Prevalences of asthma and rhinitis among adolescents in the city of Fortaleza, Brazil: temporal changes*

Comparação temporal das prevalências de asma e rinite em adolescentes em Fortaleza, Brasil

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Abstract

Objective: To describe the prevalences of asthma and rhinitis in adolescents (13-14 years of age) in the city of Fortaleza, Brazil, in 2010, comparing the results with those obtained in a prevalence survey conducted in 2006-2007. Methods: This was a cross-sectional study involving probabilistic samples of 3,015 and 3,020 adolescents in surveys conducted in 2006-2007 and 2010, respectively. The International Study of Asthma and Allergies in Childhood protocol was used on both occasions. Results: Comparing the two periods, there were no significant differences regarding cumulative wheezing, active asthma, four or more wheezing attacks within the last year, sleep disturbed by wheezing more than one night per week, and speech-limiting wheezing. The prevalences of exercise-induced wheezing, dry cough at night, and physician-diagnosed asthma were significantly higher in 2010 than in the 2006-2007 period (p < 0.01 for all). The prevalence of physician-diagnosed rhinitis was significantly lower in 2010 (p = 0.01), whereas there were no significant differences between the two periods regarding cumulative rhinitis, current rhinitis, and rhinoconjunctivitis. In both periods, dry cough at night, current rhinitis, and rhinoconjunctivitis were significantly more prevalent in females than in males (p < 0.01 for all). Also in both periods, active asthma, current asthma, rhinitis, and rhinoconjunctivitis were more prevalent in private school students than in public school students (p < 0.01 for all). Conclusions: Our data show that the prevalences of asthma and rhinitis symptoms remain high among 13- and 14-year-olds in Fortaleza, predominantly among females and private school students.

Keywords: Asthma/epidemiology; Rhinitis/epidemiology; Adolescent.

Resumo

Objetivo: Descrever as prevalências de asma e rinite em adolescentes de 13-14 anos de idade em Fortaleza (CE) em 2010 e compará-las com as prevalências obtidas em um inquérito em 2006-2007. Métodos: Estudo transversal envolvendo uma amostragem probabilística de 3.015 e 3.020 adolescentes, respectivamente, em 2006-2007 e 2010, utilizando o protocolo do International Study of Asthma and Allergies in Childhood. Resultados: Na comparação entre os dois períodos, não houve diferenças significativas em relação a sibilos cumulativos, asma ativa, quatro ou mais crises de sibilos no último ano, prejuízo do sono por sibilos > 1 noite/semana e crises limitando a fala. Em 2010, houve um aumento significativo na prevalência de sibilos após exercícios, tosse seca noturna e asma diagnosticada (p < 0,01 para todos). Em 2010, houve uma redução significativa na prevalência de rinite diagnosticada (p = 0,01), enquanto não houve diferenças significativas entre os dois períodos nas prevalências de rinite cumulativa, rinite atual e rinoconjuntivite. Em ambos os períodos, tosse seca noturna, rinite atual e rinoconjuntivite foram significativamente mais prevalentes nas mulheres que nos homens (p < 0,01 para todos). Também nos dois períodos, asma ativa, rinite atual e rinoconjuntivite foram significativamente mais prevalentes nos alunos das escolas particulares do que naqueles das escolas públicas (p < 0,01 para todos). Conclusões: Nossos dados mostram que as prevalências de sintomas de asma e rinite continuam altas entre os adolescentes de 13-14 anos em Fortaleza, com predominio no gênero feminino e em alunos de escolas particulares.

Descritores: Asma/epidemiologia; Rinite/epidemiologia; Adolescente.

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Introduction

Asthma and rhinitis are chronic inflammatory airway diseases that affect most of the general population and that, in recent decades, have been increasing in prevalence in various parts of the world. Although genetic factors are important, they alone cannot explain these increases in prevalence, and it is likely that the environment has greater relevance for the expression of these diseases. In this sense, prevalence comparison across populations and over time can be an important source of new clues to understand these conditions. The definition of asthma remains vague and inaccurate—given that its pathogenesis remains unclear—and this can hinder the identification of cases in epidemiological studies. Therefore, in 1991, the International Study of Asthma and Allergies in Childhood (ISAAC) protocol was developed with the aim of maximizing the value of research on asthma and allergies in children and adolescents by enabling comparisons of prevalences of these diseases, as well as of their spatial and temporal trends, between populations in different countries and regions.

The objectives of the initial phase of the ISAAC (ISAAC phase I) were to describe the prevalence and severity of asthma, rhinitis, and eczema in children (6-7 years of age) and adolescents (13-14 years of age) living in different locations around the world, as well as to make comparisons within and between various countries and regions; to establish baseline values for the assessment of future trends in the prevalence and severity of these diseases; and to provide structure for future etiological studies on genetics, lifestyle, medical care, and environmental factors related to these diseases. Phase II of the ISAAC was aimed at investigating the relative importance of the hypotheses of interest that were raised in phase I by using objective markers, such as the methacholine challenge test; phase III sought to evaluate the trends in the prevalence of asthma, rhinitis, and eczema at the centers participating in phase I, as well as to include new centers that did not participate in phase I and to identify the possible factors related to these trends.

In ISAAC phase I, the prevalence of asthma symptoms in the last 12 months, considering the two age groups studied, ranged from 1.6% to 36.8%, and the prevalence of allergic rhinitis ranged from 1.4% to 39.7%. More recently, the ISAAC phase III findings indicate that the international differences in the prevalence of asthma symptoms have diminished, particularly in the 13-14-year age group, the prevalence decreasing in English-speaking countries, as well as in Western Europe, and increasing in regions where it had previously been low. However, the reported increases in the prevalence of asthma symptoms in Africa, Latin America, and parts of Asia indicate that the global burden of asthma continues to increase. In South America, the mean prevalences of asthma and rhinitis have increased, and there has been a reduction in the differences among centers.

In Brazil, the results for the participation of various cities in ISAAC phase III have confirmed the previously observed high prevalences of asthma and rhinitis. In the state of Ceará, Brazil, no studies have yet been conducted in order to evaluate temporal changes in the prevalences of asthma and rhinitis. Therefore, the objective of the present study was to determine the prevalences of asthma and rhinitis in adolescents (13-14 years of age) in the city of Fortaleza, Brazil, in 2010, comparing the results with those obtained in another prevalence survey conducted in 2006-2007.

Methods

This was a cross-sectional population-based descriptive study involving public and private school students (13-14 years of age) that was carried out in the city of Fortaleza, Brazil, and comprised two surveys, one conducted in 2006-2007 and one conducted in 2010. The survey periods were from April to November of each year.

The city of Fortaleza is located on a coastal flat, immediately south of the Equator (between 3°30’S and 4°30’S), at an altitude of 15.49 m above sea level. The city encompasses an area of 4,667.8 km² and has a population of 2,431,415. The annual mean temperature ranges from 26°C to 27°C. The air quality is currently classified as fair, and the relative humidity is approximately 82%. In the 2010 Census, 72.9% of the population had a monthly income of only two times the national minimum wage or less.

The city is divided into six administrative regions. Among the schools located in those regions and enrolling 50 or more students in the age group of interest, 29 and 27 were randomly selected for analysis in the 2006-2007 period and...
in 2010, respectively. An equal proportion of 13- and 14-year-olds was selected from each region, thereby optimizing the representativeness of a sample drawn from a heterogeneous population.

In both surveys, data were collected with the asthma and rhinitis modules of the ISAAC written questionnaire, which have been validated for use in Brazil by Solé et al.\(^{19}\) and Vanna et al.\(^{20}\) respectively. The questionnaires were completed by the adolescents themselves, in the classroom, in the presence of the principal researcher or one the research assistants, the latter having been duly trained by the former and specifically instructed to avoid offering explanations that could influence the responses. Each research assistant received a copy of the ISAAC manual, which describes the field study process in detail.\(^6\) Each school was visited at least twice in order to minimize the problems related to absenteeism and to optimize the response rate.

The ISAAC questionnaire consists of three modules—asthma, rhinitis, and eczema—and it is suggested that the sample size should be 3,000 subjects per age group.\(^6,7\) We chose the 13-14-year age group because it allows greater ease of operation and high questionnaire return.

The ISAAC asthma module contains four questions on the occurrence of asthma symptoms: wheezing ever (cumulative wheezing); wheezing within the last 12 months (current wheezing or active asthma); exercise-induced wheezing; and dry cough at night in the absence of a cold or respiratory infection within the last 12 months. In addition, this module contains three questions on symptom severity within the last 12 months: number of wheezing attacks; sleep disturbed by wheezing; and speech-limiting wheezing. There is also one question on physician-diagnosed asthma (asthma ever). Asthma was defined as presence of wheezing within the last 12 months. Individuals with severe asthma were defined as those who had had “four or more wheezing attacks”, “sleep disturbed by wheezing one or more nights per week”, or “speech-limiting wheezing”, or any combination of the three, within the last 12 months. This last question refers to episodes of severe acute asthma.\(^6,7\)

The ISAAC rhinitis module, which focuses on eliciting information about symptoms unrelated to influenza or colds, contains six questions related to the following\(^6,7\): sneezing, rhinorrhea, or nasal obstruction ever (cumulative rhinitis); sneezing, rhinorrhea, or nasal obstruction accompanied by ocular symptoms (watery or itchy eyes) within the last 12 months, used in order to identify adolescents with rhinoconjunctivitis\(^7\); month or months in which nasal problems occurred (not analyzed in the present study); rhinitis-related impairment of daily activities (which measures symptom morbidity/symptom severity), used in order to determine the degree of rhinitis—“severe rhinitis” was defined as choosing “severe” as the response to this question; and rhinitis ever, used in order to identify physician-diagnosed rhinitis.

Data were processed using the Statistical Package for the Social Sciences, version 15.0 (SPSS Inc., Chicago, IL, USA). The frequencies of positive responses to the questions were obtained by considering the proportion of positive responses to each question in relation to the total number of valid questionnaires. The chi-square test was used in order to test the statistical significance of the comparisons between the results of the two surveys, as well as to analyze potential associations between the variables. The level of significance was set at \(p < 0.05\) for all tests. The study was approved by the Research Ethics Committee of the Ceará State University (Process no. 09554007-5, FR 31889).

**Results**

In the first survey, conducted in 2006-2007, a total of 3,078 questionnaires were distributed to the adolescents, with a return rate of 98.9% and a response rate of 97.9%. Therefore, we obtained 3,015 valid questionnaires. In the second survey, conducted in 2010, a total of 3,120 questionnaires were distributed, with a return rate of 100% and a response rate of 96.8%, 3,020 valid questionnaires therefore having been obtained. The characteristics of the adolescents who completed the questionnaires correctly are described in Table 1, which shows that, in both surveys, there was greater participation by females. The proportion of public schools in relation to that of private schools increased in the second survey.

Table 1 shows that the prevalences of exercise-induced wheezing, dry cough at night, and physician-diagnosed asthma were significantly higher in the second survey than in the first survey.
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(p < 0.01 for all). However, the prevalences of physician-diagnosed rhinitis and severe rhinitis were significantly lower (p = 0.01 for both). There was also a significant difference between the prevalence of active asthma and that of physician-diagnosed asthma, as well as between the prevalence of current rhinitis and that of physician-diagnosed rhinitis.

Table 2 shows that, in both surveys, most symptoms were more prevalent among private school students. The variables for which there were statistically significant differences by type of school (public or private) in the 2006-2007 period, and for which the differences remained statistically significant in 2010, are as follows: cumulative wheezing; active asthma; one to three wheezing attacks within the last 12 months; four or more wheezing attacks within the last 12 months; dry cough at night; physician-diagnosed asthma; cumulative rhinitis; current rhinitis; rhinoconjunctivitis; no rhinitis-related impairment of daily activities; and physician-diagnosed rhinitis.

In both periods, “exercise-induced wheezing” was found to be more common among private school students than among public school students, the difference being statistically significant in the 2006-2007 period (p = 0.03) and trending toward statistical significance in 2010 (p = 0.06). The variable “sleep disturbed by wheezing one or more nights per week” was more common

| Variable                                      | 2006-2007 (n = 3,015) | 2010 (n = 3,020) | p    |
|-----------------------------------------------|-----------------------|-----------------|------|
| Age                                           |                       |                 |      |
| 13 years                                      | 1,575 52.2            | 1,614 53.4      | 0.34 |
| 14 years                                      | 1,440 47.8            | 1,406 46.6      |      |
| School                                        |                       |                 |      |
| Public                                        | 2,165 71.8            | 2,559 84.7      | < 0.01 |
| Private                                       | 850 28.2              | 461 15.3        |      |
| Gender                                        |                       |                 |      |
| Male                                          | 1,372 45.5            | 1,369 45.3      | 0.89 |
| Female                                        | 1,643 54.5            | 1,651 54.7      |      |
| Cumulative wheezing                           | 1,329 44.1            | 1,326 44.5      | 0.74 |
| Current wheezing (active asthma)              | 682 22.6              | 708 23.4        | 0.44 |
| Number of attacks within the last 12 months   |                       |                 |      |
| 1-3                                          | 528 17.5              | 547 18.1        | 0.54 |
| ≥ 4                                          | 68 2.3                | 83 2.7          | 0.22 |
| Sleep disturbed by wheezing                   |                       |                 |      |
| < 1 night per week                            | 204 6.8               | 198 6.6         | 0.74 |
| ≥ 1 night per week                            | 105 3.5               | 106 3.5         | 0.95 |
| Speech-limiting wheezing                      | 105 3.5               | 109 3.6         | 0.79 |
| Exercise-induced wheezing                     | 759 25.2              | 855 28.8        | < 0.01 |
| Dry cough at night                            | 1,036 34.4            | 1,136 37.9      | < 0.01 |
| Physician-diagnosed asthma                    | 350 11.6              | 433 14.5        | < 0.01 |
| Cumulative rhinitis                           | 1,710 56.7            | 1,688 57.1      | 0.78 |
| Current or active rhinitis                    | 1,303 43.2            | 1,279 42.4      | 0.49 |
| Rhinoconjunctivitis (allergic rhinitis)       | 565 18.7              | 535 17.7        | 0.30 |
| Rhinitis-related impairment of daily activities|                       |                 |      |
| None                                          | 567 18.8              | 590 19.5        | 0.47 |
| Mild                                          | 581 19.3              | 582 19.3        | 0.99 |
| Moderate                                      | 81 2.7                | 81 2.7          | 0.99 |
| Severe                                        | 60 2.0                | 37 1.2          | 0.01 |
| Physician-diagnosed rhinitis                  | 609 20.2              | 520 17.6        | 0.01 |
among private school students only in 2010 (p < 0.01).

Table 3 shows that, at both types of schools, the proportion of students reporting various asthma-related symptoms increased significantly from the first study period to the second. Among public school students, there was also a temporal increase in the proportion of positive responses to the questions regarding “four or more attacks within the last 12 months” (p = 0.05), “exercise-induced wheezing” (p < 0.01), and “physician-diagnosed asthma” (p < 0.01). Among private school students, there was a significant increase in the proportion of positive responses to the questions regarding “cumulative wheezing” (p = 0.02), “active asthma” (p = 0.01), and “sleep disturbed by wheezing one or more nights per week” (p < 0.01), as well as an increase trending toward significance in the proportion of positive responses to “exercise-induced wheezing” (p = 0.08). For the variable “dry cough at night”, there was a significant increase among public school students and private school students (p < 0.01 and p = 0.05, respectively).

For rhinitis symptoms, there were significant changes only among public school students.
Among these students, there were increases in the prevalence of cumulative rhinitis (p = 0.05) and in the proportion of the response “no rhinitis-related impairment of daily activities” (p < 0.01), whereas there was a significant decrease in the prevalence of severe rhinitis (p = 0.03). There was no significant reduction in the prevalence of physician-diagnosed rhinitis at either type of school (Table 3).

### Discussion

Questionnaires have been the most widely used instruments in epidemiological surveys, because of their ease of use, low cost, and good acceptability, as well as because they can be self-administered, eliminating interviewer bias, and are considered to be relatively independent of climatic factors. In the ISAAC questionnaire, most questions limit the investigation to the last 12 months in order to reduce memory errors and not to interfere with the month of the study. However, a concern that arises in questionnaire-based surveys is whether the study population is able to understand the questions and provide appropriate responses. To facilitate this process,
the ISAAC questionnaire consists of objective, well-defined, and easy-to-understand questions. The ISAAC questionnaire has been validated for use in several countries and is used worldwide, allowing valid comparisons among different cities and countries in terms of the prevalences of asthma and allergies.\(^{6,7,21,22}\)

The prevalences of asthma symptoms and rhinitis symptoms were high in both of our surveys. Although there was an increase in the proportion of public school students who had lower frequencies of asthma symptoms in both surveys, there was a clear increase in the frequencies of exercise-induced wheezing and dry cough at night in the study population as a whole. A comparison of the two survey results by type of school, indicating an increase in the frequencies of some symptoms in one group but not in the other, showed that the frequencies of dry cough at night and exercise-induced wheezing increased in the two groups. It is of note that the lower proportional representation of private school students might have decreased the statistical power of our study to demonstrate an increase in the frequency of exercise-induced wheezing in this group, an increase that trended toward statistical significance.

The frequencies of exercise-induced wheezing and dry cough at night also increased in a similar comparative study conducted in the city of Recife.

### Table 4 - Distribution of the prevalence of asthma and rhinitis symptoms in 13- and 14-year-olds, by gender, in two surveys conducted in the city of Fortaleza, Brazil. 2006-2007 and 2010.

| Symptom                          | 2006/2007 |          |          | 2010      |          |          |
|----------------------------------|-----------|----------|----------|-----------|----------|----------|
|                                 | Total     | Male     | Female   | Total     | Male     | Female   |
|                                 | (n = 3,015)| (n = 1,372)| (n = 1,643)| (n = 3,020)| (n = 1,369)| (n = 1,651)|
|                                 | n°       | %        | n°       | %        | n°       | %        |
| Cumulative wheezing             | 1,329    | 44.1     | 561      | 40.9     | 768      | 46.7     | < 0.01  | 1,326    | 44.5     | 554      | 41.1     | 772      | 47.3     | < 0.01  |
| Active asthma                   | 682      | 22.6     | 275      | 20.0     | 407      | 24.8     | < 0.01  | 708      | 23.4     | 303      | 22.1     | 405      | 24.5     | 0.48    |
| Number of attacks within the last 12 months |          |          |          |           |           |           |          |
| 1-3                              | 528      | 17.5     | 206      | 15.0     | 322      | 19.6     | < 0.01  | 547      | 18.1     | 235      | 17.2     | 312      | 18.9     | 0.21    |
| ≥ 4                              | 68       | 2.3      | 29       | 2.1      | 39       | 2.4      | 0.63    | 83       | 2.7      | 31       | 2.3      | 52       | 3.1      | 0.13    |
| Sleep disturbed by wheezing      | 204      | 6.8      | 58       | 4.2      | 146      | 8.9      | < 0.01  | 198      | 6.6      | 74       | 5.4      | 124      | 7.5      | 0.02    |
| < 1 night/week                   | 105      | 3.5      | 39       | 2.8      | 66       | 4.0      | 0.08    | 106      | 3.5      | 39       | 2.8      | 67       | 4.1      | 0.07    |
| ≥ 1 night/week                   | 105      | 3.5      | 40       | 2.9      | 65       | 4.0      | 0.12    | 109      | 3.6      | 46       | 3.4      | 63       | 3.8      | 0.50    |
| Speech-limiting wheezing         | 759      | 25.2     | 343      | 25.0     | 416      | 25.3     | 0.84    | 855      | 28.8     | 357      | 26.1     | 498      | 30.2     | 0.01    |
| Dry cough at night               | 1,036    | 34.4     | 376      | 27.4     | 660      | 40.2     | < 0.01  | 1,136    | 37.9     | 424      | 31.0     | 712      | 43.1     | < 0.01  |
| Physician-diagnosed asthma       | 350      | 11.6     | 168      | 12.2     | 182      | 11.1     | 0.31    | 433      | 14.5     | 199      | 14.5     | 234      | 14.2     | 0.77    |
| Cumulative rhinitis              | 1,710    | 56.7     | 676      | 49.3     | 1,034    | 62.9     | < 0.01  | 1,688    | 57.1     | 678      | 49.5     | 1010     | 61.2     | < 0.01  |
| Current or active rhinitis       | 1,303    | 43.2     | 494      | 36.0     | 809      | 49.2     | < 0.01  | 1,279    | 42.4     | 498      | 36.4     | 781      | 47.3     | < 0.01  |
| Rhinoconjunctivitis              | 565      | 18.7     | 193      | 14.1     | 372      | 22.6     | < 0.01  | 535      | 17.7     | 185      | 13.5     | 350      | 21.2     | < 0.01  |
| Rhinitis-related impairment of daily activities |          |          |          |           |           |           |          |
| None                             | 567      | 18.8     | 48       | 3.5      | 93       | 5.7      | < 0.01  | 590      | 19.5     | 253      | 18.5     | 337      | 20.4     | 0.18    |
| Mild                             | 581      | 19.3     | 223      | 16.3     | 358      | 21.8     | < 0.01  | 582      | 19.3     | 201      | 14.7     | 381      | 23.1     | < 0.01  |
| Moderate                         | 81       | 2.7      | 25       | 1.8      | 56       | 3.4      | < 0.01  | 81       | 2.7      | 39       | 2.8      | 42       | 2.5      | 0.60    |
| Severe                           | 60       | 2.0      | 23       | 1.7      | 37       | 2.3      | 0.26    | 37       | 1.2      | 13       | 0.9      | 24       | 1.5      | 0.21    |
| Physician-diagnosed rhinitis     | 609      | 20.2     | 241      | 17.6     | 368      | 22.4     | < 0.01  | 520      | 17.6     | 214      | 15.6     | 306      | 18.5     | 0.03    |
The findings of the present study are also in accordance with those of the ISAAC phase III, in which the most significant changes were in the mean frequencies of exercise-induced wheezing (an increase of 0.15% per year) and dry cough at night (an increase of 0.51% per year). In that phase, there were small mixed changes in the prevalence of asthma symptoms, but, at most centers, increases were twice as common as were decreases. For instance, the rates of exercise-induced wheezing decreased in the eastern Mediterranean region, on the Indian subcontinent, and in Oceania, whereas they increased in the other regions of the world.

The factors involved in the differences in these asthma prevalence trends have yet to be fully elucidated. Environmental aspects associated with the lifestyle of populations and families, such as exposure to allergens, family density, sedentary habits, obesity, socioeconomic status, eating habits, early exposure to infections, etc., have been reported to be highly relevant for explaining these differences and can offer interesting opportunities for prevention.

Underdiagnosis of asthma and rhinitis, which was observed in the two surveys, has also been reported in other studies. The responses to the questions “Have you ever had asthma?” and “Have you ever had rhinitis?” depend on whether teenagers recognize these diseases, which, in turn, depends on how their symptoms are perceived by their families, their level of access to the health care system, the perception of the attending physician in their case, and their level of disease-related morbidity. A previous study found that, as the degree of morbidity decreased, the number of adolescents who did not categorize themselves as having asthma increased. In contrast, the increase in physician-diagnosed asthma observed in our second survey indicates better recognition of the problem by this population or even increased acceptance of the term “asthma”, which contributes to more cases being treated. Corroborating this possibility, our more recent survey showed that the prevalences of the various degrees of asthma severity remained stable, although the prevalences of other symptoms increased.

The frequencies of most rhinitis symptoms remained similar or identical to those previously recorded, suggesting that the prevalence of this disease has reached its peak among these adolescents living in the city of Fortaleza. Some studies have demonstrated a parallel increase in the prevalences of asthma and rhinitis, whereas others have not. In the ISAAC phase III, no consistent global temporal trend was identified in the prevalence of rhinoconjunctivitis among children.

The reduction in the frequency of physician-diagnosed rhinitis can be attributed to the increase in the proportion of public school students in the second survey, given that, in both surveys, the frequency of this variable was more than twice as high among private school students as among public school students. Corroborating this finding, there was no significant variation in the frequency of physician-diagnosed rhinitis among students attending the same type of school. These data are in accordance with those found for the city of Recife, Brazil, where the prevalence of asthma observed in 2002 was lower than was that reported in a study conducted in 1994-1995, a reduction that was also attributed to an increase in the proportion of public school students in the second survey.

Regarding the reduction in the frequency of severe rhinitis, it is supposed that if more cases of asthma are being treated, as presumed on the basis of the increase in the frequency of physician-diagnosed asthma, this could, to some extent, cause a reduction in rhinitis severity, given that patients might be receiving concomitant treatment for rhinitis and given the fact that, by treating asthma, it is possible to relieve rhinitis symptoms. These diseases have similar inflammatory mechanisms and often coexist in the same patient. There are similarities between the nasal and bronchial mucosa, and one of the most important concepts about nose-lung interactions is that there is a functional systemic link between the upper and lower airways. In addition, among public school students, there was improvement in the perception of milder symptoms of the disease—represented by the increase in the frequency of the response “no rhinitis-related impairment of daily activities”—and this might be contributing to more cases being treated and to a consequent decrease in the frequency of severe cases, a decrease that was found to be significant in this particular group.

The predominance of asthma and rhinitis symptoms among females and private school students that was observed in the second survey
confirms the findings of the first survey and has been previously discussed. [28]

In conclusion, the results of our second survey, conducted in 2010, confirm the high prevalences of asthma, rhinitis, and symptoms previously observed in this age group, revealing an increase in the frequency of exercise-induced wheezing and dry cough at night. Underdiagnosis of asthma and rhinitis remains evident, although there was an increase in the frequency of physician-diagnosed asthma and a reduction in the frequency of severe rhinitis. In addition, the present study confirms the predominance of females and private school students among the adolescents reporting symptoms of these diseases. Finally, the present study shows, for the first time, a comparison of the prevalences of asthma and rhinitis between two different periods in the city of Fortaleza, reporting current and relevant data that serve to alert health administrators and planners of the essential need to invest in the quality of primary care focused on the prevention and control of these diseases.

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