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ORIGINAL ARTICLE

Asthma in adolescents – Prevalence trends and associated factors in northeast Brazil

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Abstract
Background: Asthma is the most common chronic disease affecting children and adolescents (AD). We evaluated the prevalence of asthma and associated factors in adolescents living in a developing region in northeast Brazil using the ISAAC (*International Study of Asthma and Allergies in Childhood*) methodology.
Methods: According to the ISAAC protocol, AD (13–14 year olds, $n = 3{,}043$ in 2003 and 3,009 in 2011–12) answered the standardised written questionnaire by themselves. In addition, in 2011–12 a random sample of these AD ($n = 430$) also answered a complementary questionnaire (associated factors) and underwent a skin prick test with aeroallergens (*Dermatophagoides pteronyssinus, Blomia tropicalis, Blatella germanica, Periplaneta americana*, dog dander, cat dander, mixed grass pollen and mixed moulds, including 10 mg/mL histamine and negative controls). Data were analysed by univariate and multivariate analysis using Poisson regression.
Results: The prevalence of asthma in 2011–12 in Aracaju was 12.8%, which is lower than that recorded in 2003 (18.7%). Individuals with a dog outside the home (PR = 0.93; 95%CI = 0.88–0.98; $p = 0.018$) and those with an older sibling (PR = 0.94; 95%CI = 0.91–0.98; $p = 0.005$) were identified as protective. The presence of smokers in the residence (PR = 1.04; 95%CI = 1.00–1.09; $p = 0.039$) was associated with an increased risk of developing asthma.
Conclusions: The prevalence of asthma was significantly lower than the last ISAAC figures reported for Aracaju. Tobacco smoking, a preventable factor, continues to be associated with an increase in the occurrence of asthma and other associations may concur with the hygiene hypothesis.

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Introduction

Asthma is a common disease affecting approximately 300 million people worldwide and this number is expected to rise to 400 million by 2025.[1,2]

In Brazil, asthma affects approximately 20 million people, being responsible for 5–10% of deaths from respiratory causes and, in 2011, for 160,000 hospitalisations in the Brazilian Unified Health System.[3,4] The availability of health assistance in Brazil has improved over the last two decades, after sanitary reform was implemented via the Family Health Strategy, therefore more people can now access treatment.[5]

In the early 1990s, the *International Study of Asthma and Allergies in Childhood* (ISAAC) was created. This was the first large scale international multicentre study to demonstrate asthma prevalence worldwide in the 6–7 and 13–14 year age groups using a standardised and reproducible method.[6–9] Asthma prevalence and associated time trends vary between countries.[10–12]

Worldwide, there was significant annual variation in asthma prevalence in 82 centres (77%), with 42 registering an increase in rates between ISAAC's Phases I and III among adolescents (AD). More specifically, in Latin America seven centres detected an increased prevalence, three detected a decrease and five remained stable.[10] Brazil has demonstrated an overall decrease in prevalence between these two phases in the ISAAC.[13]

Data from Aracaju, obtained through ISAAC Phase III, demonstrated a high prevalence of asthma and the second highest rate of severe asthma in the AD group in Brazilian centres. This was higher than the national and global mean rates at the time,[9,14] however, associated factors for the development of asthma and sensitisation profiles were not studied in these children.

Therefore, in order to better understand the possible reasons for these divergent rates around the world, we conducted a study in Aracaju using the ISAAC protocol to assess the trends in the prevalence of asthma, identify associated factors and determine the local profile for aeroallergen sensitisation.

Materials and methods

This was an analytical, observational cross-sectional study performed in Aracaju, the capital of Sergipe state, located on the north-eastern coast of Brazil. The region has a hot and humid climate, with an annual average temperature of 26 °C and a population of 571,149 inhabitants.[15]

The ISAAC protocol was applied as reported previously.[6] Both written questionnaires, asthma core (WQ) and complementary (CQ), were validated previously for Brazilian language and culture.[16] Four questions were used to determine prevalence; these were exactly the same as those used in the 2003 study (ISAAC Phase III) and the research was conducted by the same group. Types of asthma were defined as follows: cumulative asthma, the subject wheezing ever in life; current asthma, the subject wheezing in the last 12 months; physician-diagnosed asthma, presence of asthma ever in life; and severe asthma, impaired speech due to wheezing in the last 12 months.

We used the data from the 2003 ISAAC survey of Aracaju[14] to estimate the asthma prevalence so that we could compare it to the data from the 2011–12 survey.

Data collection and subjects of the study

Data were collected from AD (13–14 year olds; $n = 3{,}043$ in 2003 and $n = 3{,}009$ in 2011–2012) who were randomly selected from 48 schools for the first survey[14] and 70 schools for the first part of the second survey. The schools are proportionally distributed across health districts defined by the Municipal Health Secretariat. Individuals answered the ISAAC WQ (second survey) in the classroom between November 2011 and June 2012. These data were used to establish the prevalence of asthma and related symptoms, allowing us to estimate changes in the prevalence of asthma in Aracaju.

The second survey was sent to 35 randomly selected schools (that were all in the original group) resulting in a sample size of 430 AD. We included all AD who participated in the first part from these schools ($n = 970$); current asthmatics (72 AD) and non-asthmatics (358 AD) represented 44.3% of this sample. All AD underwent skin prick tests (SPT) with aeroallergens and their parents/guardians answered the ISAAC-CQ (from September 2012 to June 2013).

Use of instruments

ADs were classified as either currently asthmatic (positive) or non-asthmatic (negative) according to their answer to the question ''wheezing in the last 12 months?'' Taking into account this classification, variables associated with asthma were evaluated. They were: perinatal conditions; breastfeeding; hygiene conditions; contact with other animals and children inside or outside the residence; personal immunisation history; personal and family history of allergic diseases; exposure to air pollutants or tobacco; number of inhabitants in the residence; residence features; neighbourhood; nutritional information and sensitisation to aeroallergens. The aeroallergens sensitivity were also analysed regarding cumulative and physician-diagnosed asthma as performed to current asthma.

All SPT were performed by the first author according to Pepys's modified puncture technique[17] and included the following allergens: *Dermatophagoides pteronyssinus, Blomia tropicalis, Blatella germanica, Periplaneta americana*, dog dander, cat dander, mixed grass pollen and mixed moulds, in addition to positive (10 mg/mL histamine) and negative (diluent) controls supplied by Immunotech® (FDA Allergenic) and supported by FAPESP-PPSUS (process # 2009-5303-5). A mean wheal diameter greater than 3 mm was considered positive. Prior approval was obtained for the study from the Federal University of Sergipe Research Ethics Committee (CAEE n. 0001.0.107.107-11).

Statistical analysis

We conducted an extensive association and correlation analysis between the presence of current asthma and the variables. Between nominal variables, the Pearson's chi-square (χ^2) test was used; between nominal and ordinal