Prevalence of asthma symptoms among adolescents in Brazil: National Adolescent School-based Health Survey (PeNSE 2012)

ABSTRACT: Objective: This study aims to describe the prevalence rates of asthma symptoms in Brazil, its Regions and State capitals, according to data from the National Adolescent School-based Health Survey, 2012. Furthermore, it aims to compare the prevalence of asthma in the capitals evaluated by PeNSE 2012 with previous results of the International Study of Asthma and Allergies in Childhood (ISAAC). Methods: Cross sectional study of 9th grade students at public and private schools of all Brazilian states and the Federal District (Brasília). A self reported questionnaire containing items from the ISAAC was applied in order to identify the presence of asthma symptoms. Results: The results of PeNSE indicate a high prevalence of asthma symptoms (23.2%) and of reports of a previous medical diagnosis of asthma (12.4%). Of the five state capitals in which the PeNSE results were compared to the ISAAC, São Paulo, Curitiba and Porto Alegre presented an increase in the prevalence of asthma symptoms. In Salvador, there was a reduction. Conclusion: Brazil is among the countries with the highest prevalence of asthma in the world, and the prevalence is still growing.

INTRODUCTION

Asthma is a chronic inflammatory disease characterized by the hyperresponsiveness of the lower airways and by the variable limitation to the airflow, which can be reversed spontaneously or with treatment. It can be clinically manifested by recurring episodes of sibilance, dyspnea, chest tightness, and cough, especially at night and in the morning, after waking up. It is estimated that 235 million people in the world have asthma, and an increment of more than 100 million cases of asthma is projected for 2025. About half of all the cases begins to present symptoms before the age of 5, and 25% only present with symptoms after the age of 40.

Despite the recent progress in the knowledge about the physiopathology of the disease and its treatment, the increased prevalence and persistence of mortality caused by asthma in the past decades are still a matter of concern. Many factors have been proposed to explain the increased prevalence of asthma observed in the past decades, including environmental, nutritional, economic and psychosocial aspects. However, environmental factors are probably the main determiners of the recent growth in the prevalence of this disease.

Until the mid-1990s, epidemiological data about asthma were limited, which made it difficult to better understand the importance and the impact of this disease. The lack of standardized instruments that were highly sensitive and specific for epidemiological research about asthma made the comparison of results and the follow-up of its temporal tendency difficult. The aforementioned scenario was altered by the International Study of Asthma and Allergies in Childhood (ISAAC), which developed instruments and a protocol to assess the
prevalence of asthma and allergic conditions in different parts of the world by employing standardized methods (written self-applicable questionnaire and/or video-questionnaire); therefore, they were comparable\textsuperscript{11,12}. In Brazil, the instrument was translated to Portuguese, and its reproducibility and validity were assessed\textsuperscript{13}. The question about respiratory sounds in the past 12 months and the global ISAAC score are the most recommended criteria for prevalence estimates of asthma symptoms.

The data from ISAAC, Phase 3, when compared to data from ISAAC, Phase 1, demonstrated that the prevalence of asthma symptoms is still increasing in several regions of the world (but not in all of them)\textsuperscript{14}. Throughout the surveys, many geographic areas showed annual variation in the prevalence of asthma symptoms, with tendency to increase in the group of students in some parts of the world, including India (+0.06), North America (+0.32), Western Europe (+0.05\%) and Eastern Mediterranean (+0.79\%). Among adolescents, the tendency of annual increase is clear in countries of Africa (+0.16\%), Latin America (+0.32\%), North of Europe (+0.26\%), Eastern Europe (+0.26\%) and India (+0.02\%). On the other hand, there has been a tendency of stability or even reduction concerning the prevalence of the disease in other regions, such as Oceania (-0.76\%), especially in the group of adolescents\textsuperscript{15}.

In Brazil, the global prevalence of active asthma ranged, from 1995 to 2002, from 21.3\% to 24.4\% (ISAAC Phase 1 and Phase 3)\textsuperscript{16}. However, it is important to point out that only five centers (cities) participated in both phases of ISAAC. In these centers, adolescents showed reduced prevalence of asthma symptoms (27.7 \textit{versus} 19.9\%), but there was no variation in the prevalence of a medical asthma diagnosis (14.9 \textit{versus} 14.7\%)\textsuperscript{16,17}. The results of the ISAAC study, phase 3, pointed out to the highest prevalence of asthma symptoms in the following cities: Salvador (BA) (24.6\%) and Vitória da Conquista (BA) (30.5\%), and the lowest presence in Maceió (AL) (14.8\%) and Itajaí (SC) (12.3\%), and the mean prevalence between Brazilian adolescents is close to 20\%\textsuperscript{15}.

Even though asthma symptoms present high prevalence in many Brazilian cities, the true magnitude of the prevalence of the disease in the different regions of the country is unknown. This fact makes it difficult to plan and execute programs that aim at its prevention and control. In this context, knowing the prevalence of asthma among adolescents in several regions of Brazil is very relevant, since such knowledge will enable the planning and the implementation of adequate strategies to prevent and control this disease.

Therefore, the study aims at describing the prevalence of asthma in Brazil, regions and capitals, according to the National Adolescent School-based Health Survey (PeNSE), 2012. Besides, it aims at comparing the prevalence of the disease in the capitals pointed out by PeNSE 2012 with results from previous ISAAC studies.

**METHODS**

This cross-sectional study was conducted in 2012 by the Ministry of Health in Brazil, together with the Brazilian Institute of Geography and Statistics (IBGE). The study...
population is composed of 9th grade students of public and private schools of all of the Brazilian states and the Federal District. The sample of PeNSE 2012 represented Brazil, its five regions, 26 capitals of the states and the Federal District (n = 109,104). For the sampling plan, the national territory was stratified as follows: each of the 26 state capitals, and the Federal District, was defined as a geographic stratum, and the other cities were grouped in each of the five major geographic regions, thus forming other five geographic strata. The sample of each stratum was allocated proportionally to the number of schools, according to the administrative dependency of the schools (private and public). For each stratum, a conglomerate sample was selected in two stages, as follows: in the first stage, school; and, in the second stage, eligible classrooms in the selected schools (9th grade, elementary school).

In the strata formed by cities that were not capitals, it was chosen to group conglomerates according to homogeneity and neighboring criteria, thus forming groups of 300 to 600 classrooms, approximately. One sample of these groups was selected in each region, and afterwards, the schools were selected. For cities that are not capitals, the primary sampling units were the groups of cities, and the secondary units were schools; the classrooms of these schools were the tertiary sampling units. In both cases, all of the students in the selected classrooms who were present on the day of data collection formed the sample of student and were invited to participate in the study.

Schools with less than 15 students in the analyzed grade were excluded. Even if they represented about 10% of the schools, they accounted for less than 1% of the total of students. Classrooms from the evening period were also excluded, because in general these students were older to the others, therefore, they could present with different risk factors in relation to other 9th grade students. The methodology is described in PeNSE, 201218.

The ninth grade was chosen because the students in this grade, mostly aged between 13 and 15 years old, have already acquired the necessary skills to answer the self-applicable questionnaire, and because they are already prone to being exposed to several risk factors, and because the resulting data would enable the comparison with other countries19. The self-applicable structured questionnaire was inserted in a smartphone without about 120 questions. In 2012, some adjustments were made to the questionnaire, in order to improve it, to introduce new themes, as well as to adjust its comparability with data obtained by the WHO survey, Health Behavior in School-Aged Children19.

With the objective of improving the knowledge about the prevalence of asthma symptoms among students, PeNSE, in 2012, incorporated this theme, including questions that were also investigated in ISAAC (Phase 1, Phase 3)20. In order to know if the student had wheezing chest in the 12 months prior to the survey, the following question was asked: “In the past 12 months, did you have wheezing (or chirping) chest?” (yes/no). And to analyze the presence of asthma at least once in life, the following was asked: “Have you ever had asthma?” (yes/no).
STATISTICAL ANALYSIS

The prevalence of asthma was estimated with a 95% confidence interval (95%CI), according to sex (male/female), its regions and state capitals. The collected information was inserted in a database, being analyzed with the statistical package SAS, v.14.

PeNSE was approved by the Ethics Research Committee of the Ministry of Health, report n. 192/2012, concerning registration n. 16805, of CONEP/MS, on 27/03/2012.

RESULTS

From the total of students that were initially selected, 47.6% of them were male and 52.4% of them were female participants, mostly aged 14 years old (46.7%). The prevalence of asthma symptoms (wheezing chest in the past 12 months) in the country was of 23.2% (95%CI 21.1 – 25.3), ranging from 24.9% (95%CI 20.0 – 29.8) to 19.8% (95%CI 18.7 – 20.8) in the Southeast and the Northeast regions, respectively. In the capitals, the prevalence of asthma symptoms was of 25.2% (95%CI 24.4 – 19.5), ranging from 18.2% (95%CI 16.4 – 20.1) in São Luís (MA), to 29.5% (95%CI 27.4 – 31.65) in São Paulo (SP). Wheezing chest was more frequent among girls (24.9%; 95%CI 23.3 – 26.4) than boys (21.4%; 95%CI 18.4 – 24.4) (p < 0.001) (Table 1, Figures 1 to 3).

Of the students, 12.4% (95%CI 11.4 – 13.5) reported having been diagnosed with asthma at least once, ranging from 18.4% (95%CI 17.3 – 19.5) in the North region to 11.4% (95%CI 9.5 – 13.2) in the Southeast region. Among the capitals, the mean was of 16% (95%CI 15.4 – 16.5), ranging from 29.3% (95%CI 26.4 – 32.1) in Porto Alegre to 12.2% (95%CI 10.0 – 14.4) in Cuiabá (Table 1, Figures 1 and 2).

Table 1. Percentage of 9th grade students who had wheezing (or chirping) chest in the last 12 months and asthma episodes at any point in their lives, by sex, indicating the 95% confidence interval, in the Brazilian total and the Capitals’ total.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td></td>
<td>%</td>
<td>95%CI</td>
<td>%</td>
</tr>
<tr>
<td>Wheezing chest in the past 12 months</td>
<td>Brazil</td>
<td>23.2</td>
<td>21.1 – 25.3</td>
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<tr>
<td></td>
<td>All capitals</td>
<td>25.2</td>
<td>24.4 – 25.9</td>
</tr>
<tr>
<td>Asthma episode at any point</td>
<td>Brazil</td>
<td>12.4</td>
<td>11.4 – 13.5</td>
</tr>
<tr>
<td></td>
<td>All capitals</td>
<td>16</td>
<td>15.4 – 16.5</td>
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DISCUSSION

The results from PeNSE point out to the high prevalence of asthma symptoms (23.2%) and of the report of asthma diagnoses in the past (12.4%) among 9th grade students, elementary school, who are usually aged between 13 and 15 years old. Such high prevalence was also observed in other regions of the world, like North America (21.5%), Latin America (18.8%) and Oceania (26.7%)\textsuperscript{15}.

Figure 1. Percentage of 9th grade students who had wheezing (or chirping) chest in the last 12 months and were diagnosed with asthma in the five Brazilian regions.

Figure 2. Percentage of 9th grade students who had wheezing (or stridor) chest in the last 12 months in Brazilian state capitals.
The analyzed age group is close to the age group of adolescents who participated in ISAAC (13 – 14 years old). Therefore, the sample from PeNSE is comparable to the one from ISAAC surveys conducted in Brazil, as well as in other parts of the world. The results of PeNSE, in comparison to those of ISAAC Phase 1 and Phase 3, indicate the increment concerning the prevalence of asthma symptoms in the population of students in some capitals of the country.¹⁷

![Figure 3. Percentage of schoolchildren of the 9th grade who were diagnosed with asthma at any point in their lives in Brazilian state capitals.](image)

![Figure 4. Prevalence of asthma symptoms among schoolchildren studied in Brazil (ISAAC Phase 1, Phase 3, PeNSE).](image)
Of the Brazilian capitals included in PeNSE, five of them conducted ISAAC surveys in both of its phases. Out of these five, São Paulo (23.3%, 18.7% and 29.5%), Curitiba (18.4%, 18.9% and 27.7%) and Porto Alegre (24.7%, 18.2% and 26.7%) presented increased prevalence of asthma symptoms, in the surveys, among adolescents. Salvador was an exception, since prevalence presented a reduction from 27% (ISAAC Phase 1) to 18.8% (Figure 4). In this city, there is an extensive public program to control asthma (ProAR), in which patients with severe asthma are provided with free medical care and medications. Besides, health professionals are trained to prevent and control this disease, since 2003, and this reveals a significant impact on the reduced number of hospitalizations caused by asthma in the city. Initiatives for asthma control have been observed in several Brazilian cities, and they contributed for the reduced morbimortality by asthma registered by DATASUS indicators in the past few years; however, there are very clear regional inequalities.

In this study, the prevalence of asthma was higher among female students. These results are compatible with the ones from several studies, in which asthma is more prevalent among boys during childhood and among girls during adolescence. There seems to be an inverse relationship between age group and prevalence of asthma as to sex. This difference would possibly be a result of hormone and behavioral changes in female teenagers, genetic polymorphisms, among other factors that are still not identified.

The findings reported here indicate the magnitude of the morbidity caused by asthma at a point of the natural history of the disease, pointing out how important this public health issue is among adolescents in the whole country. The natural history of asthma is little understood, and it is not possible to transform the observations extracted from studies, especially longitudinal ones, into clear comprehension about the evolution of the disease and its prognosis. Asthma is a chronic condition that can begin during childhood. However, infants and preschool children with recurring respiratory sounds present with varied evolutions, which are possibly related to different subjacent immunopathological mechanisms that lead to limited airflow. Three out of four children with asthma in school age do not present with symptoms of the disease once they become middle-aged adults. The risk of asthma persistency increases according to the severity of the condition, with the sensitivity to allergens, smoking and the fact of being female. The probability of asthma remission from adolescence on is inversely related to the severity of the disease. However, it is clear that asthma is also a relevant health issue during adulthood. In a representative sample of the adult Brazilian population, 12.5% of the individuals reported asthma diagnosis, and 22.6% claimed to have had asthma symptoms in the past year.

Among the explanations for the expressive increase in allergic conditions in the past decades, one is based on the hygiene hypothesis, which interprets the increasing occurrence of allergic diseases as the effect of the reduced exposure to infections at early stages in life. This would be a consequence of the general improvement in sanitary conditions of the human population in general, especially in developed regions. Some registers indicate that a large percentage of asthma cases is not exclusively attributed to atopy, and this percentage would be higher in developing countries, especially in rural areas. Little is known about the causes of non-atopic asthma, which include factors related to poverty, besides psychosocial aspects. In order to
subsidize the planning of interventions to prevent and control asthma, it is important to better identify risk factors in diversified environments.

CONCLUSION

The results of PeNSE confirm prior evidence, which puts Brazil among the countries with the highest prevalence of asthma in the world. They also reveal that this prevalence is probably growing in the population of students. These results require further investigations, which can allow us to understand the determiners of the high levels of asthma in this age group. However, the set of existing evidence is not sufficient to define asthma as a relevant health problem in the Brazilian population.

REFERENCES


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