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Original Article

Validation of a Questionnaire in Spanish on Asthma Knowledge in Teachers☆

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ABSTRACT

Objective: To evaluate the reliability and validity of the Spanish version of the Newcastle Asthma Knowledge Questionnaire (NAKQ) for determining asthma knowledge in teachers.
Methods: Design and sample: A cross-sectional observational study in educational centers of A Coruña providing preschool, primary school and/or compulsory secondary education. Centers were selected by random sampling, stratified by ownership and educational level (24 centers, 864 teachers). A total of 537 (62.1%) teachers responded (precision, ±4%, confidence, 95%).
Measurements: Age, sex, academic training, teaching experience, personal/family history of asthma, NAKQ.
Analysis: Evaluation of internal consistency (Cronbach's alpha). Concurrent validity was determined by comparing scores of asthmatic teachers or with asthmatic relatives with teachers with no contact with asthma. Test–retest reliability was evaluated in 2 randomly selected centers by the kappa index, Bland–Altman method and intraclass correlation coefficient.
Results: Mean score on the NAKQ was 15.7 ± 5.3 (median 17), correctly answering 50.6% of items.

Cronbach's alpha coefficient was 0.824 (95% CI: 0.802–0.845). NAKQ score was higher in asthmatic teachers or with close asthmatic relatives (17.7 ± 3.3) than in teachers with distant asthmatic relatives (16.1 ± 5.4) and teachers without close contact with asthma (15.1 ± 5.6; *P*<.001).

In the test–retest analysis (kappa 0.33–1), there were no differences in NAKQ score between the first and second completion (mean difference, 0.3 ± 2.3; intraclass correlation coefficient, 0.863).
Conclusions: Scores obtained with the Spanish version of the NAKQ in teachers of Spanish school centers are reliable and valid to measure their degree of asthma knowledge.
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Validación de un cuestionario en castellano sobre conocimientos de asma en profesores

Palabras clave:
Asma
Profesorado
Cuestionario

RESUMEN

Objetivo: Evaluar la fiabilidad y la validez de la versión en castellano del cuestionario *NewCastle Asthma Knowledge Questionnaire* (NAKQ) para la determinación de conocimientos sobre asma en profesores.
Métodos: Diseño y muestra: estudio observacional, transversal, en centros educativos de A Coruña con segundo ciclo de educación infantil, primaria y/o secundaria obligatoria. Los centros se seleccionaron mediante muestreo aleatorizado, estratificado según titularidad y nivel educativo (24 centros, 864 profesores). Contestaron 537 (62,1%) docentes (precisión, ± 4%, seguridad, 95%).
Mediciones: Edad, sexo, formación académica, experiencia docente, antecedentes personales/familiares de asma, cuestionario NAKQ.

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Análisis: Evaluación de consistencia interna (alfa de Cronbach). La validez concurrente se determinó comparando la puntuación en docentes asmáticos o con familiares asmáticos y docentes sin contacto con el asma. Se evaluó la fiabilidad test-retest en 2 centros seleccionados aleatoriamente, mediante índice Kappa, metodología de Bland–Altman y el coeficiente de correlación intraclase.

Resultados: La puntuación media del cuestionario NAKQ fue 15,7 ± 5,3 (mediana 17), contestando correctamente el 50,6% de ítems.

El coeficiente alfa de Cronbach fue 0,824 (IC 95%: 0,802–0,845). La puntuación NAKQ fue mayor en asmáticos o con familiares próximos asmáticos (17,7 ± 3,3) que en docentes con familiares lejanos asmáticos (16,1 ± 5,4) y docentes sin contacto próximo con el asma (15,1 ± 5,6; $P < 0{,}001$).

En el análisis test-retest (Kappa 0,33 a 1) no hubo diferencias entre la puntuación NAKQ en la primera y la segunda cumplimentación (diferencia media, 0,3 ± 2,3; coeficiente de correlación intraclase, 0,863).

Conclusiones: Las puntuaciones obtenidas con la versión española del NAKQ en profesores de centros escolares españoles son fiables y válidas para medir su grado de conocimiento de asma.

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Introduction

Asthma is the most common chronic childhood disease in developed countries.[1] In Spain, between 7.1% and 18.8% of children present the most typical characteristics of the disease.[2,3] Most treatment-compliant patients are well-controlled, thanks to diagnostic and therapeutic advances, but good control is not achieved in up to 70% of childhood sufferers.[4]

Expert consensus papers agree that treatment education must form part of disease management, and emphasize it as an essential component for improving a patient's condition. Knowledge of the different aspects of the disease is a determinant factor in patient progress. For children and adolescents, this education must extend to family members, teachers and any adult responsible for the care or supervision of a young asthma patient.[5–8]

Teachers' knowledge of asthma must be assessed in order to determine the need for educational activities, and to design their content and evaluate their efficacy. Children and adolescents spend long hours at school, under the supervision of their teachers. Thus, it is of interest to evaluate the knowledge of asthma among these professionals, to determine if training and/or informative sessions are required and what the content should be.[9]

Epidemiological studies in asthma knowledge can only be performed using a tool that is reliable and feasible from both an organizational and an economic point of view. Self-administered questionnaires, that are easy and inexpensive to complete, are useful, but they must be validated in a typical study population.

Before this study, only 3 papers evaluating teachers' knowledge of asthma had been published. All 3 used self-administered questionnaires, but no data about validation techniques were provided.[10–12] To date, no data on the validation of any questionnaire in Spanish on the knowledge of teachers in this area have been published.

The Newcastle Asthma Knowledge Questionnaire (NAKQ) for the evaluation of asthma knowledge was created and validated in English in 1990.[13] It was subsequently used in the original language[14–18] and in Spanish[19] in different populations (primarily parents,[13,15] educators,[14] students[14,18,19] and healthcare personnel[17]). In 2008, Praena Crespo et al.[20] made a transcultural adaptation of the questionnaire to Spanish, and analyzed its validity and reliability in a population of parents of asthma patients. Hence, the NAKQ questionnaire has been widely used, and 2 studies have been published confirming its reliability and validity: the original in English[13] and the Spanish adaptation,[20] both performed in parents of asthmatics. However, reliability and validity are not intrinsic properties of questionnaires; their value depends more on their use in specific populations,[21] so they must be verified in each study population.

The aim of our study was to determine the reliability of scores from the Spanish version of the NAKQ in a population of teachers, and its validity for quantifying knowledge of asthma among teachers in Spanish schools.

Materials and Methods

This was an observational, cross-sectional, descriptive study using a self-administered questionnaire on asthma knowledge completed by teachers in the region of A Coruña (Spain) between June and April 2009. This region comprises 9 municipal areas (Abegondo, Arteixo, Bergondo, Cambre, Carral, A Coruña, Culleredo, Oleiros and Sada) and covers an area of 470.7 km^2 with 384 616 inhabitants.

Two-stage cluster sampling was performed. Participating schools were selected by proportional, stratified, randomized sampling, according to whether they were public or private and their educational level (public primary schools, public secondary schools or private centers). In each school, all teachers actively imparting any type of classes in the 2008–2009 school year, at any level of preschool, primary or compulsory secondary education were included. Teachers working exclusively in post-compulsory secondary education were not included.

In the 2008–2009 school year, 4089 teachers were actively employed in the area in 96 schools (46 public primary schools, 25 public secondary schools and 25 private schools) (data from the Education Department of the Regional Administration of Galicia). It was estimated that 873 teachers would need to be included (precision, ±4%; confidence, 95%), and a response rate of 60% was expected. On the basis of the mean number of teachers, 22 schools were included, stratified by public/private status and educational level (10 public primary schools, 6 public secondary schools and 6 private schools). A reserve list of randomly selected schools was generated in case any of the initially selected schools refused to participate.

The study was performed with the approval of the Clinical Research Ethics Committee of Galicia (approval number 2009/016) and the Education Department of the Regional Administration of Galicia, which sent a letter to the selected schools informing them of the study objectives. The board of each school was then contacted, the project was explained, and they were invited to participate.

Each teacher received a letter informing them of the study objectives and requesting their consent to participate. Pursuant to the Data Protection Act 15/1999, data confidentiality was guaranteed at all times.

The NAKQ[20] was used to determine teachers' knowledge of asthma. This questionnaire consists of 31 items: 25 are true/false questions and 6 have open answers. Correct responses score 1 and incorrect 0. Open answers were interpreted in the same way as the original version,[13] as adapted by Praena Crespo et al.[20] Total score is obtained by adding the score of the 31 items:

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the higher the score, the greater the knowledge of the disease.

Each teacher recorded their age, sex, academic training (diplomas/degrees), time of teaching experience and levels taught. All participants were asked if they or anyone in their immediate setting had asthma (spouse/partner, children, parents, siblings, other family members or close friends). They were also asked if they felt their knowledge of asthma was sufficient.

Statistical Analysis

Statistical analysis was conducted using the SPSS 18.0 software package and other mathematical methods, as indicated below, when the required calculations were not included in this program. The percentage of participants with the maximum score (ceiling effect) and the percentage with the poorest score (floor effect) in the NAKQ questionnaire were calculated.

Reliability was evaluated in terms of internal consistency and test–retest reliability. Internal consistency was evaluated using Cronbach's alpha and the confidence interval was determined according to the Fan and Thompson method,[22] and compared with other estimates described by Viladrich and Doval.[21] To evaluate test–retest reliability, teachers from 2 randomly selected schools (1 public primary school and 1 private school) completed the questionnaire on 2 occasions, 15 days apart. Concordance of the responses to each question was analyzed using the kappa index. Bland–Altman and intraclass correlation coefficient were used to analyze concordance in the total questionnaire score.

To evaluate concurrent validity, the NAKQ scores and each teacher's self-assessment of their knowledge of the disease (sufficient vs insufficient) and their direct contact with asthma (asthmatic teachers or those with asthmatics among their close contacts with teachers vs no direct contact with the disease). NAKQ score was studied according to age, sex, teaching experience, academic training and educational level in which they were working. Mann–Whitney, Kruskall–Wallis and Spearman's rho were used.

Sensitivity to change was evaluated in a study of a random sample of teachers from schools in San Sebastian, selected using the same methodology.[23] This was a quasi-experimental before-and-after study, with a control group, that compared NAKQ scores before and after educational intervention. The Wilcoxon-signed rank test was used to compare the questionnaire scores, the McNemar test to compare the percentage of items answered correctly, and the Mann–Whitney *U*-test to compare baseline score and score at 3 months between the intervention group and the control group. Effect size and mean standardized response were studied to evaluate any increase in questionnaire score after intervention.

All tests were 2-tailed and $P<.5$ was considered significant.

Results

Of the 22 selected schools, 3 refused to participate, so these were replaced with schools from the reserve list. In the end, 24 schools (10 public primary education, 6 public secondary education and 8 private) were included, and 864 teachers who met the inclusion criteria participated.

The percentage of participation was 62.1%, and 537 participants returned the completed questionnaire (56.8% from public primary education, 62.1% from public secondary education and 67.2% from private schools). Characteristics of the participants are shown in Table 1.

Mean score on the NAKQ questionnaire was 15.7 ± 5.3 (median, 17.0) (Fig. 1). The floor and ceiling effect percentages were 2.0% (score =0) and 0% (score =31). On average, 50.6% of participants answered the items correctly. The percentage of correct results for each item ranged from 89.6% to 1.10% (Online Appendix: Table 1).

Table 1
General Characteristics of Teachers Participating in the Study.

	n	Mean (SD)	Median (range)
Age	472	43.9 (10.0)	44 (22–67)
Years of teaching experience	492	17.9 (10.9)	18 (0–48)
NAKQ score	537	15.7 (5.3)	17 (0–25)
	n	%	95% CI
Sex			
Men	136/526	25.9	22.0–29.7
Women	390/526	74.1	70.3–78.0
Academic training			
Diploma	227/524	43.3	39.0–47.7
Degree	297/524	56.7	52.3–61.0
Asthmatic	30/532	5.6	3.6–7.8
Asthmatics in immediate setting	195/531	36.7	33.0–41.4
Spouse or partner	32/531	6.0	4.0–8.2
Children	45/531	8.5	6.1–11.1
Parents or siblings	35/531	6.6	4.4–8.9
Other family members	67/531	12.6	9.8–15.7
Close friends	57/531	10.7	8.1–13.6
Educational level taught			
Preschool	56/499	11.2	8.3–14.1
Preschool and primary	28/499	5.6	3.5–7.7
Primary	150/499	30.1	25.9–34.2
Primary and secondary	14/499	2.8	1.2–4.3
Secondary	251/499	50.3	45.8–54.8
Would you say that your asthma knowledge is sufficient?			
No	443/473	93.7	91.4–96.0
Yes	30/473	6.3	4.0–8.6

SD: standard deviation; CI: confidence interval; n: sample size; NAKQ: Newcastle Asthma Knowledge Questionnaire.

Internal consistency analysis gave a high Cronbach's alpha coefficient of 0.824 (95% CI: 0.802–0.845).[23] As each item was excluded, in a stepwise fashion, the index ranged between 0.811 and 0.828.

Significant differences were observed in the concurrent validity of the NAKQ score, depending on the personal contact of teachers with asthma and their self-assessed knowledge of the disease (Table 2). Scores were lower for teachers with no contact with asthmatics (15.1 ± 5.6) than for asthmatic teachers or those with a spouse/partner/children/parents/siblings with asthma (17.7 ± 3.3) and in teachers with other family members/friends who were asthmatic (16.1 ± 5.4; $P<.001$). Lower scores were found in teachers who considered their knowledge of asthma to be insufficient (16.1 ± 5.0) compared to those who considered it to be sufficient (18.7 ± 2.2; $P=.006$). Other variables associated with poorer knowledge were

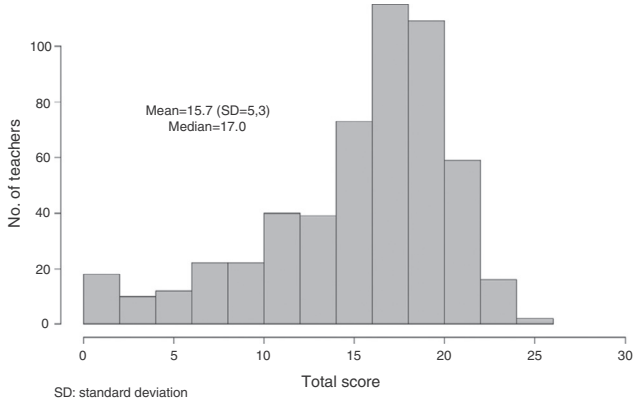

Fig. 1. Distribution of Newcastle Asthma Knowledge Questionnaire (NAKQ) scores among teachers. SD: standard deviation.

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Table 2
Newcastle Asthma Knowledge Questionnaire (NAKQ) Scores, by Various Variables.

	n	Mean (SD)	Median	*P*
Age[a]				<,001
<45 years	243	17.0 (4.5)	18	
≥45 years	229	15.3 (5.4)	17	
Sex				<.001
Men	136	17.0 (4.8)	18	
Women	390	15.4 (5.3)	17	
Years of teaching experience[b]				.006
<20 years	260	16.6 (4.9)	17.5	
≥20 years	232	15.3 (5.4)	17	
Academic training				.342
Diploma	227	16.1 (5.1)	18	
Degree	297	15.7 (5.4)	17	
Asthmatics in immediate setting				<.001
No	336	15.1 (5.6)	17	
Asthmatic or asthmatic partner, children, parents or siblings	105	17.7 (3.3)	18	
Other asthmatic relatives or friends	85	16.1 (5.4)	18	
Would you say that your asthma knowledge is sufficient?				.006
No	443	16.1 (5.0)	17	
Yes	30	18.7 (2.2)	19	
Educational level taught				.310
Preschool	56	15.5 (5.8)	17	
Preschool and primary	28	15.6 (5.9)	17	
Primary	150	16.3 (5.1)	18	
Primary and secondary	14	14.6 (3.7)	15	
Secondary	251	15.6 (5.3)	17	

SD: standard deviation; n: sample size.
Statistical significance: $P<.05$.
[a] Spearman's rho = −0.192; $P<.001$.
[b] Spearman's rho = −0.160; $P<.001$.

older age (Spearman's rho = −0.192; $P<.001$), longer teaching experience (Spearman's rho = −0.160; $P<.001$) and female sex (15.4 ± 5.3 vs 17.0 ± 4.8; $P<.001$) (Table 2).

Test–retest reliability was evaluated in 48 teachers with similar characteristics in terms of age, years of teaching experience, academic training and personal/family history of asthma, although there were more men in this group (61.7% vs 25.9%; $P<.001$). An intraclass correlation coefficient of 0.863 (95% CI: 0.768–0.920) was obtained for the overall questionnaire score. Using Bland–Altman methodology, the average difference between the scores in the 2 questionnaire submissions was 0.3 ± 2.3 (95% CI concordance: −4.2; 4.8) ($P=.330$) (Fig. 2). For each item, the percentage of concordance between the 2 items ranged from 68.7% to 100% (kappa index: 0.33–1) (online Appendix: Table 2).

Discussion

In studies published on asthma knowledge among Spanish teachers, Callén and Garmendia[10] found that 95% of teachers were unaware of inhalation techniques or the effects of bronchodilators; Rodríguez Fernández-Oliva et al.[12] reported that 64% did not know the first steps to take in the event of a crisis, and according to Cobos and Picado,[11] 91% of teachers admitted that their knowledge of the disease was poor. These and other findings suggest that there are large gaps in knowledge that could affect the course of the disease in patients. However, if an educational intervention program is to be designed, new data obtained from validated tools will be necessary.

The sample size of our study, in contrast to previous studies, was large enough to be accurate (n=537): the original study was performed in 138 parents,[13] and the transcultural adaptation to Spanish was performed in 157.[20]

Score outcomes were similar to those of other studies in subjects with average knowledge, and no significant floor or ceiling effects were found, suggesting that the questionnaire is capable of detecting especially low or especially high levels of knowledge.

Score reliability was measured in 2 ways, according to conventional test theory.[21] Firstly, internal consistency was evaluated with Cronbach's alpha. The statistical interpretation of this test is an estimate of the proportion of real variance contained in the total variance observed in the scores obtained.[21] The value achieved, 0.824 (95% CI: 0.802–0.845), which did not change as each questionnaire item was excluded, is high and indicates that 82% of the total observed variance is real variance and the rest is only error variance. Compared to other studies, this value is similar to the 0.72 (95% CI: 0.65–0.78) obtained by Praena Crespo et al.[20] The original study by Fitzclarence and Henry[13] did not report this value, and the reliability study was limited to the test–retest evaluation. No significant differences were found between the Cronbach's alpha obtained in our study and by Praena Crespo et al.[20] (single-tailed significance, $P=.20$). This Cronbach's alpha suggests high score reliability. In general, values higher than 0.6 are acceptable and scores higher than 0.8 are considered excellent. Values close to 1 would indicate redundancy of items.[21]

Secondly, a test–retest design with an interclass correlation coefficient for the total score between the 2 completions, interpreted similarly to the Cronbach's alpha, obtained an excellent internal consistency value of 0.863 (95% CI: 0.768–0.920). Praena Crespo et al.[20] reported a similar parameter, Kendall's tau-*b*, with a value of 0.856, while in the original study, an equally high Kendall's tau of 0.94 was reported.[13]

The test–retest analysis showed adequate reproducibility, confirming that scores were consistent over repeated applications of the questionnaire.[21] The percentage of concordance was high for all questions (from 68.7% to 100%). A better method for determining the degree of concordance is the kappa index, which takes into account (by subtraction) concordance due to chance. Kappa values range between −1 (complete lack of concordance), 0

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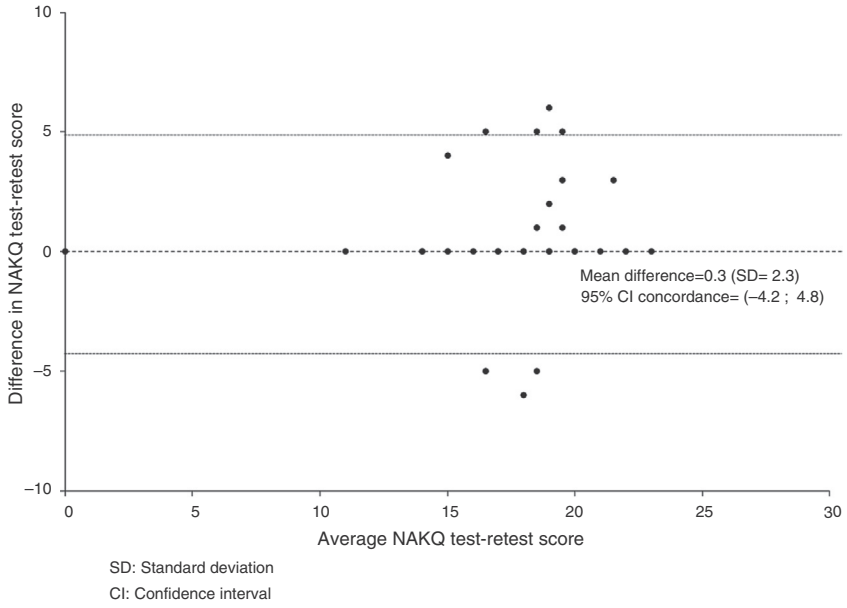

Fig. 2. *Newcastle Asthma Knowledge Questionnaire* (NAKQ) test–retest reliability. Bland–Altman graph. SD: standard deviation; CI: confidence interval.

(concordance due to chance) and 1 (full concordance). In our case, the kappa indexes for each question showed excellent consistency between repeated applications (kappa between 0.33 and 1), slightly higher than that reported by Praena Crespo et al.,[20] who found a kappa ≤ 0.2 for at least 8 items. The original validation study did not report concordance values.[13]

With respect to the validity of the scores obtained for quantifying asthma knowledge, the main advantage of our study design lies in its attempt to verify whether teachers with more contact with asthmatic patients or those who felt they had sufficient knowledge of asthma returned higher scores (concurrent validity). This was confirmed by the results, although the difference between groups with high knowledge and those with low knowledge was less than in the 2 previous reliability and validity studies, possibly because the high knowledge population (parents of asthmatic children and a high educational level) was a highly selected group. Another important aspect of validity, sensitivity to change, was evaluated using scores obtained before and after an educational intervention in a random sample of teachers in schools in San Sebastian, Spain. A significant increase was observed in the level of asthma knowledge (16.1 ± 3.4 vs 22.3 ± 4.1; $P<.001$), suggesting that the sensitivity to change of the Spanish version of the NAKQ is sufficient for use in this context.[23]

Ours is the third study to analyze the reliability of NAKQ scores and their validity for measuring asthma knowledge: in our case, we assessed the Spanish version of the questionnaire in teachers. In all 3 studies, the reliability and validity results are satisfactory, and this certainly provides evidence that the NAKQ in these populations is reliable and measures what it aims to measure: asthma knowledge in these populations. However, the potential publication bias and the possibility that studies with poor results were not published must be taken into account. Notwithstanding, in our population, our scores were both reliable (with little random error) and valid (really measure what we want to measure).

The limitations of this study are associated with sample selection and the characteristics of the study population. To control for selection bias, a randomized sample of public and private schools in the study area was determined, thus ensuring results that could be extrapolated to the original population, unlike other studies that used non-probabilistic sampling.[20] The participation rate was similar to that of similar studies,[14] and comparable between the various private and public schools and educational levels. No data are available on the sociodemographic characteristics of the teachers who did not complete the questionnaire. This prevented us determining whether there is any bias between the population that participated and the population that did not. Teachers who participated may have been more aware of asthma issues, and thus may have had greater knowledge. However, this possibility can be ruled out, as 63.3% of the participants stated that they had no contact with asthmatics, and only 6.3% thought their knowledge of the disease was adequate.

With regard to the population characteristics, the geographical limitations and linguistic peculiarities may mean that the results are not generally applicable. However, given the practically universal knowledge of Spanish among the subjects, it is unlikely that our results cannot be applied to teachers from other regions in Spain, no matter how different.

Another possible limitation derives from the collection of self-reported data that may affect the internal validity of the study. Both the diagnosis of asthma in teachers or in close family members and the assessment that they made of their knowledge is self-declared, thus exposing the study to bias in the evaluation of the concurrent validity of the questionnaire. Indeed, the reason for conducting this study was the lack of validated instruments for assessing asthma knowledge among teachers, making it difficult to evaluate the criterion validity in this context.

Our study confirms that this questionnaire is a valid and reliable tool for the scientific community to use in the evaluation of asthma knowledge among teachers in Spanish schools, and one that may be useful for planning and evaluating educational interventions aimed at improving this knowledge and for helping to optimize asthma control in Spanish schoolchildren.

To conclude, our results provide quality data to show stakeholders that scores obtained with the Spanish version of the NAKQ are reliable and valid for measuring the level of asthma knowledge among teachers in Spanish schools.

Authorship

All authors are responsible for the study and participated in its concept and design, analysis and interpretation of results, writing

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and correction of the manuscript and are in agreement with its content.

Conflict of Interests

The authors declare that they have no conflict of interests.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.arbr.2014.12.024.

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