

# Prevalence of rhinitis among Brazilian schoolchildren: ISAAC phase 3 results\*

Dirceu Solé<sup>1</sup>, Inês Cristina Camelo-Nunes<sup>1</sup>, Gustavo F Wandalsen<sup>1</sup>,  
Nelson A. Rosário Filho<sup>2</sup>, Charles K Naspitz<sup>1</sup>, Brazilian ISAAC's Group

<sup>1</sup> Division of Allergy, Clinical Immunology and Rheumatology, Department of Pediatrics,  
Federal University of São Paulo (UNIFESP), São Paulo, Brazil

<sup>2</sup> Department of Pediatrics, Federal University of Paraná, Curitiba, Brazil

## SUMMARY

**Objective:** *The International Study of Asthma and Allergies in Childhood (ISAAC) is a standardized method that allows international and regional comparisons of asthma and allergic diseases prevalence. The objective of this study was to evaluate the prevalence of rhinitis and related symptoms among 6-7 year-old children (SC) and 13-14 year-old adolescents (AD) from 20 Brazilian cities applying the ISAAC's standardized written questionnaire (WQ).*

**Methods:** *ISAAC's WQ was applied to 23,422 SC and 58,144 AD living in different regions of Brazil: North (N), Northeast (NE), Middle West (MW), Southeast (SE), and South (S).*

**Results:** *The prevalence of rhinoconjunctivitis in the last year ranged from 10.3% to 17.4% and from 8.9% to 28.5% among SC and AD, respectively. Considering SC the highest values were observed in SE region. In NE, the prevalence in countryside centres was higher than those along the coast. Among AD, the highest values were observed in N and S regions, mainly in Pará (Belém). The evaluation of populations probably with the same genetic background has shown higher prevalence among those living in urban centres (capital) in comparison to those in the countryside.*

**Conclusions:** *The prevalence of rhinitis and related symptoms were variable and predominate in Brazilian N and NE centres.*

*Key words: children, rhinitis, rhinoconjunctivitis, prevalence, ISAAC, epidemiology*

## INTRODUCTION

Although rhinitis is a common disease, it is surprising that little is known about its epidemiology<sup>(1)</sup>. Rhinitis symptoms may occasionally occur in normal individuals, and the lack of standardized and properly validated methods for the identification of rhinitis may account for the scarcity of epidemiologic data available. In general, clinical definition of rhinitis is focused on the identification of patients whose symptoms are severe enough to require medical attention<sup>(1,2)</sup>. On the other hand, epidemiologic definition relies on the nature and distribution of symptoms within a population, independently from its severity<sup>(1-3)</sup>.

The International Study of Asthma and Allergies in Childhood (ISAAC) was idealized to maximize the value of epidemiologic studies in asthma and allergic diseases, establishing a standardized method (written questionnaire, WQ) to enable international collaboration<sup>(2,4,5)</sup>. The ISAAC's main points are to examine variations in time trends of asthma, allergic rhinitis

and atopic eczema around the world, and assess the relationship between patterns found and environmental data<sup>(2,4,5)</sup>. The use of a standardized WQ in ISAAC made possible to study allergic diseases among children of culturally distinct areas. This low-cost instrument has high sensitivity and specificity<sup>(2,4,5)</sup>. Originally written in English, the WQ was translated and validated to be applied to people of different languages, as Portuguese (Brazilian culture)<sup>(6-8)</sup>.

Before the advent of ISAAC, little was known about the prevalence of asthma, allergic rhinitis and atopic eczema in developing countries. In Brazil, the ISAAC - Phase 1 survey, performed from 1994 to 1996, showed that the prevalence of asthma and allergic diseases among schoolchildren was not uniform throughout the country<sup>(8-10)</sup>.

In 2002, ISAAC Phase 3 began, with the main objective of examining time trends in the prevalence of asthma and allergic diseases in centres and countries that have participated in ISAAC Phase 1<sup>(4,5)</sup>.

Would the increased number of participating centres, from all regions of Brazil, give us more details about the prevalence of rhinitis and related symptoms in the country? Could these data let us know more about the real distribution of allergic rhinitis in Brazil? In this study we evaluated the prevalence of rhinitis and related symptoms in schoolchildren from 21 Brazilian centres in 20 Brazilian cities from all regions of the country.

## PATIENTS AND METHODS

### Centers

Twenty-one centres from 20 Brazilian cities have participated in this study. The evaluated schoolchildren were selected as standardized by the ISAAC protocol<sup>(2,4,5)</sup>. The cities, states, regions/areas, on which ISAAC Phase 3 was carried out were the following: Manaus (Amazonas, North [N]); Belém (Pará, N); Natal (Rio Grande do Norte, Northeast [NE]); Recife (Pernambuco [PE], NE); Caruaru (PE, NE); Maceió (Alagoas, NE); Aracaju (Sergipe, NE); Feira de Santana (Bahia [BA], NE); Salvador (BA, NE); Vitória da Conquista (BA, NE); Brasília (Distrito Federal, Middle-West); Belo Horizonte

(Minas Gerais, Southeast [SE]); Nova Iguaçu (Rio de Janeiro, SE); São Paulo (West and South, São Paulo [SP], SE); Santo André (SP, SE); Curitiba (Paraná, South [S]); Itajaí (Santa Catarina, S); Passo Fundo (Rio Grande do Sul [RS], S), Porto Alegre (RS, S) and Santa Maria (RS, S). Some of these centres had their data approved by the ISAAC International Data Centre and were considered as ISAAC's official centres (Tables 1 and 3).

### Patients

ISAAC WQ, previously translated and validated to the Brazilian culture<sup>(6-8)</sup> was applied to 23,422 children (SC, 6-7 year-old) and to 58,144 adolescents (AD, 13-14 year-old).

Subjects were selected among those who attended public and private schools located in these cities. Information regarding the number of schools and students in each area was obtained from their respective City Education Secretaries official records. After the sample definition, parents or guardians of the 6-7 year-old children and the adolescents themselves filled in the ISAAC WQ. The data obtained were transcribed to a

Table 1. Prevalence of rhinitis and related symptoms among 6-7 and 13-14 year-old Brazilian schoolchildren as determined by using the International Study of Asthma and Allergies in Childhood (ISAAC) written questionnaire in the different Brazilian centres. ISAAC Phase 3.

Centre	Latitude South	6 to 7 years old						13 to 14 years old					
		N	PNOSE EV	PNOSE 12	IEYES 12	IACTIV 12	HFEVER EV	N	PNOSE EV	PNOSE 12	IEYES 12	IACTIV 12	HFEVER EV
Belém	1.27	-	-	-	-	-	-	1,773	58.7	47.4	28.5	14.6	35.0
Manaus	3.06	3,011	27.7	19.5	10.6	13.2	13.4	3,009	35.2	23.0	12.8	14.6	21.0
<b>Total North</b>		<b>3,011</b>	<b>27.7</b>	<b>19.5</b>	<b>10.6</b>	<b>13.2</b>	<b>13.4</b>	<b>4,782</b>	<b>43.9</b>	<b>32.0</b>	<b>18.6</b>	<b>14.6</b>	<b>26.2</b>
Natal	5.47	855	31.5	23.3	13.3	20.8	12.7	1,020	41.4	32.0	20.0	23.8	15.3
Recife <sup>b</sup>	8.03							2,865	48.3	35.8	14.5	19.0	15.8
Caruaru <sup>b</sup>	8.17							3,026	36.9	25.5	15.4	17.5	21.6
Maceió <sup>a</sup>	9.39	1,990	32.0	24.7	11.3	14.3	14.7	2,745	39.4	26.4	13.8	15.3	11.1
Aracaju <sup>a</sup>	10.54	2,443	27.4	19.9	10.3	16.3	12.3	3,041	38.3	25.6	17.4	22.5	20.8
Feira de Santana <sup>b</sup>	12.16	440	40.9	35.9	15.5	24.3	26.8	1,732	41.5	33.0	17.2	25.3	18.7
Salvador <sup>a</sup>	12.58	998	46.9	39.8	17.4	26.0	32.3	3,020	53.6	44.2	24.4	28.2	24.2
Vitória da Conquista <sup>b</sup>	14.51	399	38.4	31.3	17.3	21.8	26.8	1,679	51.1	39.8	24.4	31.1	19.1
<b>Total Northeast</b>		<b>7,125</b>	<b>33.4</b>	<b>26.1</b>	<b>12.7</b>	<b>18.5</b>	<b>17.5</b>	<b>19,128</b>	<b>43.7</b>	<b>32.4</b>	<b>13.3</b>	<b>17.9</b>	<b>18.7</b>
Brasília <sup>b</sup>	15.46	-	-	-	-	-	-	3,009	42.7	29.3	15.4	21.1	20.0
<b>Total Mid-West</b>		-	-	-	-	-	-	<b>3,009</b>	<b>42.7</b>	<b>29.3</b>	<b>15.4</b>	<b>21.1</b>	<b>20.0</b>
Belo Horizonte <sup>b</sup>	19.55	-	-	-	-	-	-	3,088	38.8	26.1	14.5	18.1	24.4
Nova Iguaçu <sup>a</sup>	22.45	3,249	33.2	24.8	12.2	16.6	15.0	3,185	29.1	17.4	8.9	10.1	9.9
São Paulo-West <sup>a</sup>	23.30	3,312	34.8	28.9	15.1	19.7	21.3	3,181	39.9	30.1	19.8	20.2	18.9
São Paulo-South <sup>a</sup>	23.32	3,047	35.8	28.2	12.7	17.6	29.2	3,161	41.4	27.4	12.2	14.5	32.2
Santo André <sup>a</sup>	23.39	2,167	37.8	30.9	13.2	16.5	24.1	3,232	40.3	28.4	13.8	15.4	29.0
<b>Total Southeast</b>		<b>11,775</b>	<b>35.2</b>	<b>27.9</b>	<b>13.3</b>	<b>17.7</b>	<b>22.1</b>	<b>15,847</b>	<b>37.9</b>	<b>25.9</b>	<b>13.8</b>	<b>15.7</b>	<b>22.8</b>
Curitiba <sup>b</sup>	25.25	-	-	-	-	-	-	3,628	48.2	39.2	17.2	20.4	2.8
Itajaí <sup>a</sup>	26.54	1,511	25.4	19.3	13.3	14.5	16.4	2,737	31.8	22.1	12.9	14.7	19.1
Passo Fundo <sup>b</sup>	28.13	-	-	-	-	-	-	2,949	40.7	29.5	16.6	21.0	31.4
Porto Alegre <sup>b</sup>	28.15	-	-	-	-	-	-	3,007	44.5	32.1	15.9	20.0	42.1
Santa Maria <sup>b</sup>	28.19	-	-	-	-	-	-	3,057	30.1	20.6	9.6	15.9	20.7
<b>Total South</b>		<b>1,511</b>	<b>25.4</b>	<b>19.3</b>	<b>13.3</b>	<b>14.5</b>	<b>16.4</b>	<b>15,378</b>	<b>39.5</b>	<b>29.2</b>	<b>15.6</b>	<b>18.5</b>	<b>22.2</b>
<b>Total</b>								<b>58,144</b>	<b>41.0</b>	<b>29.6</b>	<b>14.6</b>	<b>17.4</b>	<b>21.4</b>

a = ISAAC phase 3 official centre (both age groups); b = ISAAC phase 3 official centre for 13-14ys group; N = number of schoolchildren; PNOSEEV = sneezing, runny or blocked nose ever; PNOSE12 = sneezing, runny or blocked nose in the last 12 months; IEYES12 = nose problem with itchy, watery eyes in the last 12 months; IACTIV12 = interference with daily activities; HFEVEREV = rhinitis ever.

Table 2. Odds ratios (OR) and 95% confidence interval (95%CI) of rhinitis and related symptoms in 6-7- and 13-14-year-old Brazilian schoolchildren according to the region where they live, and in the region Northeast according to the place of the centre: coastal or countryside. ISAAC Phase 3.

Question	6 to 7 years old		13 to 14 years old
	Region		Northeast
	Northeast x Southeast OR 95% CI	Coastal x Countryside OR 95% CI	Coastal x Countryside OR 95% CI
Sneezing, runny or blocked nose ever	0.92 (0.87-0.98)*	0.73 (0.63-0.85)*	1.12 (1.06-1.19)*
Sneezing, runny or blocked nose in the last 12 months	0.91 (0.85-0.97)*	0.66 (0.59-0.77)*	1.71 (1.60-1.82)*
Nose problem with itchy, watery eyes in the last 12 months	0.94 (0.86-1.03)	0.71 (0.51-0.87)*	0.97 (0.90-1.06)
Interference with daily activities	1.05 (0.98-1.14)	0.72 (0.61-0.86)*	0.92 (0.85-0.98)*
Rhinitis ever	0.75 (0.69-0.81)*	0.53 (0.45-0.63)*	0.86 (0.80-0.93)*

database (Epi-Info) supplied by ISAAC's coordinators. The frequency of affirmative answers to each question was analyzed according to the age group. The Brazilian regions in which there were at least two centres were compared after they had been grouped. In NE we compared the prevalence of rhinitis and related symptoms according to the place where SC and AD lived either in coastal areas (Natal, Recife, Maceió, Aracaju, Salvador) or the countryside (Caruaru, Feira de Santana, Vitória da Conquista).

In the states of Pernambuco and Rio Grande do Sul, where the population apparently shares the same genetic background, we compared the prevalence of rhinitis and related symptoms according to the area where AD lived: capital or countryside.

#### Statistics

These data were analyzed by the Chi-square test and expressed as Odds Ratio (OR) with 95% confidence intervals (95% CI).

We also calculated the OR and 95%CI for nasal problem associated to itchy and watery eyes in the last 12 months (allergic rhinoconjunctivitis) and daily activities limited by nasal symptoms (severe rhinitis) for each centre relative to a reference centre: Aracaju (NE, Sergipe) for SC, and Nova Iguaçu (SE, Rio de Janeiro) for AD. The association between prevalence of rhinitis and related symptoms and latitude was evaluated by the Spearman correlation index. The study was approved by all Local Ethical Committees. In all tests the level of rejection of the null hypothesis was 5%.

#### RESULTS

Considering both age groups the return of filled ISAAC WQ was in media 73%, varying from 62% (Aracaju) to 98% (São Paulo South).

Among SC, the prevalence of nasal symptoms without a cold sometime in their life ranged from 25.4% to 46.9%; nasal prob-

Table 3. Odds ratios (OR) and 95% Confidence intervals (95%CI) for rhinoconjunctivitis and severe rhinitis in each Brazilian centre by comparison to a reference centre (Aracaju, 6-7-year-old group; Nova Iguaçu, 13-14-year-old group).

Centre	N	6 - 7 years old		N	13 - 14 years old	
		Rhinoconjunctivitis OR (95% CI)	Severe rhinitis OR (95% CI)		Rhinoconjunctivitis OR (95% CI)	Severe rhinitis OR (95% CI)
Belém	-	-	-	1,773	4.08 (3.48-4.80)*	1.52 (1.28-1.81)*
Manaus <sup>a</sup>	3,011	1.03 (0.87-1.23)	0.78 (0.67-0.90)*	3,009	1.49 (1.27-1.76)*	1.52 (1.30-1.77)*
Natal	8,55	1.34 (1.06-1.69)*	1.35 (1.11-1.64)*	1,020	2.55 (2.10-3.11)*	2.78 (2.31-3.34)*
Recife <sup>b</sup>	-	-	-	2,865	1.73 (1.47-2.03)*	2.08 (1.80-2.42)*
Caruaru <sup>b</sup>	-	-	-	3,026	1.86 (1.59-2.18)*	1.89 (1.63-2.19)*
Maceió <sup>a</sup>	1,990	1.11 (0.92-1.34)	0.85 (0.72-1.01)	2,745	1.64 (1.39-1.93)*	1.60 (1.37-1.87)*
Aracaju <sup>a</sup>	2,443	1.00	1.00	3,041	2.16 (1.85-2.51)*	2.58 (2.32-2.97)*
Feira de Santana <sup>b</sup>	440	1.59 (1.19-2.12)*	1.65 (1.29-2.10)*	1,732	2.12 (1.78-2.53)*	3.01 (2.57-3.53)*
Salvador <sup>a</sup>	998	1.83 (1.49-2.26)*	1.81 (1.51-2.16)*	3,020	3.29 (2.84-3.82)*	3.50 (3.04-4.03)*
Vitória da Conquista <sup>b</sup>	399	1.82 (1.36-2.43)*	1.43 (1.10-1.85)*	1,679	3.30 (2.80-3.90)*	4.02 (3.45-4.70)*
Brasília <sup>b</sup>	-	-	-	3,009	1.86 (1.59-2.17)*	2.38 (2.06-2.75)*
Belo Horizonte <sup>b</sup>	-	-	-	3,088	1.73 (1.48-2.02)*	1.98 (1.71-2.29)*
Nova Iguaçu <sup>a</sup>	3,249	1.21 (1.02-1.43)*	1.02 (0.89-1.18)	3,185	1.00	1.00
São Paulo-Oeste <sup>a</sup>	3,312	1.55 (1.32-1.82)*	1.25 (1.09-1.44)*	3,181	2.53 (2.18-2.94)*	2.26 (1.95-2.61)*
São Paulo-Sul <sup>a</sup>	3,047	1.26 (1.07-1.49)*	1.09 (0.95-1.26)	3,161	1.42 (1.21-1.67)*	1.50 (1.29-1.75)*
Santo André <sup>a</sup>	2,167	1.32 (1.10-1.58)*	1.01 (0.86-1.18)	3,232	1.64 (1.40-1.91)*	1.62 (1.39-1.88)*
Curitiba <sup>b</sup>	-	-	-	3,628	2.13 (1.83-2.47)*	2.28 (1.98-2.63)*
Itajaí <sup>a</sup>	1,511	1.00 (0.82-1.24)	0.87 (0.73-1.04)	2,737	1.52 (1.29-1.79)*	1.54 (1.31-1.80)*
Passo Fundo <sup>b</sup>	-	-	-	2,949	2.04 (1.75-2.38)*	2.36 (2.04-2.73)*
Porto Alegre <sup>b</sup>	-	-	-	3,007	1.94 (1.66-2.26)*	2.23 (1.92-2.57)*
Santa Maria <sup>b</sup>	-	-	-	3,057	1.08 (0.92-1.29)	1.68 (1.44-1.95)*

a = ISAAC phase 3 official centre (both age groups); b = ISAAC phase 3 official centre for 13-14ys group;

Table 4. Prevalence of rhinitis and related symptoms among 13-14-year-old Brazilian adolescents according to the region of Brazil where they live.

Centre	North (N; 4,782)	Northeast (NE; 19,128)	Southeast (SE;15,847)	South (S; 15,378)	Chisquare/ Fischer
Sneezing, runny or blocked nose ever	43.9	43.7	37.9	39.5	N,NE>S>SE
Sneezing, runny or blocked nose in the last 12 months	32.0	32.4	25.9	29.2	N,NE>S>SE
Nose problem with itchy, watery eyes in the last 12 months	18.6	13.3	13.8	15.6	N>S>SE,N
Interference with daily activities	14.6	17.9	15.7	18.5	S,NE>SE,N
Rhinitis ever	26.2	18.7	22.8	22.2	N>SE,S>NE

lems in the last 12 months (current rhinitis) from 19.3% to 39.8%; allergic rhinoconjunctivitis (nose problem with itchy, watery eyes in the last 12 months) from 10.3% to 17.4%; severe rhinitis (nose problem interfering with daily activities) from 13.2% to 26.0%, and physician-diagnosed rhinitis (rhinitis ever) from 12.3% to 32.2% (Table 1).

According to the Brazilian region, data were grouped and compared: NE and SE. In SE we observed significant higher prevalence values, except for allergic rhinoconjunctivitis and severe rhinitis (Table 2). The comparison of NE centres, showed values significantly lower between those in the coast (Table 2). SC living in centres from Bahia (Feira de Santana, Salvador and Vitória da Conquista) had the highest risk of developing allergic rhinoconjunctivitis and severe rhinitis (Table 3).

Among AD, the prevalence of nasal symptoms without a cold some time in their life ranged from 29.1% to 58.7%; current rhinitis from 17.4% to 47.4%; allergic rhinoconjunctivitis from 8.9% to 28.5%; severe rhinitis from 10.1% to 31.1%, and physician-diagnosed rhinitis from 2.8% to 42.1% (Table 1, Figure 1). The analysis of grouped data according to Brazilian regions showed values significantly higher in the N, except for severe rhinitis (Table 4). In centres from the NE region there was a higher prevalence of current rhinitis compared to those in the coast (Table 2).

The analysis of people probably with the same genetic background and inhabiting the same area (Pernambuco [NE], and Rio Grande do Sul [S]) showed that in NE the countryside centre (Caruaru) had lower values than those observed in the capital (Recife) (Table 5). On the other hand, in S there were lower prevalences of rhinitis and related symptoms in the countryside centres (Passo Fundo and Santa Maria) when compared to the capital (Porto Alegre), except for severe rhinitis (Porto Alegre: 20.0% and Passo Fundo: 21.0%) (Table 5).

AD from Bahia's centres, Natal and São Paulo-West had the highest risk of developing allergic rhinoconjunctivitis and severe rhinitis (Table 3).

There was no significant association between Brazilian centres' latitude and prevalence of rhinitis and related symptoms (data not shown).

## DISCUSSION

The ISAAC Phase 1, which was concluded in 1996 and showed

a wide range of results<sup>(4,11)</sup>. The prevalence of current rhinitis has ranged from 1.5% to 41.8% among SC, and from 3.2% to 66.6% among AD; the prevalence of allergic rhinoconjunctivitis has ranged from 0.8% to 14.9% among SC, and from 1.4% to 39.7% among AD; and the prevalence of severe rhinitis has ranged from 0.5% to 28.1% among SC and from 2.2% to 57.4% among AD<sup>(11)</sup>.

In Brazil, ISAAC Phase 1 has enrolled schoolchildren from seven centres of seven cities all over the country and the prevalence observed were in the middle range of ISAAC global data (10). There was a wide variation according to age. In São Paulo (SE) we observed the highest prevalence of current rhinitis, allergic rhinoconjunctivitis and severe rhinitis among SC in comparison to the other centres. Among AD the highest prevalence of current rhinitis and allergic rhinoconjunctivitis were observed in Salvador (NE) although the severity of rhinitis was higher in Porto Alegre (S). In Brazil "hay fever" is described only in S region, maybe because it has a temperate climate and seasons were better defined in comparison to other regions of the country<sup>(10)</sup>. In that study, the combination



Figure 1. Prevalence of rhinoconjunctivitis among Brazilian adolescents (13-14 yrs): ISAAC phase III.

Table 5. Comparison of the prevalence (%) of rhinitis and related symptoms in 13-14-year-old Brazilian schoolchildren with the same genetic background and living in capital or countryside areas in Northeast and South region. ISAAC Phase 3.

Question	Northeast		OR	South			OR	OR
	Recife N=2,865	Caruaru N=3,026	95% CI	Passo Fundo (a) N=2,949	Porto Alegre (b) N=3,007	Santa Maria (c) N=3,057	95% CI a x c	95% CI b x c
Sneezing, runny or blocked nose ever	48.3	36.9	1.60 (1.44-1.78)*	40.7	44.5	30.1	1.60 (1.43-1.78)*	1.84 (1.68-2.07)*
Sneezing, runny or blocked nose in the last 12 months	35.8	25.5	1.64 (1.46-1.83)*	29.5	32.1	15.9	1.62 (1.44-1.82)*	1.83 (1.63-2.05)*
Nose problem with itchy, watery eyes in the last 12 months	14.5	15.4	0.93 (0.80-1.07)	16.6	20.6	9.6	1.88 (1.61-2.19)*	1.77 (1.51-2.06)*
Interference with daily activities	19.0	17.5	1.11 (0.96-1.27)	21.0	20.0	15.9	1.41 (1.23-1.60)*	1.33 (1.16-1.52)*
Rhinitis ever	15.8	21.6	0.68 (0.60-0.78)*	31.4	42.1	20.7	1.76 (1.57-1.98)*	2.79 (2.49-3.13)*

of great data variability and limited number of centres enrolled did not allow us to draw strong conclusions.

In the present study there was a 3-fold increase in the number of participating centres. Considering the SC group, as observed in ISAAC Phase 1, the prevalence of current rhinitis, allergic rhinoconjunctivitis, and severe rhinitis were in the middle range. Highest values were observed in Bahia (Feira de Santana, Salvador and Vitória da Conquista [NE]) (Table 1). However, comparing regions NE and SE there were no significant differences between them except for current rhinitis that was higher in NE (Table 2).

It has been demonstrated that air pollution is one of the main causes and/or triggers of allergic respiratory diseases<sup>(12)</sup>. In SE region there are cities with the largest people agglomeration and highest air pollution indexes of Brazil (São Paulo and Santo André). In these cities prevalence rates for rhinitis and related symptoms were intermediary (Table 1). On the other hand, analyzing the NE centres more carefully, we realize that although those on the coast were state capitals with a high population density, they show lower prevalence of rhinitis and related-symptoms in comparison to those in the countryside.

Brazil is a country with continental dimensions, whose total area of 8.5 million square kilometers is cut in N by the Equator and in SE by the Tropic of Capricorn<sup>(13)</sup>. Its climate varies according to the area. In N, NE and MW areas, the climate is tropical (high temperature) with dry and lingering summers and rainy winters. In the SE and S areas, the climate is temperate, whereas seasons are better defined in S<sup>(13)</sup>. In a recent paper, Weiland et al. have studied the relation between heat and humidity and the prevalence of asthma and allergic rhinitis in children aged 6 to 7 year-old evaluating worldwide data from 146 centres of the ISAAC Phase 1<sup>(14)</sup>. Similar to us, they did not find a positive association between prevalence of allergic rhinoconjunctivitis and latitude. However, they observed a negative association between mean annual outdoor temperature with asthma, allergic rhinoconjunctivitis and atopic eczema<sup>(14)</sup>.

Evaluating the data from AD group, we observed higher preva-

lence of rhinitis and related-symptoms when compared to SC group. The range of prevalence of current rhinitis, allergic rhinoconjunctivitis and severe rhinitis were in the same range that was obtained in ISAAC Phase 1<sup>(10)</sup>.

The comparative analysis of Brazilian regions showed higher values of current rhinitis in N and NE regions. In opposite to those observed among SC, the rates were higher in NE coastal centres. A positive association has been reported between dampness/mold indoor exposure and the risk of developing rhinoconjunctivitis<sup>(15,16)</sup>. In N and NE centres the mean outdoors daily temperatures are higher and in Manaus, Belém and those centres along the coast the humidity is also higher. In this study we have documented high risk of current rhinitis and severe rhinitis in Belém and in centres of Bahia, similarly to that observed in SC group (Table 3). May the higher indoor dampness exposure, commonly present in these cities, be the explanation for our results?

Another point to concern is the relationship between socioeconomic status (SES) and the prevalence of rhinitis and related-symptoms. In this study, Caruaru, Feira de Santana and Vitória da Conquista - centres with the lowest SES<sup>(17)</sup> (data not shown) - are between those with higher prevalence of rhinitis and related symptoms. This fact is in contrast with the Hygiene Hypothesis<sup>(18)</sup>, and was also observed previously by Mercer et al.<sup>(19)</sup>.

The Hygiene Hypothesis has been postulating that early exposure to infectious agents and/or endotoxins, and to live in an environment with great number of children are some factors related to the protection against development of asthma and allergic diseases<sup>(20)</sup>. Viral infections and parasite infection were associated with low prevalence of sensitization<sup>(21,22)</sup>. In a recent study we have not observed an inverse relationship between the prevalence trend of allergic rhinoconjunctivitis and the decreasing incidence of tuberculosis and measles<sup>(23)</sup>. Likewise, Nascimento Silva et al. did not find significant differences in the prevalence of current asthma in children with and without ascariasis infestation<sup>(24)</sup>.

Brazil was colonized by the Portuguese, and afterwards was invaded by people from other countries (Dutch and French), had African slaves and in the last century, received immigrants from several places of the world with consequent high degree of miscegenation. Because of this, Brazilian people have a great genetic diversity, which hampers any genetic study. The evaluation of people with apparently the same genetic background and living in different places in the same state confirmed data previously reported: lower values in centres located outside of the great centres<sup>(25)</sup>.

Comparing data from ISAAC Phase 1 and 3 we observed that the prevalence of rhinitis in Brazil remained stable with a non-homogenous trend of prevalence in the cities participating<sup>(26)</sup>. Although ISAAC Phase 3 data collection has been concluded around the world, final results are unknown yet. As we had observed at the end of ISAAC Phase 1, the data obtained in this study reinforce the great variability of the prevalence of rhinitis and related-symptoms around the country. More deepened studies evaluating etiology, genetics and environmental risk factors are necessary in order to allow us to conclude more properly about rhinitis and related-symptoms among Brazilian children.

#### BRAZILIAN ISAAC'S GROUP

Maria Socorro Cardoso (Federal University of Amazon, Manaus, Brazil); Bruno A Paes Barreto (State University of Pará, Belém, Brazil); Vera Dantas (Federal University of Rio Grande do Norte, Natal, Brazil); Murilo Britto (IMIP Pediatrics Institute of Pernambuco, Recife, Brazil); Almerinda R Silva and Emanuel Sarinho (Federal University of Pernambuco, Caruaru, Brazil); Francisco J Passos Soares and Mércia Lamenha Medeiros Santos (Federal University of Alagoas, Maceió, Brazil); Jackeline Motta and Ricardo Gurgel (Federal University of Sergipe, Aracaju, Brazil); Leda Solano de Freitas (Federal University of Bahia, Salvador, Brazil); Wellington Borges (Hospital de Base do Distrito Federal, Brasília, Brazil); Paulo Augusto Camargos (Federal University of Minas Gerais, Belo Horizonte, Brazil); Fábio Kuschnir and Antônio José Ledo Alves da Cunha (Federal University of Rio de Janeiro, Nova Iguaçu, Brazil); Antônio Carlos Pastorino and Cristina Miuki A Jacob (State University of São Paulo, São Paulo, Brazil); Karyn Chacon de Mello (Federal University of São Paulo, São Paulo, Brazil); Cássia Gonzalez and Neusa F Wandalsen (School of Medicine of ABC, Santo André, Brazil); Carlos Riedi (Federal University of Paraná, Curitiba, Brazil); Cláudia Benhardt (Federal University of Santa Catarina, Itajaí, Brazil); Arnaldo Porto Neto (Federal University of Rio Grande do Sul, Passo Fundo, Brazil); Gilberto B Fischer (Medical Federal Foundation of Rio Grande do Sul, Porto Alegre, Brazil); Vitor E. Cassol (Federal University of Rio Grande do Sul, Santa Maria, Brazil).

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Dirceu Solé  
Rua Mirassol, 236 apto 72  
4044-010, Vila Clementino  
São Paulo, SP  
Brazil

Tel/fax: +55-11-5579 3778  
E-mail: dirceus@ajato.com.br  
dirceusole.dped@epm.br