Prevalence of asthma and risk factors associated: population based study in São Paulo, Southeastern Brazil, 2008-2009

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ABSTRACT

OBJECTIVE: To assess the prevalence of asthma and risk factors associated in children and adolescents

METHODS: Population-based cross-sectional study with 1,185 female and male children and adolescents carried out in the city of São Paulo, Southeastern Brazil, from 2008 to 2009. Data were collected through home interviews. Respondents were selected using two-stage (census tract, household) cluster random sampling stratified by gender and age. Multiple Poisson regression was used in the adjusted analysis between the outcome and socioeconomic, demographic, lifestyle and health condition variables.

RESULTS: Of all respondents, 9.1% (95%CI 7.0;11.7) reported asthma. After adjustment, the following variables were found independently associated with asthma: age (0 to 4 years vs. 15 to 19) (PR 3.18, 95%CI 1.20;8.42); age (5 to 9 years vs. 15 to 19) (PR 6.37, 95%CI 2.64;15.39); age (10 to 14 years vs. 15 to 19) (PR 4.51, 95%CI 1.95;10.40); allergy (yes vs. no) (PR 2.22, 95%CI 1.24;4.00); rhinitis (yes vs. no) (PR 2.13, 95%CI 1.22;3.73); health conditions in the 15 days preceding the interview (yes vs. no) (PR 1.96 , 95%CI 1.23;3.11); number of rooms in the household (1 to 3 vs. 4 and more) (PR 1.67, 95%CI 1.05;2.66); and skin color (black and mixed vs. white) (PR 2.00, 95%CI 1.14;3.49).

CONCLUSIONS: This study showed the importance of factors associated with asthma including rhinitis and allergy; age between 5 to 9 years old; black and mixed skin color; and household with few rooms. Frequent health problems are seen as a common consequence of asthma.

DESCRIPTORS: Asthma, epidemiology. Child. Adolescent. Risk Factors. Cross-Sectional Studies.

INTRODUCTION

Asthma is considered an important public health problem whose morbidity and mortality are still high. Despite the recent technological advances, like the utilization of new therapeutic approaches and knowledge about the physiopathology of the disease, the increase in the prevalence and in mortality due to asthma in the last decades, particularly in children, is a worrying phenomenon which, to a certain extent, is little known.[18,a]

Asthma manifests itself in episodes of variable airflow obstruction which is reversible spontaneously or as the result of treatment. The three main

[a] GINA – Global Initiative for Asthma. Global strategy for asthma management and prevention; update 2009 [cited 2011 Oct 20]. Available from: http://www.ginasthma.org

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characteristics are: 1) chronic inflammation of the airways, in which cells like mastocytes, eosinophils and T lymphocytes play an important role; 2) bronchial hyperresponsiveness, characterized by an exaggerated bronchoconstrictor response of the airways to a bronchoconstrictor stimulus; and 3) remodeling of the airways, a process that involves factors of the bronchial inflammation, resulting in structural alterations (bronchial wall thickening, epithelial desquamation) or functional alterations (irreversible obstruction of the airflow). The symptoms include coughing, wheezing, dyspnea and chest tightness, mainly at night and in early morning.[1,a]

The risk factors that are considered the most important ones for asthma are genetics, exposure to allergens, air pollution, obesity and tobacco smoke.[6,a] The knowledge about asthma prevalence and its associated factors is important to aid the planning of actions to reduce and control the morbidity and mortality that are related to it.

Nowadays, it is estimated that 300 million people in the world have asthma and that its prevalence varies between 1% and 18% in different cities.[a] In Brazil, epidemiological studies like the ISAAC (International Study of Asthma and Allergies in Childhood), carried out in many Brazilian cities, estimated that the prevalence of asthma in children aged six and seven years was between 4.7% and 28.2%. In the population aged 13 and 14 years the prevalence was between 4.8% and 27.0%, presenting an important intragroup variation.[19]

Data from the Ministry of Health show that in the last decade there was an average of 300,000 hospitalizations due to asthma in Brazil. It is the fourth cause of hospitalizations through the *Sistema Único de Saúde* (SUS – Brazilian National Health System) and the third cause among children and adolescents. In 2006, SUS' expenses with asthma hospitalizations were R$ 96 million.[1,b] In different cities of the United States, the direct costs for each asthmatic patient per year are US$ 300.00 to US$ 1,300.00, depending on the seriousness of the disease.[4]

The mortality caused by asthma, compared to other respiratory diseases like pneumonia and chronic obstructive pulmonary disease (COPD), is still considered low, but it has been increasing in diverse countries and regions. In developing countries, the mortality has been growing in the last years.[a] In Brazil, in 2000, the mortality rate by asthma as the basic or associated cause was 2.29/100,000 inhabitants and the proportional mortality was 0.41%, representing, for the last decade, an average of 2,600 deaths per year.[1,15]

In view of the relevance of this problem in Brazil, this study aimed to estimate the prevalence of asthma in children and adolescents and to identify associated factors.

METHODS

Population-based cross-sectional study that used data from the 2008 Health Inquiry in the Municipality of São Paulo, Southeastern Brazil (ISA-Capital 2008), from 2008 to 2009. The ISA-Capital sample was composed of 3,271 people, and to the present study, children and adolescents were selected, totaling 1,185 individuals aged between zero and 19 years.

The study's participants were selected by means of a probability sample stratified by gender and age using two-stage (census tract, household) cluster sampling. To compose the sample, 70 census tracts were drawn among the 267 sampled ones in the 2002 *Pesquisa Nacional por Amostra de Domicílio* (PNAD – National Household Sample Survey).[c]

The information was obtained by means of a questionnaire structured in 21 thematic blocks. The majority of the questions were closed, and the questionnaire was administered directly to the drawn person or to the mother (or guardian) for those younger than 12 years.[d] The interviews were conducted by trained personnel and were supervised during the entire duration of the inquiry. To guarantee quality control in data collection, new interviews were performed by telephone or directly at the household for interviewees with no telephones, based on a random sample of 5% of the total of interviews. Among the visited households, there was a non-response rate of 22.5% and 7.3% of the households were closed or their inhabitants refused to inform whether there was someone belonging to the age group of interest living in the household.

The dependent variable that was used was reported asthma (yes/no) and the independent variables selected for analysis were:

- sociodemographic and economic variables: gender, 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 dwelling, number of rooms in the household, sewage disposal and presence of dogs and cats in the household;

[b] Ministério da Saúde (BR), DATASUS. Informações de saúde: epidemiológicas e morbidade. Morbidade hospitalar do SUS – por local de internação – Brasil. Sistema de Informações Hospitalares do SUS [cited 2011 Nov 15]. Available from: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sih/cnv/miuf.def

[c] Alves MCGP, Escuder MML. Plano de amostragem do ISA - Capital 2008. São Paulo; 2009 [cited 2011 Nov 10]. Available from: http://www.fsp.usp.br/isa-sp/pdf/planoamostral2008.pdf

[d] 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 2011 Nov 10]. Available from: http://www.fsp.usp.br/isa-sp/pdf/questionarioisa2008.pdf

- lifestyle and health condition variables: body mass index (BMI[e], calculated according to reported weight and height), sleeps badly and gets tired easily – which are items of the Self-Report Questionnaire (SRQ-20) –, leisure-time physical activity, hospitalization in the 12 months preceding the interview, hospitalization nights, health problems in the 15 days preceding the interview and reports on the presence of allergy, rhinitis and depression/anxiety/emotional problems. For BMI classification, the criterion proposed by the Centers for Disease Control and Prevention was adopted, by means of the BMI curve according to age and sex. Individuals whose BMI was below percentile 5 were considered as low weight; BMI between percentile 5 and below 85, normal weight; BMI between percentile 85 and below 95, overweight; BMI higher than or equal to percentile 95, obesity.

The association between the independent variables and asthma was verified in the bivariate analysis by the chi-square test with a 5% level of significance. Prevalence ratios and 95% confidence intervals were employed, and for the adjusted analysis, multiple Poisson regression was carried out.[2,7] In the multiple model, the variables with $p < 0.20$ in the bivariate analysis were considered and only those with $p < 0.05$ remained in the model. Interactions among the variables of the final model were examined. In all the analyses, the effect of sample design was considered for the analysis of inquiries based on complex designs. The program SPSS 16.0 was used, as it allows incorporating the distinct weights of the observations.

The participants or guardians signed a consent document in which the aims of the research and the information that would be asked were explained, and the secrecy of the obtained 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, with ages ranging between zero and 19 years, 589 (50.1%) were females and 691 (61.9%) had white skin color. Of the heads of families, 42% had completed Elementary School and 38.8% had completed High School; 66% of the heads of families had an income up to 2.5 minimum salaries. Regarding the dwelling places, 93.7% lived in households characterized as houses, 54.4% in their own private households and 60.1% in households with four or more rooms. Almost half of the households (42.2%) had dogs and 13.3%, cats (Table 1).

The prevalence of overweight and obesity (BMI ≥ 25 kg/m^2) was 13.9%; 76.9% did not practice physical activities in their leisure time. Of the total of individuals, 17.7% got tired easily and 21.4% slept badly. The prevalence of allergy was 21.1% and of rhinitis, 22.6%; 22.5% had some health problem in the 15 days preceding the interview (Table 2).

The estimated prevalence for self-reported asthma was 9.1% (95%CI 7.0;11.7%) and the variables associated in the crude analysis were: age ($p < 0.001$), skin color ($p = 0.017$), number of rooms in the household ($p = 0.012$), hospitalization nights ($p = 0.017$), health problems in the 15 days preceding the interview ($p = 0.001$), allergy ($p < 0.001$) and rhinitis ($p < 0.001$) (Tables 1 and 2).

For the multiple Poisson regression model, the independent variables associated with self-reported asthma were: age (zero to 4 years/15 to 19) PR = 3.18 (95%CI 1.20;8.42), age (5 to 9 years/15 to 19) PR = 6.37 (95%CI: 2.64-15.39), age (10 to 14 years/15 to 19) PR = 4.51 (95%CI 1.95;10.40), allergy (yes/no) PR = 2.22 (95%CI 1.24;4.00), rhinitis (yes/no) PR = 2.13 (95%CI 1.22;3.73), health problems in the 15 days preceding the interview (yes/no) PR = 1.96 (95%CI 1.23;3.11), number of rooms in the household (1 to 3; 4 and more) PR = 1.67 (95%CI 1.05;2.66), and skin color (black and mixed/white) PR = 2.00 (95%CI 1.14;3.49). There was no interaction among the variables of the final model (Table 3).

DISCUSSION

For the present study, the estimated prevalence for self-reported asthma in children and adolescents was 9.1% (95%CI 7.0;11.7), and for the age group between five and nine years, the prevalence was 14% (95%CI 11.9;16.6). In the United States, for the year of 2009, the prevalence of self-reported asthma in the population was 8.2%, and for the individuals between zero and 17 years, the prevalence was 9.6%.[1] The prevalence that we found in our research was also similar to the ones found in studies carried out in Egypt (9.4%)[8] and Italy (11.7%),[5] for the same age group.

The prevalence of asthma in some Brazilian cities in children aged six and seven years was 7.3% for the male sex and 4.9% for the female one. Between 13 and 14 years, the prevalence was 9.8% and 10.2%, respectively.[18] In a population-based inquiry conducted in the city of Pelotas (Southern Brazil) in 2000, using

[e] 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. :Atlanta; 2011 [cited 2011 Nov 22]. Available from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_BMI/about_childrens_BMI.html

Table 1. Sample distribution and prevalence of self-reported asthma in children and adolescents, according to sociodemographic and economic variables. São Paulo, Southeastern Brazil, 2008-2009.

Variable	n	%	Prevalence (%)	p*	PR[a] (95%CI)
Sex				0.413	
Male	596	49.9	9.9		1
Female	589	50.1	8.3		0.82 (0.52;1.31)
Age (years)				< 0.001	
0 to 4	316	22.5	7.7		3.10 (1.18;8.13)
5 to 9	189	28.2	14.0		6.05 (2.56;14.29)
10 to 14	318	25.9	10.7		4.43 (1.94;10.11)
15 to 19	362	23.3	2.6		1
Skin color				0.017	
White	691	61.9	6.9		1
Black/mixed	483	38.1	12.7		1.95 (1.12;3.40)
Level of schooling of the head of the family				0.197	
None	38	2.2	11.5		2.44 (0.46;12.77)
Elementary school	599	42.1	11.2		2.36 (0.98;5.96)
High School	367	38.8	8.5		1.74 (0.72;4.20)
Higher education	156	16.8	5.1		1
Income of the head of the family (minimum salaries)[b]				0.088	
≤ 1	296	25.0	9.8		2.46 (0.74;8.25)
> 1 to 2.5	469	40.8	13.0		3.38 (1.21;9.39)
> 2.5 to 4	161	16.5	4.2		1
> 4	148	17.7	6.5		1.57 (0.53;4.70)
Characterization of the household				0.244	
Apartment	58	6.3	5.1		1
House	1109	93.7	9.1		1.85 (0.65;5.24)
Dwelling place				0.249	
Privately owned	653	54.4	8.0		1
Not privately owned	531	45.6	10.4		1.34 (0.80;2.24)
Number of rooms in the household				0.012	
1 to 3	491	39.9	12.3		1.90 (1.14;3.15)
4 or more	693	60.1	6.9		1
Dog in the household				0.868	
No	698	57.7	8.9		1
Yes	487	42.2	9.3		1.04 (0.62;1.76)
Cat in the household				0.217	
No	1026	86.7	9.6		1
Yes	159	13.3	5.8		0.58 (0.25;1.38)
Sewage disposal				0.509	
Public sewer system	999	86.9	9.2		1.24 (0.65;2.36)
Others	171	13.1	7.5		1

*Chi-square test
[a] PR: Prevalence ratio (considering complex sampling)
[b] Income of the head of the family in minimum salaries (1 minimum salary: R$ 510.00)

the ISAAC questionnaire, the prevalence of asthma in children aged six and seven years was 14.3% for the male sex and 11.5% for the female sex.[6] Similarly, our study estimated that the prevalence of asthma between 5 and 9 years of age was 15.7% and 12.5%, respectively. For the age group of ten to 14 years, the prevalence was 11.7% and 9.5%, respectively. Still in the municipality of São Paulo, Mallol et al[10] (2000) estimated 6.1% of

Table 2. Sample distribution and prevalence of self-reported asthma in children and adolescents, according to lifestyle and health conditions. São Paulo, Southeastern Brazil, 2008-2009.

Variable	n	%	Prevalence (%)	p*	PR[a] (95% CI)
Body Mass Index (≥ 12 years)				0.357	
< 25 kg/m²	486	86.1	6.3		1
≥ 25 kg/m²	82	13.9	3.8		0.59 (1.19;1.86)
Sleeps badly (≥ 16 years)				0.450	
No	214	78.6	2.6		1
Yes	60	21.4	1.1		0.43 (0.04;4.07)
Gets tired easily (≥ 16 years)				0.590	
No	226	82.3	2.5		1
Yes	48	17.7	1.4		0.54 (0.06;5.22)
Leisure-time physical activity				0.164	
No	461	76.9	5.2		1
Yes	143	23.1	8.8		1.77 (0.78;4.04)
Hospitalization in the 12 months preceding the interview				0.315	
No	1110	94.9	8.8		1
Yes	75	5.1	13.7		1.65 (0.62;4.37)
Hospitalization nights (days)				0.017	
≤ 3	49	63.8	9.9		2.64 (0.24;29.21)
4 to 7	19	18.8	35.6		13.27 (1.32;132.91)
> 7	17	17.4	4.0		1
Health problems in the 15 days preceding the interview				0.001	
No	923	77.5	7.1		1
Yes	262	22.5	15.9		2.48 (1.43;4.28)
Presence of allergy				< 0.001	
No	954	78.9	6.8		1
Yes	230	21.1	17.8		2.98 (1.74;5.12)
Presence of rhinitis				< 0.001	
No	940	77.4	7.0		1
Yes	243	22.6	16.3		2.58 (1.65;4.02)
Depression/anxiety/emotional problems				0.720	
No	1118	95.3	9.0		1
Yes	66	4.7	10.5		1.18 (0.48;2.92)

*Chi-square test

[a] PR: Prevalence ratio (considering complex sampling)

asthma in children aged six and seven years and 10% in individuals aged 13 and 14.

Age was independently associated with asthma. The natural history of asthma is its development in the early years of life and the remission of the disease in adolescence. However, the recurrence of the symptoms in the adult is common. This remission is explained by the development of the lungs with the increase in the diameter of the airways and the reduction in the frequency of viral infections of the upper airways. The probability of asthma remission in adolescence is related to the seriousness of the disease.[14]

Reported allergy and rhinitis were found to be important aspects related to asthma. Allergy presented PR 2.2 times higher for asthma when compared to those without allergy, and rhinitis, PR 2.1 times higher for asthma. The prevalence for allergy was 21.1% (95%CI 17.9;24.7), and it increased to 41.3% among the asthmatics. For rhinitis, the prevalence of 22.6% (95%CI 19.3;26.2) rose to 40.4% among the asthmatics. In the south of Brazil, the children with allergic rhinitis from the cohort of individuals born in 1993 presented at six to seven years of age a relative risk 2.6 (95%CI 1.5;4.4) times higher for asthma when compared to children without rhinitis.[6] Cohort studies have shown that rhinitis precedes asthma and is an important risk

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

Variable	PR* (95%CI)	Standard error	p	*Deff*
Age (years)				
0 to 4	3.18 (1.20;8.42)	0.49		1.25
5 to 9	6.37 (2.64;15.39)	0.45	<0.001	1.16
10 to 14	4.51 (1.95;10.40)	0.43		0.98
15 to 19	1			
Presence of allergy				
No	1			
Yes	2.22 (1.24;4.00)	0.30	0.007	1.51
Presence of rhinitis				
No	1			
Yes	2.13 (1.22;3.73)	0.28	0.008	1.31
Health problems in the 15 days preceding the interview				
No	1			
Yes	1.96 (1.23;3.11)	0.24	0.004	1.12
Number of rooms in the household				
4 and more	1			
1 to 3	1.67 (1.05;2.66)	0.24	0.030	1.27
Race/color				
White	1			
Black/ mixed	2.00 (1.14;3.49)	0.28	0.015	1.84

*PR: Prevalence ratio (considering complex sampling)
Deff: design effect

factor for the development of this condition. Settipane et al[16] (1994) followed up individuals with and without rhinitis for 23 years. It was observed that the group with rhinitis presented a risk that was three times higher for asthma when compared to the group without rhinitis. The natural history of the atopic diseases, not including individual exceptions, manifests itself in a characteristic sequence: their onset is in childhood with atopic dermatitis and food allergy, then they go into remission, and 50% of the cases subsequently evolve to rhinitis, of which more than 40% progress to asthma.[3]

Rhinitis is recognized as a risk factor for the development of asthma in approximately 20% to 38% of the cases. Asthma and its intimate association with rhinitis are a public health problem in many countries, which leads to the need of continuous monitoring of their trends. Due to the coexistence between rhinitis and asthma, the importance of the infections and inflammations of the upper airways has been widely discussed nowadays as a factor of asthma exacerbation, and the presence of rhinitis is associated with the worsening of asthma control. This fact has been interpreted as an expression of the same disease, which affects, simultaneously, the upper and lower respiratory tracts, possibly due to common risk factors and pathogenesis.[13]

The prevalence ratio was twice as high for asthma in individuals with black and mixed skin color compared to whites, even after controlling for socioeconomic factors. Black skin color associated with higher prevalence of asthma has been observed in other studies, corroborating our result.[1,11,23] Children with non-white skin color belonging to the cohort of individuals born in 1993 in the city of Pelotas presented at the age of six and seven a relative risk 1.9 (95%CI 1.1;3.3) times higher for asthma in comparison to those with white skin color.[6] The findings seem to be consistent with the hypothesis that biological differences play an important role in the occurrence of asthma. It should be highlighted that black race refers to a determinant of identities, access to resources and opportunities of access to the healthcare services, which might increase the risk of asthma.

Individuals who lived in households with one to three rooms presented PR for asthma 1.7 times higher when compared to those who lived in households with four rooms or more. A study carried out in the South of Brazil in 2003, with secondary data referring to the Brazilian population extracted from PNAD and its health supplement, showed that being a child of parents with black skin color, living in agglomeration and in low standard households were associated with the diagnosis of asthma.[23]

The report of health problems in the 15 days preceding the interview resulted in a PR that was two times higher for asthma, when compared to the individuals who did not report health problems. Asthmatic individuals frequently present daily difficulties due to the health problems related to the disease, especially associated allergies, infections of the upper airways, emotional alterations and sleep disorders.[9] The main symptoms of asthma are coughing and recurrent dyspnea. During the crisis, triggered by one or more provocative stimuli, bronchoconstriction occurs, as well as inflammation of the airway walls and an increase in secretion, which causes the narrowing of the caliber of the bronchi and bronchioles for air passage. This situation causes air trapping in the lungs and, as a result, the airways' resistance increases, leading to a reduction in the vital capacity. The continuity of motor routines is frequently impeded, and crises can be aggravated by the state of emotional tension.[1,a]

Exposure to allergens and irritants frequently causes crises in asthmatics, with the consequent related health problems. They may also present respiratory difficulties during physical or playful activities, trainings and competitions and may think that the cause is poor physical fitness. The bronchospasm that is induced by the exercise is known as a transitory obstruction in the airways right after physical activity. Generally speaking,

the crisis starts between two and four minutes after the beginning of the physical activity, with peaks between five and 15 minutes, and disappears spontaneously around 30 to 60 minutes. Sometimes, the crisis can be sustained for more than one hour and a late response can occur between four and ten hours after the activity. The physiopathology has not been fully explained yet, but the cooling and drying of the airways due to hyperventilation seem to be the main causes.[1,21] The prevalence of this phenomenon varies between 11% and 15% in the general population and around 40% in the atopic, being higher in asthmatics – between 80% and 90%.[21]

Using self-reported morbidity is a limitation, with the risk of underestimating the prevalence of asthma due to memory bias and/or absence of a diagnosis. Solé et al[19] (2004) emphasize that the concept of asthma is underdiagnosed in Brazil, mainly when the criterion of self-reported identification of asthmatics that is employed is the question "have you ever had asthma in your life?" (from the ISAAC questionnaire), which needs the medical diagnosis of the disease for a positive answer. The authors also observed that the places of studies that added bronchitis as synonymous with asthma presented higher indexes of the disease. This fact occurs because a large part of the population does not know how to differ asthma from (acute) bronchitis, which are diseases with distinct origins and treatments. The lack of information makes people underestimate asthma and take a long time to look for help. In addition to the confusion between asthma crises and a "simple" bronchitis, the prejudices in relation to asthma and its treatment must be taken into account.

Meyer[12] (2001) defends the use of self-reporting in respiratory diseases due to the adequate sensitivity and specificity in population screenings, which may indirectly reflect the real prevalence of the disease and contribute to an indicator with a good level of reliability. Estimating the prevalence of self-reported respiratory diseases and their associated factors is a simple and direct way of obtaining elements about the health situation in the population. When the results obtained by clinical evaluations are considered, the reported morbidity offers good levels of agreement, reproducibility and cost-benefit.[22]

Cross-sectional studies with complex sample design have been used in public health, and the PR, the natural measure of this study, differs from odds ratio, mainly when the prevalence values are high. In epidemiology, Poisson regression is used for data analysis in cohort studies in which the outcome is a count of events in an interval of time. For the application to cross-sectional studies, the follow-up time is considered constant. The "log" link function assures that the adjusted values remain in the interval $[0, \infty)$, and the estimator that expresses the risk is the PR.[2,7] Furthermore, in studies involving cluster selection, variance estimates tend to be less precise than those obtained by means of simple random sampling. Studies with complex samples should provide a precise estimation of parameters, and the design effect (Deff) evaluates to what extent this was obtained, considering variance ratio in a complex approach and in a simple random approach. Deff, besides being used for research planning in the calculation of sample size, is also used to evaluate the error that is made when the complex sampling plan is ignored and data are analyzed as if they had been extracted by means of a simple random sample.[20]

Health professionals should be aware of the importance of the integrated approach to asthma, rhinitis and allergies, considering the concept of the "united airway" and searching for preventive and treatment options that act in a systemic way in relation to those conditions, when they are simultaneously present. The findings of the present study point to the importance of asthma, associated with the presence of rhinitis and allergy, age between five and nine years, black and mixed skin color, and with households with few rooms. Frequent health problems can be considered a consequence of this disease. The data from the present study show that asthma is a public health problem among children in the municipality of São Paulo and is in urgent need of effective measures for its control.

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