented if medications are taken even when there are no symptoms—between attacks.
12. Flu infections are the main causes or triggers of asthma attacks.
13. It's best not to smoke or let anyone else smoke near a child who has asthma.
14. If the parents of a child with asthma smoke outside the house, it won't affect the child.
15. If an asthmatic child gets the flu, you should apply the inhalers even if there's no coughing or wheezing.
16. Asthmatic children might have attacks that are severe enough to require hospitalization in an intensive care unit or they might even die from an attack.
17. Some medications for asthma don't work unless they're administered every day.

Patients

The questionnaire was completed by 120 parents, 66 of whom were classified as having a high level of asthma knowledge and 54 of whom had a low level of knowledge. Parents in the high level knowledge group were a convenience sample selected consecutively from among parents of asthmatic children scheduled to undergo an educational program. The program included both individual and group sessions. The high knowledge parent sample completed the questionnaire again after attending all educational sessions. A second consecutively formed convenience sample of parents with less knowledge of asthma was formed. Individuals in this sample had brought their children for treatment of a nonrespiratory complaint, were not themselves asthmatics, had no children or close relatives with asthma, and were not in close association with the disease or its management.

Twenty parents selected randomly from the high-knowledge group also completed the questionnaire a second time 10 to 15 days after the first responses, but before educational sessions started, to allow assessment of test-retest reliability.

To assess sensitivity to change, the questionnaire was completed by 20 selected randomly from the high-knowledge group of 66 parents. Those parents completed the questionnaire upon starting the asthma education program and upon completion of all sessions.

Statistical Analysis

The SPSS statistical package, version 10.0 (Chicago, Illinois, USA) and Stata version 7.0 (Stata Corporation, College Station, Texas, USA) were used to analyze the data.

Analysis of covariance (ANCOVA) was used to compare the scores of parents with high and low levels of knowledge, controlling for the effect of sociodemographic variables that were considered possibly related to asthma knowledge. Test-retest reliability was assessed with a Wilcoxon *t* test and Lin's correlation coefficient for measuring agreement.¹⁵ To determine whether the instrument presented a one-dimensional or multidimensional structure, a factor analysis of the principal components, with orthogonal rotation, was carried out. Internal consistency was reflected by Cronbach's α coefficient.¹⁶ Sensitivity to change was determined by using a Student *t* test for paired data or a Wilcoxon *t* test, as appropriate, to compare scores on the questionnaire before and after the educational intervention designed to increase knowledge and skills in relation to asthma. To calculate the number of patients needed to determine test-retest reliability and sensitivity to change, a sample size calculation was carried out.^{17,18} A sample size of 20 was deemed necessary to show a clinically important mean difference of 0.4 points between the 2 groups using a repeated measures design with a level of significance of .05 and power of 80%.

Results

Four (3.2%) of the 124 patients originally enrolled were excluded because they did not answer all questions in spite of instructions to do so. The subjects took from 4 to 7 minutes to complete the questionnaire.

TABLE 2
Patient Characteristics

Variable	No. of Patients, %
Age, months	
<24	38 (31.6)
24-36	29 (24.2)
>36	53 (44.2)
Sex	
Male	64 (53.3)
Female	56 (46.7)
Time since diagnosis of asthma, months	
<12	27 (40.9)
12-24	13 (19.6)
>24	26 (39.3)
Mother's educational level	
Secondary school	17 (14.2)
University	103 (85.8)
Father's educational level	
Secondary school	15 (12.5)
University	105 (87.5)

TABLE 3
Factor Analysis to Explore Probable Domains of Items in the Asthma Knowledge Questionnaire*

Items	Factor I	Factor II	Factor III
1	0.71		
2	0.76		
3	0.68		
4	0.53		
5	0.56		
6	0.40		
7		0.45	
8			0.86
9			0.79
10	0.52		
11		0.67	
12		0.60	
13			0.35
14			0.24
15		0.41	
16		0.29	
17		0.25	

*Factor I indicates myths and beliefs; factor II, knowledge; factor III, associated aspects. The 3 factors that are probably present among the items together explain 85% of the total variance in the results.

The mean (SD) age of the asthmatic patients was 4.5 (3.7) years. Sixty-four (53.3%) of the patients were males and 56 (46.7%) were female. The characteristics of patients and their parents are shown in Table 2.

The Kaiser-Meyer-Olkin test and the Bartlett test of sphericity showed that the data set met the criteria required for factor analysis. Three potential factors that explained 85% of the variance were identified. A fourth factor which, when considered along with the other three, explained 97% of the variance could not be retained in the model according to Kaiser's criterion because its own value reached 0.87. After rotation, the first factor included items related to myths and beliefs about the management of asthma, a second included items related to disease knowledge, and a third

comprised items related to other aspects of asthma such as physical activity and smoking (Table 3).

As expected, the parents with high knowledge of asthma had significantly higher mean total and factor scores than those with low knowledge. High knowledge parents had a significantly higher mean score for the first factor (myths and beliefs about asthma) than did the low knowledge parents (32.1 [2.8] vs 23.2 [4.3], respectively; $P<.001$). The pattern for the other factors was similar. The scores for high and low knowledge groups, respectively, were 23.7 (3.1) vs 19.1 (3.9) for the second factor (asthma knowledge) and 16.4 (2.4) vs 14.7 (2.7) for the third factor (other aspects such as physical activity and smoking) ($P<.001$ in both cases). The total scores for the 2 groups were 72.1 (4.3) and 57.9 (5.9), respectively ($P<.001$). The differences in the mean scores continued to be significant at the same level even after ANCOVA to control for the effect of sociodemographic variables suspected of influencing level of disease knowledge, such as patient age, time since diagnosis of the disease, and parents' level of education.

The difference between the mean scores of high knowledge parents before and after the 10- to 15-day interval but before educational sessions started was not statistically significant (59.6 [5.7] at the first testing and 58.9 [5.5] the second time; $P=.43$). Lin's correlation coefficients of agreement for the scores on each of the questionnaire's domains between the first and second times ranged from 0.88 to 0.94; for total score the coefficient was 0.92.

Cronbach's α was 0.73 for the questionnaire as a whole. For the individual domains this statistic ranged from 0.60 to 0.77.

Sensitivity to change was assessed by comparing the domain and total scores of 20 patients within 1 month of completion of all educational sessions designed to increase asthma-related knowledge and improve management skills. The mean score for the myths and beliefs domain was significantly higher after the educational intervention (32.0 [3.2] after education vs 23.1 (4.1) before the sessions started; $P<.001$). Likewise, the total and knowledge domain scores were higher after education. The mean total score was 57.3 (5.7) before the intervention and 68.9 (4.5) afterwards ($P=.001$). The asthma knowledge domain scores were 18.7 (3.8) before the sessions and 20.9 (2.9) afterwards, respectively ($P=.001$). The mean score for other asthma-related aspects such as physical activity and smoking, on the other hand, did not change significantly. The mean scores for that domain at the 2 testing times were 15.9 (2.6) and 15.5 (2.6) ($P=.16$).

Discussion

Insufficient knowledge of asthma has been associated with inadequate disease management and a consequent

increase of morbidity.¹⁹ The last 20 years have seen the development and implementation of various asthma education programs for pediatric patients and their parents or guardians. Assessment of such programs has shown that they can effectively increase the level of disease understanding for patients and parents and lead to significant improvement in several clinical variables, among them lung function, sense of self control, school absenteeism, number of days of restricted activity, and number of emergency department visits.²⁰⁻²³ For this reason, the evaluation and promotion of asthma knowledge plays a key role in the management of pediatric patients with asthma.¹⁰

The questionnaire developed in this study proved to be a valid instrument for measuring level of asthma knowledge. The face and content validity was assessed by systematic evaluation of each item by a interdisciplinary group of professionals with broad experience of the disease. Concurrent criterion validity was demonstrated by the questionnaire's ability to distinguish between parents with high and low knowledge of the disease. Because differences in the total score on the questionnaire and the score for each domain might be due to factors other than different degrees of asthma knowledge, we analyzed differences in the total scores and the domain scores of parents with high or low knowledge after controlling for the effect of sociodemographic variables we thought might influence knowledge. Examples were patient age, time since diagnosis of the disease, and parents' educational level. The differences in scores for each of the domains that made up the questionnaire remained significant after controlling for these variables, reinforcing the concept that differences were indeed due to change in the level of disease knowledge. These findings demonstrated the concurrent criterion validity of the instrument.

The stability of the instrument, meaning its ability to measure level of asthma knowledge over time was demonstrated by adequate test-retest reliability. Specifically, no significant differences between the mean scores on questionnaires filled out after a 10 to 15 day interval were found and Lin's correlation coefficient of agreement was 0.92. Likewise, the instrument's ability to detect change in knowledge—in other words its sensitivity—was demonstrated by significant differences on each of the domains in scores before and after the educational intervention to increase asthma knowledge. It should be considered that most patients enrolled had been previously diagnosed with asthma and that they had therefore received information about the disease in the usual course of medical treatment. However, that information had not been provided in a systematic way following protocol, whereas the educational intervention was systematically structured. The lack of significant differences before and after education with regard to

the domain described as other asthma-related aspects, such as physical activity and smoking, may be attributable to the fact that relevant information has already been provided so that people in the community in general are already aware of the toxic effects of smoking without regard to the educational intervention as a source of information. Such prior knowledge would make it necessary to have a larger sample to demonstrate score differences before and after education on that domain. One option would be to eliminate those items from the questionnaire; however, we chose to preserve them given the importance of preventing smoking in effecting a decrease in morbidity due to asthma in pediatric patients.^{24,25}

Factor analysis showed that asthma knowledge is a multidimensional concept rather than a single-dimensional one. Our findings are similar to those of Ho et al,¹⁰ who developed an instrument containing 25 items to be completed by the parents of asthmatic children. That questionnaire also displayed a multidimensional structure. Likewise, Allen and Jones⁵ found that the asthma knowledge questionnaire they developed for adults had such a structure, although they attributed the lack of interpretability of its domains to the small number of subjects in their study. Because we found our questionnaire had a multidimensional structure, we decided to measure its psychometric properties with regard to its distinct domains as well as in its totality.

The main limitation of the present study was that the population was composed of a group of parents referred to an asthma education program, such that it is likely that their children had more severe asthma and thus they might have already had higher levels of knowledge of the disease than is the case for the general population. Moreover, because the study was performed with users of a prepaid private medical insurance plan, most had a high socioeconomic level, also evidenced by the fact that the majority had attended university. These traits could place limits on the generalization of the results to other populations with different characteristics, as they might have made it easier for the parents to respond to the questionnaire. For this reason, should the instrument be used in populations that are different from the one we studied, it would be important to re-analyze its psychometric properties and the ease with which the questionnaire is completed. Another limitation is the likelihood that we did not include all dimensions pertinent to the construct. However, as the questionnaire is intended to be filled in by the parents of asthmatic children, emphasis was placed on items or domains related to aspects of the disease that might possibly increase morbidity.

In conclusion, given the demonstrated psychometric properties demonstrated in this study, we consider that the questionnaire is a useful and reliable tool for

quantifying the baseline level of asthma knowledge of parents of asthmatic children and to determine the efficacy of an educational intervention intended to increase knowledge and understanding of the disease. If it were to be used in populations different from our study population, it would be important to analyze its psychometric properties in those populations and verify the ease with which the parents completed the questionnaire.

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