

## Comparison between two methods of asthma control evaluation based on individual perception\*

Comparaç o entre dois m todos de avaliaç o do controle da asma baseados na percepç o individual

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### Abstract

**Objective:** To compare the subjective perception of asthma control reported by the patient with that measured by the score obtained on the Asthma Control Questionnaire 6-item version (ACQ-6) in patients with severe asthma and to determine whether asthma control is associated with the number of emergency room visits in the previous month. **Methods:** This was a cross-sectional study involving 528 patients treated at the Bahia State Asthma and Allergic Rhinitis Control Program Central Referral Clinic between August of 2008 and March of 2010, in the city of Salvador, Brazil. The patients completed the ACQ-6 and answered a specific additional question in order to evaluate their own perception of asthma control in the previous week. **Results:** We evaluated 423 patients who met the inclusion criteria. The sample was predominantly female (81.3%), and 64.3% had an income lower than two times the national minimum wage. The mean age was  $49.85 \pm 13.71$  years, and the duration of asthma symptoms was  $32.11 \pm 16.35$  years. The patients had been regularly treated via the program for  $36.65 \pm 18.10$  months. Based on the subjective perception of asthma control, only 8% of the patients considered their asthma to be uncontrolled, whereas 38.8% had an ACQ-6 score  $\geq 1.5$ , which indicates poor control. The kappa statistic revealed poor concordance between the two methods. There was a direct association between uncontrolled asthma and the number of emergency room visits in the previous month ( $p < 0.001$ ). **Conclusions:** In this sample of patients, the subjective perception of asthma control differed from that measured by the ACQ-6 score, and the patients overestimated their own level of asthma control, which puts them at risk of being undertreated.

**Keywords:** Asthma; Health services; Questionnaires.

### Resumo

**Objetivo:** Comparar a percepç o subjetiva do controle da asma informada pelo paciente com aquela obtida por meio do escore do *Asthma Control Questionnaire* com seis quest es (ACQ-6) em pacientes com asma grave e verificar se o controle da asma est  associado ao n mero de visitas a salas de emerg ncia no m s anterior. **M todos:** Estudo transversal de 528 pacientes acompanhados na Central de Refer ncia do Programa para Controle da Asma e Rinite Al rgica na Bahia, entre agosto de 2008 e març o de 2010, em Salvador (BA). Os pacientes responderam ao ACQ-6 e a uma quest o adicional espec fica para avaliar sua percepç o do controle da doenç a na semana pr via. **Resultados:** Foram avaliados 423 pacientes, que preencheram os crit rios de inclus o. A maioria era do g nero feminino (81,3%) e possu a renda familiar menor que dois sal rios m nimos (64,3%). A m dia de idade foi de  $49,85 \pm 13,71$  anos, e a duraç o dos sintomas de asma foi de  $32,11 \pm 16,35$  anos. Os pacientes eram regularmente tratados no programa h   $36,65 \pm 18,10$  meses. Baseados na percepç o subjetiva do controle, 8% dos pacientes consideraram a sua asma n o controlada, enquanto 38,8% obtiveram escore do ACQ  $\geq 1,5$ , indicando falta de controle. O coeficiente kappa revelou fraca concord ncia entre os dois m todos. Houve uma associaç o direta entre falta de controle e n mero de visitas a emerg ncia no m s anterior ( $p < 0,001$ ). **Conclus es:** Nesta amostra de pacientes, a percepç o subjetiva do paciente sobre o controle da asma diferiu da medida por meio do ACQ-6, e os pacientes superestimaram seu controle, trazendo risco de subtratamento. **Descritores:** Asma; Serviç os de Sa de; Question rios.

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## Introduction

Severe asthma is the form of the disease that requires increased doses of drugs, has frequent exacerbations, and causes nocturnal awakenings and activity limitation, as well as  $FEV_1$  or  $PEF \leq 60\%$  of predicted, demanding the use of rescue medication.<sup>(1)</sup> It is present in approximately 5-10% of asthma patients and is the form of the disease that causes the highest morbidity and mortality. Guidelines for the treatment of asthma advocate control of the disease, with a consequent reduction in the risk of exacerbations and in long-term morbidity.<sup>(1-3)</sup>

Various instruments that include measurement of key outcomes of asthma treatment have been designed to evaluate disease control<sup>(4-8)</sup>: the Asthma Control Questionnaire (ACQ) has been designed and extensively tested for this purpose.<sup>(9)</sup> The ACQ measures adequacy of asthma control and change in asthma control, which occurs spontaneously or as a result of treatment. The ACQ has been recently validated for use in Brazil,<sup>(10)</sup> and has been found to have good accuracy, responsiveness, and reproducibility when administered to patients with severe asthma.

In asthma patients, symptoms and pulmonary function vary significantly. In addition, a significant proportion of these individuals inaccurately assess their degree of airway obstruction. The perception of airflow limitation in asthma patients during stable periods or during acute bronchoconstriction is an independent phenomenon and poses an additional difficulty in evaluating the patient. Asthma patients with poor perception of asthma control are at increased risk of overestimating their level of control and being undertreated.<sup>(11)</sup> Poorly controlled or inadequately treated asthma can have an unfavorable course with extremely severe exacerbations, which can be fatal or near fatal.

Although patient perception is a priority for researchers and clinicians, there is as yet no consensus on a gold standard for the objective measurement of patient perception of asthma control. The primary objective of the present study was to compare the subjective perception of asthma control reported by the patient with that measured with the ACQ 6-item version (ACQ-6).

## Methods

This was a cross-sectional study evaluating severe asthma patients admitted to the central

referral clinic of the *Programa para o Controle da Asma na Bahia* (ProAR, Bahia State Asthma Control Program). We selected male and female patients who were 18 years of age or older and who had been diagnosed with severe asthma<sup>(2)</sup> more than 6 months prior. We did not select patients who had radiological changes in more than 25% of the lung fields or who had severe and debilitating diseases, such as COPD, bronchiectasis, diffuse pulmonary fibrosis, pulmonary hypertension, severe neuromuscular disease, and cognitive or psychiatric disorders.

All patients who attended their routine visit at the ProAR central referral clinic between August of 2008 and March of 2010 were invited to participate in the study. The patients selected underwent a complete clinical evaluation and spirometry, as well as completing a structured questionnaire designed to elicit social, biological, economic, and clinical data.

In the medical interview, patients were systematically asked how they would rate their level of asthma control in the seven days preceding the visit with the following question: "How have you been feeling in the last seven days?" The response options were "(a) controlled, (b) partly controlled, and (c) uncontrolled", reproducing the Global Initiative for Asthma guideline-defined classification levels of asthma control.<sup>(2)</sup> The answer to that question was considered to be the subjective perception of asthma control.

Pulmonary function testing was performed with a Koko<sup>®</sup> spirometer (PDS Instrumentation Inc., Louisville, CO, USA), in accordance with the American Thoracic Society protocol<sup>(12)</sup> and the reference values for the Brazilian population.<sup>(13)</sup>

To analyze the results, we used the Statistical Package for the Social Sciences, version 14.0 (SPSS Inc., Chicago, IL, USA). Descriptive variables are expressed as means, medians, and proportions. The association between dichotomous variables was analyzed by bivariate logistic regression, and the kappa statistic was used to measure the concordance between the methods.

To test the concordance between the methods, we recoded the subjective perception of asthma control. Individuals classified as "partly controlled" were included in the "controlled" group, given that this intermediate group was similar to the "controlled" group, as determined by statistical analysis of correlation.

Occurrence of emergency room visits in the last thirty days was considered to be a dependent clinical variable, whereas gender, age, ethnicity, level of education, occupation, income, body mass index (BMI), time since entry into the ProAR, duration of symptoms, diagnosis and severity of allergic rhinitis, hospitalization for asthma, level of asthma control/ACQ-6 score, level of asthma control/subjective perception, and spirometric values were considered to be independent variables.

The present study was approved by the Research Ethics Committee of the Federal University of Bahia (Resolution 168/2008). All participants gave written informed consent.

## Results

We consecutively selected 528 patients with severe asthma. Of those, 105 individuals (20%) were excluded from the analysis for the following reasons: unavailability of chest X-rays, in 50; presence of radiological changes in more than 25% of the lung fields, in 37; unavailability of spirometry results in the last 6 months and inability to undergo the test on the day of the study evaluation because of poor clinical status, in 16; and diagnosis of COPD, in 3. One of those 105 patients met two exclusion criteria.

We evaluated 423 patients, of whom 344 (81.3%) were female and 377 (89.1%) self-reported being Black or Mulatto. The mean age was  $49.85 \pm 13.71$  years. The mean BMI of the participants was  $28.18 \pm 5.57$  kg/m<sup>2</sup> (range, 17.16-52.05 kg/m<sup>2</sup>). Of the respondents, 253 (59.8%) were illiterate or had had only 9 years of schooling, 240 (56.7%) were employed/self-employed, 178 (42.1%) were unemployed, and 272 (64.3%) reported a family income lower than two times the national minimum wage. The main characteristics of this sample are listed in Table 1.

The mean duration of asthma symptoms was  $32.11 \pm 16.35$  years, and the median age at onset of symptoms was 11 years (range, 5-30), the onset of symptoms having occurred before the age of 12 years in 214 patients (50.6%). The mean duration of follow-up treatment via the ProAr was  $36.65 \pm 18.10$  months. Rhinitis was observed in 92.4% of the patients, most of whom had moderate to severe persistent rhinitis (56.7%), as determined by the classification proposed in one study.<sup>(14)</sup>

The pulmonary function values were found to be low in the patients under study. The mean FEV<sub>1</sub> and FEV<sub>1</sub>/FVC values (in percentage of predicted) were  $63.22 \pm 18.70\%$  and  $77.00 \pm 14.46\%$ , respectively, whereas the median (range) bronchodilator response and FEF<sub>25-75%</sub> values were 10 (5-20) and 33 (21-48), respectively.

Among the patients who required emergency room visits in the previous month, the mean FEV<sub>1</sub> and FEV<sub>1</sub>/FVC values (in percentage of predicted) were  $58.64 \pm 21.87\%$  and  $73.21 \pm 16.55\%$ , respectively, whereas the median (range) FEF<sub>25-75%</sub> was 27 (15-43). Among those who did not require emergency room visits in the previous month, those values were  $63.61 \pm 18.40\%$ ,  $77.32 \pm 14.36\%$ , and 35 (22-49), respectively.

In the medical interview, 389 and 34 patients (92% and 8%), respectively, reported their asthma to be controlled/partly controlled and uncontrolled. A total of 164 patients (38.8%) had an ACQ-6 score  $\geq 1.5$  and were therefore classified as having uncontrolled asthma.

Of the total of patients evaluated, 33 (7.8%) had asthma exacerbations and required emergency room treatment. Of those 33, 15 (45.5%) reported having uncontrolled asthma, whereas 24 (72.7%) had an ACQ-6 score  $\geq 1.5$ . We found a discrepancy between the subjective perception of asthma control and the ACQ-6 score in 13 patients (39.4%).

Of the 390 patients who did not require emergency room treatment, 19 (9.4%) perceived their asthma to be uncontrolled and 140 (35.9%) had an ACQ-6 score  $\geq 1.5$ . We found that 135 patients (34.6%) perceived their level of asthma control differently from what was indicated by their ACQ-6 score.

The subjective perception of asthma control differed from that measured by the ACQ-6 score; however, both methods of asthma control evaluation analyzed in the present study were inversely and significantly associated with the number of emergency room visits in the previous month ( $p < 0.001$ ).

The sensitivity and specificity of the subjective perception of asthma control in comparison with those of the ACQ-6 score were 15.9% and 96.9%, respectively, as shown in Table 2.

Although there was no great discrepancy in accuracy, there were differences in sensitivity, specificity, rate of false negatives, negative predictive values, and positive predictive values

**Table 1** – Clinical and sociodemographic characteristics of the 423 patients with severe asthma studied.<sup>a</sup>

Characteristic	Visited the emergency room in the last 30 days	Did not visit the emergency room in the last 30 days	Sample as a whole
	(n = 33)	(n = 390)	(n = 423)
Gender			
Male	7 (21.2)	72 (18.5)	79 (18.7)
Female	26 (71.8)	318 (81.5)	344 (81.3)
Age, years <sup>b</sup>	47.06 ± 12.78	50.10 ± 13.78	49.85 ± 13.71
BMI, <sup>b</sup> kg/m <sup>2</sup>	27.37 ± 5.68	28.26 ± 5.57	28.18 ± 5.57
BMI range			
< 18.5 kg/m <sup>2</sup>	2 (6.1)	4 (1)	6 (1.4)
18.5-24.9 kg/m <sup>2</sup>	10 (30.3)	114 (29.2)	124 (29.3)
25-29.9 kg/m <sup>2</sup>	10 (30.3)	149 (38.2)	159 (37.6)
≥ 30 kg/m <sup>2</sup>	11 (33.3)	123 (31.5)	134 (31.7)
Level of education			
Illiterate	3 (9.1)	35 (9.0)	38 (9.0)
9 years of schooling	14 (42.4)	201 (51.5)	215 (50.8)
High school	14 (42.4)	142 (36.4)	156 (36.9)
College	2 (6.1)	12 (3.1)	14(3.3)
Employment status			
Unemployed	10 (30.3)	168 (43.1)	178 (42.1)
Employed/self-employed	23 (69.7)	217 (55.7)	240 (56.7)
Rhinitis	29 (87.9)	362 (92.8)	391 (92.4)
Pre-BD FEV <sub>1</sub> , % of predicted <sup>b</sup>	58.64 ± 21.87	63.61 ± 18.40	63.22 ± 18.70
BD response <sup>c</sup>	11 (2.0-25.5)	10 (5.5-19.0)	10 (5.0-20.0)
FEV <sub>1</sub> /FVC, % of predicted <sup>b</sup>	74.67 ± 16.55	78.22 ± 13.10	77.00 ± 14.46
Pre-BD FEF <sub>25-75%</sub> , % <sup>c</sup>	30 (18-47)	36 (23-49)	33 (21-48)
Duration of asthma, years <sup>b</sup>	31.03 ± 17.56	32.21 ± 16.27	32.11 ± 16.35
Onset of asthma before the age of 12 years	19 (57.6)	195 (50.0)	214 (50.6)
Follow-up via the ProAR, months <sup>b</sup>	36.52 ± 19.16	36.66 ± 18.00	36.65 ± 18.10

BMI: body mass index; BD: bronchodilator; and ProAR: Programa para Controle da Asma e Rinite Alérgica na Bahia (Bahia State Asthma and Allergic Rhinitis Control Program). aValues expressed as n (%), except where otherwise indicated. bValues expressed as mean ± SD. cValues expressed as median (interquartile range).

between the patients who required emergency room visits and those who did not.

The kappa statistic revealed poor concordance between the subjective perception of asthma control and that measured by ACQ-6 score (kappa = 0.15). We found a higher kappa value (i.e., 0.24), although not statistically so, among those patients who visited the emergency room in the previous month.

## Discussion

In the present study, we found that, in general, there was concordance between the subjective perception of asthma control and that measured by the ACQ-6 score for most patients. However, we also found that, in a significant proportion

of cases, disease control was overestimated, as evidence by the discrepancy between the subjective perception of asthma control and the ACQ-6 score. This fact is important because patients with uncontrolled asthma might require emergency room treatment or unscheduled medical visits. Most of the asthma patients evaluated were overweight Black or Mulatto women who were in the 41-60 year age bracket and who had a low level of education and a low family income.

The ProAR patients receive educational interventions in monthly meetings, guidance in the waiting room, and individual guidance during visits, all of which demystify the disease and highlight the importance of asthma treatment and asthma control evaluation so that they

**Table 2** – Evaluation of the sensitivity and specificity of the subjective perception of asthma control in comparison with those of an ACQ-6 score  $\geq 1.5$ , based on emergency room visits among the 423 patients studied.

Characteristic	Sample as a whole	Visited the emergency room in the last 30 days	Did not visit the emergency room in the last 30 days
	(n = 423)	(n = 33)	(n = 390)
Accuracy	65	60	66
Sensitivity	15.9	54.0	9.3
Specificity	96.9	77.8	97.6
Positive predictive value	76	86	68
Negative predictive value	64	39	66
False-negative rate	84	45	90
Kappa statistic	0.15*	0.24**	0.08***

Values expressed as %, except for the kappa statistic. \* $p < 0.001$  (95% CI: -0.015 to 0.665). \*\* $p = 0.1$  (95% CI: 0.01-0.47). \*\*\* $p = 0.002$  (95% CI: -0.012 to 0.182).

are able to put the action plan into practice during asthma attacks. Therefore, although the patients had a low level of education, we found it unnecessary to explain the concepts of each level of control before asking the patients how they would rate their level of asthma control. The ACQ-6 was administered to all patients by trained raters who were unaware of the subjective perception of asthma control, and individuals with an ACQ-6 score  $< 1.5$  were considered to have controlled asthma.

The poor concordance found between the two methods for measuring asthma control in the present study constitutes evidence of the subjectivity and inaccuracy of such measurements and draws attention to the need to use objective methods to determine the degree of airway obstruction in the follow-up of patients with severe asthma.

Temprano & Mannino<sup>(15)</sup> found that female patients with asthma used health care services more often than did their male counterparts and suggested that the former have better perception of asthma control. However, in our study, male patients sought emergency room treatment more often than did female patients (8.8% vs. 7.5%). The perception of asthma control was similar between males and females.

Among the patients who required emergency room visits in the previous month, there was a high proportion of patients ( $> 30\%$ ) with an  $FEV_1$  of 20–40% of predicted, which characterized severe obstructive lung disease, and a reduced  $FEF_{25-75\%}$  (median, 27; range, 15.0–42.5), which indicated small airway obstruction, although this particular spirometric index varied widely.

Pulmonary function seemed more impaired in those patients than in those who did not require emergency room visits in the previous month. When comparing pulmonary function between the patients who accurately perceived their own level of asthma control (i.e., those whose subjective perception was in agreement with that measured by the ACQ-6 score) and those with poor perception, we found no significant differences in  $FEV_1$ ,  $FEV_1/FVC$ , or  $FEF_{25-75\%}$  values.

In most studies, asthma patients are classified by degree of airflow obstruction, as measured by  $FEV_1$ .<sup>(16)</sup> One study found that, among patients with severe asthma, the post-bronchodilator percentage of predicted  $FEV_1$  was  $71.8 \pm 23.1$ .<sup>(17)</sup> One cohort study of patients with moderate to severe asthma (median follow-up, 11 years) reported that the mean percentage of predicted  $FEV_1$  was  $62 \pm 22$  during hospitalizations.<sup>(18)</sup> Because a reduction in  $FEV_1$  is expected in periods of hospitalization and exacerbation, we can suppose that pulmonary function is more impaired in the ProAR patients in whom spirometric indices are low in an outpatient setting.

In 34.6% of the patients who did not require emergency room visits in the previous month, there was a discrepancy between the subjective perception of asthma control and that measured by the ACQ-6 score. The same discrepancy was found in 39.4% of those who required emergency room treatment. This demonstrates that methods that rely on subjective perception (as determined by different means of evaluation) do not provide the same results.

In the present study, the ACQ-6 was able to identify a 27.2% higher proportion of

patients with uncontrolled asthma and poor subjective perception of asthma control. These are individuals who require more care to prevent severe exacerbations. We recommend the use of a structured questionnaire with proven reliability for evaluating asthma control in clinical practice, such as the ACQ, in order to increase the safety of the follow-up of patients with severe asthma.

Previous studies have compared the use of different methods of measuring asthma control with that of the ACQ. In 2000, Juniper et al.<sup>(19)</sup> compared the use of the ACQ with that of a symptom diary and found good concordance between the two, suggesting that it is more practical to perform a single evaluation with the ACQ on the day of the visit than to have the patient keep a symptom diary for seven days. Four years later, Juniper et al.<sup>(20)</sup> compared asthma control as estimated by clinicians with asthma control as estimated by the ACQ scores and concluded that clinicians tended to overestimate improvements in asthma control and underestimate deteriorations, the ACQ having been considered an objective instrument for measuring asthma control.

In the present study, the kappa statistic for concordance between the two methods of asthma control evaluation was 0.15, indicating poor concordance between the subjective perception of asthma control and that measured by the ACQ-6 score.

Considering the low sensitivity of the subjective perception of asthma control in relation to that measured with the structured questionnaire and considering that subjective perception had a high rate of false-negative results (i.e., 0.84), we can affirm that patients do not accurately perceive their own level of asthma control. This shows that when patients consider their asthma to be controlled, their judgment cannot be trusted. This confirms that the use of a structured questionnaire in clinical practice can be useful in the evaluation of asthma control, as demonstrated in previous studies.<sup>(19,20)</sup>

Poor perception of asthma control can have an impact on self-care in terms of the correct use of maintenance and rescue medications, resulting in an increased risk of future exacerbations. Bateman et al.<sup>(21)</sup> identified current lack of asthma control as a predictor of future risk of exacerbations and perpetuation of the lack of control.

Identifying uncontrolled asthma is important for adequate treatment adjustments. The low sensitivity of subjective perception requires that health professionals be especially careful not to base their decision to adjust or maintain the current treatment exclusively on that perception, given that physicians tend to change treatment strategies only for patients with uncontrolled asthma.<sup>(22)</sup> Individuals with poor perception of asthma control might be at increased risk of severe exacerbations, given that they fail to detect worsening in time to institute preventive treatment,<sup>(23)</sup> as well as constituting a group at increased risk of developing respiratory failure.<sup>(24)</sup>

In 2008, Leite et al.<sup>(10)</sup> calculated the sensitivity and specificity of the ACQ-6 relative to the evaluation by a specialist. Using an ACQ-6 score of 1.5 as a cut-off point, those authors found a sensitivity of 77%, a specificity of 84%, a positive predictive value of 0.9, and a negative predictive value of 0.67 in the identification of uncontrolled asthma. The ACQ-6 is sensitive and specific. Scores  $\geq$  and  $<$  1.5, respectively, indicate uncontrolled asthma and controlled asthma. In that study,<sup>(10)</sup> there was a comparison between the ACQ scores and the evaluation of asthma control by a pulmonologist, which was used as the gold standard for classifying asthma control, including information regarding pulmonary function. It was concluded that the questionnaire was a good identifier of uncontrolled asthma, which is a major concern in clinical practice.

In 2005, De Peuter et al.<sup>(25)</sup> stated that overestimation of symptoms is associated with excessive use of medication and need for hospitalization. In 2008, Chapman et al.<sup>(22)</sup> reported that patients who did not require urgent or specialist care were more likely to report short-term symptom control of asthma than were those who required one or more emergency room visits.

In our group of patients with severe asthma and a recent history of emergency room visits, the high positive predictive value of subjective perception showed that a significant proportion of patients identified uncontrolled asthma, relative to the ACQ-6 score.

In the present study, there was an association between uncontrolled asthma and visits to the emergency room in the previous month; however, considering the latter to be a dependent variable, we found no other significant associations. In 2010, Hermosa et al.<sup>(26)</sup> studied factors associated

with asthma control (ACQ) in patients with severe asthma and showed that emergency room visits in the previous year constituted the variable that most influenced the indicators of asthma control, although adherence to treatment, patient knowledge of the disease, BMI, gender, and number of visits to a physician in the previous 3 months also influenced asthma control.

A study conducted under the auspices of the ProAR reported a good rate of adherence to treatment (i.e., > 80%).<sup>(27)</sup> All ProAR patients receive multidisciplinary follow-up and participate in monthly educational sessions, in which they are provided with information about the disease and its comorbidities, becoming more aware of their disease. In addition, at each medical visit, ProAR patients are given an action plan so that, during exacerbations, they know what to do. This reduces the need for emergency room treatment. This might explain the low frequency of emergency room visits in the month preceding the evaluation visit among the patients with severe asthma in the present study.

In 2009, Brandão et al.<sup>(28)</sup> found the following risk factors for emergency room visits for asthma exacerbations: having chronic rhinitis; having asthma that is more severe; and having a low level of education. In the present study, none of those factors were significantly associated with emergency room visits in the previous month. Reflecting on this discrepancy, we speculate that the power of our study to detect statistically significant associations between the outcome (emergency room visits) and the exposure variables was low, given that the number of emergency room visits was monitored over a period of only 30 days, a small number of visits having been noted.

We found that more than 92% of the individuals under study had rhinitis associated with asthma. Of those, 56.7% had moderate to severe rhinitis, which suggests that these individuals have greater difficulty in controlling their asthma. Ponte et al.,<sup>(29)</sup> in a one-year follow-up of a cohort of 557 patients, found a strong association between moderate to severe rhinitis and increased asthma severity, demonstrated by a greater number of exacerbations and visits to the emergency room, as well as by poorer disease control.

One of the limitations of the present study was the use of a convenience sample of patients enrolled in an asthma control program in an

urban center. It is possible that patients who visit outpatient clinics more regularly are more adherent to treatment and have better asthma control, whereas those who seek emergency room treatment more often have uncontrolled asthma. However, the ProAR is a referral program for severe asthma treatment in the state of Bahia, and patients are referred to the program from major emergency rooms and by specialists in the city of Salvador. Two studies of ProAR patients found good adherence to treatment (> 80%)<sup>(27)</sup> and good inhaler technique<sup>(30)</sup> among those patients.

In conclusion, we can state that there is a discrepancy between the subjective perception of asthma control (as determined by the answer to a simple question) and that measured by a structured questionnaire, i.e., the ACQ-6. The sensitivity of subjective perception in identifying uncontrolled asthma is very low in comparison with that of the ACQ-6 score, which indicates that many patients with uncontrolled asthma believe that they have controlled asthma. Regardless of the method used in order to determine asthma control (i.e., subjective perception or the ACQ-6 score) in our sample, uncontrolled asthma was found to be associated with emergency room visits in the last 30 days.

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