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Respiratory diseases and associated factors: population-based study in São Paulo, 2008-2009

ABSTRACT

OBJECTIVE: To assess the prevalence of acute bronchitis, rhinitis, and sinusitis among children and adolescents and identify associated factors.

METHODS: This is a population-based, cross-sectional study. A household survey was conducted with 1,185 children and adolescents from the city of São Paulo (Southeastern Brazil), from 2008 to 2009. The participants were selected by means of probability sampling, stratified by sex and age, and by two-stage cluster sampling. For the adjusted analysis, multiple Poisson regression was used.

RESULTS: Of the respondents, 7.3% reported acute bronchitis, 22.6% rhinitis and15.3% sinusitis. After the adjusted analysis, the following characteristics were associated with self;reported acute bronchitis: age 0 to 4 years (PR=17.86; 95%CI: 3.65;90.91), 5 to 9 years (PR=37.04; 95%CI: 8.13;166.67), 10 to 14 years (PR=20,83; 95%CI: 4.93;90.91), allergy (PR=3.12; 95%CI: 1.70;5.73), black and mixed-ethnicity (black and white) skin color (PR=2.29; 95%CI: 1.21;4.35), and living in a household with 1 to 3 rooms (PR=1.85; 95%CI: 1.17;2.94). As to self-reported rhinitis, the following characteristics were associated: age 10 to 14 years (PR=2.77; 95%CI: 1.60;4.78), 15 to 19 years (PR=2.58; 95%CI: 1.52;4.39), allergy (PR=4.32; 95%CI: 2.79;6.70), asthma (PR=2.30; 95%CI: 1.30;4.10) and living in flats (PR=1.70; 95%CI: 1.06;2.73). Concerning self-reported sinusitis, the following characteristics were associated: age 5 to 9 years (PR=2.44; 95%CI: 1.09;5.43), 10 to 14 years (PR=2.99; 95%CI: 1.36;6.58), 15 to 19 years (PR=3.62; 95%CI: 1.68;7.81), allergy (PR=2.23 (95%CI: 1.41;3.52) and obesity (PR=4.42; 95%CI: 1.56;12.50).

CONCLUSIONS: Respiratory diseases were more prevalent in population groups with defined characteristics, such as age group, self-reported diseases, type of household and obesity.

DESCRIPTORS: Child. Adolescent. Respiratory Tract Diseases, epidemiology. Risk Factors. Socioeconomic Factors. Cross-Sectional Studies.

INTRODUCTION

Respiratory diseases characterized by acute bronchitis, (allergic) rhinitis and sinusitis (chronic rhinosinusitis) are important causes of morbidity in children and adolescents around the world. In the United States, these diseases were responsible for the highest number of visits to outpatient health services for people up to 15 years old between 2001 and 2002. In addition, they exercise

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an important pressure on the health services and are responsible for frequent school absenteeism.[a]

These respiratory diseases also have a prominent position in Brazil. The recent increase in the cases of hospitalizations of children and adolescents possibly occurs due to bronchial irritation from infectious and noninfectious causes, like atmospheric pollutants, cigarette smoke and other allergens.[11]

The prevalence of episodes of acute bronchitis is 5% per year in the United States. It is one of the most common infections in children younger than five years and it is responsible for numerous hospitalization cases.[12]

According to the last Brazilian consensus,[b] rhinitis is described in the literature as one of the most frequent chronic diseases in childhood. Although little importance is given to it, it produces great discomfort and can be associated with serious problems like sleep apnea, asthma and repeated respiratory infections. The mean prevalence of symptoms related to allergic rhinitis in Brazil was 29.6% among adolescents (13-14 years) and 25.7% among schoolchildren (six-seven years) between 2002 and 2003. Brazil is in the group of countries with the highest prevalence of allergic rhinitis in the world.[18]

Rhinitis and sinusitis are quite common in clinical practice and are conditions which are frequently associated. It is estimated that sinusitis affects approximately 31 million people annually in the United States, one of the most prevalent affections of the upper airways, with high financial cost to society.[10]

Both sinusitis and rhinitis may mean decrease in the quality of life and aggravation of comorbidities; it addition, they may demand significant expenditures on health. They may also create indirect costs to society, as the lost school days can reduce school learning. Although rhinitis and sinusitis frequently occur in the population, little is known about the epidemiology of these diseases. The same can be said about acute bronchitis. The absence of a standardized method to identify them in epidemiological studies is an important limitation to obtain these data.[c]

Although respiratory diseases in childhood and adolescence are common, information about the frequency and distribution of respiratory diseases in children and adolescents is scarce in Brazil. Regarding the municipality of São Paulo (Southeastern Brazil), there are few population-based studies about estimation of the prevalence of these respiratory diseases and associated factors for these age groups.[5] Population health surveys play an important role in the knowledge of current aspects about the population's morbidity situation. Health information subsidizes actions supported by objective data backed by scientific evidence. Population health surveys carried out periodically are important to generate information that is not obtained in continuous national records, and are fundamental to plan and evaluate the policies of prevention and control of health problems and of health promotion in the municipal or regional level.[2]

The aim of this study was to estimate the prevalence of acute bronchitis, rhinitis and sinusitis in children and adolescents and to identify associated factors.

METHODS

Cross-sectional, population-based study with data from the 2008 *Inquérito de Saúde no Município de São Paulo* (ISA - Capital 2008 - Health Survey in the Municipality of São Paulo), from 2008 to 2009. The sample of ISA – Capital was of 3,271 people, and for this study, children and adolescents were selected, totaling 1,185 individuals aged between zero and 19 years.

The participants were selected by probability sampling, stratified by sex and age, and by two-stage cluster sampling: census tracts and households. Seventy sectors were drawn from *Pesquisa Nacional por Amostra de Domicílio* (PNAD-2002 – National Household Sample Survey), which sampled 267 urban census tracts in the municipality.[d]

A questionnaire structured in 21 thematic blocks whose majority of questions was closed was administered to the drawn person or to the mother/guardian, for children younger than 12 years.[e] The interviews were conducted by trained personnel who were supervised during the period of the survey. To ensure quality control, new interviews were conducted by telephone or directly in the households for those without telephone, based on a random sample of 5% of the interviews. The non-response rate was 22.5% and there was 7.3% of vacant households or households whose inhabitants refused to inform if anyone belonging to the age group lived there.

[a] Schappert SM, Burt CW. Ambulatory care visits to physician offices, hospital outpatient departments, and emergency departments: United States, 2001-02. National Center for Health Statistics. *Vital Health Stat 13*. 2006 [cited 2011 Sep 15];(159):1-67. Available from: http://www.cdc.gov/nchs/data/series/sr_13/sr13_159.pdf

[b] II Consenso Brasileiro sobre Rinites. *Rev Bras Alerg Imunopatol.* 2006 [cited 2011 Sep 19];29(1):29-58. Available from: http://www.asbai.org.br/revistas/Vol291/consenso.pdf

[c] Diretrizes Brasileiras de Rinossinusites. *Rev Bras Otorrinolaringol.* [on line]. 2008 [cited 2011 Sep 19];74(2 Supl):6-59. Available from: http://www.scielo.br/pdf/rboto/v74n2s0/a02.pdf

[d] Alves MCGP, Escuder MML. Plano de amostragem do ISA - Capital 2008. São Paulo; 2009 [cited 2010 Sep 2]. Available from: http://www.fsp.usp.br/isa-sp/pdf/planoamostral2008.pdf

[e] Universidade de São Paulo, Faculdade de Saúde Pública. Inquérito de Saúde no Município de São Paulo - ISA Capital 2008: questionário completo. São Paulo; 2008 [cited 2010 Sep 2]. Available from: http://www.fsp.usp.br/isa-sp/pdf/questionarioisa2008.pdf

The dependent variables were self-reported acute bronchitis, rhinitis and sinusitis (yes; no). The independent variables were: sex, age, skin color, level of schooling of the head of the family, income of the head of the family, characterization of the household, type of household, number of rooms, sewage disposal, presence of dogs in the household, of cats, presence of allergy, of asthma, body mass index (BMI,[f] calculated according to reported weight and height), hospitalization in the 12 months before the interview, and nights of hospitalization. For the BMI classification, the criterion proposed by Centers for Disease Control and Prevention was adopted, by means of the BMI curve according to age and sex. Low weight was considered BMI below percentile 5; normal weight, BMI between percentile 5 and below 85; overweight, BMI between percentile 85 and below 95; and obesity, BMI higher than or equal to percentile 95.

The association between the independent and dependent variables was estimated in the bivariate analysis by the chi-square test, with level of significance of 5%. Prevalence ratios were used, as well as 95% confidence intervals, and multiple Poisson regression was performed for the adjusted analysis. The variables which had $p < 0.20$ in the bivariate analysis were considered and those with $p < 0.05$ remained in the multiple model. Interactions between the variables of the final model were examined. The effect of sample design was considered for the analysis of surveys based on complex outlines in the analyses. The program SPSS 16.0 was utilized. It allows incorporating the distinct weights of the observations.

The participants signed a consent document in which the aims of the research and the information that would be requested were explained and the secrecy of the information was guaranteed. The research protocol was approved by the Research Ethics Committee of the School of Public Health of Universidade de São Paulo (Process no. 381/2001).

RESULTS

Of the 1,185 interviewees aged between zero and 19 years, 50.1% were women and 61.9% had white skin color. In addition, 94% lived in households characterized as houses, 56.1% owned the place where they lived and 60.1% lived in homes with four rooms or more. Dogs were present in 42.3% of the households and cats, in 13.3%. The prevalence of asthma was 9.1% (95%CI: 7.0;11.7) and of allergy, 21.1% (95%CI: 17.9;24.7) (Table 1).

Self-reported prevalence of acute bronchitis was 7.3% (95% CI: 5.5;9.8), of rhinitis, 22.6% (95%CI: 19.3;26.2), and of sinusitis, 15.3% (95%CI: 12.6;18.5).

Acute bronchitis was significantly associated with age ($p < 0.001$), skin color ($p = 0,007$), presence of allergy ($p = 0.001$), of asthma ($p < 0.001$), number of nights of hospitalization (four to seven nights, $p = 0.012$), and with number of rooms in the household ($p = 0.004$). Rhinitis was associated with age ($p = 0.001$), with presence of allergy ($p < 0.001$), of asthma ($p < 0.001$), level of schooling of the head of the family ($p = 0.005$), and with the characterization of the household ($p = 0.001$). Sinusitis was associated with age ($p = 0.002$), with BMI[f] ($p = 0.014$), presence of allergy ($p < 0.001$), and presence of asthma ($p = 0.009$) (Table 2).

In the multiple Poisson regression model, the following variables were associated with self-reported acute bronchitis: ages from zero to four years (PR = 17.86; 95%CI: 3.65;90.91), from five to nine years (PR = 37.04; 95%CI: 8.13;166.67), from ten to 14 years (PR = 20.83; 95%CI: 4.93;90.91), presence of allergy (PR = 3.12; 95%CI: 1.70;5.73), black and mixed-ethnicity (black and white) skin color (PR = 2.29; 95%CI: 1.21;4.35), and one to three rooms in the household (PR = 1.85; 95%CI: 1.17;2.94) (Table 3). The interaction test was not significant among the independent variables. Age and skin color did not modify the association for presence of allergy ($p = 0.998$ and $p = 0.528$, respectively), and number of rooms in the household did not modify the association for skin color ($p = 0.187$).

The following variables were associated with self-reported rhinitis: ages ten to 14 years (PR = 2.77; 95%CI: 1.60;4.78), 15 to 19 years (PR = 2.58; 95%CI: 1.52;4.39), reporting to have allergy (PR = 4.32; 95%CI: 2.79;6.70), reporting to have asthma (PR = 2.30; 95%CI: 1.30;4.10) and living in a flat (PR = 1.70; 95%CI: 1.06;2.73). There was no interaction between presence of asthma and allergy ($p = 0.196$), and age did not modify the association for presence of asthma ($p = 0.840$) and of allergy ($p = 0.687$) (Table 3).

Self-reported sinusitis was associated with: age five to nine years (PR = 2.44; 95%CI: 1.09;5.43), ten to 14 years (PR = 2.99; 95%CI: 1.36;6.58), 15 to 19 years (PR = 3.62; 95%CI: 1.68;7.81), reporting to have allergy (PR = 2.23; 95%CI: 1.41;3.52), and being obese (PR = 4.42; 95%CI: 1.56;12.50) (Table 3). There was no interaction between presence of allergy and body mass index ($p = 0.457$).

DISCUSSION

The estimated prevalence for episodes of acute bronchitis found in the present study is similar to that of the United States, around 5% per year. Acute bronchitis is one of the most common infections in children under

[f] Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. Division of Nutrition, Physical Activity, and Obesity. Healthy Weight - Assessing Your Weight: About BMI for Children and Teens. USA: 2011 [cited 2011 Sep 13]. Available from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html

Table 1. Distribution of the studied population according to investigated variables. São Paulo, Southeastern Brazil, 2008-2009. (n = 1,185)[a]

Variable	n	%	95%CI
Sex			
Male	596	49.9	46.5;53.3
Female	589	50.1	46.7;53.5
Age (years)			
0 to 4	316	22.5	19.4;26.0
5 to 9	189	28.2	24.8;32.0
10 to 14	318	25.9	22.8;29.3
15 to 19	362	23.3	19.7;27.4
Skin color			
White	691	61.9	56.8;66.7
Black/Mixed-ethnicity (white and black)	483	38.1	33.3;43.2
Body Mass Index (> 12 years)			
Underweight	116	21.0	17.2;25.2
Normal weight	366	65.0	60.1;69.6
Overweight	63	10.7	8.3;13.8
Obese	19	3.3	1.9;5.6
Presence of allergy			
No	954	78.9	75.3;82.1
Yes	230	21.1	17.9;24.7
Presence of asthma			
No	1.093	90.9	88.3;93.3
Yes	92	9.1	7.0;11.7
Hospitalization in the 12 previous months			
No	1.110	94.9	93.3;96.1
Yes	75	5.1	3.9;6.7
Nights of hospitalization (hospitalized in the 12 previous months)			
Up to 3	39	63.8	50.4;75.4
4 to 7	19	18.8	11.7;28.8
More than 7	17	17.4	8.5;32.1
Level of schooling of the head of the family (in years)			
Never or up to 3	140	10.2	7.9;13.0
4 to 7	358	24.5	20.5;28.9
8 to 11	506	48.5	44.1;53.0
12 or more	156	16.8	12.9;21.7
Income of the head of the family (minimum salaries)[b]			
Less than or equal to 1	296	25.0	21.3;29.2
> 1 to 2.5	469	40.8	36.2;45.5
> 2.5 to 4	161	16.5	13.5;20.0
> 4	148	17.7	13.6;22.8
Characterization of the household			
House	1.109	93.7	89.5;96.3
Flat	58	6.3	3.7;10.5
Type of household			
Ceded	162	15.2	11.4;20.0
Rented	328	28.7	24.0;33.9
Private	653	56.1	50.2;61.8
Number of rooms in the household			
1 to 3	491	39.9	34.3;45.8
4 and more	693	60.1	54.2;65.7
Sewage disposal			
Public system	999	86.9	80.1;91.7
Others	171	13.1	8.3;19.9
Dog in the household			
No	698	57.7	53.3;62.1
Yes	487	42.3	37.9;46.7
Cat in the household			
No	1.026	86.7	83.0;89.7
Yes	159	13.3	10.3;17.0

[a] Variable that presented the highest number of losses obtained n = 1,074.
[b] Income of the head of the family in minimum salaries (1 minimum salary: R$ 510.00).

five, and it is responsible for the majority of the causes of hospitalization.[12] The United States performed more than 5 million consultations for acute bronchitis between 2001 and 2002, and classified it among the most frequent diseases in the outpatient health services.[a]

In Germany, the prevalence of self-reported bronchitis in children aged five to seven years was 21.3% in Munich, 33% in Dresden and 31.8% in Leipzig between 1995 and 1996. The prevalence of bronchitis was 24.4% in Munich and 36.8% in Dresden for children between nine and 11 years.[23] The prevalence of acute bronchitis for children between five and nine years old was lower in the present study: 13%.

Age was associated with acute bronchitis, mainly in the first years of life. Presence of allergy was associated with acute bronchitis. This disease frequently refers to an infectious process propagated by the upper airways and is a complication of rhinitis or pharyngitis, more common in atopic (allergic) individuals.[12] Black or mixed-ethnicity skin color and living in households with lower number of rooms were also associated with acute bronchitis. Although skin color relations are not defined by a social group, ethnic differences are associated with social inequalities and condition the way of living of groups of individuals. Thus, blacks are considered more susceptible to respiratory infectious diseases. Agglomeration and low socioeconomic level are important factors for acute lower respiratory tract infections, as well as allergies and associated comorbidities, like asthma.[17]

The mean prevalence of clinically diagnosed rhinitis in Europe was 22.7% (95%CI: 21.1;24.2) in 2001, similar to the present study in São Paulo. The European countries that were evaluated were: Belgium (28.5%;

Table 2. Prevalence of self-reported acute bronchitis, rhinitis and sinusitis in children and adolescents and its associations with the independent variables. São Paulo, Southeastern Brazil, 2008-2009.

Variable	Acute bronchitis			Rhinitis			Sinusitis		
	%	n	p*	%	n	p*	%	n	p*
Sex			0.407			0.793			0.377
Male	8.1	42		23.0	124		14.3	79	
Female	6.6	30		22.2	119		16.3	95	
Age (years)			<0.001			0.001			0.002
0 to 4	6.5	15		12.2	28		6.5	11	
5 to 9	13.0	25		21.7	38		15.1	28	
10 to 14	8.1	30		28.9	89		18.0	59	
15 to 19	0.4	2		26.7	88		21.0	76	
Skin color			0.007			0.149			0.082
White	5.1	29		24.3	150		13.7	87	
Black/mixed-ethnicity (white and black)	11.1	43		19.4	90		18.1	87	
Body Mass Index (> 12 years)			0.317			0.912			0.014
Underweight	5.8	8		27.7	31		18.0	21	
Normal weight	3.9	16		28.6	97		19.2	71	
Overweight	0.0	0		32.7	19		19.0	14	
Obese	5.6	1		30.2	6		51.0	9	
Presence of allergy			0.001			<0.001			<0.001
No	5.6	46		15.8	140		12.2	112	
Yes	13.9	26		48.1	103		26.9	62	
Presence of asthma			<0.001			<0.001			0.009
No	0	0		20.8	206		14.3	152	
Yes	80.8	72		40.4	37		25.0	22	
Hospitalization in the 12 previous months			0.139			0.302			0.819
No	7.0	63		23.0	232		15.2	166	
Yes	13.7	9		16.2	11		16.5	8	
Nights of hospitalization[a]			0.012			0.189			0.303
Up to 3	9.9	4		15.6	7		22.4	7	
4 to 7	35.6	3		33.7	4		11.6	1	
More than 7	4.0	2		0.0	0		0.0	0	
Level of schooling of the head of the family (in years)			0.069			0.005			0.693
Never or up to 3	13.1	12		18.3	23		13.1	19	
4 to 7	6.9	22		19.2	69		17.9	59	
8 to 11	8.3	35		21.1	101		14.4	71	
12 or more	2.7	3		35.5	47		14.8	20	
Income of the head of the family (minimum salaries)[a]			0.104			0.083			0.968
≤ 1	8.3	18		21.0	55		14.8	44	
> 1 a 2,5	10.9	43		21.7	97		16.1	71	
> 2,5 a 4	2.1	3		16.0	30		16.5	29	
> 4	6.0	7		30.4	37		16.2	20	
Caracterização do domicílio			0.064			0.001			0.549
Casa	7.4	66		21.8	222		15.5	165	
Apartamento	2.2	2		37.5	20		11.9	6	

To be continued

Table 2 continuation

Variable	Acute bronchitis			Rhinitis			Sinusitis		
	%	n	p*	%	n	p*	%	n	p*
Type of household			0.186			0.138			0.075
Ceded	11.2	14		26.6	41		14.1	26	
Rented	7.5	22		17.6	53		10.7	36	
Private	6.1	33		23.9	140		17.5	103	
Number of rooms in the household			0.004			0.116			0.079
1 to 3	10.5	43		19.8	91		12.2	61	
4 and more	5.4	29		24.5	152		17.4	113	
Sewage disposal			0.980			0.090			0.087
Public system	7.2	60		23.5	547		14.0	140	
Others	7.1	10		16.8	45		18.8	32	
Dog in the household			0.453			0.787			0.182
No	7.9	47		23.0	140		14.9	104	
Yes	6.5	25		21.1	103		14.4	70	
Cat in the household			0.096			0.646			0.507
No	8.0	67		22.3	209		14.0	143	
Yes	3.0	5		24.9	34		19.5	31	

* Chi-square test.
[a] Only for those who were hospitalized in the 12 previous months.
[b] Income of the head of the family in minimum salaries (1 minimum salary: R$ 510.00).

95%CI: 24.5;32.5), France (24.5%; 95%CI: 21.0;28.0), Germany (20.6%; 95%CI: 16.5;24.6), Italy (16.9%; 95%CI: 12.9;20.9), Spain (21.5%; 95%CI: 18.5;24.4) and England (26.0%; 95%CI: 20.3;31.7%).[4] Rhinitis presents important variations in the prevalence indexes of its symptoms. According to studies carried out in hundreds of cities in Africa, North and South America, Asia, Australia and Europe, with 463,801 children aged 13 to 14 years, and in dozens of cities in the same regions, except for Africa, with 257,800 children aged six to seven years, the prevalence of rhinitis symptoms varied from 3.2% to 66.6% and from 1.5% to 41.8%, respectively.[20]

The mean prevalence of rhinitis in 20 Brazilian cities for children aged six to seven years and for adolescents aged 13 to 14 years was 25.7% and 29.6%, respectively. For the present study, the estimated prevalence of rhinitis for the age group between five and nine years was 22%, and between ten and 14 years, 29%, similar to the Brazilian mean. In São Paulo, the International Study of Asthma and Allergies in Childhood (ISAAC) – Phase 3 – pointed prevalence of symptoms of rhinitis (sneezing, coryza or nasal stuffiness present in the absence of a cold) for children and adolescents of around 29% from 2002 to 2003. The prevalence of rhinitis by medical diagnosis was 19.3% for children and 21.4% for adolescents, values that are similar to the ones found in the present study.[18]

The presences of asthma and allergy were associated with rhinitis. Batlles-Garrido et al[3] (2010) found odds ratio 2.2 (95%CI: 1.22;4.02) times higher for rhinitis in asthmatics when compared to non-asthmatic individuals, and for the presence of atopy, the odds ratio was of 2.5 (95%CI: 1.93;3.42). Epidemiological studies show that, many times, asthma and rhinitis coexist in the same person. At least 60% of the asthmatics have rhinitis and approximately 20% to 30% of the people with rhinitis have asthma.[7]

Law et al[15] (2003) stated that consultations in emergency services are responsible for 1% of the direct costs with rhinitis, but account for 62% of the expenditures on asthma in the United States. Rhinitis, intimately associated with asthma, is a public health problem in many countries, which leads to the need of monitoring its tendencies continuously. Clinical observation and data from the literature show that the adequate approach to inflammation in the upper airways is indispensable to the satisfactory handling of the asthmatic. People with rhinitis frequently present a reduction in the quality of life, caused by sleep disorders, fatigue, irritability, daytime sleepiness, and memory deficits. In addition, the financial impact becomes higher when the related comorbidities are considered, like asthma, sinusitis and allergies.[7,16]

Due to the coexistence between allergic rhinitis and asthma, the importance of the upper airways infections as an intensification factor for asthma and the importance of the presence of rhinitis as a risk factor for sinusitis have been widely discussed. Rhinitis is associated

Table 3. Multiple Poisson regression model for self-reported respiratory diseases in children and adolescents. São Paulo, Southeastern Brazil, 2008-2009.

Variable	PR (95%CI)	Standard-error	p	Design effect
Acute bronchitis				
Age (years)				
15 to 19	1			
10 to 14	20.83 (4.9;90.9)	0.73		0.58
5 to 9	37.04 (8.1;166.7)	0.81	<0.001	0.65
0 to 4	17.86 (3.6;90.9)	0.76		0.70
Presence of allergy				
No	1			
Yes	3.12 (1.70;5.73)	0.31	<0.001	1.64
Skin color				
White	1			
Black/mixed-ethnicity (white and black)	2.29 (1.21;4.35)	0.33	0.011	1.96
Number of rooms in the household				
4 and more	1			
1 to 3	1.85 (1.17;2.94)	0.23	0.008	1.00
Rhinitis				
Age (years)				
0 to 4	1			
5 to 9	1.77 (0.98;3.18)	0.22		1.70
10 to 14	2.77 (1.60;4.78)	0.27	0.001	1.40
15 to 19	2.58 (1.52;4.39)	0.26		1.23
Presence of allergy				
No	1			
Yes	4.32 (2.79;6.70)	0.22	<0.001	1.82
Presence of asthma				
No	1			
Yes	2.30 (1.30;4.10)	0.29	0.004	1.24
Characterization of the household				
House	1			
Flat	1.70 (1.06;2.73)	0.24	0.027	0.81
Sinusitis				
Age (years)				
0 to 4	1			
5 to 9	2.44 (1.09;5.43)	0.23		1.94
10 to 14	2.99 (1.36;6.58)	0.27	0.010	1.86
15 to 19	3.62 (1.68;7.81)	0.39		1.78
Presence of allergy				
No	1			
Yes	2.23 (1.41;3.52)	0.24	<0.001	1.91
Body Mass Index				
Underweight	1			
Normal weight	1.01 (0.58;1.73)	0.45		0.91
Overweight	0.99 (0.44;2.44)	0.52	0.012	1.19
Obese	4.42 (1.56;12.50)	0.56		0.93

with worse control of asthma. This is interpreted as the expression of one disease that affects simultaneously the upper and lower respiratory tracts, probably due to common risk factors and pathogenesis.[7,16]

Living in flats was associated with rhinitis, supporting the hygiene hypothesis, which interprets the variation in the risks for allergic diseases as a reflex of the reduction in the exposure to microbial agents in the early phase of life. According to this hypothesis, the change to the modern lifestyle would be responsible or co-responsible for the significant increase in allergic diseases in the last decades. Strachan (1989)[21] considers it as the only coherent and biologically plausible explanation for the variations in allergy observed among more or less numerous families, modern lifestyle (flats) or in farms and fields (houses). However, the following aspects seem to contradict this hypothesis: high rates of respiratory disease among the poor urban population in the USA and in other industrialized countries, the lungs of many atopic children are abnormal before the occurrence of any infection, and there is no evidence that the incidence or type of viral respiratory infections have decreased during the period of thirty years in which the prevalence of the allergic diseases increased.[24]

As for sinusitis, it is estimated that it affects one out of every six adults in the United States and its diagnosis is considered one of the most common in clinical practice. These statistics possibly underestimate the real prevalence in the country, because approximately 20% of the affected people do not look for medical assistance. Sinusitis by medical diagnosis presented prevalence around 10% in Europe, Japan and in the United States in 2001.[19] The prevalence of self-reported sinusitis was higher in the present study. A large part of the studies about the prevalence of this disease refers to the North American and European realities; few studies present information on Latin America.[c] Sinusitis generates a direct and indirect impact on the global economy due to its high prevalence; also, it brings significant repercussions on the quality of life of the affected children and their parents. Cunningham et al[9] (2000) showed that parents of children with sinusitis attributed to them greater physical limitation compared to children with asthma.

Allergy and obesity were associated with sinusitis in the present study, and age presented dose-response effect depending on the increase in the age group. Hoover et al[13] (1997) observed odds ratio 4.3 (95%CI: 1.5;12.8) times higher for sinusitis in allergic individuals when compared to non-allergic ones. According to consensus recommendations, the term sinusitis has been replaced by rhinosinusitis due to the numerous anatomic, histological and physiopathological relations between the nose and the paranasal sinuses. There is no genetic predisposition to sinusitis; however, there is family predisposition to allergies, which are considered the main predisposing factors to sinusitis. The symptoms overlap and sinusitis rarely occurs without other allergies. Evidences show that asthma, rhinitis (and other allergies) and sinusitis would represent parts of one single inflammatory syndrome, the "united airways disease". The risk factors that are most implicated in sinusitis are the allergies and viral infections of the airways.[1,7,13,16]

No studies that showed or explained consistently the association identified between obesity and sinusitis were found. One of the possible interpretations refers to the association between gastro-oesophageal reflux disease and respiratory symptoms in children, a disease that is also related to presence of overweight and obesity,[25] although there are controversies.[14] On the other hand, the increased presence of proinflammatory cytokines in obese individuals and these substances would be related to the local and systemic inflammatory responses of the airways.[6] Obese people present higher risks for asthma and other associated diseases, like sinusitis and allergies, due to the relation between these respiratory diseases and circulating levels of these cytokines, which are higher in obese people. Nevertheless, little is known about the physiological, mechanic, immunologic, genetic and environmental mechanisms that participate in the relation.[8]

Concerning the study's limitations, self-reported morbidity may underestimate the prevalence of respiratory disease due to memory bias and/or absence of diagnosis. To epidemiology, estimating the prevalence of self-reported respiratory diseases in the population is a simple and direct way of obtaining information about health and presents good levels of agreement, reproducibility and cost-benefit when the results of clinical evaluations are obtained, which can indirectly reflect the real prevalence of the disease in the population.[22]

Table 4 synthesizes the final outcomes that are common, similar and specific to acute bronchitis, rhinitis and sinusitis. Presence of allergy was associated with the three diseases. Atopic individuals are more susceptible to the associated comorbidities, and

Table 4. Final outcomes that are common, similar and specific to self-reported acute bronchitis, rhinitis and sinusitis in children and adolescents. São Paulo, Southeastern Brazil, 2008-2009.

Outcomes	Acute bronchitis	Rhinitis	Sinusitis
Common	Age (zero to 14 years)	Age (10 to 19 years)	Age (5 to 19 years)
	Allergy	Allergy	Allergy
Similar	Household (1 to 3 rooms)	Household (flat)	-
Specific	Skin color (black/ mixed-ethnicity (white and black)	Asthma	Obesity

they frequently have more than one sensitized shock organ: bronchial mucosa (asthma), nasal mucosa (rhinitis), conjunctiva (allergic conjunctivitis) and skin (atopic dermatitis).[1,16,c] Sinusitis and rhinitis exist without other associated allergies with lower frequency, and acute bronchitis affects a higher number of atopic individuals. The age group ten to 14 years was common among the three respiratory diseases. Household aspects were similar between acute bronchitis and rhinitis. The hygiene hypothesis can explain part of the high prevalence of rhinitis in those who live in flats, unlike the relation between low number of rooms (one to three) in the household and acute bronchitis, which can be related to low socioeconomic level, agglomeration and low standard of living, which in turn can increase the risk of lung infection by virus or bacteria, mainly among children.[17] Black and mixed-ethnicity skin color was specifically associated with acute bronchitis. Admitting that the individuals' skin color determines their socioeconomic conditions, or that ethnic differences are associated with social inequalities and condition the way of living of groups of people, blacks can be more susceptible to infectious respiratory diseases. Another specific outcome was the presence of asthma in people with rhinitis. The current literature considers asthma and rhinitis as expressions of the same disease, which affects, concomitantly, the upper and lower airways.

Respiratory diseases – rhinitis, sinusitis and acute bronchitis – are more prevalent in certain population groups and are an important public health problem in children and adolescents. Respiratory diseases in childhood and their impact on the health system generate epidemiological studies to dimension the problem and to know, in addition to their prevalences, the etiologic factors involved, so as to implement measures to control these diseases and reduce the associated morbidity and mortality. Allergic individuals from zero to 14 years whose skin color are black and mixed (black and white) who live in households with few rooms were associated with acute bronchitis; allergic individuals between ten and 19 years, asthmatic and who live in flats were associated with rhinitis; and allergic individuals between five and 19 years and obese were associated with sinusitis.

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