Knowledge of Asthma in School Teachers in Nine Spanish Cities

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Summary. Objective: To analyze the knowledge of asthma and its management in Spanish school teachers using the Newcastle Asthma Questionnaire (NAKQ). Design: Descriptive, observational prevalence study, using a self-report questionnaire on knowledge about childhood asthma and its management by teachers in pre-school, primary, and secondary schools in nine Spanish cities. Age, sex, academic training, teaching experience, courses in which they taught, and personal and family history of asthma, were collected from each teacher. For knowledge determination, the validated Spanish version of the NAKQ was used. Results: A total of 208 centers participated, including 7,494 teachers. The questionnaire was completed by 4,679 teachers (62.4%). The mean score of correct responses was 16.0 ± 4.8 points out of 31

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(median = 17, range: 0–30). Only 6.8% of teachers were capable of pointing out the three main symptoms of the disease; 1.5% knew the triggering factors of an asthma attack; 8.6% knew two medicines useful during an asthma attack; 32.7% knew that inhaled medications had less side effects than pills, and only 3.8% knew of ways to prevent asthma attacks during exercise. In the multivariate analysis, variables significantly associated with a higher questionnaire score were a "lower age" (Beta coefficient = −0.09), "male gender" (Beta = 0.77), "being asthmatic" (Beta = 2.10), or "having close relatives with asthma" (Beta = 1.36) and "teaching in a private school" (Beta = 0.66) or in "compulsory secondary education" (Beta = 0.59). Conclusions: Teachers have a low level of knowledge about asthma, with an important limitation in some aspects of the disease. They should be trained to recognize the main symptoms of the disease, on how to act in the event of symptoms, and the early identification of situations in which the pupils require health care assistance. **Pediatr Pulmonol.** © 2015 Wiley Periodicals, Inc.

INTRODUCTION

There is a very wide variation in the prevalence of asthma symptoms all over the world.[1] It is estimated that around 10–12% of children and adolescents in Spain are affected by this disease.[2,3] It also has a high morbidity, although more than half of the children are not adequately controlled, which has a significant impact on the patients, their families, and society.[4]

Therapeutic education is part of the treatment and is fundamental to improve this situation. This has as its aim, to change the attitudes of the patients, and in the case of children, the adults in their environment (family, teaching staff, etc.), by improving the knowledge and skills necessary to face the challenges of the different aspects of the disease. The assessment of knowledge is essential in order to propose educational activities and their contents.[5]

The characteristics and needs of children with asthma in schools, and, therefore, the assessment of the knowledge of the school staff, can differ from one country to another. This may be influenced by the characteristics of the disease (prevalence, triggering factors, . . .), the health system (universality, accessibility to diagnoses, and treatments, . . .), as well as the school system (universality, mandatory, health personnel in the centers, . . .). Children spend more than 30% of the time in schools in Spain, where schooling is obligatory and, thus, practically universal between 3 and 16 years old. The presence of health personnel in schools is uncommon, with the pupils being mainly under the supervision and care of their teachers. Therefore, the role of the teachers as adults responsible for the care and supervision of children with asthma is indisputable. The assessment of their knowledge of the disease is required to determine the current situation and to propose educational measures and improve the school environment.

Up to carrying out the present work, there have been three studies in Spain that show limited knowledge by school teachers on asthma and its management, but there were notable limitations in their methodology (non-documented validation of questionnaires), method of selection, and sample size or representativeness (local character).[6–8]

In this work, it is proposed to analyze the knowledge of teachers as regard asthma and its management using the Newcastle Asthma Questionnaire (NAKQ),[9] which is widely used in studies in different populations and countries, translated into Spanish,[10] and recently validated in Spanish school teachers.[11,12] The questionnaire is used as self-report, which enables the study to be extended to a wide population of nine Spanish Cities and their catchment area, and depending on the results obtained, to evaluate its representativeness at national level.

MATERIALS AND METHODS

Design

A descriptive, observational study of prevalence, using a self-report questionnaire on knowledge about childhood asthma and its management by teachers in pre-school, primary, and secondary schools in nine Spanish cities and their catchment areas (A Coruña, Badajoz, Barcelona, Granada, Madrid, Palma de Mallorca, San Sebastián, Tenerife, and Valencia).

Inclusion and Exclusion Criteria

The study was conducted between February and June 2010 in public and private education centers, in which any cycle of obligatory school year was taught: second cycle of pre-school education (3–5 years), primary education (6–11 years), and/or secondary education (12–16 years) in each one of the areas of the study. Nursery schools or integrated centers of professional training were not included.

The study population consisted of all teachers working during the 2009–2010 academic year in schools in each

one of the areas of the study and met the following inclusion criteria: teachers who taught any speciality in the aforementioned courses, teachers who gave their consent to participate in the study. Those teachers who did not meet the previous inclusion criteria were excluded.

Sample

Two-stage cluster sampling was performed in each one of the study areas, taking the education center as the sample unit. Proportional random-stratified sampling was used in order to select the participating centers according to status and education level (public primary schools, public secondary schools, private schools). In each of the selected schools, all the teachers who met the inclusion criteria were surveyed.

To plan the sample size, a list was used with the number of centers and teachers in each of the areas studied. The sample size necessary for each area was determined in order to estimate the parameters of interest with a confidence of 95% and a precision of $\pm 4\%$, assuming 60% participation. A list was prepared of additional centers in case of rejection by any school, or a low completion rate by the teachers.

Ethics

Approval was received from the Clinical Research Ethics Committee of Galicia (Code 2009/016) and authorization was obtained from the appropriate education bodies. The informed consent was requested from the teachers in order for them to participate in the study.

Measurements

Each teacher was given a questionnaire that had to be returned self-reported anonymously. Age, sex, academic training, years teaching experience, courses in which they taught, and personal and family history of asthma was collected from each teacher.

For the determination of knowledge, the NAKQ, translated into Spanish[10] and validated in Spanish teachers,[11,12] was used. This questionnaire consists of 31 items, (25 are answered with true or false and 6 with open responses), in which correct responses were given one point, being able to obtain a total of between 0 and 31 points. A higher score indicated a higher level of knowledge. The open questions were interpreted strictly following the evaluation criteria of the questionnaire.[9,10]

Statistical Analysis

A descriptive analysis was performed on all the variables. The influence on the results of different variables related to the teachers and/or the schools was also assessed. The Pearson and Spearman Rho correlation coefficients were calculated in order to determine the relationship between quantitative variables. The distribution of the variables was determined using the Kolmogorov–Smirnov test. The Student's t-test or analysis of variance was used for the comparison of means. Depending on the cases, the Mann–Whitney test or Kruskal–Wallis test was used. We also tested for the presence or absence of linear trends in knowledge scores as a function of both age and teaching experience, by analysis of variance.

Due to the study design, teachers were naturally grouped within schools and cities, so interdependence between teachers in the same school and/or the same geographical area could not be discarded. To take this into account, a multilevel linear regression analyses with random intercepts was conducted to determine those factors independently associated with knowledge level. Random variability between cities and between schools within cities was taken into account.

All tests were performed with a bilateral approach, with values of $P < 0.05$ being considered significant. The analyses were performed with the SPSS 19.0 and EPIDAT 3.1 programs for Windows. Multilevel regression analysis was performed in R 3.2.0, with the package *nlme* added.

RESULTS

A total of 208 centers participated, with 7,494 teachers who taught in classes that fulfilled the established selection criteria. The questionnaire was completed by 4,679 teachers, with a percentage participation of 62.4% being obtained. Table 1 shows the number of centers and teachers in each area of the study, as well as those finally included and the corresponding percentage participation.

Table 2 summarizes the characteristics of the teachers out of the total that completed the questionnaire and by area.

Of the teachers who completed the questionnaire, 5.8% stated that they were asthmatics, 15.6% had an asthmatic in their close family circle (spouse, children, parents, and or brothers/sisters), and 14.2% had asthmatics in other family or close friends. Almost two-thirds (64.5%) stated not to know anybody with this disease.

Those teachers who answered less than 10% (<4 questions) of the NAKQ questionnaire (n = 17) were excluded from the analysis. The mean score of correct responses was 16.0 ± 4.8 points (median = 17, range: 0–30). The mean score of the knowledge questionnaire varied significantly between the different study areas. However, the median score was 17 or 18 points, depending on the area considered (Fig. 1).

The percentage of correct responses to each one of the questionnaire items can be observed in Table 3. To highlight some results: only 6.8% of teachers were capable of pointing out the three main symptoms of the disease; only 1.5% know the triggering factors of an asthma attack;

TABLE 1— Total Number of Educational Centers and Teachers in Each of the Participating Areas

	Total		Sample			
	Centers (n)	Teachers (n)	Centers (n)	Teachers (n)	Respondents[1] (n)	Participation rate (%)
A Coruña	96	4,089	24	864	537	62.2
San Sebastián	51	2,302	17	743	519	69.9
Madrid	135	6,085	24	831	630	75.8
Granada	161	2,917	20	646	406	62.8
Tenerife	257	8,015	32	998	506	50.7
Cataluña	125	4,631	24	976	618	63.3
Badajoz	70	2,436	24	902	414	45.9
Mallorca	108	4,359	21	765	448	58.6
Valencia	59	2,759	22	769	601	78.2
TOTAL	1,062	3,7593	208	7,494	4,679	62.4

Number of centers and teachers selected for the study and participation rate.
[1]Teachers who gave consent to participate in the study and completed the questionnaire.

no more than 8.6% knew two medicines useful during an asthma attack; only 32.7% knew that inhaled medications had less side effects than pills, and only 3.8% knew of ways to prevent asthma attacks during exercise.

There also appears to be some widespread false beliefs about the disease, as such that only 53.6% of the teachers knew that cow's milk does not increase mucus production in children with asthma. Also, no more than 52.1% knew that asthma does not harm the heart, and that only 58% knew that children with asthma do not become addicts to their medication.

In the univariate analysis, a significant association was observed in the questionnaire score both with age (Spearman's rho $= -0.217$; $P < 0.001$) and years of teaching experience (Spearman's rho $= -0.198$; $P < 0.001$), being higher in younger teachers and with less professional experience, as well as in men compared to women (16.7 vs. 15.8; $P < 0.001$). This score is also significantly higher in teachers with asthma (18.1 ± 3.6), or with close family with the disease (17.1 ± 3.9) ($P < 0.001$) (Table 4).

The level of academic qualifications of the teachers was also associated with the questionnaire score, being higher in graduates than in those with diplomas (16.4 vs. 15.8, $P = 0.002$). Thus, teachers who taught the obligatory secondary education course (16.3 ± 4.7) obtained higher scores than those who taught primary (15.8 ± 5.1) or pre-school education (15.6 ± 5.0) ($P = 0.021$). The teachers of private schools also achieved a significantly higher number of correct responses than those of public schools (16.6 vs. 15.5; $P < 0.001$) (Table 4).

In the multivariate analysis, the variables associated with a higher questionnaire score were a lower age (Beta coefficient $= -0.09$; $P < 0.001$), the male gender (Beta coefficient $= 0.77$; $P < 0.001$), the fact of being asthmatic (Beta coefficient $= 2.10$; $P < 0.001$) or having close relatives with asthma (Beta coefficient $= 1.36$; $P < 0.001$), and teaching in a private school (Beta

coefficient $= 0.66$; $P < 0.001$). There were no differences in the questionnaire score according to the teachers' academic training or education level that they were teaching in class, although those who taught the obligatory secondary education course were associated with higher scores (Beta coefficient $= 0.59$; $P = 0.029$) (Table 5).

DISCUSSION

In Spain, teachers are responsible for the supervision and care of the scholars for a wide timeframe during the school year, and it is necessary to determine their level of knowledge about asthma and their training needs in order to improve "self-care" of the disease.

Three studies conducted in Spain agreed with the lack of knowledge of the teachers.[6–8] Another local study conducted after these works, on adolescents and secondary school professors, showed a low level of knowledge by the teachers.[13] This situation needs to be confirmed by a study that is more rigorous in methodology and representativeness, in order that its results may serve as a basis for future recommendations and interventions. The present work analyzes a wide sample of teachers of all education levels of obligatory schooling in nine Spanish cities, in order to obtain data about them and to infer, where possible, what happens at national level.

Questionnaires are useful tools for carrying out prevalence studies in large populations, due to their easy management, administration, and economy. They must have validity and reliability, specifically in the study population. In this work, the NAKQ,[9] translated into Spanish,[10] was chosen because it has demonstrated the capacity to differentiate between individuals with high or low levels of knowledge about asthma in different populations.[13–21] Despite being used repeatedly on teachers,[13–17,19–21] there were no validation data on this population until the study published by our group on the validation of the Spanish version of the NAKQ in a

TABLE 2—Characteristics of Participants in Each of the Study Areas

|	Total	A Coruña	Madrid	San Sebastián	Tenerife	Badajoz	Granada	Mallorca	Valencia	Barcelona
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	42.8±10.20	44.0±10.0	43.4 ± 11.2	43.5 ± 9.4	43.8 ± 9.5	44.2 ± 9.3	44.0 ± 10.1	42.1 ± 10.4	42.1 ± 10.1	39.5 ± 10.0
Years of teaching experience	17.3±10.8	17.7±10.8	17.8 ± 11.6	19.7 ± 10.1	17.5 ± 10.0	18.6 ± 10.5	18.8 ± 10.9	15.9 ± 10.5	16.6 ± 10.8	14.3 ± 10.5
	%	%	%	%	%	%	%	%	%	%
Gender										
Male	27.4	25.9	25.1	20.2	25.2	29.8	41.6	30.9	28.0	24.5
Female	72.6	74.1	74.9	79.8	74.8	70.2	58.4	69.1	72.0	75.5
Academic degree										
Diploma (3-year degree program)	50.2	43.3	41.5	48.8	52.6	55.5	45.5	56.4	48.2	61.0
Graduate (4–5-year undergraduate/ master degree program)	49.8	56.7	58.5	51.2	47.4	44.5	54.5	43.6	51.8	39.0
Personal or close contact with asthma										
Non-asthmatic and no known asthmatic	64.5	62.6	67.9	56.5	59.8	66.2	56.7	65.6	71.9	69.1
Asthmatic	5.8	5.7	5.4	5.8	6.3	5.0	7.8	8.6	3.9	4.8
Close relatives with asthma (spouse/partner, daughters/sons, parents, brothers/sisters)	15.6	15.2	13.7	19.4	19.5	14.8	20.3	12.8	12.7	13.6
Other relatives or friends with asthma	14.2	16.5	13.0	18.4	14.4	14.0	15.2	13.0	11.5	12.5
Teaching educational level										
Pre-school	15.7	11.2	16.4	22.3	14.7	14.2	12.5	13.8	16.2	18.0
Pre-school + primary school	7.5	5.6	9.3	5.7	8.3	8.7	2.5	11.5	6.8	8.0
Primary school	35.4	30.1	30.5	39.1	38.3	38.4	34.3	29.7	36.1	42.1
Primary school + compulsory secondary education	2.7	2.8	1.9	6.3	3.1	0.7	3.3	1.8	3.2	0.8
Compulsory secondary education	38.8	50.3	41.9	26.6	35.6	37.9	47.5	43.2	37.6	31.1

SD, standard deviation.
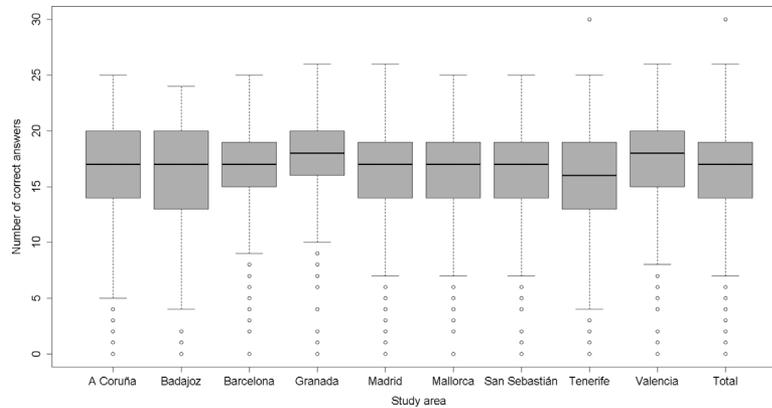
Fig. 1. Boxplot of total scores in the Newcastle asthma knowledge questionnaire (NAKQ) for participants in each of the study areas.

sample of teachers, selected with identical methodology to their previous work.[12] This is the first large study that uses the NAKQ on teachers, in which its validity and reliability has been previously validated in the population analyzed.[11,12]

The percentage participation was similar to that of the majority of published works (60–70%),[15–21] and higher than others.[22–24] There is variability between the study areas, probably due to the dissimilar characteristic of the centers (public or private/state subsidized, education stages) and/or the teachers (age, contact with asthma).

The sample size, much higher than that in other studies, as well as including teachers of all educational environments and obligatory stages in nine Spanish cities, give the results special relevance and representativeness.

Knowledge of Teachers as Regard Asthma (NAKQ Questionnaire)

To determine the knowledge level that the mean of correct responses in the questionnaire represents, the results must be compared with previous studies that differentiate between individuals with a high and low knowledge of asthma. Thus, in the validation study of the original NAKQ questionnaire, conducted on parents of asthmatic children, the high knowledge group (very specific asthmatic parents: recruited into support groups, and considered by their paediatrician as very knowledgeable) had a mean of correct responses of 25.3, compared to 13.0 in the least knowledgeable group (parents with no relationship with the disease).[9] In the validation study of the Spanish version of the NAKQ, a score of 16.8 was obtained in parents with a low knowledge of asthma (with no relationship with the disease or its treatments), and 23 points in the high knowledge group (parents with asthmatic children subjected to an educational intervention).[10] In the validation study of the Spanish version of the NAKQ in teachers,[12] the teachers group with low knowledge obtained a mean of 15.1 correct responses (teachers with

no relationship with asthma) and a 17.7 in the high knowledge group (asthmatic teachers or with close family with asthma, although without any specific training). According to these comparisons, it can be concluded that the mean of 16 obtained in this study is similar to that obtained in the groups less knowledgeable of the disease. Studies in other countries, using the same questionnaire on teachers, obtained similar results with scores between 14 and 16.5,[17,18,20] although in some of them that used different interpretation criteria, a score of 20 points was achieved.[19] This leads to thinking that the low level of knowledge on asthma by teaching staff is a common problem in many countries.

The results obtained show higher scores in teachers with asthma or family with the disease. The same occurs in the validation study on teachers[12] and in other similar studies.[19,23] This seems to indicate that there is a large group of teachers with no close contact with the disease that have very low knowledge of the disease, and another group with close contact with asthma with a higher score, although far from the scores of the highly knowledgeable group (25.3 and 23).[9,10] This suggests a wide margin for improvement and the need for training, very evident in teachers with no relationship with asthma, but also necessary in those with more contact with the disease.

There are certain demographic characteristic that could influence knowledge levels, such as sex, age, teaching experience, teaching in a class in a private center, or academic level). Other studies[15,23–25] that analyzed these aspects did not obtain homogeneous results, possible due to being conducted in dissimilar geographical, organizational or cultural contexts. In our study, differences between different areas were also found in the knowledge level of teachers, which could be due to a different information level or the different characteristics of the teachers. Despite these variations by area or according to demographic characteristics, the level of knowledge of teachers is low in all cases and thus they need to be trained.

TABLE 3— Percentage of Correct Responses in Each of the 31 Items in the Newcastle Asthma Knowledge Questionnaire (NAKQ)

	Correct answer	% Correct answers	95%CI
(1) What are the three main symptoms of asthma?	Cough, wheeze, breathlessness	6.8	6.1–7.5
(2) More than 1 in 10 children will have asthma at some time during their childhood (T/F).	T	56.0	54.6–57.5
(3) Children with asthma have abnormally sensitive air passages in their lungs (T/F).	T	71.8	70.4–73.0
(4) If one child in a family has asthma then all his/her brothers and sisters are almost certain to have asthma as well (T/F).	F	89.4	88.5–90.3
(5) Most children with asthma have an increase in mucus when they drink cows milk (T/F).	F	53.6	52.1–55.0
(6) Write down all the things you know that cause asthma (sometimes called trigger factors).	Infection, exercise, and allergens	1.5	1.1–1.8
(7) During an attack of asthma, the wheeze may be due to muscles tightening in the wall of the air passages in the lungs (T/F).	T	63.2	61.8–64.6
(8) During an attack of asthma, the wheeze may be due to swelling in the lining of the passage in the lungs (T/F).	T	55.6	54.1–57.0
(9) Asthma damages the heart (T/F).	F	52.1	50.7–53.7
(10) Write down two asthma treatments (medicines) which are taken every day on a regular basis to prevent attacks of asthma from occurring (T/F).	Two of oral/inhaled steroids, chromones, montelukast, inhaled steroids, and long-acting beta-2 agonist bronchodilator combinations	2.9	2.4–3.3
(11) What are the asthma treatments (medicines) which are useful during an attack of asthma?	Two of beta-2 agonist, ipratropium bromide, oral steroids, oxygen	8.6	7.8–9.4
(12) Antibiotics are an important part of treatment for most children with asthma (T/F).	F	73.6	72.4–74.9
(13) Most children with asthma should note at dairy products (T/F).	F	59.6	58.1–70.0
(14) Allergy injections cure asthma (T/F).	F	77.1	75.9–78.3
(15) If a person dies from an asthma attack, this usually means that the final attack must have begun so quickly that there was no time to start any treatment (T/F).	F	54.4	53.0–55.9
(16) People with asthma usually have "nervous problems" (T/F).	F	71.1	69.8–72.4
(17) Asthma is infectious (i.e., you can catch it from another person) (T/F).	F	93.4	92.7–94.1
(18) Inhaled medications for asthma (e.g., Ventolin puffers, Terbasmin drypowder) have fewer side effects than tablets/syrup (T/F).	T	32.7	31.3–34.0
(19) Short courses of oral steroids (such as Estilsona, Dacortin, prednisone) usually cause significant side effects (T/F).	F	40.5	39.1–49.2
(20) Some asthma treatments (such as Ventolin) damage the heart (T/F).	F	63.4	62.0–64.8
(21) A 5-year-old boy has an attack of asthma and takes two puffs of Ventolin from a puffer (metered dose inhaler). After 5 min, he is no better. Give some reasons why this might have happened.	Two of empty puffer, out of date medication, insufficient dose, incorrect technique, severe attack	2.5	2.0–2.9
(22) During an attack of asthma, which you are managing at home, your child is requiring the metered dose inhaler with chamber (or mask) every 2 hr. He/she is gaining benefit but is breathless after 2 hr. Provided that he/she does not get any worse, it is fine to continue the treatment every 2 hr (T/F).	F	28.7	27.4–30.0
(23) Write down ways of helping to prevent attacks of asthma during exercise (T/F).	Two of beta-2 agonist or chromones pre-exercise, warm-up, improve control of asthma, nose breathing, warm humid environment	3.8	3.3–4.4
(24) Children with asthma become addicted to their asthma drugs (T/F).	F	58.0	56.5–59.4

TABLE 3— (*Continued*)

	Correct answer	% Correct answers	95%CI
(25) Swimming is the only suitable exercise for asthmatics (T/F).	F	76.7	75.5–77.9
(26) Parental smoking may make the childs asthma worse (T/F).	T	91.4	90.6–92.2
(27) With appropriate treatment most children with asthma should lead a normal life with no restrictions on activity (T/F).	T	90.5	89.7–91.4
(28) The best way to measure the severity of a childs asthma is for the doctor to listen to his chest (T/F).	F	50.8	49.3–52.2
(29) Asthma is usually more of a problem at night than during the day (T/F).	T	46.3	44.9–47.8
(30) Most children with asthma will have stunted growth (T/F).	F	73.9	72.6–75.1
(31) Children with frequent asthma should have preventive drugs (T/F).	T	53.8	52.3–55.2

CI, confidence interval.
Questions requiring a true/false response are marked (T/F).

The NAKQ validation studies are based on its capacity for discriminating between individuals with low and high knowledge on the overall score obtained. However, the individualized analysis of the responses can orientate us toward which points are important for future interventions. The low rate of correct answers in the open questions is systematically observed in all the studies, without altering its validity.

In the detailed analysis of the questions, an acceptable knowledge is observed on some of the pathophysiological aspects of the disease (concept of hypersensitivity of the bronchi and bronchial obstruction), in the similar way as occurs in other studies, such as that of Bell.[19] There are greater differences in other aspects (concept of inflammation) suggesting that the concept of asthma as an inflammatory disease is less known in our population.[19]

On the other hand, there are very few teachers who knows the main asthma symptoms, which could imply a difficulty to recognize and act on the beginning of an attack.[18–20] They have little information on treatments, particularly preventive, as the same as occurs in other similar studies.[18–20] This could be because these treatments are taken outside school hours. There is also a lack of knowledge of the medication that should be administered in an attack, despite the fact that many pupils may require rescue medication during school hours.

Frequently, there are false beliefs about the side effects of the medication for asthma. The lack of knowledge of the medication to use for the symptoms or an attack of the disease, along with false fears about them, can limit the actions of the teaching staff when a pupil requires it.

They have little information on symptom triggering factors or an asthma attack. The school environment is where children carry out a large part of their physical activity. The fact that the most of teachers do not know different ways of preventing an attack triggered by exercise indicates the need to train them on this matter.[19,20,24–27]

In other published studies performed using different methodology,[7,8,16,22,23,28–33] they also show a low level of knowledge of the disease among teachers, with a disparity of results in the concepts analyzed. In general, in countries with high childhood asthma prevalence, such as Australia[34] and New Zealand,[35] the teachers were only relatively informed. However, erroneous concepts, such as the possible development of addiction with the continuous use of asthma medications, are observed in teachers everywhere.[35]

Limitations of the Study

Although the response rate is acceptable (comparable or superior to other studies),[14–23] selection biases cannot be ruled out on not knowing the characteristics of the teachers that did not take part. The voluntary completion of the questionnaires could mean that those teachers most interested in the topic would participate, thus overestimating the knowledge level. To ensure sample representativeness in each year, a stratified sample was made according to qualifications and education stage. A higher response rate was observed in private centers and a lower completion rate in public secondary education schools, which could produce a bias, and should be taken into account on interpreting the results.

Information biases are minimized by the use of a validated questionnaire that has demonstrated its reliability and validity for the evaluation of knowledge about asthma in the teaching population.[11,12]

This study provides data of interest within the limits inherent in a cross-sectional study. It is useful to know

TABLE 4— Total Scores in the Newcastle Asthma Knowledge Questionnaire (NAKQ) According to Teachers' Characteristics

	Mean (SD)	Median	P
Age			<0.001
1st quartile (21–34 years)	17.5 (3.8)	18	
2nd quartile (35–43 years)	16.6 (4.6)	18	
3rd quartile (44–51 years)	15.7 (4.8)	17	
4th quartile (52–69 years)	14.8 (5.2)	16	
Years teaching experience			<0.001
1st quartile (0–8 years)	17.2 (3.9)	18	
2nd quartile (9–17 years)	16.6 (4.7)	18	
3rd quartile (18–26 years)	15.5 (5.1)	17	
4th quartile (27–48 years)	14.8 (5.3)	16	
Gender			<0.001
Men	16.7 (4.5)	18	
Women	15.8 (4.9)	17	
Personal or close contact with asthmatics			<0.001
Asthmatic	18.1 (3.6)	19	
Close relatives with asthma (spouse/partner, daughters/sons, parents, brothers/sisters)	17.1 (3.9)	18	
Other relatives or friends with asthma	16.0 (4.7)	17	
Non asthmatic and no known asthmatic	15.6 (5.1)	17	
Academic degree			0.002
Diploma (3-year degree program)	15.8 (4.9)	17	
Graduate(4–5 year undergraduate/master degree program)	16.4 (4.6)	17	
Teaching educational level			0.021
Pre-school	15.6 (5.0)	17	
Pre-school + primary school	16.2 (4.6)	17	
Primary school	15.8 (5.1)	17	
Primary school + compulsory secondary education	16.5 (4.1)	17	
Compulsory secondary education	16.3 (4.7)	17	
Type of center			<0.001
Public center	15.5 (5.1)	17	
Private center	16.6 (4.6)	18	

SD, standard deviation.

knowledge levels, but it does not allow making causal interpretations of the results. Although the use of multivariate techniques allows eliminating the confounding effect or effect modification of some variables over others, the relationships found do not have to have a causal significance.

The characteristics of the centers and the teachers show differences between the study areas, due to the diversity between the areas studied, although they belong to cities and Autonomous Regions of different sizes and characteristics, and with a different rural/urban ratio. It is difficult to compare between areas, although it has the advantage of the diversity of Spain. In any case, the level of knowledge is low in all areas, and thus the need for a common teacher training course that could be generalized throughout Spain.

TABLE 5— Multilevel Linear Regression Model for Total Scores of the Newcastle Asthma Knowledge Questionnaire (NAKQ), Adjusting for Teachers' Characteristics

	Beta coefficient	SE	P	95%CI	
Age (years)	−0.09	0.01	<0.001	−0.11	−0.08
Malegender	0.77	0.16	<0.001	0.45	1.09
Academic degree (3-year degree program)	0.01	0.18	0.994	−0.36	0.36
Personal contact with asthma					
No contact with asthma					
Asthmatic teacher	2.10	0.30	<0.001	1.51	2.68
Close relatives with asthma (spouse/partner, daughters/son, parents, brothers/sisters)	1.36	0.19	<0.001	0.98	1.75
Other asthmatic friends or family	−0.03	0.20	0.878	−0.43	0.36
Private center	0.66	0.22	0.003	0.22	1.10
Teaching educational level					
Pre-school					
Pre-school + primary school	0.14	0.31	0.662	−0.48	0.76
Primary school	0.40	0.21	0.065	−0.02	0.82
Primary school + compulsory secondary education	0.05	0.48	0.918	−0.90	1.01
Compulsory secondary education	0.59	0.27	0.029	0.06	1.13

SE, standard error; CI, confidence interval.

In conclusion, the findings of the present study, more or less consistent with other publications,[18–20,24,25,27,32,33] show that teachers have a low level of knowledge about asthma, with an important limitation in some aspects of the disease, which is very significant for the progress and well-being of the patients inside and outside school hours. To improve this situation, teachers should be trained to recognize the main symptoms of the disease, on how to act in the event of symptoms, and the early identification of situations in which the pupils require health care assistance.[36,37] They must also be educated about the relationship between exercise, asthma, and medication, with the aim of preventing symptoms or attacks and/or avoid over-protective attitudes. On the other hand, training and information on individual triggering factors will help to establish environmental measures in the classroom and sports areas, which could improve the lives of children with asthma.[26]

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