

# Original Article

## Low income as a protective factor against asthma in children and adolescents treated via the Brazilian Unified Health System\*

Baixa renda como fator de proteção contra asma em crianças e adolescentes usuários do Sistema Único de Saúde

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### Abstract

**Objective:** To analyze the role that low income plays in the development of asthma in children and adolescents. **Methods:** A case-control study using a questionnaire. **Results:** A total of 687 participants were studied at a tertiary hospital via the Brazilian Unified Health System. Ages ranged from 5 to 15 years, and 54.7% of the participants were male. Nearly half of the individuals (49.1%) lived in the metropolitan area of the city of Recife, and the remainder lived in the countryside. Most (98.1%) lived in concrete houses or apartments, with a mean of 5.7 rooms and 4.8 occupants per residence. Mean maternal level of education was 6.8 years of schooling. The median monthly per capita income was R\$ 103.75 (Brazilian reals). The sample was stratified according to cut-off points related to the national minimum wage (R\$ 350.00): <25% of minimum wage = very low income (39% of the sample); <50% of minimum wage = low income (37.3% of the sample); and ≥50% of minimum wage = satisfactory income (23.7% of the sample). There was no association between poverty and development of asthma. **Conclusions:** Poverty is not protective against asthma in children and adolescents treated via the Brazilian Unified Health System, as we might suppose based on the hygiene hypothesis. However, cohort studies are needed in order to confirm these findings.

**Keywords:** Asthma; Poverty; National health programs/Brazil; Child; Adolescent; Case-control studies.

### Resumo

**Objetivo:** O estudo visou analisar o papel da baixa renda como fator de risco para o desenvolvimento de asma em crianças e adolescentes. **Métodos:** Estudo de caso-controle com questionário. **Resultados:** Foram estudados 687 participantes, de 5 a 15 anos de idade, usuários do Sistema Único de Saúde, em um hospital terciário, sendo 54,7% masculinos. Quase metade (49,1%) residia na zona metropolitana do Recife e o restante no interior. Moravam em casa de alvenaria 98,1%, com média de 5,7 cômodos e 4,8 moradores. Suas mães estudaram em média 6,8 anos. A mediana da renda mensal per capita foi de R\$ 103,75. Baseando-se na renda mensal per capita inferior a 25 e 50% do salário mínimo, classificou-se a amostra em muito baixa renda, baixa renda e renda satisfatória, cujos percentuais foram, respectivamente: 39, 37,3 e 23,7. Não se observou associação entre baixa renda e desenvolvimento de asma. **Conclusões:** A baixa renda não exerce, em crianças e adolescentes usuários do Sistema Único de Saúde do nordeste do Brasil, efeito protetor no surgimento de asma, como poderia se supor, baseando-se na teoria da higiene. Todavia, estudos de coorte são necessários para confirmar estes achados.

**Descritores:** Asma; Pobreza; Sistema único de saúde; Criança; Adolescente; Estudos de casos e controles.

### Introduction

Asthma is a chronic inflammatory airway disease resulting in recurrent airflow obstruction that is reversible (spontaneously or through treatment). Atopy is its most common predisposing factor.<sup>(1-3)</sup> Due to its high prevalence as well as to the repercussions for the individual, family and society,<sup>(4-10)</sup> asthma is a major problem in Brazil and worldwide.

In 1997, according to the *Pesquisa Nacional de Amostras de Domicílios* (PNAD, Brazilian National Household Survey), approximately 33% of the Brazilian population had an income below the poverty line; and 14% were destitute. Although Brazil is in the top 33% of all countries in terms of wealth, the ratio between the poverty level and per capita income puts it in the bottom 22%.<sup>(11)</sup> Also according to

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the PNAD, there is unequal distribution of wealth in Brazil, not only by social class but also by geographic region. The highest percentage of families with a monthly family income of less than two times the national minimum wage was found in the Northeast (47%) and the lowest percentage was found in the Southeast (16%). The opposite occurred with the percentage of families with a monthly family income of 10 or more times the national minimum wage: 39% of families in the Southeast and 15% of families in the Northeast.<sup>(12)</sup>

The interaction of these two typical problems can have significant repercussions for children. Poverty can affect the etiology, exacerbation, perception and management of asthma.<sup>(13)</sup> The relationship between poverty and asthma is corroborated by the hygiene hypothesis,<sup>(14)</sup> which states that poor individuals are more often exposed to microbial agents and, as a consequence, less likely to develop the disease.

Studies carried out in different localities have produced conflicting results regarding the association between asthma and poverty. In England, a cross-sectional study involving approximately 6000 school children showed that the prevalence of wheezing was higher among children from the less privileged social classes.<sup>(15)</sup> Similar findings were observed in studies conducted in Singapore<sup>(16)</sup> and in the city of Recife, which is located in the state of Pernambuco, Brazil.<sup>(9)</sup> In a prospective cohort study conducted in New Zealand and involving 1000 individuals monitored up to the age of 26, no association was observed between these variables.<sup>(17)</sup> In a case-control study involving 163 children residing in the city of Cuiabá, Brazil, gender, maternal education, income, breastfeeding duration and passive smoking were not found to be associated with asthma.<sup>(18)</sup> In a study conducted in the city of São Paulo, Brazil and involving 1390 infants under five years of age,<sup>(19)</sup> the odds ratio for recent wheezing in those whose families had a monthly income of less than 50% of the minimum wage was 3.1, with a 95% confidence interval (95% CI) of 1.66-5.8.

The objective of this study was to analyze the role that low income (a proxy for poverty) plays in the development of asthma in children and adolescents in the Northeast of Brazil, via the Brazilian *Sistema*

*Único de Saúde* (SUS, Unified Health System). This study was designed to test the hypothesis that poor children and adolescents are less likely to develop asthma.

## Methods

Patients aged 5-15 years treated in the pediatric department of the *Instituto Materno Infantil Professor Fernando Figueira* (IMIP, Professor Fernando Figueira Mother and Child Institute) were selected for inclusion in this case-control study. The IMIP is a pediatric tertiary referral center of SUS. Approximately two thirds of its clientele come from the metropolitan area, and the remainder come from the countryside and from other states.

Participants were admitted consecutively, on weekday mornings, from March to July of 2006.

The study sample consisted of outpatients treated in the general pediatric department. Inclusion criteria were having been previously diagnosed with asthma or having had at least three previous episodes of wheezing and dyspnea. Controls were selected from among outpatients treated in the following pediatric departments: neurology, orthopedics, surgery and ophthalmology. The choice of controls from these departments was aimed at minimizing selection biases, since controls from the general pediatric department could come in greater proportion from the metropolitan area of Recife and, unlike the cases, would likely have been treated for acute diseases.

Individuals with heart disease were excluded, as were those with immunodeficiency, malnutrition, lung diseases other than asthma or severe neurological diseases, as well as those with tuberculosis, systemic mycosis, psychomotor retardation and physical activity limitation caused by a condition other than asthma.

The data were collected using a questionnaire comprising 42 closed questions (Appendix\*), which was filled out by one of the researchers or by a recipient of a grant from the Brazilian National Council for Scientific and Technological Development, both of whom had received prior training in the administration of the questionnaire.

The sample size of 700 individuals was calculated in accordance with the following assumptions for an unpaired case-control case: a 95% CI; a power of

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80%; a 70% frequency of exposure among non-ill individuals (based on a pilot questionnaire); an odds ratio of 1.7; and losses of 10%.

Low income and very low income were defined, according to the criteria used by the federal government, as 50% and 25%, respectively, of the monthly minimum wage, which, at the time of this writing, was 350 Brazilian reals (R\$350.00).<sup>(12)</sup>

In the univariate statistical analysis, we used the chi-square test or Fisher's exact test, with a significance level of 5%, in addition to the prevalence ratio, with a 95% CI.

The multivariate analysis was carried out following a hierarchical conceptual model, including variables with a level of significance of <20%.

The study was approved by the Ethics in Research Committee of the IMIP (protocol no. 728/06). One of the parents, or the legal guardian, of each participant gave written informed consent.

## Results

A total of 689 participants were studied, 54.7% of whom were males, and ages ranged from 5 to 15 years, with mean and standard deviation of  $8.9 \pm 2.1$  years. Nearly half of the individuals (49.1%) were from the metropolitan area of Recife, 33.2% being from the forest zone of the state, 12.8% being from the wilderness zone, 4.4% being from the backwoods zone, and 0.6% being from other states in the Northeast.

The vast majority of the participants (98.1%) lived in concrete houses, the number of rooms ranging from 1 to 15, with a mean and standard deviation of  $5.7 \pm 1.7$  rooms. The number of persons per household ranged from 2 to 15, with a mean and standard deviation of  $4.8 \pm 1.7$  persons.

Maternal years of schooling ranged from 0 to 18, with a mean and standard deviation of  $6.8 \pm 3.6$  years.

There was no statistically significant difference between the cases and controls in terms of any of the variables evaluated.

Monthly family income ranged from R\$ 50.00 to R\$ 6480.00, with a median of R\$ 460.00 and a 25-75% interquartile range of R\$ 330.00-700.00. Monthly income per capita ranged from R\$ 12.50 to R\$ 1100.00, with a median of R\$ 103.75 and a interquartile range of R\$ 70.00-175.00. Using the cut-off points established by the federal government,

269 participants (39%) were classified as having a very low income, and 257 participants (37.3%) were classified as having a low income. Together, these two groups accounted for 76.3% of the sample.

No statistically significant association was found between poverty and asthma. The p value found in the univariate analysis demonstrated that adjusting for potential confounding factors would not change this result significantly, thereby rendering the multivariate analysis useless (Table 1). Potential confounding factors were as follows: age; gender; place of origin; type of dwelling; number of rooms in the dwelling; maternal level of education; history of atopy; breastfeeding; eating pattern after weaning; vaccination schedule; medication use; viral diseases; previous parasitic infections or tuberculosis; passive smoking; and the presence of animals or aeroallergens in the household.

## Discussion

There is sufficient evidence that the prevalence of pediatric asthma is currently high in Brazil, at least in urban zones.<sup>(6-9,20-22)</sup> In Brazil, however, knowledge regarding risk factors, which is crucial to prevention and treatment, remains quite limited.

The objective of the present study was to analyze the role that poverty plays in the development of asthma (as a risk factor or as a protective factor), using the hygiene hypothesis as a theoretical reference.<sup>(13)</sup> We found no apparent association between poverty and asthma in children and adolescents, based on the genetic and sociodemographic characteristics evaluated in our study. Another study<sup>(18)</sup> produced similar results. In a case-control study involving 163 children 4-14 years of age, treated at

**Table 1** - Univariate analysis between low income and asthma in children and adolescents aged 5-15 years, treated at the pediatric outpatient clinic of the Professor Fernando Figueira Mother and Child Institute, between March and July of 2006, stratifying the groups by monthly per capita income.

Salary range	Without asthma	With asthma <sup>a</sup>	Total
<R\$87.50	146	123	269
R\$ 88.00-174.50	142	115	257
>R\$175.00	89	74	163
Total	377	312	689

<sup>a</sup>Pearson's chi-square test of association = 0.2588, p = 0.97.

pediatric outpatient clinics or pediatric emergency rooms in Cuiabá, the authors found no relationship between asthma and poverty (defined as an income of <50% of the monthly minimum wage), reporting only a relationship between asthma and allergen sensitization. However, other authors,<sup>(19)</sup> in a population-based survey comprising 1132 infants younger than 5 years of age, also compared asthma symptoms with a monthly income of <50% of the minimum wage and found an odds ratio of 3.16 (95% CI: 1.70–5.85). In a study conducted in Brasília, Brazil,<sup>(23)</sup> 6437 children and adolescents, 6–7 and 13–14 years of age, respectively, were evaluated. Although the authors found a higher prevalence of asthma symptoms in the upper socioeconomic groups, they did not mention how the cut-off points were determined. A cross-sectional study of school children in Recife<sup>(8)</sup> produced results similar to those of the abovementioned study,<sup>(23)</sup> in which the prevalence of asthma symptoms was significantly higher in school children whose mothers had a higher level of education. Those three studies, however, were not designed to determine risk, and their findings might have been affected by biases or confounding factors.

Studies carried out in other countries have also produced discrepant results. In a survey conducted in Singapore using the International Study of Asthma and Allergies in Childhood (ISAAC) protocol, the authors found the prevalence of asthma to be higher in children from the upper socioeconomic classes.<sup>(16)</sup> In a prospective cohort study monitoring children from birth and involving approximately 1000 individuals residing in a city in New Zealand, no relationship was found between socioeconomic status during childhood and asthma at the age of 26.<sup>(17)</sup> In a community in the United Kingdom,<sup>(15)</sup> a survey using the ISAAC protocol in over 6000 children between 8 and 9 years of age demonstrated an association between asthma morbidity/mortality and lower socioeconomic status.

Worldwide, poverty is a burden for those who live in it. The determinants and characteristics of poverty vary among populations, even within Brazil. According to one study,<sup>(11)</sup> poverty in Brazil results from the unequal distribution of wealth and unequal opportunities for socioeconomic inclusion. Poverty is more widespread in the northern and northeastern regions of the country. Even without scientific evidence, comparing different communi-

ties, it can be hypothesized that the determinants of poverty in Singapore and New Zealand, for example, are different from those observed in Brazil, and that the findings can therefore differ.

It cannot be stated that the lack of a relationship between poverty and asthma found in our study resulted from the homogeneity of the sample studied, which consisted mostly of poor individuals, since subgroups were representative in all strata. However, since social inequality in Brazil is high,<sup>(11)</sup> the external validity of this study is limited to patients treated via the SUS, and our findings cannot be extrapolated to the general population.

This study has limitations that need to be addressed. First, all data were collected using a questionnaire. The characterization of asthma based on the presence of three or more lifetime episodes of wheezing or on a previous diagnosis of asthma, although criteria that are widely used and accepted,<sup>(1,24)</sup> might have generated overdiagnosis of cases and selection bias. For studies aimed at determining asthma risk, some authors<sup>(25)</sup> recommend that pulmonary function tests and allergy tests be included. Due to logistical constraints, it was not possible to carry out these complementary tests. Another potential limitation is memory bias, which might have resulted in an underestimation of the number of cases of asthma. In order to avoid this bias in determining poverty, we used the per capita income of the last month as a proxy for per capita income in the first years of life, assuming that the socioeconomic situation of the participants remained stable throughout their lives. This might have also generated a non-differential selection bias.

Despite these limitations, the study appears valid and, in a reasonably precise manner, confirms that poverty has no effect on asthma in children and adolescents treated via the SUS in the Northeast of Brazil. However, further studies are needed, especially cohort studies, in order to clearly explain this relationship in Brazil.

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