

PEDIATRICS

Validity and Reproducibility of the Asthma Core International Study of Asthma and Allergies in Childhood (ISAAC) Written Questionnaire Obtained by Telephone Survey

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Objective. To assess the reproducibility and validity of the International Study of Asthma and Allergies in Childhood (ISAAC) asthma written questionnaire (IAWQ) for 6- to 7-year-old children administered to their parents/caregivers through a telephone interview. **Methods.** Our study included 100 children selected from three health units in Rio de Janeiro, Brazil. In total, 50 asthmatic and 50 non-asthmatic children were evaluated; all participants were required to own a household telephone line. Initially, telephone interviews were conducted with the parents/caregivers using the IAWQ. After 2 weeks, parents/caregivers were invited to complete the IAWQ under supervision provided by the researchers. After fifteen days, the telephone interviews were repeated. The reproducibility between the two telephone interviews was assessed using kappa (κ) coefficients; the construct validity was assessed by comparing the answers obtained in the initial telephone interview in both groups according to the clinical diagnosis of asthma performed by a specialist using sensitivity and specificity coefficients. **Results.** Overall, data from 75 children (39 asthmatics) were analyzed, as 25 patients were excluded from the study (11 did not answer phone calls and the responding parents/caregivers for 14 patients were not the same in all study phases). Perfect agreement was observed for the indicator “wheezing in the last 12 months” ($\kappa = 1$), while substantial agreement was observed for the “wheezing with exercise,” “speech limited by wheezing,” and “asthma ever” indicators (κ range, 0.7–0.8). The sensitivity and specificity for “wheezing within the last 12 months” were 64.1% (95% confidence interval (CI), 47.2–78.8) and 88.9% (95% CI, 73.9–96.9), respectively. For the “asthma ever” indicator, the sensitivity and specificity were 87.2% (95% CI, 77.6–95.7) and 100% (95% CI, 90.3–1), respectively. Questionnaire specificity was high for all asthma severity indicators. **Conclusions.** The IAWQ for children aged 6–7 years adapted for telephone interviews showed good reproducibility and adequate validity with an ability to distinguish between asthmatic and non-asthmatic participants. Thus, this method could be utilized in epidemiological studies on childhood asthma in locations where telephone lines are available.

Keywords asthma, epidemiology, ISAAC, reproducibility, telephone, validity

INTRODUCTION

Chronic noncommunicable diseases (CNCDs) will become a major global health challenge over the next several decades, especially in low-income countries (1). Asthma is one of the most frequent CNCDs that occurs in childhood, and it has become an important public health problem in Brazil (2, 3). In 2006, the Brazilian Ministry of Health established the Surveillance of Risk and Protective Factors for CNCDs by Telephone inquiry (VIGITEL). The primary objective of this program was to continuously monitor the frequency and distribution of risk and protective factors for chronic diseases in all Brazilian state capitals. The VIGITEL system uses computer-assisted interviews that have been performed

annually to detect any changes in the habits or behaviors of the Brazilian population (1). The use of this tool to obtain data in a faster, more practical, and less expensive fashion than traditional methods has prompted its use by researchers in Brazil in light of its high response rate (4).

The majority of epidemiological studies concerning asthma use a written questionnaire (WQ) as a research tool. The International Study of Asthma and Allergies in Childhood (ISAAC) is a landmark epidemiological study of asthma and other allergic diseases that provided international and regional comparisons of disease prevalence and risk factors associated with this condition (5).

In general, administration of the ISAAC asthma written questionnaire (IAWQ) to 13- to 14-year-old children under the supervision of investigators has shown a high response rate, with greater than 91% of participants completing the survey (6). However, in children aged 6–7 years, where

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the IAWQ is completed by the parents/caregivers at home, the response rate may be lower and the study results can be compromised (7, 8).

The aim of this study was to evaluate the validity and reproducibility of the IAWQ for 6- to 7-year-old children when administered to their parents/caregivers through a telephone interview.

METHODS

This study was completed in Rio de Janeiro, Brazil, from December 2009 to January 2010. Overall, 100 children 6–7 years of age whose households contained a telephone line or a mobile phone were included in the study. The city of Rio de Janeiro is located in the Southeast region of Brazil and 76.6% of the population has fixed telephone coverage (4).

Patients were recruited from three asthma centers (ACs), which are units of the Municipal Health Department where asthmatic patients are treated on an outpatient basis by allergists and/or pulmonologists. The three ACs studied were located in contiguous and homogeneous geographic areas. The human development indexes (HDIs) of these areas ranged from 0.85 to 0.95. This index takes into account resident education, longevity, and family income to measure the degree of economic prosperity and the quality of life of a population in a particular geographical area (9). Participant distribution according to AC 1, AC 2, and AC 3 was 62%, 24%, and 14%, respectively.

Fifty patients diagnosed as having asthma by specialists according to the Global Initiative for Asthma guidelines (10) and the patients' clinical records constituted the "asthma group." The "control group" consisted of 50 non-asthmatic children who attended the general outpatient pediatric clinics in each of the three ACs. The IAWQ for children 6–7 years of age, previously validated, was administered to the parents/caregivers of children for data collection (11).

The main indicators assessed were the presence of current asthma symptoms (wheezing within the last 12 months), physician-diagnosed asthma (asthma ever), frequency of disease symptoms (attacks within the last 12 months), and disease severity (sleep disturbed by wheezing and speech limited by wheezing). According to the ISAAC protocol, wheezing-associated speech impairment is considered the primary indicator of disease severity and the indicator that can be used to indirectly assess the level of disease control (5). Telephone interviews were conducted by professionals from a public opinion research company who had previous experience using this methodology for health surveys. The interview team was trained by the researchers for 2 days.

The IAWQ was adapted to allow its use in computer-assisted telephone interviews. Questions were read slowly and directly from the screen of a video monitor, and responses were recorded directly and immediately in an electronic record.

The first phase of the study consisted of telephone interviews with the parents/caregivers of the study participants.

In addition to the questions in the IAWQ, the parents/caregivers were also asked supplementary questions to obtain sociodemographic data.

The second phase of the study was performed after a period of 2 weeks, when the parents/caregivers of the children were invited by telephone to visit their children's respective AC to complete the IAWQ under the supervision of the principal investigator.

Fifteen days later, a second telephone interview was performed by a different interviewer. The same IAWQ was used, and only data provided by the same parent/caregiver throughout all three phases of the study were considered for analysis.

The reproducibility of the phone-administered questionnaire was assessed using the kappa (κ) coefficient. The results were classified as follows: above 0.80, almost perfect agreement; between 0.61 and 0.80, substantial agreement; between 0.41 and 0.60, moderate agreement; between 0.21 and 0.4, fair agreement; and below 0.21, slight agreement (12).

The construct validity was assessed by comparing the answers obtained during the first telephone interview with the clinical asthma diagnostic criteria used as the diagnostic standard in our study. The sensitivity and specificity coefficients and their respective 95% confidence intervals were calculated as previously described (12).

Additionally, to assess the agreement between the IAWQ completed directly by the parents/caregivers and those completed by phone in the first interview, the κ coefficient was used as previously described.

The data were stored in an Excel database, and all statistical analyses were performed using SPSS statistical software, version 13 (13).

This study was approved by the Ethics Committee of the City Health Department and the Civil Defense Department of Rio de Janeiro. Written informed consent was replaced by verbal consent obtained before beginning the interview; oral consent was recorded in the research files.

RESULTS

In total, 25 children from the 100 children initially selected were excluded from the study for failure to answer phone calls for 3 consecutive days during the first phase of the study (11 children) and when the respondents were not the same in the three phases (14 children). Similar proportions of patients were excluded from each of the participating AC. The average duration of the telephone interviews was 10 minutes. No differences in the HDIs for the three geographical areas studied were observed. Of the 75 children included in the study, 45 (60%) were male and 39 (52%) were asthmatics. In the asthmatic group, mothers accounted for 79.5% of respondents; fathers, 7.6%; and grandparents, 10.3%. Only 2.6% of the patients surveyed involved a caregiver other than those mentioned above. For the non-asthmatic children, mothers, fathers, and grandparents were the respondents 77%, 8.3%, 8.3%, and 5.4% of the time, respectively. The percentages for each

TABLE 1.—Reproducibility of asthma indicators from the IAWQ for 6- to 7-year-old children administered through a telephone interview with their parents/caregivers.

Indicator	Telephone interview		Kappa (κ) coefficient
	First, <i>n</i> (%)	Second, <i>n</i> (%)	
Any history of wheezing	24 (32.0)	30 (40.0)	0.4
Wheezing within the last 12 months	46 (61.0)	46 (61.0)	1.0
Attacks within the last 12 months	63 (84.0)	64 (85.3)	0.5
Sleep disturbed by wheezing	67 (89.3)	65 (86.7)	0.5
Speech limited by wheezing	62 (82.7)	64 (85.3)	0.7
Asthma ever	41 (54.7)	45 (60.0)	0.8
Wheezing with exercise	57 (76.0)	59 (78.7)	0.7
Coughing at night	34 (45.3)	34 (45.3)	0.6

Note: ISAAC, International Study of Asthma and Allergies in Childhood; IAWQ, ISAAC asthma written questionnaire.

TABLE 2.—Validity of asthma indicators from the IAWQ for 6- to 7-year-old children obtained through a telephone interview with their parents/caregivers compared with clinical asthma diagnostic criteria.

Indicator	Telephone interview	
	Sensitivity (95% CI)	Specificity (95% CI)
Any history of wheezing	89.7 (75.7–97.1)	55.6 (38.1–72.1)
Wheezing within the last 12 months	64.1 (47.2–78.8)	88.9 (73.9–96.9)
Attacks within the last 12 months	28.2 (15.0–44.9)	97.2 (85.5–99.9)
Sleep disturbed by wheezing	15.4 (5.9–30.5)	94.4 (81.3–99.3)
Speech limited by wheezing	33.3 (19.1–50.2)	100 (90.3–1)
Asthma ever	87.2 (77.6–95.7)	100 (90.3–1)
Wheezing with exercise	41 (25.6–57.9)	94.4 (81.3–99.3)
Coughing at night	74.4 (57.9–86.9)	66.7 (49.0–81.4)

Note: 95% CI, 95% confidence interval; ISAAC, International Study of Asthma and Allergies in Childhood; IAWQ, ISAAC asthma written questionnaire.

type of respondent were not statistically different between the asthmatic and non-asthmatic children.

Table 1 shows the reproducibility of the IAWQ data obtained from the two telephone interviews. Perfect agreement was observed for “wheezing within the last 12 months,” while substantial agreement was observed for “wheezing with exercise,” “speech limited by wheezing,” and “asthma ever.” Moderate agreement was observed for the remaining indicators.

Table 2 shows the results of the construct validity assessment for the IAWQ. The “asthma ever” question presents high sensitivity and specificity with 87.2% and 100%, respectively. On the other hand, with the exception of “wheezing within the last 12 months” and “coughing at night,” which exhibited both sensitivity and specificity coefficients above 60%, the other indicators generally showed low sensitivity and high specificity compared with the clinical asthma diagnostic criteria.

When the two methods of IAWQ administration were compared, an almost perfect agreement was observed for “asthma ever” ($\kappa = 0.8$) and moderate to substantial agreement was observed for the other asthma indicators, with κ coefficients ranging from 0.4 to 0.7 (Table 3).

DISCUSSION

Electronic methods for data collection, including interactive oral responses obtained via telephone interview, are

TABLE 3.—Agreement between the IAWQ answers given by the parents/caregivers of 6- to 7-year-old children and the answers obtained from the first telephone interview.

Indicator	Kappa (κ) coefficient
Any history of wheezing	0.5
Wheezing within the last 12 months	0.6
Attacks within the last 12 months	0.7
Sleep disturbed by wheezing	0.4
Speech limited by wheezing	0.5
Asthma ever	0.8
Wheezing with exercise	0.6
Coughing at night	0.6

Note: ISAAC, International Study of Asthma and Allergies in Childhood; IAWQ, ISAAC asthma written questionnaire.

widely applied as substitutes for WQs (14). The implementation of a new method that presents comparable validity and reproducibility to existing methods and increases data quality while also minimizing data loss in epidemiological studies on asthma has been the goal of several researchers (15, 16).

This study shows that the IAWQ for 6- to 7-year-old children adapted for computer-assisted phone interviews has good reproducibility. There was substantial and/or moderate agreement for most indicators of asthma analyzed using this methodology. Furthermore, absolute agreement was observed for questions regarding wheezing within the last 12 months, which is considered the best

indicator for evaluating the prevalence of current asthma in epidemiological studies (5).

This strong reproducibility indicates that computer-assisted telephone interviews have a high level of standardization and that respondents understood the questions because consistent answers were provided. The validity of an asthma questionnaire can be assessed by comparing the obtained responses with different clinical or functional measures (5). A significant correlation was observed between the IAWQ and bronchoprovocation tests with histamine or methacholine, which are considered the “gold standard” for asthma diagnosis (17, 18); spirometry results (19); serum IgE levels (20); aeroallergens sensitization; and clinical diagnoses made by specialists (21). This last criterion mentioned showed high sensitivity and specificity in a previous study that validated the IAWQ in Brazilian children and adolescents (11).

In regard to indicators of asthma severity, our results showed low sensitivity but high specificity. These findings were similar to those reported in another IAWQ validation study in which a bronchial challenge test with methacholine was used as the standard diagnostic criterion (22). In this study, the sensitivity coefficients for the number of attacks, sleep disturbed by wheezing, and speech limited by wheezing were 32.5%, 27.3%, and 14.3%, respectively; in contrast, the specificity coefficients for the number of attacks, sleep disturbed by wheezing, and speech limited by wheezing were 100%, 99.2%, and 100%, respectively. Taken together with our results, these findings suggest that the clinical diagnosis of asthma and the diagnosis by provocation testing have similar accuracy to information provided by the IAWQ. A positive response to the occurrence of “wheezing in the last 12 months” exhibited high sensitivity and specificity (88% and 90%, respectively) compared with objective measurements of pulmonary function in asthmatic patients (5, 7). In our study, although the sensitivity of this parameter was not as high, its specificity was good. These results can be explained by the fact that our sample was derived from a hospital-based population where children have been followed by a specialist and regularly use asthma drugs, suggesting good control of the disease throughout the study period.

On the other hand, the questions pertaining to “asthma ever” exhibited excellent specificity and sensitivity coefficients. The term “asthma” has limited use in our culture to describe wheezing diseases, but is largely used by specialists (23). A positive response obtained to the “asthma ever” question is associated with physician-diagnosed asthma and more severe disease symptoms, possibly explaining the results concerning this indicator in our sample (5, 23). The IAWQ was developed primarily as a tool for the epidemiological diagnosis of asthma, and it has been shown to discriminate between the majority of asthmatic and non-asthmatic children and adolescents on a population level. However, in other scenarios, the IAWQ may not be able to identify all patients with asthma compared with the use of clinical and functional diagnostic criteria (24, 25).

Studies using computer-assisted interviews have shown the usefulness of this technique in epidemiological surveys

for other CNCDS, such as cardiovascular diseases, in the metropolitan areas of Brazilian states from the Southern, Southeastern, and Midwest regions where telephone coverage is above 70% (4). Additionally, computer-assisted interviews were also successfully used in these regions in studies focusing on physical activity habits and sedentary lifestyles.

Our results show that the IAWQ adapted for this methodology has good reproducibility and high concordance between the clinical diagnosis of asthma by a specialist and the questionnaire completed by parents/caregivers.

CONCLUSIONS

In conclusion, the IAWQ administered to the parents/caregivers of 6- to 7-year-old children through a telephone interview is able to discriminate between asthmatic and non-asthmatic children and is an appropriate tool for epidemiological studies on childhood asthma, especially in areas where telephone coverage is above 70%.

DECLARATION OF INTEREST

This article has been read and approved by all authors. This article is unique, is not under consideration by any other publication, and has not been published elsewhere. The authors report no conflicts of interest in this work.

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