

Prevalence of Symptoms of Eczema in Latin America: Results of the International Study of Asthma and Allergies in Childhood (ISAAC) Phase 3

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■ Abstract

Background: The aim of the International Study of Asthma and Allergies in Childhood (ISAAC) was to evaluate the prevalence of symptoms of eczema among children living in different parts of Latin America. Data were from centers that participated in ISAAC Phase 3.

Methods: This was a cross-sectional questionnaire survey of 93 851 schoolchildren (6 to 7 years old) from 35 centers in 14 Latin American countries and 165 917 adolescents (13 to 14 years old) from 56 centers in 17 Latin American countries.

Results: The mean prevalence of current flexural eczema in schoolchildren was 11.3%, ranging from 3.2% in Ciudad Victoria (Mexico) to 25.0% in Barranquilla (Colombia). For adolescents, the prevalence varied from 3.4% in Santo André (Brazil) to 30.2% in Barranquilla (mean prevalence, 10.6%). The mean prevalence of current symptoms of severe eczema among schoolchildren was 1.5%, ranging from 0.3% in Ciudad Victoria, Toluca, and Cuernavaca (Mexico) to 4.9% in La Habana (Cuba). For adolescents, the mean prevalence was 1.4%, ranging from 0.1% in Mexicali Valley (Mexico) to 4.2% in Santa Cruz (Bolivia). These prevalence values are among the highest observed during ISAAC Phase 3. In general, the prevalence of current symptoms of eczema was higher among the Spanish-speaking centers for both schoolchildren and adolescents.

Conclusion: Environmental risk factors must be evaluated in order to identify potential causes for the differences observed, even in centers from the same country.

Key words: Atopic eczema. Children. Adolescents. Epidemiology. Flexural eczema.

■ Resumen

Antecedentes: El objetivo del estudio ISAAC (International Study of Asthma and Allergies in Childhood) era evaluar la prevalencia de los síntomas de eccema en niños residentes en diferentes zonas de Latinoamérica. Los datos procedían de centros que participaron en la fase III del estudio ISAAC.

Métodos: Se realizó un estudio de diseño transversal mediante cuestionario con 93.851 escolares (entre 6 y 7 años de edad) de 35 centros de 14 países de Latinoamérica y con 165.917 adolescentes (entre 13 y 14 años de edad) de 56 centros de 17 países de Latinoamérica.

Resultados: La prevalencia media del eccema flexural actual en los escolares fue del 11,3% y osciló entre el 3,2% en Ciudad Victoria (México) y el 25,0% en Barranquilla (Colombia). En los adolescentes, la prevalencia se situó entre el 3,4% en Santo André (Brasil) y el 30,2% en Barranquilla (prevalencia media 10,6%). La prevalencia media de síntomas actuales de eccema grave entre los escolares fue del 1,5%, y osciló entre un 0,3% en Ciudad Victoria, Toluca y Cuernavaca (México) y un 4,9% en La Habana (Cuba). En los adolescentes, la prevalencia media fue del 1,4%, y osciló entre el 0,1% en el Valle de Mexicali (México) y el 4,2% en Santa Cruz (Bolivia). Estos valores de prevalencia se encuentran entre los valores más altos observados en la fase III del estudio ISAAC. En general, la prevalencia de síntomas actuales de eccema fue superior en los centros de habla hispana, tanto para los escolares como para los adolescentes.

Conclusión: Deben evaluarse los factores de riesgo ambientales para identificar las posibles causas de las diferencias observadas en centros del mismo país.

Palabras clave: Eccema atópico. Niños. Adolescentes. Epidemiología. Eccema flexural.

Introduction

The International Study of Asthma and Allergies in Childhood (ISAAC) is a landmark in epidemiological studies on atopic dermatitis [1]. Until 1999, when the results of ISAAC Phase 1 were published, little was known about the prevalence of atopic eczema outside Northern Europe [2]. Data available for 256 410 children aged 6 to 7 years in 90 centers and 458 623 adolescents aged 13 to 14 years in 153 centers worldwide showed marked variability in the prevalence of symptoms of eczema, from less than 2% in Iran to over 16% in Sweden in children aged 6 to 7 years and from less than 1% in Albania to over 17% in Nigeria for those aged 13 to 14 years [2]. A higher prevalence of atopic eczema symptoms has been reported in Australasia and Northern Europe, and a lower prevalence in Eastern and Central Europe and Asia. Similar patterns have been observed for symptoms of severe atopic eczema [2].

In Latin America, ISAAC Phase 1 showed a variation in the prevalence of symptoms of eczema for 6 to 7-year-olds from 4.8% in Mexico to 10.9% in Chile and from 4.4% in Mexico to 10.8% in Paraguay for the 13 to 14-year-olds [2]. Compared with global values, these would be considered in the middle range [2]. ISAAC Phase 1 showed that atopic eczema is a common health problem for children and adolescents throughout the world. As with asthma and rhinitis, the prevalence of symptoms of atopic eczema varies widely, both within and between countries inhabited by similar ethnic groups; therefore, environmental factors may be critical in determining disease expression [2].

ISAAC Phase 3 was completed after a period of 7 years and new data from those centers involved in Phase 1 were obtained [3,4]: the prevalence of symptoms of eczema had increased slightly in the intervening period. As in Phase 1, there was a wide variation in the prevalence of symptoms ranging from 2.0% in Iran to 22.3% in Sweden among 6 to 7-year-olds and from 1.4% in China to 21.8% in Morocco among 13 to 14-year-olds [4].

ISAAC Phase 3 in Latin America collected data from a significantly larger number of centers than Phase 1 (93 851 children aged 6 to 7 years in 35 centers in 14 countries, and 165 917 children aged 13 to 14 years in 56 centers in 17 countries, namely, 25.0% of all children participating in ISAAC Phase 3). Such a large sample, which includes centers that represent most of the characteristics and disparities of the region, helps to provide a more accurate picture of the prevalence, severity, and variability of atopic eczema in Latin America.

We evaluated the prevalence and risk of symptoms of eczema among Latin American patients treated at centers participating in ISAAC Phase 3.

Patients and Methods

ISAAC Phase 3 included centers that had participated 7 years previously in ISAAC Phase 1 (Phase 3A) and new centers that only participated in Phase 3 (Phase 3B). The methods used in ISAAC Phase 3 were the same as those used in Phase 1 [1,5]. The study population comprised random samples of schools in 2 age groups: 6 to 7 years (parental completion of questionnaires) and 13 to 14 years (self-completion of questionnaires). In both age groups, a simple 1-page written core questionnaire was used to assess symptoms of asthma, rhinoconjunctivitis, and atopic eczema [1,5].

This study was performed in Latin America, and each collaborating center was responsible for completing a registration document, as well as obtaining the necessary ethics committee approval prior to the start of the study. Detailed descriptions of the collaborating centers and registration, sampling frame, selection of participants, questionnaires, data management and analysis, quality control measures, and other methodological issues have been published elsewhere [1,5].

A sample size of 3000 participants per age group was recommended in order to provide sufficiently accurate estimates of symptom severity, although smaller sample sizes

(minimum of 1000) were permitted for prevalence comparisons among participating centers [1,5].

The core questionnaire was translated from English into Spanish and Portuguese, the 2 languages spoken by the populations studied, and these translations were validated prior to Phase 3 [6-9].

This study focuses on the atopic eczema component of the core questionnaire. Participants were asked the following questions:

1. Have you (Has your child) ever had an itchy rash which was coming and going for at least 6 months?

2. Have you (has your child) had this itchy rash at any time in the past 12 months?

3. Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?

4. Only for 6 to 7-year-olds: At what age did this itchy rash first occur? (Under 2 years, Age 2-4 years, Age 5 or more)

5. Has this itchy rash cleared completely at any time during the past 12 months?

6. In the past 12 months, how often, on average, have you (has your child) been kept awake at night by this itchy rash? (Never in the past 12 months; Less than 1 night per week; One or more nights per week)

7. Have you (has your child) ever had eczema?

In addition to these questions, 2 combinations of symptoms were evaluated: current symptoms (affirmative responses to questions 2 and 3) and current symptoms of severe eczema (respondents who have current symptoms of eczema [as above] and who have 1 or more nights per week sleep disturbance from rash) [4].

As in Phase 1, the two age groups were analyzed separately. Symptom prevalence was calculated by dividing the number of positive responses to each individual question by the number of completed questionnaires. Comparisons between the prevalence of positive responses according to language of the center were made using the chi-square test. The relationship between prevalence of each question and latitude [10] of the center were evaluated using the Spearman (rank) correlation coefficient. Odds ratios (OR) for current symptoms of eczema and current symptoms of severe eczema for each Latin American center (with 95% confidence interval [CI]) were expressed in relation to a reference center. Data from the collaborating centers were processed, checked, and approved by the ISAAC International Document Center in Auckland, New Zealand [3].

The Spearman correlation coefficient was applied to evaluate the correlation between the mean prevalence of current symptoms of eczema and severe eczema in each country in terms of the following: gross national income (in US dollars) per capita in 2003 [11]; infant mortality rate/1000 live newborns [12]; percentage of children younger than 1 year of age immunized against poliomyelitis, measles, diphtheria, tetanus, pertussis, and tuberculosis; percentage of population with potable water; percentage of population with sewage disposal services; annual proportion of registered deaths in children aged under 5 years due to intestinal infectious disease; and incidence of tuberculosis/100 000 inhabitants [13].

Results

The 6 to 7-year-old group comprised 93 851 children from 35 centers in 14 Latin American countries, with a mean response rate of 86.2% (95% CI, 83.1%-89.3%). Table 1 shows the prevalence of symptoms of eczema in each center. The prevalence of eczema in all categories—ever, first occurrence after 4 years of age, clearance of rash in the last year, and current sleep disturbance (1 or more nights/wk)—was negatively associated with the latitude of the center. Apart from the prevalence of rash ever, eczema ever, and current sleep disturbance (1 or more nights/wk) due to symptoms of atopic eczema, the prevalence of symptoms of atopic eczema was significantly higher among Spanish-speaking children (n=72 052) (Table 2).

All centers showed a significantly higher risk of current symptoms of eczema for 6 to 7-year-olds (Figure 1) when compared to Ciudad Victoria (Mexico) as the reference center for the lowest prevalence. Quito (Ecuador) and Barranquilla (Colombia) were the centers with the highest risk of current symptoms of eczema. Regarding the risk of higher prevalence of current symptoms of severe eczema, significant values were observed in most centers for the 6 to 7-year-olds, apart from Monterrey, Toluca, Cuernavaca (Mexico), San Salvador (El Salvador), and Rosario City (Argentina). La Habana (Cuba) and San Pedro Sula (Honduras) were the centers with the highest risk of current symptoms of severe eczema (Figure 2).

The 13 to 14-year-old group comprised 165 917 children from 56 centers in 17 Latin American countries, with a mean response rate of 91.4% (95% CI, 89.4%-93.5%). Table 3 shows the prevalence of symptoms of eczema in each center. There was a significant inverse relationship between the prevalence of sleep disturbance (1 or more nights/wk) and the latitude of the center. A higher prevalence of all symptoms was observed among Spanish speaking adolescents (n=58 418) (Table 2).

Mexicali Valley (Mexico) was the reference center for the 13 to 14-year-olds. The highest risks of current symptoms of eczema were observed in Barranquilla (Colombia), South Santiago (Chile), and Santa Cruz (Bolivia) (Figure 3). São Paulo and Santo Andre (Brazil), and Merida, Toluca, and Cuernavaca (Mexico) were the centers with the lowest risk (Figure 3). Regarding the risk of current symptoms of severe eczema, the highest risk was identified in Santa Cruz (Bolivia), Barranquilla (Colombia), and San Pedro Sula (Honduras), and the lowest risk was identified in Merida and Cuernavaca (Mexico), and in Itajaí and São Paulo (Brazil) (Figure 4).

For 6 to 7-year-olds, there was a significant negative correlation between gross national income per capita and mean country prevalence (excluding Cuba) of current symptoms of eczema ($r=-0.564$; 95% CI, -0.856 to -0.0003 ; $P=.01$), but not for current symptoms of severe eczema ($r=-0.539$; 95% CI, -0.846 to -0.036 ; $P=.057$). However, for 13 to 14-year-olds, both relationships were significant ($r=-0.678$ [95% CI, -0.886 to -0.275], $P<.001$; $r=-0.648$ [95% CI, -0.870 to -0.209], $P<.01$), respectively).

There were no significant relationships between the mean prevalence of current symptoms of eczema/severe eczema in each country and the following: infant mortality rate;

Table 1. Prevalence of Symptoms of Atopic Eczema Among Latin American Children Aged 6 to 7 Years in ISAAC Phase 3 Centers and the Association With Latitude

Center	Latitude	N	Rash Ever	Current Rash	Rash in Flexures	First Occurrence				Clearance of Rash in Last Year	Current ≥ 1 Night/ Wk Sleep Disturbance	Eczema Ever	Current Symptoms of Eczema	Current Symptoms of Severe Eczema
						<2 years	2-4 years	>4 years	>4 years					
Northern Hemisphere														
Mexicali Valley	32 40N	2568	12.5	6.2	7.6	1.7	2.5	3.7	6.1	1.1	3.6	5.4	0.8	
Monterrey	25 40N	3030	8.6	5.4	4.4	0.8	1.6	3.4	3.2	0.7	2.9	4.1	0.6	
Coahuila Victoria	23 44N	2603	4.6	3.3	3.2	0.9	1.7	2.3	3.0	0.5	2.0	2.3	0.3	
La Habana	23 08N	1803	38.3	22.3	24.8	15.2	5.8	3.5	12.1	6.0	26.4	18.2	4.9	
Mérida	20 58N	2896	13.8	8.4	10.0	3.3	3.0	4.0	3.6	0.8	6.8	8.2	0.8	
México (1)	19 24N	3205	12.4	9.5	10.9	14.4	3.6	5.1	85.9	1.0	4.1	8.7	0.7	
Ciudad de México (3)														
Toluca	19 24N	3493	9.8	9.0	10.3	1.8	4.0	4.8	5.8	1.2	2.4	8.8	1.0	
Cuernavaca	19 17N	3235	7.8	5.9	5.4	1.2	2.1	2.4	2.8	0.4	3.4	5.4	0.3	
Villahermosa	18 55N	2579	6.7	4.1	4.1	1.1	1.4	3.3	90.0	0.4	1.2	4.0	0.3	
San Pedro Sul ^a	18 00N	2678	10.9	6.7	7.8	2.1	2.6	2.5	4.6	1.6	5.4	6.1	1.0	
San Salvador	15 31N	1907	26.0	17.1	18.8	4.0	6.2	9.7	80.1	4.0	13.6	15.9	3.9	
Manágua	13 41N	1365	17.4	11.4	13.65	3.3	5.9	5.1	85.5	0.6	10.1	6.4	0.6	
Barranquilla	12 06N	3286	34.6	22.8	20.7	6.4	10.1	7.4	18.7	3.4	17.4	20.0	2.9	
Caracas	10 57N	3209	24.6	23.7	25.0	5.7	8.6	13.5	21.9	2.8	13.6	20.9	2.4	
Costa Rica ^a	10 30N	2999	17.5	14.4	14.2	2.9	5.8	8.3	11.0	3.2	33.2	12.4	2.8	
Davida-Panamá ^a	9 56N	3234	21.6	16.3	10.8	4.2	4.7	7.7	13.7	2.8	8.6	8.9	1.6	
Bogotá	8 26N	2942	25.1	18.2	17.6	5.3	7.0	10.5	14.1	2.5	35.1	14.4	1.8	
Calí	4 36N	3256	21.3	16.9	14.5	4.1	5.4	7.1	7.9	1.6	8.8	14.3	1.5	
Calí	3 25N	3005	9.5	8.2	9.4	2.6	2.7	4.9	17.8	1.4	13.0	7.3	1.2	
Southern Hemisphere														
Quito	1 05S	3055	33.6	27.3	22.5	7.3	9.2	10.8	16.1	2.9	10.9	22.5	2.7	
Manaus Amazonas	3 06S	3011	19.2	12.0	8.1	3.0	3.0	5.9	8.3	1.7	15.2	7.7	1.3	
Maceió	9 39S	1990	17.1	10.6	7.6	3.0	3.5	4.5	7.9	2.4	10.0	7.1	1.8	
Aracaju	10 55S	2443	25.4	13.0	11.4	-	-	-	9.4	2.1	9.9	10.1	1.1	
Salvador	12 58S	1069	10.7	8.4	7.1	-	-	-	9.2	2.3	14.2	6.1	1.1	
Nova Iguaçu	22 45S	3249	20.2	13.3	9.8	4.2	5.0	5.2	9.6	3.1	15.4	8.9	2.3	
São Paulo ^a	23 32S	3047	16.5	11.0	7.3	3.0	3.6	4.7	8.7	1.4	13.1	6.8	0.9	
São Paulo West	23 32S	3312	18.4	12.8	9.5	4.3	5.7	6.9	11.8	2.0	12.0	7.4	1.2	
Santo André	23 39S	2167	11.6	8.1	5.3	3.5	3.1	1.6	6.0	1.0	7.9	5.3	0.8	
Itajaí	26 54S	1511	15.6	10.7	8.7	2.4	4.7	6.5	9.3	1.0	13.5	6.9	0.8	
Paysandí	32 19S	1512	14.9	11.3	7.9	3.2	3.6	4.6	8.6	2.5	8.1	7.9	2.4	
Rosario City	32 57S	2952	9.3	6.5	4.2	1.8	1.6	2.6	4.9	0.8	9.2	4.2	0.5	
South Santiago ^a	33 26S	3075	22.3	18.9	16.6	5.0	6.6	5.0	13.0	2.2	18.2	14.8	2.0	
Valdivia ^a	39 49S	3183	16.8	13.4	11.7	5.5	3.8	3.8	7.8	1.4	11.1	11.7	1.3	
Neuquén	38 57S	1930	16.2	15.6	11.4	4.4	7.0	6.8	13.8	2.4	12.8	9.7	1.5	
Punta Arenas ^a	53 10S	3052	18.1	14.4	14.1	4.8	4.8	7.7	7.8	1.4	30.8	12.1	1.3	
Total mean			17.4	12.7	11.3	4.3	4.6	5.7	17.1	1.9	12.1	10.0	1.5	
Global Spearman r			-0.334 ^b	-0.260	-0.245	-0.058	-0.209	-0.414 ^a	-0.368 ^a	-0.341 ^a	-0.137	-0.271	-0.294	

^aCenters that participated in ISAAC Phases 1 and 3^bP<.05

Table 2. Prevalence of Symptoms of Eczema in Latin America by Language

	N	Rash	Current Rash	Rash in Flexures	First Occurrence				Clearance of Rash in Last Year	Current 1 or More Nights/Wk Sleep	Eczema Ever	Current Symptoms of Eczema	Current Symptoms of Severe Eczema
					< 2 Years	2-4 Years	> 4 Years						
6 to 7 years old													
Portuguese	21 799	17.9	11.5	8.5	4.2	5.1	9.1	1.9	12.5	7.6	1.3		
Spanish	72 052	17.2	13.1	12.2	4.7	5.9	19.5	1.8	12.0	10.7	1.5		
Odds ratio		1.05 ^a	0.87 ^a	0.67 ^a	0.89 ^a	0.85 ^a	0.41 ^a	1.06	1.05 ^a	0.68 ^a	0.86 ^a		
95% CI		1.01-1.09	0.82-0.90	0.64-0.71	0.83-0.96	0.80-0.92	0.39-0.43	0.95-1.18	1.01-1.10	0.64-0.72	0.76-0.99		
Total	93 851	17.4	12.7	11.3	4.6	5.7	17.1	1.9	12.1	10.0	1.5		
13 to 14 years old													
Portuguese	58 418	13.9	8.7	5.2	-	-	7.8	1.5	10.1	4.3	0.7		
Spanish	107 499	18.9	13.5	11.9	-	-	18.8	2.0	10.6	10.4	1.6		
Odds ratio		0.69 ^a	0.61 ^a	0.41 ^a	-	-	0.37 ^a	0.76 ^a	0.95 ^a	0.39 ^a	0.43 ^a		
95% CI		0.67-0.71	0.59-0.63	0.39-0.42	-	-	0.35-0.38	0.71-0.83	0.92-0.98	0.37-0.40	0.39-0.48		
Total	165 917	17.1	11.8	9.5	-	-	14.9	1.8	10.4	8.3	1.3		

^aP<.05

percentage of children younger than 1 year of age immunized against poliomyelitis, measles, diphtheria, tetanus, pertussis, and tuberculosis; percentage of population with potable water; percentage of population with sewage disposal services; annual proportion of registered deaths under 5 years of age due to intestinal infectious disease; and incidence of tuberculosis (data not shown).

Discussion

Latin America comprises an area of 21 069 501 km² with 541 million inhabitants living in 20 countries and 10 dependencies. The population of Latin America is a composite of ancestries, ethnic groups, and races, making it one of the most—if not the most—diverse regions in the world. The specific characteristics of the population vary from country to country. Some have a generally mixed population, whereas in others, the population is of Amerindian origin. In some countries, the population is mainly of European origin and in others, of African origin. Most or all Latin American countries have Asian minorities [14]. All the ISAAC reports show that the worldwide variability of asthma, rhinitis, and atopic eczema is not exclusively associated with racial or ethnic factors, and that other, much more important and less evident factors (eg, environmental conditions) could be responsible for the differences observed in this region.

Although the validity of the ISAAC eczema questionnaire has been questioned in some populations [15-18], it is generally accepted as a valuable tool in epidemiological studies of atopic eczema worldwide. The reasons proposed for the differences observed between the studies include cultural conceptions of terminology, differences between parents' and children's perception of symptoms, the transient nature of the signs of atopic eczema, differences in what physicians consider a typical case, and translation problems [15]. However, concern over the validity of the questionnaire is somewhat less marked in Latin America as the core questionnaire was validated after its translation to Portuguese and Spanish, and has proven to be adequate in identifying patients with eczema [8,19].

The ethnic/genetic differences between people living in Latin America are a potential cause of variation in the prevalence of symptoms of eczema in the region. The mean prevalence of current symptoms of eczema in some Latin American locations where the population is of African origin, for example, the Caribbean countries and some cities in Brazil (Recife, Salvador, Vitoria da Conquista, Feira de Santana, Belo Horizonte), varies significantly, from 4.4% in Brazil to 10.1% in La Habana, Cuba. The latter is similar to the values observed in African countries (mean, 13.3%; range, 6.5%-21.8%) [3,20].

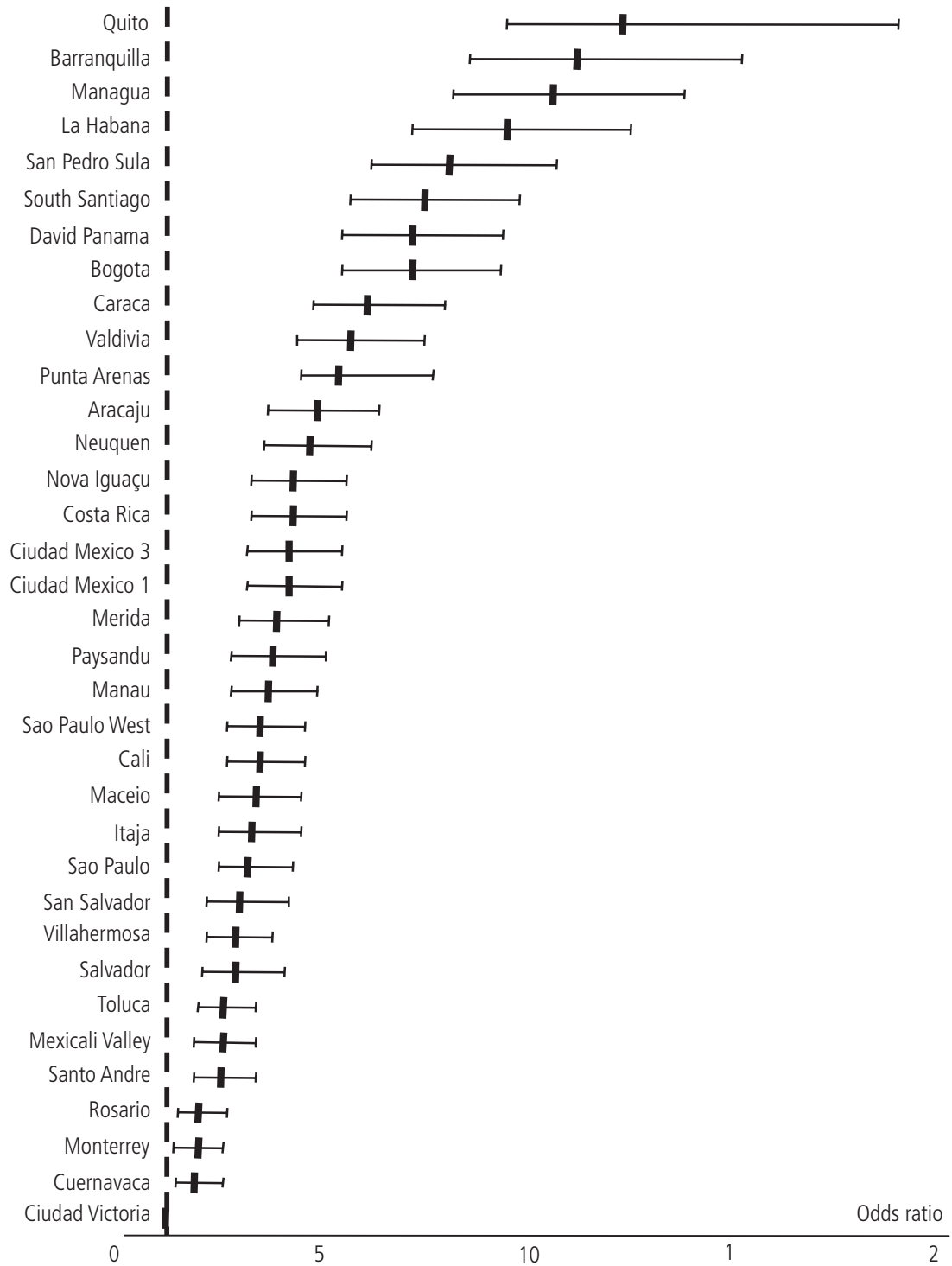


Figure 1. Odds ratios and 95% confidence intervals for current symptoms of eczema in centers participating in ISAAC Phase 3 in Latin America (Ciudad Victoria, children aged 6 to 7 years).

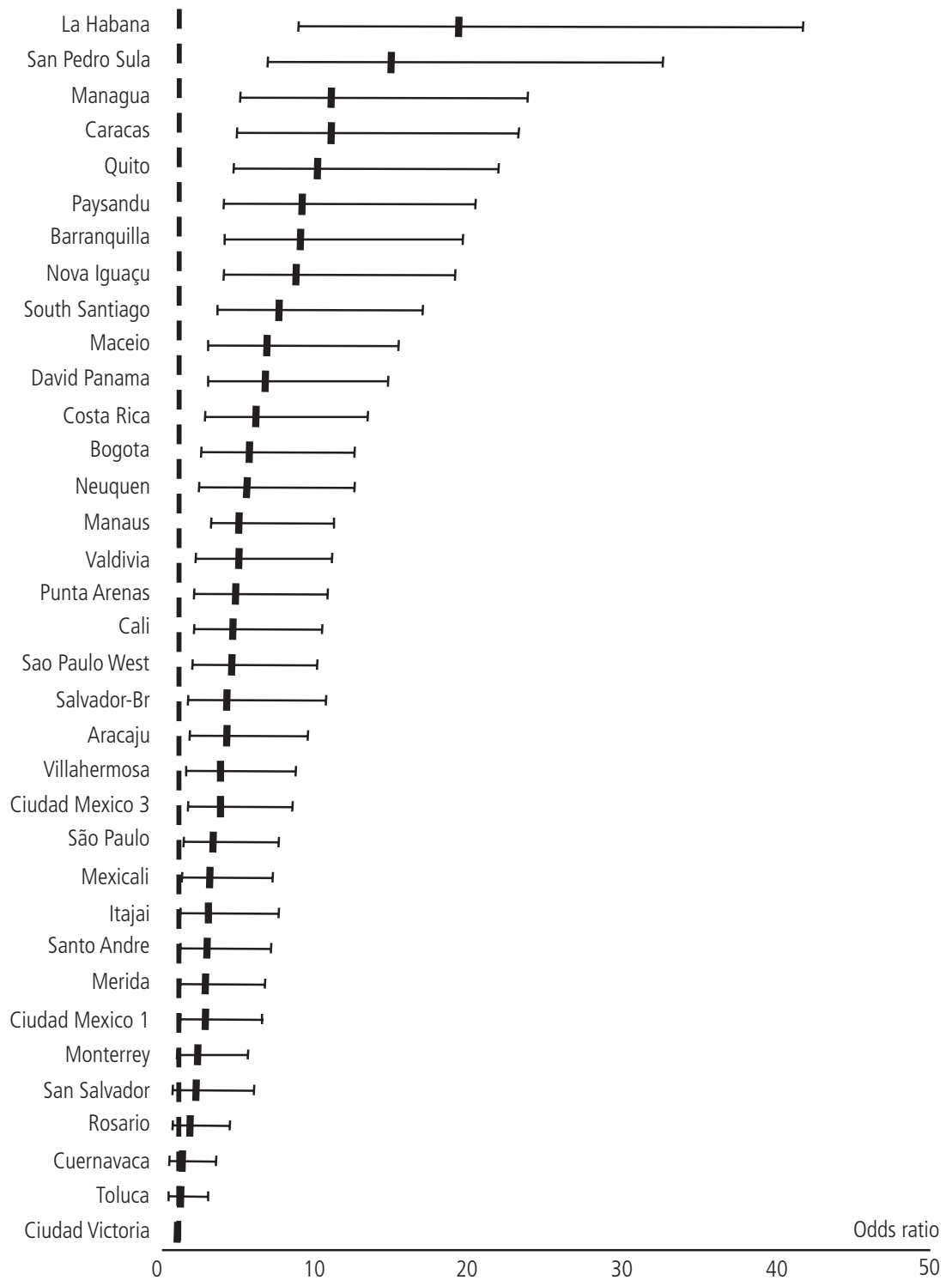


Figure 2. Odds ratios and 95% confidence intervals for current symptoms of severe eczema in centers participating in ISAAC Phase 3 in Latin America (Ciudad Victoria, children aged 6 to 7 years).

Table 3. Prevalence of Symptoms of Atopic Eczema in Latin American Children Aged 13 to 14 years in ISAAC Phase 3 Centers and the Association With Latitude

Center	Latitude	N	Rash Ever	Current Rash	Rash in Flexures	Clearance of Rash in Last Year	Current ≥ 1 Night/Wk Sleep Disturbance	Eczema Ever	Current Symptoms of Eczema	Current Symptoms of Severe Eczema
Northern Hemisphere										
Mexicali Valley	32 40N	2 988	5.4	3.3	3.7	3.1	0.3	1.3	2.8	0.1
Monterrey	25 40N	3 006	11.3	6.6	4.2	5.0	1.2	1.5	4.0	0.8
Ciudad Victoria	23 44N	3 122	8.9	5.8	7.0	3.5	1.5	0.8	5.1	1.1
La Habana	23 08N	3 026	21.2	14.3	12.6	13.6	3.0	13.8	10.1	2.2
Mérida	20 58N	3 019	7.4	4.2	4.2	2.5	0.4	1.2	3.4	0.3
Ciudad de México (1)	19 24N	3 891	11.3	8.9	10.1	89.0	1.0	2.3	8.5	0.9
Ciudad de México (3)	19 24N	3 474	8.2	7.9	7.9	5.5	0.7	1.2	7.4	0.6
Ciudad de México (4)	19 24N	2 662	9.1	8.0	8.2	6.3	0.8	1.5	6.7	0.6
Toluca	19 17N	3 021	7.4	4.1	3.6	3.1	0.9	4.1	3.1	0.5
Cuernavaca ^a	18 55N	1 431	6.0	3.8	2.9	2.2	0.3	9.5	2.8	0.3
Villahermosa	18 00N	3 109	8.4	5.7	6.5	4.1	1.3	3.8	5.3	1.1
San Pedro Sula	15 31N	2 675	21.8	16.3	17.5	83.5	3.6	7.7	15.6	3.6
San Salvador	13 41N	3 260	18.4	11.5	6.2	87.3	0.8	6.6	5.3	0.6
Manágua	12 06N	3 263	48.9	23.7	21.1	21.6	3.5	15.4	20.4	3.0
Barranquilla	10 57N	3 204	37.6	29.7	30.2	29.2	4.6	16.1	24.6	3.9
Caracas	10 30N	3 000	13.3	9.8	9.2	8.5	2.4	26.2	7.2	1.7
Costa Rica ^a	9 56N	2 436	17.0	12.8	7.0	9.9	2.2	7.6	6.3	1.3
David-Panamá ^a	8 26N	3 183	25.2	18.3	17.6	14.1	2.5	35.5	14.5	1.7
Bogotá	4 36N	3 830	24.6	16.7	13.1	9.3	1.7	3.7	12.1	1.5
Calí	3 25N	3 100	11.4	8.2	11.3	19.8	2.0	2.3	6.9	1.4
Southern Hemisphere										
Quito	1 05S	3 014	30.5	22.4	19.9	11.8	2.4	11.7	19.9	2.2
Guayaquil	2 10S	3 082	25.6	17.9	13.5	13.5	2.6	17.5	13.3	2.4
Manaus Amazonas	3 06S	3 009	18.3	10.7	5.8	7.1	1.9	14.2	5.7	1.2
Recife ^a	8 05S	2 865	15.4	10.1	5.0	6.5	1.5	12.2	4.8	1.0
Caruaru	8 17S	3 026	16.4	10.3	6.5	10.2	2.1	14.1	4.9	1.0
Maceió	9 39S	2 745	13.0	7.5	4.0	5.1	1.3	6.4	3.9	0.8
Aracaju	10 55S	3 043	16.9	11.2	7.9	11.2	2.7	13.1	5.7	1.3
Lima ^a	12 03S	3 022	17.3	12.8	13.7	11.6	1.2	20.7	10.5	1.0
Feira de Santana	12 16S	1 732	12.4	8.5	5.8	11.8	2.4	2.5	3.8	1.2
Salvadora	12 58S	3 020	14.8	10.7	6.5	12.0	2.4	2.2	5.1	1.0
Vitória da Conquista	14 51S	1 679	15.4	10.4	7.7	14.4	2.9	2.5	4.6	1.0
Brasília	15 48S	3 009	16.8	10.2	5.6	10.2	2.1	13.6	4.3	0.9
Santa Cruz	17 48S	3 257	33.3	28.1	22.5	17.3	5.0	13.3	21.1	4.2
Belo Horizonte	19 53S	3 088	14.9	9.1	5.2	9.7	1.7	12.0	3.8	0.4
Calama	22 28S	1 618	28.8	22.0	24.7	15.4	2.9	21.1	19.7	2.6
Nova Iguaçu	22 45S	3 185	15.7	8.9	4.1	5.8	1.1	9.4	4.1	0.6
São Paulo ^a	23 32S	3 161	12.4	7.1	3.6	4.9	0.6	12.7	3.5	0.2
São Paulo West	23 32S	3 181	15.2	9.7	6.9	9.3	1.4	8.6	4.8	0.8
Santo Andre	23 39S	3 232	14.0	7.1	3.4	4.9	0.6	12.2	3.4	0.4
Salta	24 47S	3 000	16.2	12.1	8.1	9.3	1.5	12.7	8.0	1.2
Asunción ^a	25 16S	3 000	29.0	21.3	17.7	15.0	2.9	23.2	17.7	2.6
Curitiba ^a	25 25S	3 628	8.8	6.3	3.7	4.6	0.4	4.1	3.7	0.4
Itajaí	26 54S	2 737	9.9	7.0	3.9	5.9	0.8	9.0	3.3	0.3
Passo Fundo	28 15S	2 949	13.6	8.6	5.5	7.3	1.4	13.4	5.0	0.8
Rural Santa Maria	29 41S	3 057	12.6	8.0	4.8	7.9	1.5	11.9	4.0	0.7
Santa Maria	29 41S	3 065	10.6	6.8	3.6	5.5	1.3	9.9	3.2	0.7
Porto Alegre ^a	30 01S	3 007	11.3	7.0	5.0	7.1	1.0	11.7	4.1	0.7
Córdoba	31 24S	3 445	12.9	9.6	6.4	7.8	1.2	9.6	6.3	0.9
Paysandú	32 19S	1 738	12.7	8.6	5.4	6.0	2.1	2.5	5.4	1.7
Rosario City	32 57S	3 099	13.6	9.9	6.6	5.8	1.6	9.8	6.4	1.2
South Santiago ^a	33 26S	3 026	31.8	25.4	26.8	16.1	3.8	31.9	22.0	3.0
Montevideo ^a	34 53S	3 177	12.9	8.4	5.2	6.0	1.5	9.4	5.2	1.2
Neuquén	38 57S	3 172	17.9	13.3	9.5	11.8	2.1	4.7	8.4	1.5
Valdivia	39 49S	3 105	22.3	16.9	13.3	10.1	1.8	12.6	13.1	1.7
Chiloe	42 00S	3 000	22.9	16.5	12.6	12.2	2.1	15.5	9.8	1.1
Punta Arenas ^a	53 10S	3 044	23.3	18.5	15.4	55.6	1.7	8.1	13.2	1.3
Total mean			17.1	11.8	9.5	14.9	1.8	10.4	8.3	1.3
Global Spearman r			-0.235	-0.224	-0.212	-0.240	-0.285 ^b	-0.107	-0.162	-0.219

^aCenters that participated in ISAAC Phases 1 and 3^bP<.05

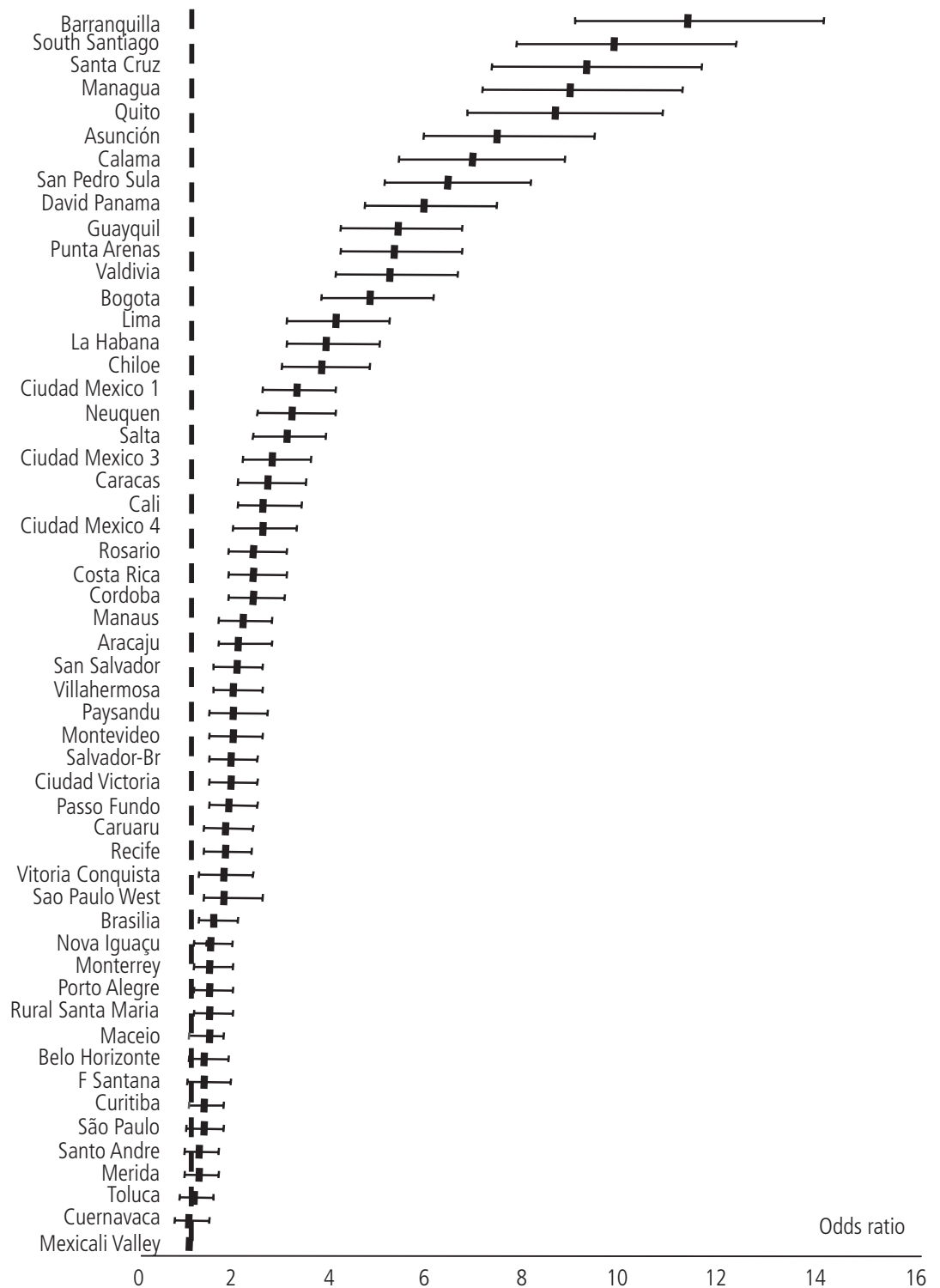


Figure 3. Odds ratios and 95% confidence intervals for current symptoms of eczema in centers participating in ISAAC Phase 3 in Latin America (Mexicali Valley, children aged 13 to 14 years).

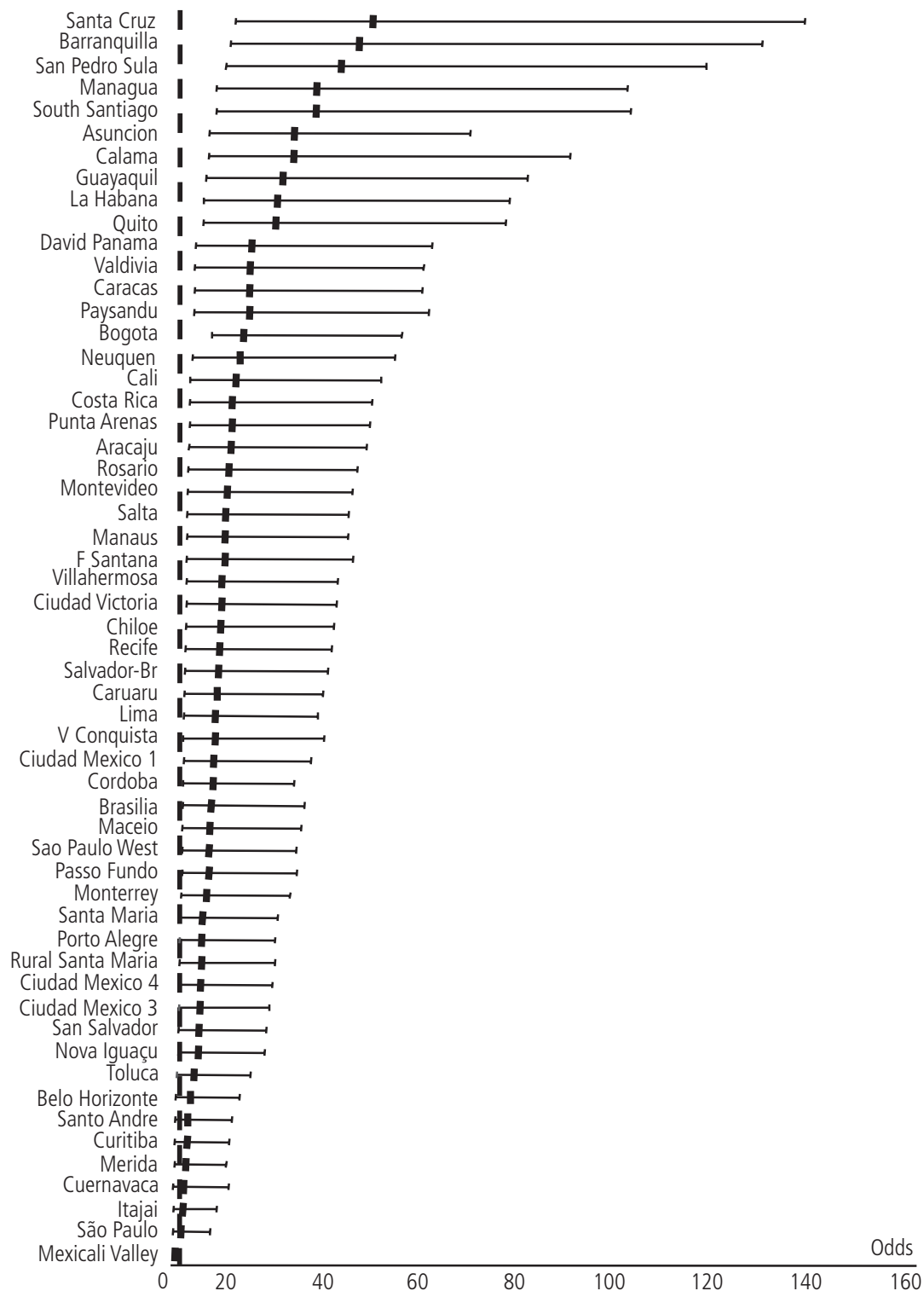


Figure 4. Odds ratios and 95% confidence intervals for current symptoms of severe eczema in centers participating in ISAAC Phase 3 in Latin America (Mexicali Valley, children aged 13 to 14 years).

In places where miscegenation between people of African descent and other races is less common, use of health care resources for atopic eczema is a marker of the high prevalence and severity of the condition. A cross-sectional study performed during the period 1990-1998 in the United States evaluated the use of health care resources for atopic eczema based on data from the National Ambulatory Medical Care Survey. In comparison with whites, the risk of per capita visits to the doctor due to atopic eczema was 3.4 (95% CI, 2.5-4.7) for people of African descent and 6.7 (95% CI, 4.8-9.5) for Asian/Pacific Islanders [21]. As mentioned above, Asian/Pacific Islanders are minorities in most or all Latin American countries [14]. However, São Paulo and Belém (Brazil) and Peru received a large number of Japanese immigrants during the 20th century. The prevalence of current symptoms of atopic eczema was 10.5% in Lima and 4.2% in São Paulo.

The prevalence of eczema symptoms in centers from Spain (4.0%) and Portugal (5.1%) [3,4] was significantly lower than in Spanish-speaking and Portuguese-speaking Latin American centers (Table 2). The same pattern was also observed for the prevalence of asthma and rhinitis in Latin America [22,23]. These data do not allow us to conclude that genetic or ethnic factors are the main determinants of variability in the prevalence of eczema symptoms in this region.

Heat and humidity have been considered risk factors for atopic eczema. Data from 146 ISAAC Phase 1 centers show a significant and positive correlation between the prevalence of symptoms of atopic eczema and latitude, and a negative correlation with the decrease in mean annual outdoor temperature [24]. These findings suggest that climate may affect the prevalence of atopic eczema in children. Although there was a trend in Latin America toward a higher prevalence of current symptoms of eczema and of severe eczema in centers near the equator, there were few significant associations between prevalence and latitude. Nevertheless, latitude was significantly and positively associated with the prevalence of sleep disturbance due to atopic eczema.

Altitude did not appear to affect the prevalence of current symptoms of eczema or of severe eczema. Centers located above 2000 m (Bogota, Quito, Calama, Mexico City, and Toluca), did not have a consistently higher or lower prevalence than centers located at sea level.

Exposure to hard water as a higher risk factor for atopic eczema in primary school children has been documented by ecological studies in the UK [25] and Japan [26]. In Latin America there are several areas with hard water, although the water is usually softened for human consumption.

Air pollution due to exhaust emissions, which is associated with urbanization and a westernized lifestyle, is one of the reasons for the rising frequency of allergic diseases observed in most industrialized countries [27,28]. Martín Fernández-Mayoralas et al [29] evaluated the influence of air pollution on the prevalence of atopic eczema in 13 to 14-year-old schoolchildren living in the city of Cartagena, Spain. High levels of atopic eczema and severe eczema were observed among those exposed to high levels of air pollutants. Similar results were observed by Arnedo-Pena et al in the same region some years later [30].

Considering the data from the largest cities in Latin America involved in this study (Mexico City, São Paulo, Lima,

Bogota, Santiago de Chile, Belo Horizonte, and Caracas) and potential sources of air pollution, we did not observe a clear relationship between exposure and increased prevalence of current symptoms of eczema, severe eczema, or both (Tables 1 and 2). In a previous study, we evaluated the relationship between exposure to gaseous air pollutants and the prevalence of symptoms of asthma, rhinitis, and atopic eczema in adolescents from 5 large cities in Brazil. Although we did not detect a characteristic pattern for all the symptoms evaluated or a specific air pollutant, these data suggested a relationship between greater exposure to photochemical pollutants and a high prevalence or risk of symptoms of asthma, rhinitis, and atopic eczema [31].

Also interesting is the relationship between socioeconomic status and the prevalence of atopic eczema and related symptoms. Depending on the criteria applied to characterize socioeconomic status, results vary. Inequality of income and poverty continue to be the main challenges in Latin America. The Economic Commission for Latin America and the Caribbean (ECLAC) has described Latin America as one of the most unequal regions in the world [32], and the World Bank reports that almost one-quarter of the population lives on less than US\$2 a day. The most unequal countries (according to the Gini index [33]) are Bolivia, Haiti, and Colombia, whereas the least unequal countries are Ecuador, Venezuela, and Uruguay. Differences in infrastructure (eg, water and sanitation) are also common and the quality of infrastructure is often low [34]. A significant negative association between gross national income per capita and prevalence of current symptoms of eczema and of severe eczema has been observed, mainly among adolescents. The absence of specialized treatment in developing countries may explain these results. Contrary to our results, Stewart et al [35], when evaluating international data from ISAAC Phase 1, observed a positive relation between gross national product per capita and the prevalence of eczema in both age groups. More recently, Flohr et al [36], when evaluating the association between allergic sensitization and eczema as part of ISAAC Phase 2, observed a positive association with national per capita income and prevalence of eczema.

Although we observed a significant negative association between gross national income per capita and the prevalence of symptoms of eczema, we are aware that our study does have some limitations, arising mainly from its cross-sectional design. The time sequence of events cannot be established with certainty and the areas compared may differ markedly with regard to the various risk factors discussed. Thus, any attempt to infer a cause-effect relationship could lead to confusion. The correlation between the prevalence of symptoms of atopic eczema and socioeconomic parameters should be interpreted with caution, as data from individual centers may differ substantially from national data. Our objective was to understand the marked discrepancies observed in the prevalence of symptoms of eczema in Latin America.

In conclusion, atopic eczema is an allergic disease whose prevalence has increased during the last 7 years in Latin America, mainly among 6 to 7-year-olds. A significant negative association has been observed among country gross national income per capita and prevalence of symptoms of eczema, and a trend toward higher prevalence has been identified among

centers close to the equator. Complementary studies evaluating environmental risk factors are necessary to explain the differences observed, even in centers from the same country.

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