

## Risk factors for ER visits due to asthma exacerbations in patients enrolled in a program for the control of asthma and allergic rhinitis in Feira de Santana, Brazil\*

Fatores de risco para visitas à emergência por exacerbações de asma em pacientes de um programa de controle da asma e rinite alérgica em Feira de Santana, BA

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### Abstract

**Objective:** To determine the risk factors for ER visits due to asthma exacerbations in patients monitored at a referral center. **Methods:** Prospective cohort study of 253 outpatients (children and adults) with asthma who were monitored for 12 months at the Referral Center of the Program for the Control of Asthma and Allergic Rhinitis in the city of Feira de Santana, Brazil. **Results:** Exacerbations were common, and 36.5% of the patients sought ER treatment within the twelve-month period. The risk factors for asthma exacerbations were being over 20 years of age (OR = 1.34; 95% CI: 1.06-1.70), residing in an urban area (OR = 1.19; 95% CI: 1.06-1.33); having a low level of education (OR = 1.53; 95% CI: 1.00-2.39); having severe asthma (OR = 1.65; 95% CI: 1.24-2.18); and having chronic rhinitis (OR = 2.20; 95% CI: 1.00-4.80). **Conclusions:** In this cohort, having chronic rhinitis, having asthma that is more severe and having a low level of education were the main risk factors for ER visits due to asthma exacerbations. These results are similar to those reported for asthma patients who are receiving no regular treatment.

**Keywords:** Asthma/etiology; Health services; Program evaluation.

### Resumo

**Objetivo:** Determinar os fatores de risco para atendimentos de emergência por exacerbações da asma em pacientes acompanhados em um centro de referência. **Métodos:** Estudo de coorte prospectiva de 253 crianças e adultos com asma e monitorados por 12 meses no Centro de Referência do Programa de Controle da Asma e Rinite Alérgica de Feira de Santana, BA. **Resultados:** As exacerbações foram frequentes, e 36,5% dos pacientes buscaram assistência em serviços de emergência no período de 12 meses. Os fatores de risco associados às exacerbações foram idade > 20 anos (OR = 1,34; IC95%: 1,06-1,70); residência em zona urbana (OR = 1,19; IC95%: 1,06-1,33); baixa escolaridade (OR = 1,53; IC95%: 1,00-2,39); asma grave (OR = 1,65; IC95%: 1,24-2,18); e rinite crônica (OR = 2,20; IC95%: 1,00-4,80). **Conclusões:** Ter de rinite crônica, asma mais grave e baixa escolaridade foram os principais fatores de risco para atendimentos de emergência por exacerbações da asma nesta coorte. Esses resultados são semelhantes àqueles descritos para pacientes com asma sem tratamento regular.

**Descritores:** Asma/etiologia; Serviços de saúde; Avaliação de programas e projetos de saúde.

### Introduction

Asthma is a relevant public health problem worldwide<sup>(1)</sup> and is among the diseases that are most commonly related to ER visits and hospitalizations in children.<sup>(2,3)</sup> The lack of appropriate control of the symptoms of the disease results in exacerbations and hospitalizations due to

asthma and, consequently, in increased asthma-related morbidity and mortality rates.<sup>(1)</sup>

In Brazil, there were 273,000 hospitalizations due to asthma in 2007, and the hospitalization costs to the Unified Health Care System were 98 million Brazilian reals.<sup>(4)</sup> The proportion of

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patients with asthma who receive ER treatment due to exacerbations ranges from 30.0% to 92.7% in the different regions of Brazil.<sup>(5,6)</sup> The diagnosis of asthma in ER visits accounts for 16% of the visits to pediatric clinics.<sup>(7)</sup> Annually, there are 2,000 asthma-related deaths, 70% of which involving hospitalized patients; approximately 50% of the patients with medical indication for ICU treatment<sup>(7)</sup> do not have access to treatment. The physiopathology, diagnosis and treatment of asthma are well-known. However, in some regions of Brazil there is limited access to inhaled drugs for the treatment of the severe form of the disease. Asthma symptoms can be controlled, and appropriate pharmacological treatment with inhaled corticosteroids reduces the number of hospitalizations and deaths due to asthma.<sup>(8)</sup>

Various factors have been associated with ER visits of individuals with exacerbated asthma, such as low income, limited access to health care services, limited access to medications, low level of education, asthma severity, noncompliance with treatment and previous hospitalizations due to asthma.<sup>(5,9-11)</sup> Uncontrolled asthma results in invaluable losses for patients, their families and the public health sector.<sup>(12)</sup> Despite this critical situation, there is little knowledge of the clinical characteristics of and risk factors among these patients who remain susceptible to exacerbations while receiving treatment for the secondary prevention of asthma. The identification of risk factors for ER visits and greater attention during the follow up of asthma patients can reduce severe exacerbations of the disease and, consequently, asthma-related mortality.<sup>(8)</sup>

The *Programa para o Controle da Asma e Rinite Alérgica* (ProAR, Asthma and Allergic Rhinitis Control Program) in the State of Bahia, Brazil, is a health care, training and research program of the Unified Health Care System that provides free inhaled medication and instruction to patients with asthma and rhinitis.<sup>(13)</sup> The ProAR in the city of Feira de Santana (ProAR-FS) is a pioneering program and represents the only regional initiative for the multidisciplinary care of patients with asthma and rhinitis in the countryside of the State of Bahia. The municipal program treats children and adults with asthma at primary care centers and at the referral center of the program, providing secondary prevention

through the distribution of inhaled corticoids, asthma education and rehabilitation.<sup>(14)</sup>

The objective of the present study was to determine the risk factors associated with ER visits due to asthma exacerbations in children and adults monitored at the outpatient clinic of the Referral Center of the ProAR-FS.

## Methods

This was a prospective cohort study of 253 asthma patients, who were enrolled in the ProAR-FS and monitored at the Referral Center of the ProAR-FS, between January of 2007 and December of 2007. The information regarding ER visits due to asthma exacerbations within a one-year period was registered on a form specific to the present study and filled out by physicians who worked in the outpatient clinic. Asthma exacerbation was characterized by cough, dyspnea and wheezing that were partially or completely reversed with the use of a bronchodilator.

The inclusion criteria were as follows: being clinically diagnosed with asthma; being at least 4 years old (to avoid the controversial diagnosis of asthma in patients with transient wheezing); not using asthma controller medications; having been referred by physicians of the primary health care clinics or the Family Health Program for outpatient follow up at the referral center for at least 12 months. Patients who did not receive ER treatment in the last 12 months, smokers and patients with severe comorbidities, such as congestive heart failure and cerebral palsy, were excluded from the present study.

The following data were obtained from the form specific to the present study: demographic data (gender, age at admission to the outpatient clinic, place of birth and place of residence); socioeconomic data (family income, in number of times the national minimum wage, and level of education); anthropometric data (height and weight);

Data regarding nutritional status (body mass index)<sup>(15)</sup>; data regarding asthma history (age at first attack, severity of the disease and frequency of ER visits in the 12 months before and after admission to the outpatient clinic); data regarding medical care (use of prophylactic medication, number of follow-up visits during monitoring and respiratory therapy); and data regarding overall health status (including

comorbidities, such as allergic rhinitis, arterial hypertension and diabetes). The classification of the patients as children, adolescents or adults was in accordance with the criteria of the World Health Organization.<sup>(15)</sup>

The diagnosis and classification of asthma severity were carried out by a pulmonologist at the first ProAR-FS patient visit and were performed in accordance with the Global Initiative for Asthma criteria.<sup>(2)</sup> The diagnosis of rhinitis was based on the criteria established in the World Health Organization "Allergic Rhinitis and its Impact on Asthma" workshop.<sup>(16)</sup>

The patients and their family members were included in an asthma education program, which is part of the ProAR-FS and provides information on the disease, on its triggering factors, on the appropriate use of medications, on the identification of attacks and on the use of an action plan for asthma exacerbations. Medication for asthma and allergic rhinitis were dispensed at the treatment facility and consisted of inhaled corticosteroids (beclomethasone or budesonide), bronchodilators (albuterol or formoterol), topical nasal corticosteroids (beclomethasone or budesonide), antihistamines and oral corticosteroids, in the doses recommended by the attending physician. The medication was distributed via the pharmacy, after the completion of a form containing identification, type of medication, date, quantity dispensed, and the subsequent units dispensed (upon the return of the empty medicine bottle). Formoterol (6 µg and 12 µg) and budesonide (200 µg and 400 µg), which are in the high-cost medications group, were not used.

Pulmonary rehabilitation was offered to patients with controlled moderate or severe asthma. It was performed by physical therapists and aimed to prevent thoracic deformities, as well as promoting the appropriate use of the respiratory muscles. In addition, it provided an opportunity to reinforce the correct use of the inhaled medications.

The project was approved by the Research Ethics Committee of the Bahia Foundation for Science Development.

### Statistical analysis

To calculate the sample size, we used the PEPI program (Sagebrush Press, Salt Lake City, UT, USA). Descriptive statistics was used in order

to calculate the frequency of ER visits after admission to the program. The bivariate analysis (with Pearson's chi-square test) was used in order to determine the association between the independent variables and the occurrence of ER visits.

Statistical analyses were carried out using the Statistical Package for the Social Sciences, version 14.0 (SPSS Inc., Chicago, IL, USA).

## Results

We studied 253 asthma patients (107 children, 44 adolescents and 102 adults), between 4 and 76 years of age.

The analysis of the clinical characteristics of the sample revealed a higher frequency of asthma exacerbations in female patients who were overweight and presented a low level of education, a low family income, greater asthma severity and a high frequency of rhinitis symptoms (Table 1).

The frequency of chronic rhinitis and severe asthma was high in patients who had exacerbations after 12 months of treatment.

**Table 1** - Clinical and demographic characteristics of the cohort followed up at the referral center of the Program for the Control of Asthma and Allergic Rhinitis in the city of Feira de Santana (ProAR-FS), Brazil.<sup>a</sup>

Variable	Patients (n = 253)
Age, years	11 (32)
Female	137 (53.8)
Resident of the urban area	222 (87.7)
≤ 9 years of schooling	176 (70.1)
Family income ≤ the national minimal wage	182 (75.5)
Nutritional status	
Underweight	34 (13.4)
Normal weight	138 (54.5)
Overweight	52 (20.6)
Obese	29 (11.5)
Type/severity of asthma	
Intermittent	2 (0.8)
Mild persistent	36 (14.2)
Moderate persistent	104 (41.2)
Severe persistent	111 (40.0)
Rhinitis symptoms	218 (86.1)
Parental history of asthma	182 (71.9)

<sup>a</sup>Data presented as n (%).

**Table 2** – Factors associated with ER visits due to asthma exacerbations during follow up at the referral center of the Program for the Control of Asthma and Allergic Rhinitis in the city of Feira de Santana (ProAR-FS), Brazil.

Factor	Risk for exacerbations, OR (95% CI)*		
	Children	Adults	Total sample
	(n = 151)	(n = 102)	(n = 253)
Age > 20 years	-	-	1.34 (1.06-1.70)
Female	1.14 (0.86-1.51)	1.20 (0.98-1.47)	1.12 (0.84-1.50)
Resident of the urban area	1.12 (1.00-1.26)	1.15 (1.00-1.42)	1.19 (1.06-1.33)
≤ 9 years of schooling	1.15 (0.70-1.80)	2.23 (1.00-5.20)	1.53 (1.00-2.39)
Family income ≥ the national minimum wage	1.01 (0.93-1.07)	1.12 (0.82-1.52)	1.08 (0.89-1.30)
Overweight or obesity	1.16 (0.56-2.42)	1.04 (0.70-1.53)	1.06 (0.89-1.27)
Severe asthma	1.25 (1.00-1.63)	2.03 (1.09-3.83)	1.65 (1.24-2.18)
Chronic rhinitis	7.88 (1.09-57.1)	3.19 (1.00-10.75)	2.20 (1.00-4.80)
No respiratory therapy	1.60 (1.19-2.16)	1.00 (0.73-1.36)	1.29 (1.06-1.54)

\*Bivariate analysis (chi-square test).

There were 184 asthma exacerbations in 92 patients (36.5%), of which 45 were children or adolescents and 47 were adults. The asthma exacerbations were frequent during patient monitoring, and 20 patients (21.7%) had more than one ER visit. Among these patients, the number of ER visits due to exacerbations ranged between 2 and 6. Of the 253 patients studied, 15 (6.3%) were hospitalized. Among the hospitalized patients, 6 were children, 2 were adolescents and 7 were adults.

The bivariate analysis revealed that being over 20 years of age was associated with ER visits (Table 2). The following factors were also associated with ER visits: having 9 or fewer years of schooling (OR = 1.53; 95% CI: 1.00-2.39); having severe asthma (OR = 1.65; 95% CI: 1.24-2.18); and having asthma with chronic rhinitis (OR = 2.20; 95% CI: 1.00-4.80).

In the group of children and adolescents, the factors associated with ER visits were as follows (Table 2): having chronic rhinitis (OR = 7.88; 95% CI: 1.09-57.1); not receiving respiratory therapy (OR = 1.60; 95% CI: 1.19-2.16); living in an urban area (OR = 1.12; 95% CI: 1.00-1.26); and presenting greater asthma severity (OR = 1.25; 95% CI: 1.00-1.32). Among the adults, the following factors were associated with ER visits: having severe asthma (OR = 2.03; 95% CI: 1.09-3.83); having had 9 or fewer years of schooling (OR = 2.23; 95% CI: 1.00-5.20) and having chronic rhinitis (OR = 3.19; 95% CI: 1.00-10.75).

## Discussion

The present study revealed that, despite the marked reduction in ER visits after patients were admitted to the program and monitored at the referral center, the need for ER visits due to asthma exacerbations persisted in some patients receiving anti-inflammatory treatment and monitored at the center. Studies have shown that patients who continue to present asthma exacerbations even if properly monitored and treated might require more intensive treatment for the control of asthma, indicating a more severe form of the disease (for which maintenance treatment with inhaled corticosteroids does not suffice) or that airway inflammation has become nonresponsive to these medications.<sup>(17,18)</sup> Multiple exacerbations with hospitalization were observed in 6.3% of the patients, indicating that additional interventions are necessary in order to reduce the exacerbations and hospitalizations due to asthma during the follow up of these patients and possibly the associated risk of death. The occurrence of exacerbations during patient follow up might have been related to the limited access to highly effective medication for the control of asthma (high-cost medications) and, consequently, to the increased difficulty in controlling asthma in patients with the severe form of the disease, which is nonresponsive to treatment with the medication available at the referral center, or yet to the irregular use of the asthma controller medication. However, these patients were instructed and supervised

regarding the use of the inhaled medication during follow-up treatment at the outpatient clinic.

The high frequency of parental history of asthma in the pediatric and adult age brackets underscores the genetic basis of asthma.<sup>(7)</sup> Having had fewer than 8 years of schooling has been associated with exacerbations and ER visits in adults.<sup>(10)</sup> Previous studies have reported that a low level of education is a risk factor for ER visits.<sup>(5,9)</sup>

The combination of chronic rhinitis and asthma lead to a three times higher risk for the development of asthma exacerbations in adults and to a seven times higher risk for the development of asthma exacerbations in children. In a retrospective analysis of data from the health care system, it was demonstrated that patients with rhinitis had a high rate of ER visits.<sup>(19)</sup> A recent prospective cohort study carried out in Salvador revealed greater severity of asthma in patients who had concomitant rhinitis.<sup>(20)</sup>

In adults, severe asthma was a risk factor for ER visits due to asthma exacerbations, which is in accordance with previous observations indicating the association between inflammation and asthma severity.<sup>(19)</sup> Severe asthma is responsible for a higher number of hospitalizations and ER visits and, therefore, represents a high burden to the health care system.<sup>(10)</sup>

In the present study, there was a predominance of overweight patients (56.5%). Obesity and overweight can lead to changes in the respiratory mechanics, resulting in a reduction in the functional residual capacity and tidal volume, leading to worsening of the asthma symptoms, as well as to an increase in the risk for developing gastroesophageal reflux or worsening of existing reflux symptoms. However, in the present sample, we did not observe an association between obesity or overweight and asthma exacerbations or ER visits.<sup>(21-23)</sup>

In the present study, children who did not receive respiratory therapy presented a higher risk of asthma exacerbations. The effect of respiratory therapy on asthma is controversial because few controlled studies have investigated it; however, some studies evaluated the clinical aspects and spirometry data of asthma patients submitted to a respiratory rehabilitation program<sup>(24)</sup> and showed a reduction in the number of exacerbations, together with an increase in vital capacity

and FEV<sub>1</sub>, after the rehabilitation program.<sup>(25,26)</sup> At the ProAR-FS, respiratory therapy aims to improve the respiratory pattern and to reduce thoracic deformity between the attacks, as well as to correct the inappropriate use of inhaled medication and reinforce the correct technique, which contributed to the good results obtained.

The limitations of the present study are related to the existence of potential confounding factors and to the fact that there was no control group, since the benefits of follow up in the referred program are well known. In addition, the underuse of high-cost medication to control severe asthma in patients enrolled in the ProAR-FS might have resulted in an overestimation of the number of asthma exacerbations and of ER visits in the present study.

The factors associated with asthma exacerbations in patients monitored at the outpatient clinic of the ProAR-FS referral center were similar to those reported in the literature for asthma patients who are not enrolled in asthma programs. The knowledge of these factors is a key factor for public institutions and health care professionals to plan and provide better health care to asthma patients regarding the treatment and monitoring of these patients.

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