

EPIDEMIOLOGY

Prevalence and severity of asthma and related symptoms in 6- to 7-year-old schoolchildren of Rio de Janeiro using of the ISAAC questionnaire by telephone survey

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Abstract

Objective: To evaluate the prevalence and severity of asthma and its association with sex in 6- to 7-year-old schoolchildren from the city of Rio de Janeiro (RJ), obtained by a telephone survey. **Methods:** A cross-sectional study using the International Study of Asthma and Allergies in Childhood (ISAAC) Written Questionnaire for Asthma adapted and validated by telephone interviews was conducted. The random sample was recruited systematically, without replacement, taking into account the proportion of school classes and students in each regional coordination of the Municipal Secretariat of Education, which supplied the students' telephone numbers. The data were collected by a polling company from May to July 2010. Prevalence ratios (PRs) and 95% confidence intervals (95% CI) were compared using the difference in proportions test suitable for large samples to analyze the association between asthma and sex. **Results:** In total, 3216 interviews from parents/caregivers of children were analyzed; 51.4% of the children were males. Mothers were the primary respondents (71.9%). The prevalence rates of "wheezing ever" and "wheezing in the last 12 months" were 52.2% and 20.9%, respectively, and were significantly higher among boys (PR: 1.10, 95% CI: 1.03–1.18 and PR: 1.27, 95% CI: 1.10–1.45). The same pattern was observed for "asthma ever" (PR: 1.44, 95% CI: 1.12–1.85) and for "severe asthma" (PR: 1.42, 95% CI: 1.11–1.82). **Conclusion:** The prevalence of asthma was high among RJ's students. Most of the indicators of the disease were more prevalent among boys. Our results were similar to those observed in other Brazilian and international centers using the traditional ISAAC protocol. The use of this method can be an alternative for epidemiological studies of childhood asthma especially in areas where the telephone coverage is high.

Keywords

Asthma, childhood, epidemiology, ISAAC, prevalence, telephone

History

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Introduction

A chronic non-communicable disease (CNCD) that is more common in childhood, asthma, has emerged as an important public health problem in Latin America in recent decades [1]. Asthma interferes with millions of individuals' daily quality of life, and it also has a large socio-economic impact, especially in low-income population if access to treatment and the high cost for the public health system are considered [2].

Since 2006, Brazil's Ministry of Health has been developing a system to continuously monitor the frequency and distribution of risk and protective factors for CNCDs in all of Brazil's state capitals and in the Federal District, based on telephone surveys among individuals older than 18 years (Vigitel) [3]. However, this initiative has not included data on asthma or strategies for its treatment in any age group.

The International Study of Asthma and Allergies in Childhood (ISAAC) was a landmark epidemiological study of asthma that enabled both international and regional comparisons of its prevalence and severity [4]. Data from different centers participating in the ISAAC phase III study in Brazil provided evidence that the mean prevalence of active

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asthma was high, with 24.3% of schoolchildren aged 6–7 years and 19.0% aged 13–14 years [5] affected.

Since 2005, the treatment of asthmatic children in the city of Rio de Janeiro (RJ) has been managed by the Municipal Health and Civil Defense Secretariat, which provides care and medications. Despite advances in public health policies regarding asthma in RJ, the real prevalence and severity of asthma in the pediatric population remain unknown.

The aim of this study was to evaluate the prevalence and severity of asthma and related symptoms and their relationship with sex in 6- to 7-year-old schoolchildren living in RJ and studying in public municipal schools, using the standard ISAAC written questionnaire for asthma (IWQA) adapted and validated by telephone survey.

Methods

This study used a cross-sectional design with 6- to 7-year-old children enrolled in the first cycle of their elementary schools' initial and intermediate classes of the Municipal Secretariat of Education (MSE).

RJ is a large city with 6 323 037 inhabitants and a population density of 5037 inhabitants/km². The city is located in the Southeastern region of Brazil [6]. Approximately 75% of its population has fixed-line telephone [3] coverage, and this percentage increases to nearly 100% when mobile phone coverage is added.

According to the MSE's information, in 2009, there were 114 000 students aged 6–7 years distributed throughout 7040 classes. The telephone line registration – landline or mobile – of the students' parents/caregivers is updated annually at enrollment time.

The sample was a stratified proportional sample that was separated into 10 independent strata, corresponding to each Regional Education Coordination (REC) covering the entire geographic area of the city of RJ. The RECs are the MSE's administrative divisions, which aim for greater homogeneity within the strata for the asthma variable of interest and for heterogeneity among the RECs.

After stratification by RECS, the sample was split into two stages: the first stage selected the school classes, and the second stage selected the students. A systematic random sample, without replacement and with equal probability of selection of subjects at each stage, was used, until completion the ISAAC proposed sample size of 3000 students. This sample size allows the detection of difference in the prevalence of wheezing in a 12-month period and its severity in the entire of city of RJ and in other different geographical centers with a power of 99% and 90%, respectively, at the 1% significance level [4,7]. To assess the accuracy of the estimates and of the conclusions obtained with the expanded sample and to enable comparability among different variables, the coefficient of variation was adopted as a measurement of dispersion. This coefficient was calculated in terms of proportions of classes and students per school. Thus, the adopted probability sampling model and each primary sampling unit selected, in addition to representing itself, also represented other units that were not selected, allowing for the generalization of the results to the targeted population.

Telephone survey and data collection

Data collection instrument

The IWQA was used to collect data from 6- to 7-year olds. This instrument was originally validated in Brazil in 1998 by Solé and colleagues [8]. Recently, it was adapted and validated by our group for use by telephone [9].

The data were collected directly from the parents/caregivers of children. The IWQA consists of eight questions about current and past asthma symptoms; it also assesses asthma severity. To minimize memory errors and possible seasonal interferences, the questions are limited to the past 12 months [4]. Socio-demographic data were also collected from the participants. The telephone numbers of the parents/caregivers of the children were obtained from the MSE, as previously described. Before the data collection stage, the research was described to the participants by the schools through folders sent home to the students' parents/caregivers.

Data collection was conducted from May to July 2010 by technicians of a polling company with prior experience in this type of health survey, who had been previously trained and guided by the researchers. The calls were made during business hours on weekdays, and additional calls were made on Saturdays to phone lines that had not responded.

The selected students' parents/caregivers were invited to participate in the survey by telephone. The questions were read directly from the computer screen, and responses were recorded electronically. Those who did not respond to telephone calls for three consecutive days, those who were not parents/caregivers of student and those who refused to participate in the study were excluded. Due to the low quality of information obtained from the MSE's registered phone numbers, the initial sample of students' telephone numbers was increased from 3000 to 5000. Among the most frequent errors observed were incomplete data, such as missing telephone digits, schools with incorrect names and/or nonexistent districts.

Study variables

The best indicator for the prevalence of active asthma was obtained by the percentage of positive responses to the question, "Has your child had wheezing during the last 12 months?" [10]. Asthma-related symptoms, such as nocturnal coughing without having a cold, wheezing after exercise, number of asthma attacks, sleep disturbance and speech limitation caused by wheezing attacks in the last 12 months, were also assessed [4,11]. Those children who, in the last 12 months, presented four or more wheezing episodes, had more than one night with a sleep disturbance or had a speech limitation due to wheezing were considered to have severe asthma, according to previously established criteria [12]. Physician-diagnosed asthma (asthma ever) was indirectly assessed by the question, "Has your child ever had asthma during your life?" [11]. Socio-demographic data of children and their parents/caregivers also were included in the questionnaire.

Data analysis

The socio-demographic data and the responses to the questions were coded as individual variables. Differences between proportions were evaluated by the differences between proportions test suitable for large samples with a normal distribution. Prevalence ratios (PRs) and 95% confidence intervals (95%CI) were used for the analysis of associations between the prevalence and severity of asthma symptoms and sex. Results were considered to be statistically significant at the $p < 0.05$ level [13]. SPSS, version 16.0 (SPSS Inc., Chicago, IL) was used for the data analysis [14].

Ethical aspects

Due to the nature of the research, signed informed consent forms were replaced by verbal consent, which was obtained over the telephone and was then recorded in the research files in CDs. This study was approved by RJ's Research and Ethics Committee of the Municipal Health and Civil Defense Secretariat.

Results

The final sample consisted of 5000 telephone numbers, derived from 743 classes distributed through the 10 RECs. Data from 3216 students (64.3%) were collected, 51.4% of whom were boys. Mothers were the primary respondents (71.9%). Among the parents/caregivers in the sample, 35.7% had not completed elementary education, 25.7% reported having completed elementary school and 38.6% had completed high school or higher education (Table 1). The average length of the interviews was 20 minutes.

Table 1. Sample characteristics – Rio de Janeiro, 2010.

Variables	N = 3216	%
Sex		
Male	1652	51.4
Female	1564	48.6
Respondent		
Mother	2312	71.9
Father	312	9.7
Others	592	18.4
Parents/caregivers education level		
Elementary or below	1147	35.7
Complete elementary	827	25.7
High school and/or higher	1242	38.6

Table 2 shows the prevalence of asthma and related symptoms by sex. The prevalence rates of “wheezing ever in life” and “wheezing during the last 12 months” were 52.2% and 20.9%, respectively, and both rates were significantly higher among boys. The same pattern was observed for the prevalence of “one to three attacks in the last 12 months” and “physician-diagnosed asthma”. The prevalence of “four or more attacks” in the last 12 months was significantly higher among boys. The prevalence of both “sleep-disturbed” and “speech-limited” was higher among boys, but the differences did not reach statistical significance. However, when “severe asthma” was defined as the presence of positive responses for any of these last three variables, its prevalence was significantly higher in boys. No statistically significant difference was found between sexes for “nocturnal coughing without having a cold”, “wheezing with exercise”, “disturbed sleep” or “limited speech” (Table 2).

No statistically significant difference was found between the prevalence of active asthma, or other indicators of the disease, and the educational level of the parents/caregivers (below elementary: 21.5%; elementary: 19.7%, high school: 21.2% [PR: 1.05; 95%CI: 0.86–1.26]).

Discussion

The standard IWQA has proved to be a valuable tool in epidemiological studies. It is easy to understand, it has a low cost and its implementation does not depend on a trained interviewer [4,15]. Furthermore, it correlates well with objective measurements of disease assessment, such as the presence of bronchial hyperresponsiveness, spirometric tests and the clinical diagnosis of asthma made by a physician [4].

Designed for children in two age groups, 6–7 years old and 13–14 years old, the questionnaire has a high rate of return – more than 95% – when applied directly by researchers to adolescents in schools. In contrast, in the younger age group, the questionnaire was sent to the parents/caregivers' homes, and the response rate was approximately 60% [15], which is a degree of loss that might have compromised the final analysis of the results. Several biases might have been associated with the low return rate, such as not understanding the issues, not returning the questionnaire or even greater adherence by those respondents whose children had the studied disease [16].

Electronic methods of data collection, including interactive voice response through telephone calls, are being widely used in place of written questionnaires [17]. The use of the

Table 2. Prevalence of asthma and related symptoms among 6- to 7-year-old schoolchildren according to sex.

Symptoms	Total (N = 3216) n (%)	Female (N = 1564) n (%)	Male (N = 1652) n (%)	PR	95% CI
Wheezing ever	1687 (52.5)	779 (49.8)	908 (55.0)	1.10	1.03–1.18**
Wheezing in the last 12 months	673 (20.9)	288 (18.4)	385 (23.3)	1.27	1.10–1.45**
1 or 3 attacks in the last 12 months	435 (14.6)	189 (12.9)	246 (16.3)	1.31	1.06–1.6**
≥4 attacks in the last 12 months	194 (6.0)	77 (4.9)	117 (7.1)	1.44	1.09–1.90**
Sleep disturbed	139 (4.3)	58 (3.7)	81 (4.9)	1.32	0.95–1.84
Speech limited	91 (2.8)	37 (2.4)	54 (3.3)	1.38	0.91–2.09
Asthma ever	234 (7.3)	93 (5.9)	141 (8.5)	1.44	1.12–1.85**
Wheezing with exercise	190 (5.9)	81 (5.2)	109 (6.6)	1.27	0.96–1.68
Nocturnal coughing	1037 (32.2)	498 (32.6)	498 (31.8)	1.02	0.93–1.13
Severe asthma	283 (8.8)	115 (7.4)	168 (10.2)	1.42	1.11–1.82**

PR: prevalence in males/females ratio; 95% CI: 95% confidence interval.

** $p < 0.05$ (difference between proportions test).

CNCDs' risk factor monitoring system by telephone in Brazilian urban areas has important features, such as simplicity, low cost and agility. This system has been used successfully in populations in which telephone services reach the majority of the population, which is a situation that applies to almost all Brazilian cities [18].

In a validation study conducted in 6- to 7-year-old children, both asthmatic and non-asthmatic, treated at health facilities of RJ's Municipal Health and Civil Defense Secretariat by a disease specialist, the IWQA was adapted for use as a telephone survey. It showed excellent reproducibility and high sensitivity and specificity for most indicators of asthma analyzed by this tool, compared with the clinical diagnosis of asthma [9].

The prevalence of active asthma – 20.9% in our sample – was high and similar to the prevalence found in other large Brazilian cities. Data from the ISAAC phase III study in Brazil estimated the mean prevalence of active asthma to be 24.3% among 6- to 7-year olds. The prevalence rates of active asthma in the South, North, Northeast and Southeast regions were 20.6%, 21%, 24.4% and 26%, respectively [5]. In other municipalities in the State of RJ, such as Duque de Caxias, Seropédica and Nova Iguaçu, the prevalence rates of active asthma were also high, at 28.4% [16], 31.1%, [19] and 26.6% [20], respectively. The mean prevalence rates of active asthma both in Latin America and worldwide is 19.6% and 10.2%, respectively [21].

In this study, the prevalence of the main indicators of asthma and their severity was significantly higher among boys. A 1.3:1 PR was found between sexes when examining the prevalence of active asthma in particular. Similar findings have been observed by other national authors [16,22,23], and they have followed the same pattern observed in international results [24].

It was observed that the percentage of positive responses to “asthma ever”, 7.3%, was much lower than the corresponding prevalence of “wheezing during the last 12 months”, 20.9%. Such findings were also similar to the data from previous studies using the IWQA in 6- to 7-year olds in Brazil. The average prevalence of “physician-diagnosed asthma” was 10.3%, and the prevalence rates were 10.6%, 10.3% and 7.3% in Brazil's Northeast, South and Southeast regions, respectively [5]. In general, the physician used the term “asthma” for the most severe cases of the disease [25]. Furthermore, this result could be interpreted as a medical underdiagnosis of asthma, which might have resulted in undertreatment of the disease. Thus, these results should warn us about the possibility of undertreatment occurring among asthmatic schoolchildren in RJ.

Among the many challenges in the implementation of a new method that has validity and reliability compared to existing methods, there is the need to be mindful of the quality of the information obtained with the new process [26,27]. Accordingly, some relevant aspects concerning this study are highlighted.

Currently, according to the 2010 Census of Population data, 4 of 10 households are headed by women, who are responsible for supporting their families [6]. Furthermore, a study conducted in the city of Vitoria, in the southeast of Brazil, pointed to the mothers of children in public schools as being responsible for the feeding and hygiene care of their

children and, therefore, being more capable of answering questions regarding their children's health [28]. In our sample, mothers accounted for approximately 70% of the respondents.

Despite the low educational level of the respondents in this study, no significant difference was found between the prevalence of the analyzed asthma indicators and the respondents' schooling. This finding suggests that the validated questionnaire, within the socio-cultural context of the same population in which it was applied, was well understood and well accepted by the respondents, in addition to motivating participation and providing the desired information [29]. Moreover, the adopted probability sampling model used in this study enabled the generalization of the results of this research for RJ's population of students in this age group. When considered collectively, these observations reinforce the quality of the data obtained by this study.

Comments

In conclusion, the prevalence of asthma and related symptoms among 6- to 7-year-old schoolchildren in RJ was high, thus providing evidence that asthma is a public health problem in our city.

The similarity of our data to those from other Brazilian and international cities, where traditional written data collection methods were used, shows that administering the IWQA by telephone survey is adequate for epidemiological studies of childhood asthma.

The use of this method, especially in areas where the population's telephone coverage is more than 70%, could become an important tool for monitoring and establishing health policies, for developing preventive programs focusing on asthma, as well as possibly other CNCDs that are common in childhood, and for improving patients' and their families care and quality of life.

Declaration of interest

This manuscript has been read and approved by all of the authors. This paper is unique, is not under consideration by another publication and has not been published anywhere else. The authors report no conflicts of interest in this work.

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