Original Article

Relationship between home environmental control and exacerbation of asthma in children and adolescents in the city of Camaragibe in the state of Pernambuco, Brazil

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Background: Hypersensitivity to dust mites, mold and pet dander found in the home is common among patients with asthma. Home environmental control to reduce exposure to allergens is one of various therapeutic measures that can be taken.

Objectives: To determine the prevalence of adequate home environmental control among a study population monitored by the Family Health Program and to identify any possible correlation with the exacerbation of asthma among children between the ages of 5 and 14 in the city of Camaragibe, located in the state of Pernambuco, Brazil.

Method: A transversal study was carried out involving 210 mothers/guardians of children, to whom International Study of Asthma and Allergies in Children questionnaires were administered in order to characterize the exacerbation of asthma attacks. The Environment Assessment Guide of Allergic Patients was used to assess the bedrooms and living rooms in the home.

Results: Among the 210 asthmatic children and adolescents evaluated in 2001, adequate home environmental control was observed in 141 (67.1%), and no correlation was observed between the degree of environmental control and fewer (< 3) asthma attacks (p = 0.39). Regarding the rooms where the asthmatic patients sleep, inappropriate furnishings were found in the homes of 93 patients (44.3%), including rag curtains in 84 cases (40.2%). Passive smoking was reported in 77 cases (36.7%).

Conclusion: The level of home environmental control was satisfactory in the great majority of the residences, which may have contributed to the fact that no correlation was found between home environmental control and lower frequency of acute asthma attacks among the population studied.

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Key Words: Asthma. Environment Control. Frequency of Attacks.

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INTRODUCTION

Asthma is the most common chronic airway disease. It is characterized by airflow obstruction, which may reverse spontaneously or with treatment[1,2]. Hypersensitivity to domestic dust mites, mold and pet dander is the principal predisposing factor for asthma and allergic rhinitis, although respiratory viruses also constitute a significant determinant[3]. Cockroach allergens, common in homes, are capable of causing asthma attack in predisposed patients and may sensitize 50% to 60% of asthmatics in Brazil[4]. Notable among irritants are cigarette smoke, climatic changes and pollution. Emotional aspects, such as stress, should be borne in mind as possible aggravating factors[3,5].

Over the last three decades, the incidence of allergic rhinitis and asthma has grown in parallel with the increase in air pollution and diesel exhaust. Therefore, environmental pollutants might favor IgE responses[6-9]. This increase in the incidence and prevalence has caused a great deal of concern among scholars. Consequently, in 1989, the International Study of Asthma and Allergies in Childhood (ISAAC) was initiated, with the objective of determining the prevalence and severity of asthma, rhinitis and eczema in children from various regions[6-9]. Solé, using the ISAAC, found the prevalence of diagnosed asthma in Brazil to be from 4.7% to 20.7% among children between the ages of6 and 7, and from 4.8% to 21.9% among adolescents between the ages of 13 and 14(8, 9). In the city of Recife (in the state of Pernambuco), the author found the annual prevalence of asthma to be 27.16% among children between the ages of 6 and 7, and 18.1% among adolescents between the ages of 13 and 14[8,9].

It is well known that asthmatic children who continue wheezing throughout childhood present recurrent exacerbations associated with allergenic exposure. Early exposure to large quantities of domestic dust mites, fungi and animal-derived allergens is an extremely significant sensitizing factor. The development of techniques for the measurement of environmental exposure to allergens made a series of epidemiological studies possible. These studies resulted in strong evidence that, in various parts of the world, sensitization and exposure to domestic allergens are primary factors in asthma, particularly among children and young adults. Taking these aspects into consideration, recent studies have shown a correlation between the quantity of dust mite antigens in the home and the severity of asthma, as evaluated by the degree of bronchial hyperreactivity and the variation in peak expiratory flow. Accordingly, the reduction of the allergen load in the home might constitute the first line of anti-inflammatory treatment[4]. Creating an allergen-free home environment for asthma sufferers is therefore a very important objective.

The majority of patients with asthma present a positive skin test response at least to one aeroallergen. Studies suggest that the clinical manifestations of the disease are reduced when environmental control measures to reduce allergenic exposure are adopted[11-14]. Although there is conflicting data regarding the effectiveness of environmental control in sensitized children, most studies involve the analysis of a given aspect of environmental control as an isolated measure, which does not always reflect the reality of what occurs in the life of the patient. In addition, many studies are not sufficiently controlled: some present small sample size, and others analyze measures which are not sufficiently aggressive to reduce the exposure[14-16].

On the other hand, in addition to the biological plausibility, some studies have suggested that long-term reduction of the allergens to which the patient is exposed is beneficial. There is some consistency among such studies in terms of reduced total and specific IgE, less bronchial hyperreactivity, improved peak expiratory flow and forced expiratory volume in one second, and reduced eosinophilic bronchial inflammation. Nevertheless, in clinical practice, any treatment of respiratory allergy not involving environmental control as an integral and active part rarely achieves satisfactory results. Knowledge of which allergens cause hypersensitivity in the patient and which are most commonly found in the environment of the asthmatic has been extremely important to education about the disease and to orientation regarding environmental control[17,18]. Covering mattresses and pillows with impermeable materials is possibly the most important environmental control measure since these constitute the largest repositories of domestic dust mites[12-14].

In the current approach to the treatment of asthma, education about the disease plays a fundamental role. When the mothers of asthmatic children are educated regarding means of

controlling the disease in their children, they know how to use the prescribed medications appropriately, how to carry out appropriate environmental control measures and when to seek emergency treatment.

Within this context, questions arise regarding the practice of environmental control measures in the homes of asthmatic children and adolescents. This study was carried out with the general objective of determining the prevalence of appropriate environmental control among a study population monitored by the Family Health Program, as wel as identifying any possible correlation with the frequency of asthma exacerbations among children and adolescents between the ages of 5 and 14 in the city of Camaragibe, located in the state of Pernambuco, Brazil.

METHODS

This was a transversal study. From April to October of 2002, data was collected in the municipality of Camaragibe, located in the greater metropolitan area of the city of Recife, capital of the state of Pernambuco. Five Family Health Program units were selected. Each unit consists of 800 to 1200 families. The population studied was composed of every male and female child and adolescent living in the area and treated by the five Family Health Program staff members in territory l. The sample consisted of 210 mothers or guardians of the children and adolescents between the ages of 5 and 14, living and being treated in the described area, who presented one or more episodes of wheezing or dyspnea in the preceding year (2001).

The software Epi Info 6.0 was used for calculating sample size, and a sample size of 210 was obtained. The sample was calculated based on an expected frequency of asthmatics of 27%, with the worst estimate being that 21% of the children found in the area of study actually presented asthma. This data was based on a study conducted in the city of Recife, which, in 1996, presented climatic, socioeconomic and cultural conditions similar to those of the city of Camaragibe. It is notable that this was a populational study (rather than a sample study), and that it included all children (between 5 and 14 years of age) who had one or more attack of dyspnea with wheezing in 2001, provided that they belonged to one of the five randomly-chosen Family Health Program units.

Data was collected only after approval of the research project by the ethics committee (affiliated with the National Committee) and by the Camaragibe City Hall.

In order to determine the exacerbation of the attacks, we used question 3 of the ISAAC form, dividing the children into two groups: those having had one to three attacks in 2001, and those having had four or more attacks in 2001. Asthma attacks were defined as those episodes of dyspnea that prompted the seeking of emergency medical attention and responded well to the use of a bronchodilator.

With regards to the evaluation of environmental control, we used the Guide for Evaluation of the Allergic Environment, created by the Allergic Rhinitis Orientation Center of the Medical College of the University of São Paulo[19]. The guide consists of a form designed to evaluate the home environment of asthmatics, including various questions regarding environmental factors that aggravate asthma, such as carpets, curtains, rugs, the type of bed the child sleeps in, whether the bed has any inappropriate accessories, such as cushions, stuffed animals or blankets that give off fibers. The form also includes questions regarding the ambience: whether the space is well ventilated or humid, and whether there is evidence of mold on the walls. We also check whether anyone smokes in the home, whether there are any pets, and whether there are fibrous plants or any other environmental irritants. Through similar questions, it is possible to evaluate the bedroom and living room, which are the rooms in which the asthmatic patient spends the most time. This form allows the interviewer, while in the home of the patient, to identify and note the environmental irritants observed. This is important because it reinforces the veracity of the information obtained since the interview is conducted in the house of the patient, and the interviewer is able to observe and evaluate the environment and the response of the relative simultaneously, which validates the form administered to these patients.

At the first available opportunity, we used the ISAAC form to interview the mothers or guardians. Subsequently, the interviewer used the Guide for Evaluation of the Allergic Environment to evaluate, *in locus*, the bedroom and the living room of the

home in order to identify inappropriate accoutrements (stuffed animals, bedcovers that give off fibers or feathers, objects that accumulate dust, etc.) and qualify ventilation (adequate or inadequate), i.e. whether there were windows or the space was stuffy.

Every question is multiple choice (presenting four alternatives). The mothers or guardians of the children choose one of the alternatives and the interviewer, by observing the environment, confirms or repudiates the answer. At the end of each section, there is a blank designated for registering the total number of points. At the end of the form, there is a similar blank for registering the sum total of all sections. A score, varying from 0 to 50, was created. From 0 to 15 points, the environment is considered appropriate; above 15 points, the environment is considered inappropriate. In order to be evaluated as appropriate, the bedroom and the living room should be free of carpet, rugs, cushions, pets and airway irritants, pillows should have covers, down comforters, when present, should have duvets, the bedroom should contain essential furniture (bed, wardrobe), and there should be no evidence of humidity on the ceilings. These characteristics result in a total score lower than 15 points. Therefore, the lower the overall total score, the lower the index of possible environmental factors provoking asthma will be. The interview forms were applied in the home of the children and adolescents during multiple visits by the interviewer, accompanied by community health agents.

In this study, we intended to analyze only the potential exposure factors that could be easily verified by professionals of the Family Health Program, thereby providing an accessible clinical application of the studied data, we did not measure the levels of exposure to aeroallergens.

In order to analyze the data, we used the Epi info 6.0 software, the chi-square test with Yates' correction and, when indicated, Fisher's exact test. The level of significance was set at ≤ 0.05.

TABLE 1
Characterization of the population studied

Characteristic	(n = 210) n	%
Age (children/adolescents)		
d" 7 years old	82	39.0
> 7 years old	128	61.0
Position in the family		
1st child	90	42.9
2nd to 13th child	120	57.1
Relationship		
Mother	148	70.5
Other	62	29.5
No. of people in the home		
d" 4	99	47.1
> 4	111	52.9
Family income		
d" 2X the minimum wage	87	69.6
> 2X the minimum wage	38	30.4

RESULTS

Table 1 shows the characteristics of the population studied. Of the 210 children evaluated, 128 (61%) were over the age of 7, and 90 (42.9%) were the first-born child. Among the interviewees, 148 (70.5%) were the mothers. We observed that 111 (52.9%) of the homes studied housed more than 4 people, and that, in 87 (69.6%) of these homes, the family income was lower than 2 times the official minimum wage.

Among the 210 asthmatic children and adolescents evaluated in 2001, adequate home environmental control was observed in 141 (67.1%), which indicates a certain degree of parental knowledge regarding environmental control measures.

Figure 2 shows air and environmental conditions in the bedroom and living room of the homes of the children. In addition to from the data presented in the figure, we found humidity in 94 (45%) and poor ventilation in 32 (15.2%) of the bedrooms.

Table 2 shows the association between the presence of irritants in the bedroom of the children and adolescents and the frequency of asthma attacks. In the four or more asthma attacks group, we observed that 37 (78.7%) of the 47 patients lived in well-ventilated environments, 4 (8.5%) were exposed to smoking in the home, 9 (19.1%) slept in the same room with a pet. In the same group, 20 (43.5%) of the rooms studied presented humidity. Among the 163 cases in the one to three attacks group, the environment was well-ventilated in 141 (86.5%), there was humidity in 74 (45.4%),

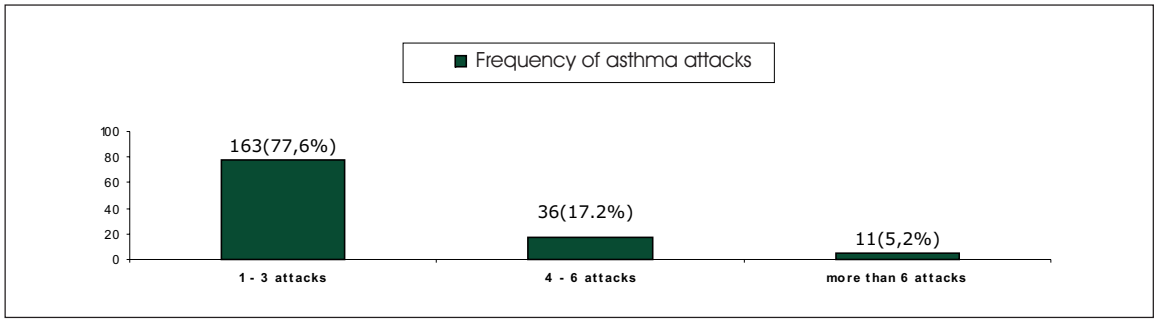

Figure 1. Frequency of exacerbations of asthma attacks presented by the 210 children and adolescents between the ages of 5 and 14. Camaragibe (PE), April-October, 2002.

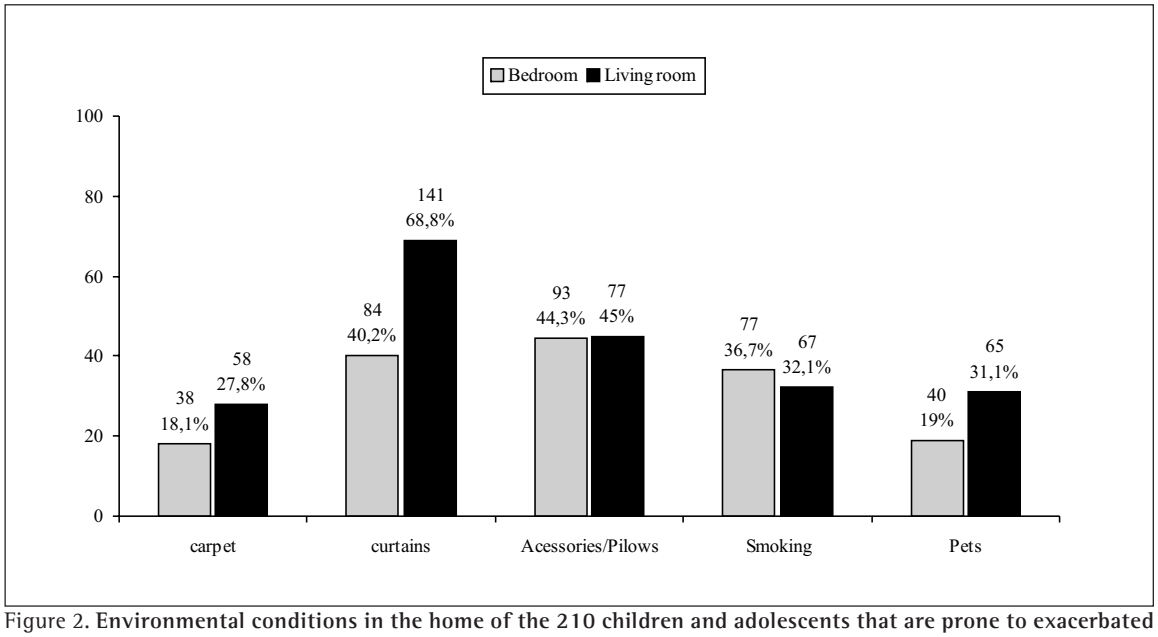

Figure 2. **Environmental conditions in the home of the 210 children and adolescents that are prone to exacerbated asthma attacks. Camaragibe (PE), April-October, 2002.**

pets in the bedrooms of 31 (19%) and exposure to smoking in 17 (10.4%). There was no significant difference between the groups.

We found no significant difference between the degree of environmental control in the homes of patients having had one to three asthma attacks and those presenting four or more attacks (chi-square = 0.74; $p = 0.39$).

DISCUSSION

Since this was a transversal study, we could not come to any conclusions about the efficiency of environmental control in reducing the number of asthma attacks. In order to address this question, we would have to make an observational cohort or case-control study. Nevertheless, we have outlined the reality of environment control measures in the homes of 210 resident children and adolescents of five units of the Family Health Program in Camaragibe. It is important to point out that, in most of the literature consulted, it is recommended that, in order to both reduce the intensity of attacks and increase the intervals between them, environment control measures be made part of the treatment of asthmatics.

In the present study, we found that, although coming from low-income families, most of the children were older than 7 and almost half of them

were first-born children (Table 1). Although it cannot be inferred from this study, some authors have suggested that asthma is more frequent in first-born children or in only children.

Appropriate environmental control was found in most of the homes studied. The frequency of appropriate environmental control observed in the homes of the children and adolescents monitored in the study was 141/210 (67.1%). This may indicate that the mothers or guardians received some kind of orientation. Nevertheless, of the 210 homes, the degree of environmental control was inappropriate in 69 (32.9%), suggesting that, in this group, the use of educational techniques can provide some benefit. Contrary to what we expected, the frequency of satisfactory environmental control was high. Perhaps the health community agent in this region had been successful in educating relatives since asthma management is currently included in basic health activities. Another possible explanation is that, since this area is part of the greater metropolitan area of Recife, the community may have had access to information about the disease or orientation from secondary or emergency health services. The manifestation of the disease is more severe in individuals or populations submitted to precarious living conditions[20].

In accordance with what is expected in community studies of asthma, Figure 1 shows that, among the 210 children interviewed, 11 (5.2%) had had six or more attacks within the preceding year (2001). It is important to emphasize that the cases of frequent episodic asthma correspond to a small portion of the total number of cases, and they could be perfectly absorbed and appropriately treated in clinics specifically designed to treat asthmatics. Regarding attack severity, most of the children and adolescents had mild attacks. Thus, there was a significant reduction in the number and severity of attacks. As previously mentioned, this was likely due to the efficient work of the Family Health Program in Camaragibe, the first city to receive international recognition by the United Nation's Children's Fund.

In a study of environment control, Miranda et al.[21] compared asthmatic children who might or not have access to orientation about the disease and found that, among 58 bedrooms, there were curtains in 23 (39.6%) and carpet in 16 (27.6%). The authors found no significant difference between patients who frequently visited clinics and those who did not[21]. In another study involving outpatients and conducted by Bettencourt et al.[22], home environmental conditions were analyzed, and the authors found out that there were foam pillows, duvets and curtains in most of the bedrooms of the patients monitored. There were also inappropriate accoutrements in the living room. The authors recommended that the same environmental measures taken in the bedroom should be taken in the living room, which is the second most frequently used room. In general, the results obtained by Bettencourt et al.[22] are similar to those of this study, in which we found, in the living rooms, curtains in 141 (68.8%), cushions in 77 (45%), smoking and pets in approximately 30% and rugs in 58 (27.8%) (Figure 2).

Table 2 shows that the presence of possible factors of irritation for the upper airways did not differ between asthmatic patients that had four or more attacks and those who had three or less acute exacerbations.

Despite being considered harmful by laypeople, smoking is still the principal domestic pollutant. The smoking habit is highly prevalent, especially in urban areas of developing countries. In such countries, approximately one-third of all women and one-half of all men smoke, and the number of passive smokers among children varies from 38% to 45%[23,24]. In this study, there was no statistical significance found in the analysis of the relationship between airway irritants (smoking and others) and the higher frequency of acute attacks. However, analyzing this relationship was not the objective of this study.

In addition to smoking, proliferation of dust mites and fungi is caused by humidity and inappropriate objects in the bedroom. It is well known that frequent contact with these allergens causes asthma attacks in children.

In the present study, inappropriate objects were found in 93 (44.3%) of the homes. In a study conducted by Miranda and Santana[21], in which environmental control in the homes of asthmatic children was evaluated, the authors concluded that the domestic environment is

TABLE 2

Distribution of the frequency of possible upper-airway irritating factors in the bedrooms of the homes of the 210 asthmatic children and adolescents between the ages of 5 and 14 in relation to the frequency of exacerbation of attacks in Camaragibe (state of Pernambuco), April-October, 2002

Irritant	Frequency of attacks				STATISTIC
Bedroom environment	4 or more attacks		1 to 3 attacks		
	n	%	*n*	%	
Well-ventilated	37	78.7	141	86.5	$x^2 = 1.7$
Poorly-ventilated	10	21.3	22	13.5	$p = 0.19$
Total	47	100.0	163	100.0	
Exposure to smoking	4 or more attacks		1 to 3 attacks		
	n	%	*n*	%	
YES	04	8.5	17	10.4	Yates'
NO	43	91.5	146	89.6	$x^2 = 0.01$
Total	47	100.0	163	100.0	$p = 0.91$
Animals in the bedroom	4 or more attacks		1 to 3 attacks		
	n	%	*n*	%	
YES	09	19.1	31	19.0	Yates'
NO	38	80.9	132	81.0	$x^2 = 0.04$
Total	47	100.0	163	100.0	$p = 0.84$
Humidity	4 or more attacks		1 to 3 attacks		
	n	%	*n*	%	
YES	20	43.5	74	45.4	Yates'
NO	26	56.5	89	54.6	$x^2 = 0$
Total	47	100.0	163	100.0	$p = 0.94$

extremely important in the process of preventing allergic diseases. The authors noted that a significant number of the children in their sample slept in rooms in which the conditions were less than ideal. Among the 150 homes evaluated, there were curtains in 60 (40%), carpet in 40 (27.3%) and mold in 46 (30.7%)[21].

It is interesting to see that, in our study, although the patients had some contact with curtains and rugs in their bedrooms, the mothers or guardians adopted frequent cleaning measures in these rooms, which resulted in an adequate environmental evaluation score, according to the previously established criteria.

In addition to environmental conditions, the number of people that use the same bedroom is also important in controlling the disease. Patients with bronchial asthma should avoid contact with people who have colds or other airway infections since respiratory viruses frequently provoke attacks[25]. Other environmental factors, as well as biological, psychological and social determinants, affect asthma in a multifactorial manner. It is reductionism to focus on environmental control only for irritants and aeroallergens.

In our study, overall environmental control was similar between patients presenting sporadic (three or less) attacks and those presenting more frequent (four or more) attacks. The high frequency of satisfactory environmental control in both groups studied might have masked the potentially beneficial effect of environmental controlin reducing severe attacks in asthmatics. Further studies, specifically designed to analyze this question in depth, should be conducted.

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