

# International Study of Asthma and Allergies in Childhood: Validation of the rhinitis symptom questionnaire and prevalence of rhinitis in schoolchildren in São Paulo, Brazil

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Written questionnaires (WQ) have been widely used in epidemiologic studies. In order to yield comparable results, they must be validated after translation to another language. The International Study of Asthma and Allergies in Childhood (ISAAC) WQ has been previously validated by a comprehensive study, but its validation in Brazil has not been performed. Our objectives were to validate the rhinitis component of the ISAAC's self-applicable WQ following its translation to Portuguese, and to determine the prevalence of rhinitis and related symptoms among Brazilian children living in the city of São Paulo. A group of 10 pediatricians and 10 pediatric allergists graded the questions from 0 to 2 and established a maximum score for each question. The WQ was answered by parents or guardians of children 6–7 years of age with rhinitis (R) (n=27) and of control children of the same age without rhinitis (C) (n=27). The WQ was also completed by adolescents 13–14 years of age with rhinitis (R) (n=32) and without rhinitis (C) (n=32). Half of these individuals answered the same WQ after 2–4 weeks, to ensure reproducibility. Cut-off scores of 4 and 3 were identified for the 6–7- and 13–14-year-old groups, respectively, as scores predictive of rhinitis. The prevalence of rhinitis was 28.8% in the group of 3005 children 6–7 years of age and 31.7% in the group of 3008 children 13–14 years of age, respectively. Using the global cut-off score, these prevalences were even higher, in the order of 34.7% and 40.7%, respectively. In conclusion, the rhinitis component of the ISAAC WQ was proven to be reproducible, adequate and able to discriminate children and adolescents with and without rhinitis, and revealed that the prevalence of rhinitis among Brazilian children living in the city of São Paulo was as high as the prevalence of rhinitis in other areas of the world.

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Epidemiologic studies have documented an increase in the prevalence of rhinitis, similarly to asthma, in different areas of the world. In Switzerland, the prevalence of seasonal allergic rhinitis has increased from 0.82% in 1926 to 11.1% in 1991 (1). In the UK, there has been an increase in the annual prevalence of seasonal allergic rhinitis from 12% in 1958 to 23.3% in 1970 (2). Similar data have been reported by other authors (3–8). However, lack of standardization of patient

identification has hampered comparisons among different populations over time (9).

Although rhinitis is a common disease, it is surprising that little is known about its epidemiology (10,11). Rhinitis symptoms may occasionally occur in normal individuals, and the lack of a standardized and properly validated method for the identification of rhinitis may account for the scarcity of epidemiologic data available. In general, clinical definition of rhinitis is focussed

on the identification of patients whose symptoms are sufficiently severe to require medical attention (12). On the other hand, epidemiologic definition relies on the nature and distribution of symptoms within a population, independent from severity (12).

The use of a standardized written questionnaire (WQ) in the International Study of Asthma and Allergies in Childhood (ISAAC) study made possible the study of allergic diseases among children of culturally distinct populations. This low-cost method is easily applied and has high sensitivity and specificity (13,14). Originally written in English, the questionnaire needs to be validated following translation in order to be applied to populations of different languages. It will then allow not only intra-regional and international comparisons, but also disease monitoring over the years (15).

In the present study, we have validated the component of the ISAAC's WQ pertaining to rhinitis, to evaluate its applicability for determining the prevalence of rhinitis and related symptoms in schoolchildren of the southern region of the city of São Paulo.

## Materials and methods

### Validation of the WQ

*Translation and scoring of the questionnaire.* The standardized ISAAC questionnaire, originally written in English, was translated to Portuguese, and the adequacy of the translated questionnaire was confirmed in a preliminary study with a group of school children or their guardians. Back-translation to English resulted in a few modifications from the original questionnaire, including the use of the word 'rhinitis' instead of 'hay fever' in question 6. Hay fever is very uncommon in Brazil and the term is not used as a substitute for rhinitis. In the present study, we addressed only the rhinitis questions of the WQ, numbered 1–6 in 'Part II'. For validation of the WQ, 10 general pediatricians and 10 pediatric allergists were asked to grade each question from 0 to 2, according to their own view of the importance of the diagnosis of rhinitis. The maximum value for each question was considered as the one chosen by  $\geq 70\%$  of the physicians. Using this approach, questions 1, 2, and 3 were graded with a score of 2 for an affirmative answer and as zero for a negative answer. Question 4 was graded with a score of 2 for January, February, March, October, November, and December; as 1 for the other months; and as zero for no answer. Question 5 was graded as

2 for 'moderate amount' and 'a lot'; as 1 for 'a little'; and as zero for 'not at all'. Question 6 was graded as 1 for an affirmative answer and as zero for a negative answer.

*Patients.* Two groups of children, one consisting of 54 children 6–7 years of age and the other of 64 adolescents 13–14 years of age, participated in the section of the study designed to validate the WQ. Children with rhinitis were selected from those who attended the Pediatric Allergy Clinic at UNIFESP-EPM and had been followed-up for at least 1 year. Control children without rhinitis were selected from those who attended the General Pediatrics Clinic of the same Institution. Parents or guardians of 27 children with rhinitis and of 27 control children (age-range 6–7-years old), were interviewed. In addition, in the 13–14-year age-group, 32 adolescents with rhinitis and 32 controls answered the questionnaire.

*Study design.* After completing the WQ, the interviewers attributed scores to the answers to each question, as outlined above, and a global score was calculated for each child. The sensitivity and specificity of the obtained scores was calculated and cut-off values (ROC curve) were established. The likelihood ratio was calculated to evaluate the probability of the result of a diagnostic test being expected in patients with and without the disease being studied (15,16). In order to evaluate the ISAAC WQ reproducibility, 50% of the individuals completed the questionnaire again, 2–4 weeks later. These responses were compared based on the global cut-off score (15,16).

### Prevalence study

After validation, the WQ was applied to schoolchildren living in São Paulo, from June to October 1995, under the supervision of investigators A.T.V. or E.Y. Subjects were selected among children who attended public and private schools in the southern area of the city of São Paulo, and were children from families of mid and low socioeconomic classes. Information regarding the number of schools and students in the area was obtained from the official records of the Secretary of Education of the city of São Paulo, and schools that had students in the 6–7-year-old and 13–14-year-old age-groups were selected for inclusion in the study. Twenty-seven schools comprising 4127 students in the age-range of 6–7 years were selected at random from the 167 schools in the area. Twenty-eight schools, comprising 3200

students 13–14 years of age, were randomly selected from the 124 schools in the area.

Collected data were entered into the database Epi-Info, provided by the ISAAC coordinators. The frequency of responses to each question was evaluated according to gender and age-range. The answer to modified question number 6, ‘Has your child ever had rhinitis?’ (6–7-year olds) or ‘Have you ever had rhinitis?’ (13–14-year olds), was cross-checked with answers to other questions in order to verify disagreement. We evaluated the prevalence of rhinitis based on the global cut-off score and compared it with the prevalence of physician-diagnosed rhinitis. The study was approved by the Ethics committee of UNIFESP-EPM.

Statistical analysis

Non-parametric tests were used for data analysis. Sensitivity and specificity values were measured by comparison of the global score in each questionnaire with the clinical diagnosis (15,16). The following tests were also used: the ROC curve, to obtain the global cut-off scores; likelihood ratio; the McNemar test, to compare the answers to the questions, considering the diagnosis of rhinitis; and the Kappa test, to compare the frequency of children with rhinitis identified by the global cut-off score in both WQs (15,16). A p-value of <0.05 was considered significant (indicated by an asterisk).

Results

Validation

Results of the ISAAC WQ applied to children with and without rhinitis aged 13–14 years, and to

the parents or guardians of children aged 6–7-years old, are shown in Table 1. Figure 1 shows the frequency of global scores in children with rhinitis and in control children, in the 6–7-year-old (Fig. 1a) and 13–14-year-old (Fig. 1b) age-groups, along with the sensitivity and specificity for each of the scores. There is a clear distinction between children with rhinitis and controls, as defined by the global score. Among children 6–7-years old, a global score of 4 was identified as the cut-off for distinguishing children with rhinitis from controls. Among the 13–14-year-old children, a score of 3 was identified as the cut-off for distinguishing adolescents with rhinitis from controls. According to these global cut-off scores, the likelihood ratio was 8.76 for a positive test and 0.04 for a negative test among 6–7-year-old children (p <0.05), and 6.25 for a positive test and 0.25 for a negative test among 13–14-year-old adolescents (p <0.05). According to the global cut-off scores, children were defined as having rhinitis or not by questionnaires completed 2–4 weeks apart. Concordance rates were 94.5% and 100% for the 6–7-year-old and 13–14-year-old age-groups, respectively (McNemar test). In both age-groups, the WQ was significantly reproducible (Kappa test, Kw=0.89 for 6–7-year olds; Kw=1.0 for 13–14-year olds; p <0.05).

Prevalence of rhinitis symptoms

Response rates of 72% and 94% were obtained among children 6–7-years old and 13–14-years old, respectively. In both age-groups, ≈ 51% of the responders were female (Table 2).

The prevalence of nasal symptoms ever was significantly higher among 13–14-year-old adolescents than among 6–7-year-old children (45.3% and 40.0%, respectively). In the group

Table 1. Affirmative answers to questions 1–6 of the International Study of Asthma and Allergies in Childhood (ISAAC) rhinitis written questionnaire given by children with rhinitis (A) and control children (C) of the two age-groups

Question	6–7-year-old age-group		13–14-year-old age-group	
	A n=27 (%)	C n=27 (%)	A n=32 (%)	C n=32 (%)
1. Sneezing, runny or blocked nose ever	26 (96.3)	3 (11.1)	23 (71.9)	6 (18.8)
2. Sneezing, runny or blocked nose in the past 12 months	20 (74.1)	3 (11.1)	21 (65.6)	2 (6.3)
3. Nose problem with itchy, watery eyes in the past 12 months	15 (55.6)	0 (0.0)	17 (53.1)	1 (3.4)
4. When did it occur:				
January to March	13 (48.1)	1 (3.7)	13 (40.6)	2 (6.3)
April to September	26 (96.3)	1 (3.7)	19 (59.4)	7 (21.9)
October to December	10 (37.0)	0 (0.0)	3 (9.4)	0 (0.0)
5. Interference with daily activities				
Not at all	10 (37.0)	0 (0.0)	0 (0.0)	2 (6.3)
A little	11(40.7)	1 (3.7)	16 (50.0)	4 (12.5)
A moderate amount	3 (11.1)	0 (0.0)	3 (9.4)	0 (0.0)
A lot	2 (7.4)	0 (0.0)	1 (3.1)	0 (0.0)
6. Rhinitis ever	21(77.8)	0 (0.0)	26 (81.3)	2 (6.3)

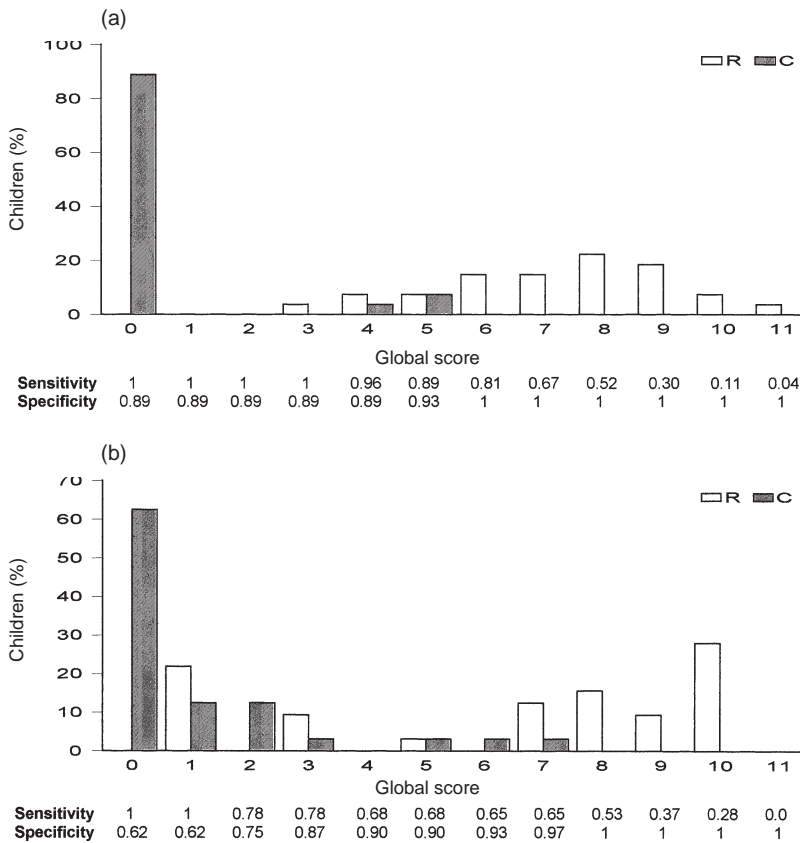


Fig. 1. Global score obtained in questions 1–6 of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire, and its sensitivity and specificity among (a) 6–7-year-old children and (b) 13–14-year-old adolescents with rhinitis (R) and controls (C). The global score was obtained by summing each question score (see text).

of 6–7-year-old children, the prevalence of nasal symptoms ever was higher among boys; in the group of 13–14-year-old adolescents, this prevalence was higher among girls (Table 2).

The prevalence of nasal symptoms in the past 12 months was similar in both age-groups

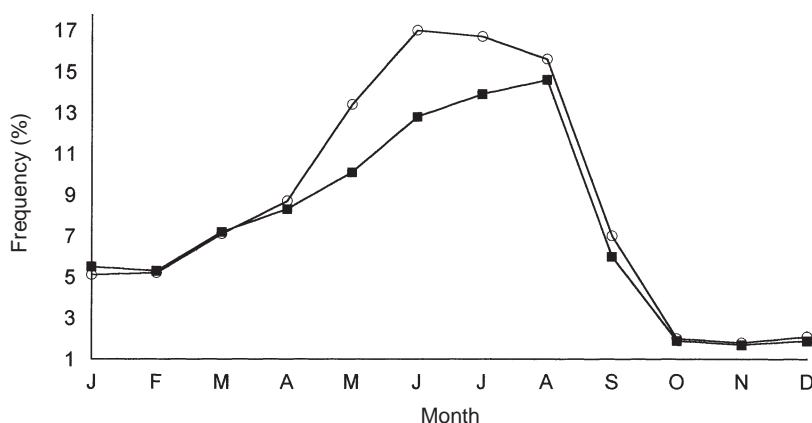
(33.8% and 34.0% for 6–7-year olds and 13–14-year olds, respectively). However, the prevalence was higher among 6–7-year-old boys than among 6–7-year-old girls or 13–14-year-old boys. Among the adolescents, the prevalence among girls was higher than among boys of the

Table 2. Prevalence of rhinitis and related symptoms among 6–7-year-old children and 13–14-year-old adolescents, as determined by using the International Study of Asthma and Allergies in Childhood (ISAAC) written questionnaire

Question	6–7-year-old age-group			13–14-year-old age-group		
	M (n=1459)	F (n=1546)	All (n=3005)	M (n=1465)	F (n=1543)	All (n=3008)
1. Sneezing, runny, blocked nose without a cold, ever	43.5*	36.7	40.0	43.4	47.1*†	45.3‡
2. Sneezing, runny, blocked nose without a cold in the past 12 months	37.6*†	30.3	33.8	32.0	35.8*†	34.0
3. Nasal symptoms without a cold in the past 12 months, accompanied with itchy/watery eyes	13.8	12.4	13.0	12.7	15.9*†	14.4
4. Occurring in						
October to March	31.7	19.3	22.4	25.9	22.6	23.6
April to September	75.3	80.7	77.6	74.1	77.4	75.8
5. Interference with daily activities						
Not at all	79.1	82.3	80.7	80.0	79.1	79.5
A little	15.6	13.1	14.3	17.3	17.2	17.3
A moderate amount	4.3	3.1	3.9	1.9	2.5	2.2
A lot	1.0	1.1	1.1	0.8	1.2	0.9
6. Rhinitis ever	33.2*	24.5	28.8	30.9	32.5†	31.7‡
Global score (≥ cutoff)§	38.2*	31.4	34.7	39.6	41.7†	40.7‡

Data are expressed as the percentage of the total in each column: M, male; F, female.  
 \*Significantly higher comparing gender in the same age-group ( $p < 0.05$ ; chi-squared test).  
 †Significantly higher comparing ages of the same gender ( $p < 0.05$ ; chi-squared test).  
 ‡Significantly higher comparing ages ( $p < 0.05$ ; chi-squared test).  
 §Global score was obtained by summing each question score (see text).

Fig. 2. Frequency of nasal symptoms, according to the month of the year, among 6–7-year-old children (■) and 13–14-year-old adolescents (○).



same age-group and in girls 6–7-years old (Table 2).

The prevalence of ocular symptoms associated with nasal symptoms was 13.0% and 14.4% among 6–7-year-old and 13–14-year-old age-groups, respectively. The prevalence among adolescent girls was higher than among boys of the same age-group and in girls 6–7-years old (Table 2).

The highest frequency of nasal symptoms was found in the coldest months of the year, from April to September, with no significant differences according to age or gender between the two age-groups (Table 2 and Fig. 2). Similarly, there were no significant differences in the reports of interference with daily activities among children of both age-groups (Table 2).

The prevalence of ‘rhinitis ever’ was significantly higher in the 13–14-year-old adolescents, as compared with 6–7-year-old children (31.7% and 28.8%, respectively). The prevalence among boys 6–7 years of age was significantly higher than among girls of the same age-group; the opposite was observed among the adolescents (Table 2).

According to the global cut-off score, the prevalence of rhinitis was also significantly higher among 13–14-year-olds, as compared with 6–7-year-olds (40.7% and 34.7%, respectively). Similarly, the prevalence among boys 6–7 years of age was significantly higher than among

girls of the same age-group; the opposite was observed among the adolescents (Table 2).

Comparing the answers given to the questions 1, 2, 3 and 5 with the response to the question, ‘Has your child (have you) ever had rhinitis?’, variable concordance rates were observed, and significant discordances were verified for all questions. Overall, it was more frequent to answer yes to the symptoms than to acknowledge having rhinitis, except for the question about interference with daily activities (Table 3).

### Discussion

Validation of the Portuguese-translated and modified ISAAC WQ allowed us to identify a larger proportion of patients with rhinitis. A global cut-off score was used to establish values for high sensitivity and high specificity, which was very useful for distinguishing healthy individuals from those with rhinitis.

A constructive validation, comparing answers to the questionnaire with physical examination and/or laboratory tests, is an appropriate method of validation. However, owing to the inherent difficulties of performing this method in a large number of individuals, as in our study, we chose to use the global cut-off score (apparent validation) (15), which was extremely helpful in the interpretation of our results.

Table 3. Concordance frequency (%; McNemar test) between answers (positive or negative) to questions 1, 2, 3, and 5, and global score, in relation to answers (positive or negative) to question number 6 (‘Has your child (have you) ever had rhinitis?’)

Question	6–7-year-old age-group		13–14-year-old age-group	
	M	F	M	F
1. Nasal symptoms ever	76.6	76.5	65.8	62.4
2. Nasal symptoms in the past 12 months	77.7	78.9	69.7	66.8
3. Nasal and ocular symptoms in the past 12 months	74.1	78.1	69.7	69.8
5. Interference with daily activities	75.4	79.2	29.0	31.1
Global score (all)	78.1			69.9

Question 6 of the ISAAC WQ allows investigation of the medical diagnosis in relation to the symptoms of rhinitis. The term 'hay fever' used in the ISAAC WQ has a positive predictive value of 71% for detecting atopy among individuals with rhinitis (13,14); however, in Brazil the prevalence of hay fever is very low in the south of the country (17) and the meaning of the word is not known by most people. For this reason, in the present study the question was modified to 'Has your child (have you) ever had rhinitis?'.

The definition of patients with rhinitis in epidemiologic studies is highly variable. A history of past diagnosis of rhinitis, assessed by the question, 'Has your child (have you) ever had rhinitis?', is the simplest way to verify, with a high degree of specificity, the prevalence of the disease. The accuracy of the response depends on several factors, including: consultation with a physician, the number of physicians consulted, and understanding the rhinitis diagnosis given by the physician. In addition, the patients' subjective approach to the diagnosis of rhinitis is important, and it is not uncommon for some patients to deny it. In the present study, this was observed by the frequency of 78.0% and 81.3% of positive answers to the question, 'Has your child (have you) ever had rhinitis?', among patients seen at our subspecialty clinic, who had the diagnosis of rhinitis established by a physician. It is possible that if methods other than a questionnaire had been applied in the evaluation of these patients, they would have had the diagnosis of rhinitis confirmed, demonstrating the relatively low sensitivity of this particular question.

The identification of patients with possible rhinitis by the presence of rhinitis symptoms has been the approach most widely used when it is not possible to perform nasal smear cytology, rhinomanometry, non-specific or specific nasal provocation, mucosal biopsy, or to evaluate changes in the results of these procedures following medication use. In general, the presence of rhinitis symptoms in the 12 months prior to application of the questionnaire has been thought to be more reliable, minimizing memory errors. In temperate regions, with well-defined seasons, it is recommended that the questionnaire should be applied out of the pollen season, to avoid interference with the responses to the questionnaire (13,18).

The ISAAC study, using a standardized and validated instrument (the WQ), allowed (for the first time) comparisons of data from different regions of the world. At the end of the first phase of the ISAAC study, 155 centers of 56 countries in Europe, Asia, Africa, Australia, and North and South America, have participated, comprising

463,801 students in the 13–14-year-old age-range. In the 6–7-year-old age-range, 257,800 students were included from the 91 participating centers of 38 countries from the regions mentioned above, except Africa (19).

Analysis of the data obtained in the first phase of the ISAAC showed a wide variation in the results. The cumulative prevalence of nasal symptoms without respiratory infection ranged from 2.0 to 64.8% among the 6–7-year-old children, and from 4.2 to 80.5% among the 13–14-year-old adolescents (19). The results of this study are in the middle of these ranges, being 40.0% and 45.3%, respectively.

The prevalence of nasal symptoms without respiratory infection in the past 12 months has been reported to be 1.5–41.8% and 3.2–66.6% among children 6–7-years old and adolescents 13–14-years old, respectively (19). In the present study, a prevalence of 33.8% and 34.0%, respectively, was found in both age-groups. The prevalence of nasal symptoms associated with ocular symptoms has been found to vary from 0.8 to 14.9% and 1.4 to 39.7% for the 6–7- and 13–14-year-old age-groups, respectively (19). Among the children in the present study, prevalences of 13.0% and 14.4% were identified for the 6–7- and 13–14-year old age-groups, respectively. Austin et al. (20) observed a prevalence of 18.2% for rhinoconjunctivitis among English adolescents. Falade et al. (21) observed a prevalence of 39.2% among Nigerian adolescents.

Interference with daily activities in the past 12 months has been reported in 0.5–28.1% and in 2.2–57.4% of the 6–7-year-old children and 13–14-year-old adolescents, respectively (19). In the present study, it occurred in  $\approx$  20.0% of the children, being moderate to high in only 5%. Therefore, although nasal symptoms were frequent, they resulted in little interference with daily activities, indicating a low degree of disease severity.

Using the global cut-off score criteria based on reports of symptoms, we found a prevalence of rhinitis of 34.7% among 6–7-year-old children, and of 40.7% among the adolescents; these values were higher than the prevalence using the ISAAC criteria. The results showed a higher sensitivity of the global cut-off score in the children of this study.

The prevalence of rhinitis was high among the children in this study, even if we consider that criteria might have been used that could lead to under-diagnosis. The rhinitis component of the ISAAC questionnaire, translated to Portuguese and applied to Brazilian children, has provided an adequate and reproducible way for differentiating between children with and without rhinitis.

However, its use in our country as an isolated tool may result in under-diagnosis of rhinitis, as the major diagnostic criteria [an answer 'yes' to the question 'Has your child (have you) ever had rhinitis?'] relies on previous diagnosis of the disease. Some particular characteristics of our population, including cultural aspects and use of different diagnostic terms, may compromise the evaluation of prevalence, if this criteria is used alone. Therefore, the prevalence of rhinitis in Brazil should best be evaluated by using both the ISAAC criteria and the global cut-off score criteria, for obtaining a more realistic estimate of the true prevalence of rhinitis.

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