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The prevalence of asthma and atopy in schoolchildren from Porto Alegre, Brazil, has plateaued

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Summary

Objective: A significant increase in the prevalence of asthma and atopy was observed in epidemiological studies conducted in 1980, 1989 and 1998, with schoolchildren of Porto Alegre. The present study aims to determine changes in the prevalence of symptoms of current and lifetime asthma and also to document the prevalence of atopy in schoolchildren from a region of Porto Alegre.

Methods: This was a cross-sectional study in which schoolchildren from 5th to 8th grade (10–18 years), from four schools located in the same geographic area were interviewed. The questionnaire covered symptoms suggestive of lifetime or current asthma (at some point in life or in the last twelve months, respectively). In addition, skin tests were performed in a subset of 241 schoolchildren.

Results: 964 students were interviewed from a total of 1195 registered. The prevalence of lifetime asthma symptoms was found to be 41.7%, symptoms of current asthma 14.9% and atopy 52.7%. Compared to previous studies, the prevalence of lifetime asthma and atopy has stabilized while the prevalence of current asthma fell from 22% to 14.9% ($P < 0.001$).

Conclusions: In the last decade the prevalence of atopy and lifetime asthma has plateaued, while the prevalence of current asthma fell.

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Introduction

Asthma is marked by geographical variations in prevalence; the reason for these changes in different regions remains unknown, although several factors may be involved in each region. Currently, it is estimated that 300 million people suffer from asthma worldwide [1].

A worldwide increase in the prevalence of asthma and atopy has been observed in many countries, including Brazil [2–5]. In the city of Porto Alegre, Rio Grande do Sul, Brazil, three similar epidemiological studies of asthma in children and adolescents were performed. The first, conducted in 1980, showed a prevalence of lifetime asthma (defined as symptoms sometime in the past or present) of 6.7% and atopy, determined by skin tests, of 15.8% [6]. In the second study nine years later, conducted in the same schools and with the same methodology, the percentage of lifetime asthma had increased significantly to 16.5%. The prevalence of current asthma (symptoms in the last 12 months) was 10.9% [7]. In the third study, conducted in 2000 in the same schools, the prevalence of lifetime asthma, current asthma and atopy was 42.5%, 22% and 50.1%, respectively [8].

The aim of this study was to verify and update the latest changes in the prevalence of symptoms of current and lifetime asthma and atopy in schoolchildren from a region of Porto Alegre, Brazil.

Materials and methods

This is a cross-sectional study in which 964 children from 5th to 8th grade (10–18 years), from four schools located in the same geographic area from Porto Alegre – RS, Brazil, were interviewed in the period of March–June of 2013. These schools were the same that participated in the three earlier studies.

Initially, a questionnaire was performed that included questions covering demographic data, smoking, symptoms suggestive of asthma, such as shortness of breath and wheezing at some point in life (considered as lifetime asthma) or in the last 12 months (considered as current asthma), symptoms following exercise, family history of asthma and medications used. The questionnaire was the same used in earlier studies [6–8]. Study participants who answered positively to question number 2 (Have you had this kind of problem in the past twelve months?) underwent a second interview with the ACT questionnaire (Asthma Control Test), which has five items that relate to symptoms, use of rescue medication and effect of asthma on daily activities. The score is calculated from the sum of the values of each question, which are worth one to five points, so the score ranges from 5 to 25 points, allowing classifying asthma in uncontrolled when <20 points and controlled when greater than or equal to 20 points [9].

The second stage of the research was to perform skin tests for investigation of allergic reaction. The method of puncture (“prick-test”) was chosen because it is considered to be secure, easy to use, and has good sensitivity, specificity and reproducibility. A random sample of 241 students had prick-tests, which was performed on the ventral side of the right forearm, with readings after 15 min, using two allergens: mites and grass. A negative control with diluent and a

positive control with histamine were used. We used mites and grass because they are the two most prevalent allergens in the south of Brazil, and were the same used in the three previous studies. A diameter of greater than 2 mm was considered as positive and was measured with a ruler.

Sample size calculation was performed to estimate the number of students to perform the skin test; assuming a prevalence of atopy in the order of 50%, with a margin of error of 6.5%, 228 students were estimated. Differences in proportion were tested using the chi-square test. We compared the prevalence of current asthma and lifetime asthma between the periods 1998 and 2013 by testing for the difference between two proportions.

The level of significance in this study was $\alpha = 0.05$. Data were analyzed with SPSS, version 17.0 (Statistical Package for Social Sciences – SPSS, Inc, Chicago, IL, USA) and Min-itab version 16.

This study was approved by the Ethics Committee in Research of the Pontifical Catholic University of Rio Grande do Sul – PUCRS.

Results

964 individuals were interviewed, 502 females (52%). Smoking prevalence was 1.5%. Lifetime asthma symptoms were identified in 402 students (41.7%); there were no significant differences between genders. The sample was divided into three groups: 10–12 years, 13–15 years and 16–18 years, and the prevalence of lifetime asthma and current asthma were similar in the three groups as shown in Table 1. A positive family history was reported by 54.7% of students with lifetime asthma symptoms. Symptoms of current asthma were identified in 144 (14.9%) of students, with a prevalence of 18% in girls, significantly higher than the 11.7% found in boys ($P < 0.05$). Atopy was identified in 52.7% of the tested students, and was higher in males (64.2% vs. 43.2%; $P < 0.001$). Information about prevalence of asthma and atopy are found in Table 1.

The results of the present study were compared to those obtained in previous surveys from 1980, 1989 and 1998, as shown in Table 2. It appears that there had been an increase in the lifetime prevalence of asthma from 1980 to 1989, 1989 to 1998, but stabilization from 1998 to 2013 (Fig. 1). The prevalence of current asthma increased between 1989 and 1998 and decreased significantly between 1998 and 2013 ($P < 0.001$), as shown in Fig. 2. The prevalence of atopy had tripled between 1980 and 1998 and stabilized between 1998 and 2013 (Fig. 3).

Of the 144 students who had symptoms of current asthma who responded ACT questionnaire, 68.1% were uncontrolled. Among students with symptoms of current asthma 52.1% were using medication. The most commonly used medications were: short-acting beta2 agonist (32.6%), inhaled corticosteroids (7.7%), oral corticosteroids (4.9%), combination of inhaled corticosteroids and long-acting beta2 agonist (4.2%) and 2.7% unknown.

Discussion

Our study shows stabilization of asthma and atopy prevalence in a region from Brazil. Recent studies have shown

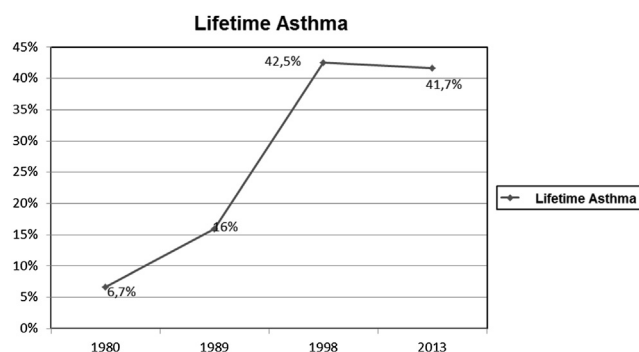
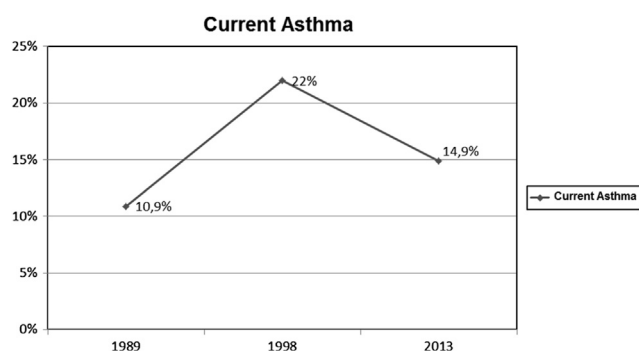
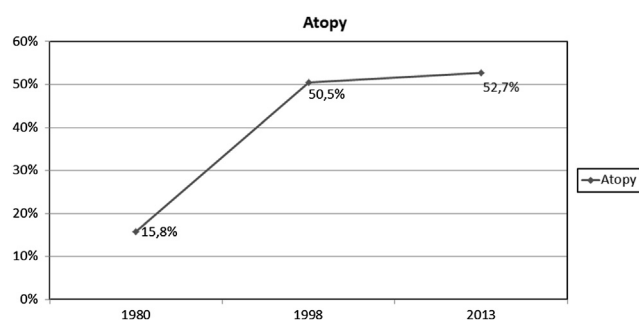
Table 1 Prevalence of asthma and atopy.

Variable	N°	%	P value
Lifetime asthma	402	41.7%	
<i>Gender</i>			
Male	190	41%	P > 0.05
Female	212	42.3%	
<i>Age</i>			
10–12 years	121	42.6%	P > 0.05
13–15 years	259	42.2%	
16–18 years	22	33.3%	
Current asthma	144	14.9%	
<i>Gender</i>			
Male	54	11.7%	P < 0.008
Female	90	18%	
<i>Age</i>			
10–12 years	43	15.1%	P > 0.05
13–15 years	93	15.1%	
16–18 years	8	12.1%	
Atopy	127	52.7%	
<i>Gender</i>			
Male	70	64.2%	P < 0.001
Female	57	43.2%	
<i>Lifetime asthma</i>	60	61.9%	P < 0.02
<i>Current asthma</i>	18	69.2%	P > 0.05

similar trends. In a smaller city from Brazil, the prevalence of wheezing and shortness of breath in the last 12 months remained stable over a ten year period [10]. The same stabilization has been described by Zollner et al. in Germany, in a study conducted about current wheezing and asthma between 1992 and 2001 [11]. Lötvall et al. showed that in West Sweden in the period 1990–2008, the prevalence of asthma that had been rising, has now stabilized [12]. The stabilization in the prevalence of asthma has also been reported in the United States, with a reduction in mortality rates from 1980 to 2007 [13].

The reasons for the recent stabilization in the prevalence of asthma throughout the world are unknown. It is possible that a combination of factors, such as genetic susceptibility and exposure to environmental factors are responsible for this phenomenon.

The earlier increase in asthma and atopy prevalence that happened until the last decade had been attributed to several factors, but especially to environmental changes. The Hygiene Hypothesis is one of the most repeated explanations to justify this fact. The Hygiene Hypothesis suggests that some kind of resistance, which is acquired through early

**Figure 1** Longitudinal lifetime asthma prevalence.**Figure 2** Longitudinal current asthma prevalence.**Figure 3** Longitudinal atopy prevalence.

exposure to micro-organisms, is necessary to the maturation of the immune system. Not having this exposure could lead to the development of diseases mediated via IgE, such as asthma [14]. Since the beginning of the last century, people began to live in more ventilated environment with fewer people sleeping in the same room, with reduced risk of infections due to vaccines and/or antibiotics, which may have contributed to a hypertrophy of the immunologic system and

Table 2 Longitudinal Asthma and atopy prevalence.

Variables	Year			
	1980	1989	1998	2013
Sample size asthma questionnaire	1.111	1.169	855	964
Current asthma	NA	127 (10.9%)	188 (22%)	144 (14.9%)
Lifetime asthma	74 (6.7%)	196 (16.5%)	363 (42.5%)	402 (41.7%)
Sample size atopy skin test	1.111	NA	503	241
Atopy	176 (15.8%)	NA	251 (50.1%)	127 (52.7%)

an increase in atopic diseases. These environmental changes have probably stabilized in the last decade and this perhaps could explain the plateau that occurred in the epidemiology of asthma and atopy.

It is also possible that the high prevalence of asthma has reached a plateau because the maximum number of genetically susceptible people has been sensitized by the environment. Even if environmental conditions may follow the same trends of change in the last decade, these changes alone would not lead to the emergence of asthma if there was not an individual genetic predisposition for it.

Besides stabilization, a phenomenon of decrease in symptoms of current asthma decreased was observed in the last decade in our study. This might be due to the introduction of inhaled steroid use in Brazilian public system since, even though only a small proportion of subjects were on preventive therapy (11.9%). It could also be related to a reduction in exposure of smoking [15]. Several studies indicate a reduction of smoking in Brazil; in 1989 about 32% of the population aged 15 or more were smokers, while in 2008 the prevalence was 17, 2% and in 2012 14.8% [16–18].

Our study also evaluated atopy prevalence. Skin testing was performed on 241 schoolchildren and found a prevalence of atopy of 52.7%. The presence of atopy in students in our study was significantly higher in males. These results were consistent with the research conducted by Arbes et al. in the United States in 2008, that found the prevalence of atopy of 54.2%, with a higher prevalence among men than women [19]. Our study is also consistent with a German study where the prevalence of atopic sensitization also remained unchanged from 1992 to 2001 [11].

One limitation of the study is due to non-performance of pulmonary function tests for the diagnosis of asthma, which may have overestimated the prevalence of the disease. However, the questionnaire reflects the symptoms typically associated with asthma and used in other large epidemiological studies [20]. It was also the same used in our previous three epidemiological studies, making the comparison over time adequate.

Our study used the same methodology and involved a similar population over a period of 30 years. The results likely reflect the real changes in asthma and atopy prevalence in recent decades, confirming the recent global trends of stabilization of the disease.

Conclusion

After a significant increase in the prevalence of asthma and atopy between 1980 and 1998 in a large city from Brazil, there has been stabilization in the last decade in lifetime asthma and atopy. Although asthma prevalence remains high, there has been a reduction in the prevalence of symptoms of current asthma.

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