

Impact of a short-term educational intervention on adherence to asthma treatment and on asthma control*

Impacto de uma intervenção educacional de curta duração sobre a adesão ao tratamento e controle da asma

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Abstract

Objective: To evaluate the effect of a short-term individualized education program on adherence to asthma treatment, inhalation techniques, and asthma control. **Methods:** A prospective study involving patients aged 14 years or older, with a confirmed diagnosis of asthma and recruited from the asthma outpatient clinic of a university hospital in the city of Porto Alegre, Brazil. The study was conducted in two phases (before and after the educational intervention). At a routine medical visit, the participants completed a general questionnaire in order to assess the level of asthma control and inhalation techniques. The participants also underwent pulmonary function testing. Subsequently, they participated in an asthma education program, which consisted of one individualized session. The participants were reevaluated after three months. **Results:** Of the 174 patients recruited, 115 completed the study. Between the first and second evaluations, there was a significant improvement in the effective use of inhaled corticosteroids (90.4% vs. 93.3%; $p = 0.003$), the effective use of long-acting β_2 agonists (57.4% vs. 63.5%; $p < 0.0001$), the effective use of a combined regimen with these two medications (57.4% vs. 62.6%; $p < 0.0001$), and the self-reported adherence to corticosteroid therapy ($p = 0.001$). There was a significant decrease in the proportion of patients visiting ERs (30.4% vs. 23.5%; $p = 0.012$). However, the level of asthma control and the inhalation technique did not improve significantly ($p = 0.095$ and $p = 0.512$, respectively). **Conclusions:** This short-term asthma education program resulted in an improvement in the use of medications for asthma control and a decrease in the number of ER visits, although it had no significant effect on the inhalation technique.

Keywords: Ambulatory care; Patient education as topic; Respiratory therapy; Metered dose inhalers.

Resumo

Objetivo: Avaliar o efeito de um programa educativo individualizado de curta duração para asma sobre a adesão ao tratamento, técnicas inalatórias e controle da doença. **Métodos:** Estudo prospectivo em duas fases (antes e depois da intervenção) em pacientes com idade ≥ 14 anos e com diagnóstico confirmado de asma, recrutados no ambulatório especializado de um hospital universitário em Porto Alegre (RS). Durante a visita médica de rotina, os participantes responderam um questionário geral para avaliar o nível de controle da asma e a técnica inalatória e foram submetidos a testes de função pulmonar. Participaram, então, de um programa educativo em asma que consistiu de uma sessão individualizada. A reavaliação ocorreu em três meses. **Resultados:** Dos 174 pacientes recrutados, 115 completaram o estudo. Entre as avaliações, houve uma melhora significativa no uso efetivo de corticosteroides inalatórios (90,4% vs. 93,3%; $p = 0,003$), no uso efetivo de β_2 -agonistas de longa ação (57,4% vs. 63,5%; $p < 0,0001$), no uso efetivo do regime combinado dessas duas medicações (57,4% vs. 62,6%; $p < 0,0001$) e na adesão relatada ao tratamento com corticosteroides ($p = 0,001$). Houve uma redução significativa na proporção de pacientes com visitas a emergência (30,4% vs. 23,5%; $p = 0,012$), mas o nível de controle da asma e a técnica inalatória não melhoraram significativamente ($p = 0,095$ e $p = 0,512$, respectivamente). **Conclusões:** Este programa educativo de curta duração resultou em maior utilização das medicações de controle da asma e em redução das visitas a emergência, apesar de não ter ocorrido efeito significativo sobre a técnica inalatória.

Descritores: Assistência ambulatorial; Educação de pacientes como assunto; Terapia respiratória; Inaladores dosimetrados.

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Introduction

The dimensions of the problem of asthma remains a highly significant public health issue.⁽¹⁾ Despite major advances in the understanding of asthma pathogenesis and in asthma treatment, the prevalence of 'the disease has increased in the last two decades, having reached 6-10% by 2006.⁽²⁾ In Brazil, the annual number of asthma-related hospitalizations is approximately 350,000, asthma being the fourth leading cause of hospitalization via the Brazilian Unified Health Care System.⁽³⁾

Because asthma is an incurable clinical condition, the primary goal of asthma treatment is to achieve disease control.⁽⁴⁾ However, despite the advances in asthma treatment and in the implementation of guidelines for disease management, asthma remains poorly controlled.^(1,5) Potential explanations for this failure include the prescription of inappropriate medications and the incorrect use of medications on the part of asthma patients.⁽¹⁾ Although it is essential to prescribe and provide pharmacological treatment that is appropriate to the level of asthma severity, education and guidance on asthma self-management have recently become recognized as aspects that must also be addressed within their clinical context.^(3,6,7) Various types of asthma education programs have been developed. Such programs differ in terms of approach, setting in which the disease is addressed, and outcomes considered.⁽⁸⁻¹⁸⁾ There is a real need to adapt this knowledge about asthma education to clinical practice and to make it accessible at public outpatient clinics specializing in asthma. That need motivated us to develop a project in which the impact that a short-term educational intervention has on asthma management would be evaluated. Therefore, the objective of this study was to evaluate the impact that a short-term individualized education program, administered during a routine outpatient visit, has on adherence to maintenance treatment, on the correct use of inhalers, and on the level of asthma control.

Methods

This was a prospective study conducted in two phases (before and after an educational intervention). All patients who agreed to participate were studied sequentially.

The study protocol was approved by the Research Ethics Committee of the *Hospital de Clínicas de Porto Alegre* (HCPA), located in the city of Porto Alegre, Brazil. All patients, or their legal guardians (for patients under 18 years of age), gave written informed consent.

The study population comprised patients treated at the asthma outpatient clinics of the HCPA. We recruited individuals ≥ 14 years of age who had been previously diagnosed with asthma. A physician who was a member of the research team confirmed the diagnosis on the basis of the following criteria: symptoms consistent with asthma, accompanied by reversible airway obstruction (an improvement in FEV₁ $\geq 12\%$ and ≥ 200 mL after the administration of a short-acting inhaled β_2 agonist); or hyperresponsiveness on bronchial challenge testing. We included only those patients who had made at least two prior visits to one of the outpatient clinics mentioned above and for whom the pharmacological treatment regimen had already been adjusted to the level of asthma severity.⁽¹⁹⁾

The exclusion criteria were as follows: having another chronic lung disease (emphysema, chronic bronchitis, or bronchiectasis); and failing to submit to all of the evaluations required by the study protocol.

At a routine outpatient visit, the patients were invited to participate in the study. After that outpatient visit, the volunteers were interviewed by one of the research team members, using a questionnaire that assessed the following variables: age; gender; ethnicity; marital status; level of education; family income; smoking status; comorbidities; financial burden of obtaining asthma medication; regularity of the use of asthma medication; self-reported adherence to the use of inhaled corticosteroids (weekly frequency of use); type of inhaler used; correctness of inhaler use; and classification of asthma severity. The questionnaire included a checklist for evaluating appropriate patient handling of the device used for inhaling the corticosteroid. Prior to the study outset, the principal investigator trained all members of the research team (composed of medical students) on the correct use of each device and on how to score each stage of the evaluation process. The patients were asked to demonstrate their inhalation technique, using placebo. For the

use of metered dose inhalers, patients were evaluated regarding the correctness of the following steps: shaking the inhaler before using it; exhaling normally before using the inhaler; holding the inhaler at an appropriate distance (3–5 cm) from the lips if a spacer is not used or, if a spacer is used, placing the inhaler in the mouth and creating an adequate seal with the lips; (after squeezing the inhaler) inhaling slowly and deeply; and (after inhalation) performing a breath-hold of at least 10 seconds. For the use of dry powder inhalers, patients were evaluated regarding the correctness of the following steps: exhaling normally before using the inhaler; placing the inhaler in the mouth and creating an adequate seal with the lips; inhaling as forcefully and deeply as possible; and (after inhalation) performing a breath-hold of at least 10 seconds. Regardless of the type of device being used, patient technique was classified as correct only if all steps were performed correctly.

Asthma severity was categorized on the basis of the daily medication regimen is use, as proposed in the 2002 Global Initiative for Asthma (GINA) guidelines.⁽¹⁹⁾

The level of asthma control was assessed in accordance with the classification proposed in the 2006 GINA guidelines.⁽⁷⁾ Asthma was considered controlled if all of the following characteristics were present: daytime symptoms \leq twice a week and no asthma attacks in the last 3 months; no limitations of activities of daily living; no asthma-related nocturnal symptoms or awakenings; rescue medication required \leq twice a week; and normal airflow (FEV_1 and PEF both \geq 80% of predicted). Asthma was considered partially controlled if one or two of those characteristics were absent. Asthma was considered uncontrolled if more than two of the characteristics were absent or if the patient had been admitted to the ER or hospitalized for asthma in the last 12 months. An asthma attack was defined as an exacerbation requiring the use of a systemic corticosteroid.

Pulmonary function was assessed with a computerized spirometer (Jaeger-v4.31; Jaeger, Würzburg, Germany). We recorded FVC, FEV_1 , and the FEV_1/FVC ratio. All parameters are expressed as the percentage of the predicted value for age, gender, and height.⁽²⁰⁾

We measured PEF using a portable peak flow monitor (Vitalograph; Boehringer Ingelheim,

Ingelheim am Rhein, Germany). The results are expressed as the percentage of the predicted value for age, gender, and height.⁽²¹⁾ Subsequently, the patients attended an individualized educational session, which lasted approximately 45 min and was delivered by one of the medical students on the research team. The process followed a structured schedule that addressed the following educational points: what asthma is and what its symptoms are; what the triggers of asthma are and how to avoid or reduce exposure to those factors; what asthma medications are available and what their purposes are, with a focus on relief and maintenance treatment and special emphasis on the importance of inhaled corticosteroids for disease control; evaluation of the inhalation technique and, if necessary, correction of the errors identified; recognition of the early signs of exacerbation and remedial review of the asthma attack treatment prescribed at the medical visit; and instruction on how to obtain asthma medications via the public health care system, including the administrative process involved. During the session, the presenter responded to requests for clarification and addressed all questions that arose.

In accordance with the study protocol, we reevaluated each patient during a routine visit at approximately 3 months after the educational intervention.

The statistical analysis was performed with the Statistical Package for the Social Sciences, version 15.0 (SPSS Inc., Chicago, IL, USA). Data are expressed as number of cases (proportion), mean \pm SD, or median (interquartile range). Categorical variables were compared with the chi-square test with adjusted standardized residuals and, when necessary, Yates' correction or Fisher's exact test. Continuous variables were compared with the t-test for paired samples or the Wilcoxon test. All statistical tests were two-tailed. The level of significance was set at 5%.

Results

Between June of 2007 and June of 2009, 174 patients were invited to participate in the study. Of those, 30 declined and 29 were excluded: 27 because they had another chronic lung disease; and 2 because they failed to appear for all of the evaluations required by the study

protocol. Therefore, 115 patients completed the study.

Table 1 shows the general characteristics of the patients studied. Females predominated (73.9%). The mean age was 51 years, and the median age at which asthma was diagnosed was 30 years. Most were White (81.7%), were married or had a steady partner (53.9%), had a low level of education (61.7% had 8 years of schooling

or less), and had a low family income (70% of the families received less than 3 times the national minimum wage). Regarding smoking status, 62.6% had never smoked, 35.7% were former smokers, and only 1.7% currently smoked. Of the 115 patients, 72 (62.6%) were classified as having severe persistent asthma, 28 (24.3%) were classified as having moderate persistent asthma, 14 (12.2%) were classified as having mild persistent asthma, and 1 (0.9%) was classified as having mild intermittent asthma.

Table 1 – General characteristics of the 115 patients studied.

Variable	Result
Gender ^a	
Female	85 (73.9)
Male	30 (26.1)
Age ^b , years	51.3 ± 15.4
BMI ^b , kg/m ²	27.1 ± 4.9
Age at diagnosis ^c , years	30 (39)
Race ^a	
White	94 (81.7)
Non-White	21 (18.3)
Marital status ^a	
Married/steady partner	62 (53.9)
Divorced/separated	15 (13.0)
Widowed	12 (10.4)
Single	26 (22.6)
Level of education ^a	
≤ 8 years of schooling	71 (61.7)
> 8 years of schooling and < college	36 (31.3)
College	8 (7.0)
Monthly family income ^a	
< 3 × the national minimum wage	81 (70.4)
≥ 3 and < 10 × the national minimum wage	33 (28.7)
≥ 10 × the national minimum wage	1 (0.9)
Smoking status ^a	
Never smoker	72 (62.6)
Former smoker	41 (35.7)
Current smoker	2 (1.7)
Comorbidities ^a	
None	71 (61.2)
1	39 (33.6)
2	6 (5.2)
Classification of asthma severity ^{a,d}	
Mild intermittent	1 (0.9)
Mild persistent	14 (12.2)
Moderate persistent	28 (24.3)
Severe persistent	72 (62.6)

^aValues expressed as n (%). ^bValues expressed as mean ± SD. ^cValores expressed as median (interquartile range). ^dAs defined in the Global Initiative for Asthma guidelines.⁽¹⁹⁾

Table 2 shows the comparisons of the study variables at the first and second evaluations. There were differences between the pre-intervention and post-intervention results in terms of how the financial burden of obtaining asthma medications was distributed, with an increase in the proportion of patients who obtained their medications via the public health care system (22.6% vs. 27.0%), a decrease in the proportion of those who acquired their medications using their own resources (64.3% vs. 55.7%), and an increase in the proportion of those who used a combination of the two in obtaining their medications (13.0% vs. 17.4%), the differences being significant ($p < 0.0001$ for all). There was a significant improvement in the effective use of inhaled corticosteroids (90.4% vs. 93.0; $p = 0.003$), the effective use of long-acting β_2 agonists (57.4% vs. 63.5%; $p < 0.0001$), and the effective use of a combined regimen of inhaled corticosteroids and long-acting β_2 agonists (57.4% vs. 62.6%; $p < 0.0001$). There was a significant difference between the pre-intervention and post-intervention time points in terms of the type of inhaler used for administration of corticosteroids ($p < 0.0001$). There was no statistically significant difference in the correct use of inhalers (metered dose inhalers or dry powder inhalers), analyzed together or separately ($p > 0.05$), nor was there a significant difference in the number of errors in the use of metered dose inhalers ($p = 0.098$) or dry powder inhalers ($p = 0.136$). The proportion of patients reporting ER visits in the last 3 months decreased significantly (30.4% vs. 23.5%; $p = 0.012$). Although not statistically significant, there were improvements in FEV₁ ($p = 0.143$) and PEF ($p = 0.119$).

Figure 1 shows the level of asthma control before and after the asthma education program.

Table 2 – Comparisons between the results obtained before and after the asthma education program.

Variable	Before	After	p
Financial burden of obtaining asthma medications ^a			
Fully on the public health care system	26 (22.6)*	31 (27.0)*	< 0.0001
Fully on the patient	74 (64.3)*	64 (55.7)*	
Shared between the public health care system and the patient	15 (13.0)*	20 (17.4)*	
Regular use of controller medications ^a			
Inhaled corticosteroids	104 (90.4)	107 (93.0)	0.003
Long-acting β_2 agonists	66 (57.4)	73 (63.5)	< 0.0001
Inhaled corticosteroids + long-acting β_2 agonists	66 (57.4)	72 (62.6)	< 0.0001
Xanthine	4 (3.5)	4 (3.5)	0.134
Use of inhalers ^a			
Metered dose inhaler	46 (40.7)*	39 (34.5)*	< 0.0001
Aerolizer [®]	48 (42.5)*	62 (54.9)*	
Turbuhaler [®]	9 (8.0)*	5 (4.4)*	
Diskus [®]	10 (8.8)*	7 (6.2)*	
Correct use of inhalers ^a	57 (50.4)	71 (62.8)	0.512
Correct use of metered dose inhalers ^a	11 (26.8)	18 (43.9)	1.000
Correct use of dry powder inhalers ^a	39(65.0)	44 (73.3)	1.000
Number of errors in the use of metered dose inhalers ^b	2 (3)	2 (3)	0.098
Number of errors in the use of dry powder inhalers ^b	0 (1)	0 (1)	0.136
ER visits in the last 3 months ^a	35 (30.4)	27 (23.5)	0.012
FEV ₁ , % of predicted ^c	64.9 \pm 20.8	67.8 \pm 21.2	0.143
PEF, % of predicted ^c	62.7 \pm 22.9	60.1 \pm 22.8	0.119

^aValues expressed as n (%). ^bValues expressed as median (interquartile range). ^cValues expressed as mean \pm SD. *Adjusted standardized residuals; > 1.96 or < -1.96 implies a significant difference. The chi-square test was used for categorical variables; the t-test for paired samples was used for continuous variables with normal distribution, and the Wilcoxon test was used for variables without normal distribution.

There was no statistically significant change in the level of asthma control ($p = 0.095$).

Figure 2 shows the self-reported adherence to the use of inhaled corticosteroids before and after the educational intervention. There was a significant difference between the two time points ($p = 0.001$). The proportion of patients who reported using the medication 5 or more days a week increased from 88.7% to 91.3%, whereas the proportion of patients who reported using the medication 3 or more days a week but less than 5 days a week decreased from 3.5% to 1.7%, and the proportion of patients who reported using the medication less than 3 days a week did not change significantly (7.8% vs. 7.0%).

Discussion

This prospective study, conducted in two phases (before and after an educational intervention), showed that a short-term individualized education program, delivered at a routine outpatient visit, had a positive

impact on asthma management over a 3-month follow-up period, although it did not contribute to an increase in the level of asthma control. The positive impact was modest, although statistically significant, and occurred in the form of an improvement in the use of the medications prescribed for asthma control, an improvement in the self-reported adherence to treatment (weekly frequency of use of the medications), and a decrease in the proportion of patients reporting ER visits. The educational intervention had no effect in terms of improving the inhalation technique.

The asthma education line of research has expanded rapidly since 1984. A first generation of studies investigated the abilities that should be developed by patients, the models of programs that should be implemented, and the importance of motivation in the self-management of the disease. A second generation of studies extended the research beyond the confines of medical clinics and to populations of adults with asthma. Sociobehavioral interventions were

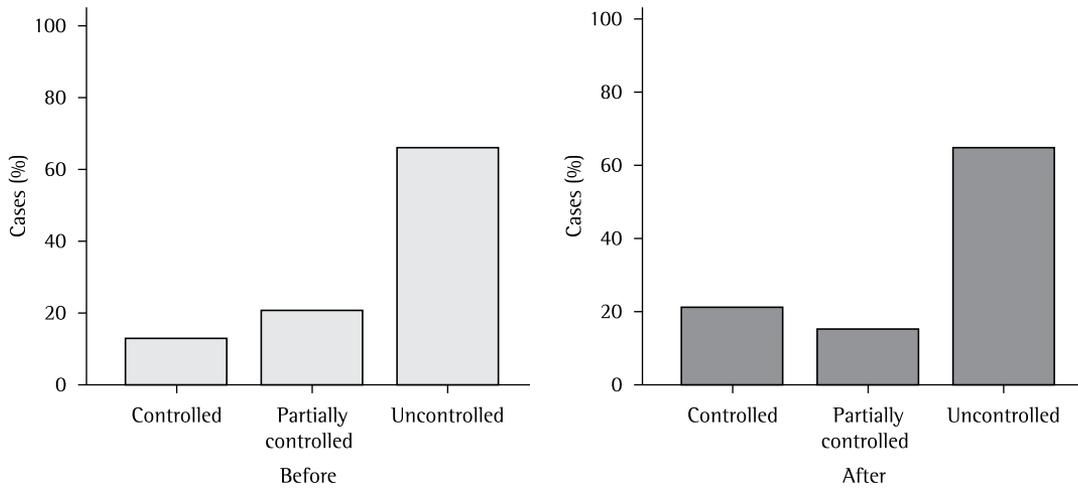


Figure 1 - Comparison of the level of asthma control, evaluated in accordance with the recommendations of the Global Initiative for Asthma,⁽⁷⁾ before and after the asthma education program (p = 0.095).

found to be beneficial. More recently, research related to asthma education has examined interventions provided by various types of educators using different learning formats in a range of settings and focusing especially on socially disadvantaged minorities.⁽²²⁾ The present study is unique not only in that it adapted the learning process to the routine clinical care of a population of asthma patients, most of whom were classified as having severe asthma, had a low family income, and had a low level of education, but also in that it modeled a short-term format that allows the delivery of the educational intervention during routine care and thus makes it possible to include the maximum number of patients. One positive aspect of providing the

educational intervention at a routine visit is the fact that there is no need for the patient to schedule another visit or go to the hospital again. Studies have shown that a certain percentage of patients do not return to the hospital for this purpose, even after having expressed a desire to do so.^(23,24) Inhaled corticosteroids are the most effective class of medications for the treatment of persistent asthma.⁽²⁵⁾ An important point in the present study was that the educational approach emphasized the need for long-term adherence to corticosteroid therapy, which resulted in an improvement in the use of these medications. The delayed clinical impact that the use of inhaled corticosteroids has on asthma symptoms, in comparison with the immediate

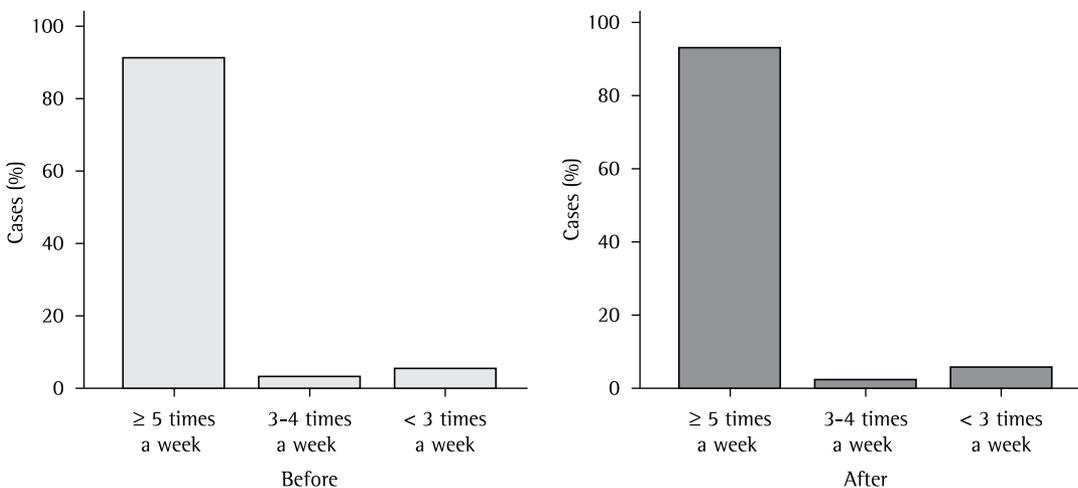


Figure 2 - Comparison of the self-reported adherence to inhaled corticosteroid therapy before and after the asthma education program (p = 0.001).

relief obtained with inhaled bronchodilators, seems to be a major factor affecting adherence to the prescribed corticosteroid therapy.⁽²⁶⁾ This might explain the fact that, after the educational intervention, some of our patients remained non-adherent to treatment regimens including these medications. The combined use of long-acting inhaled β_2 agonists and inhaled corticosteroids is the most effective strategy for controlling moderate and severe asthma.⁽⁷⁾ Therefore, the (modest) impact caused by the educational intervention delivered in the present study (an improvement in the use of a combined regimen of inhaled corticosteroids and long-acting inhaled β_2 agonists) might have contributed to the decrease in the proportion of patients visiting the ER over the 3-month study period.

The efficacy of asthma treatment depends on patient ability to perform the inhalation technique correctly. Many studies have shown that education has a significant impact on the proportion of patients who use inhalers correctly.^(27,28) The fact that our study revealed no effect of the educational intervention on the proportion of patients who performed the inhalation technique correctly or on the number of errors in the use of inhalers, might be due to the short duration of the educational intervention and the lack of reinforcement in subsequent visits. It has been shown that patients do not retain such information for long periods. Therefore, if recommendations are to have a positive impact, they should be made more than once and should be put in writing, as a form of reinforcement. The criteria used for evaluating the inhalation technique in the present study were those established in previous studies.⁽²⁶⁾

Another aspect to be considered is that, because the patients were being treated at a university hospital, they had already received considerable education on the disease. This increased the baseline and minimized any cumulative effect of the educational intervention during the study period. However, the fact that 47% of the patients studied used inhalers incorrectly suggests that there was still a considerable need for such educational interventions. In the state of Rio Grande do Sul, not all medications for the maintenance treatment of asthma are available via the public health care system. Beclomethasone dipropionate and short-acting

β_2 agonist bronchodilators for use in metered dose inhalers are available in primary health care facilities in most cities. However, long-acting β_2 agonists (formoterol and salmeterol), as well as the combination of inhaled corticosteroids and long-acting β_2 agonists, are available for free to only a small minority of these patients. In the present study, the educational intervention included explanations of the administrative procedures involved in obtaining medications via the public health care system. This resulted in a significant increase in the proportion of patients who obtained the medications via the public health care system (22.6% vs. 27.0%) and a decrease in the proportion of patients who acquired the medications using their own financial resources (64.3% vs. 55.7%). The availability and accessibility of the medications are central to appropriate treatment and, consequently, to adequate asthma control.⁽²⁹⁾ It should be mentioned that the changes observed in the type of inhaler used after the educational intervention might have been due to changes in their availability via the public health care system.

The lack of impact on the level of asthma control found in the present study might be attributable to the fact that there was still a number of patients who were non-adherent to the use of maintenance medications, to the fact that there were still errors in the use of inhalers, or even to difficulties in obtaining the medications. In the present study, the level of asthma control was evaluated in accordance with the criteria proposed by the GINA guidelines.⁽⁷⁾ Although this measure has not been validated in the literature, it combines several important markers of asthma control.⁽³⁰⁾ Conversely, the 3-month interval between the educational intervention and the reevaluation was sufficient for the intervention to have had an impact on the level of disease control.

The major limitation of the present study is related to its two-phase design (before and after the educational intervention). The fact that this was not a randomized clinical trial prevents us from stating definitely that the impact observed on the factors studied is attributable exclusively to the educational intervention. Another aspect is that the medication for the treatment of asthma was not made widely available to all patients for free. Therefore, despite the educational

intervention, there might have been difficulties in obtaining the medication, and this might have minimized the impact of the intervention. It should also be borne in mind that the study was conducted at a referral center operating within the public health care system, which translated to our sample consisting of patients of lower socioeconomic status and with greater asthma severity. This limits the generalization of results. Furthermore, because 37.4% of our patients were smokers or former smokers, it is possible that the sample was contaminated with COPD patients. However, none of the patients studied met the clinical or radiological criteria for emphysema or chronic bronchitis. In addition, all of our patients met the clinical and functional criteria for a diagnosis of asthma. Finally, it should be considered that 30 patients (17.2%) declined to participate in the study, which might have created a selection bias, because those patients might have had a lower level of education and therefore could have obtained a greater benefit from the educational intervention.

In conclusion, the present study showed that a short-term individualized education program delivered during a routine outpatient visit had a positive impact on asthma management, with an improvement in the use of the prescribed medications, an improvement in the self-reported use of these medications, and a decrease in the number of asthma-related ER visits, although the educational intervention did not contribute to an increase in the level of asthma control.

Although the challenges of improving the availability and accessibility of asthma medications in the public health care system remain, the educational model is being improved through the determination of which groups can benefit from short-term interventions and which need long-term education programs that are more intensive, addressing behavioral aspects.

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