

Healthcare Program for Children with Severe Asthma: impact analysis

Verónica Giubergia, MD^a, Nora Fridman, BS^b and Hebe González Pena, MD^a

SUMMARY

Introduction. Asthma is a major economic burden to families and public healthcare since it leads to a large number of emergency room (ER) visits and hospital admissions. Whereas healthcare programs for children with asthma have proved to be very effective to improve the course of the disease, there is less information about programs for children with severe asthma.

Objective. To comparatively analyze the impact of the Healthcare Program for Children with Severe Asthma (*Programa de Atención de Niños con Asma Grave*, PANAG).

Methods. This was a longitudinal, pre- and post-intervention study. Two approaches were used to compare the frequency of asthma exacerbations and hospital admissions due to severe asthma in a group of patients: regular follow-up in a public hospital (pre-intervention period, 18 months) and follow-up while participating in PANAG (post-intervention period, 18 months). During the Program, patients received preventive treatment free of charge; educational activities were also organized.

Results. Twenty children were included, 16 (80%) out of the 20 were females, and the mean age was 13.3 years (SD 3.8). During the pre-intervention period 59 asthma attacks were recorded; after PANAG was implemented, they decreased to 26. This accounts for a significant reduction of 55% of asthma attacks ($p=0.0002$). During the period previous to PANAG implementation, there were 4 asthma-related hospital admissions. In the period after the program implementation, there was only one hospital admission.

Conclusions. The Healthcare Program for Patients with Severe Asthma is an effective strategy to manage this disease. This healthcare program is affordable to be used in a public hospital.

Key words: severe asthma, healthcare program, asthma attacks, exacerbation, hospital admissions.

<http://dx.doi.org/10.5546/aap.2012.382>

INTRODUCTION

Asthma is the most common chronic disease in childhood.¹ It has a high impact on public health systems and results in a high number of emergency room visits and hospital admissions.²

The most important objective in the treatment of asthma is to achieve

total control of symptoms. Different national and international consensus and guidelines state that persistent asthma should be treated with long-acting preventive medications, generally related to the use of inhaled corticosteroids (IC).²⁻⁴ These drugs decrease the frequency of asthma attacks and improve lung function.⁵ However, the rate of patients who use IC on a regular basis is low. It is estimated that 41% of asthma patients in Europe, 35% in USA, 14% in Asia, and 5% in Brazil use this medication.^{6,7}

Patients diagnosed with severe asthma, accounting for 5-7% of the total number of children with asthma, are a small but very vulnerable group.⁸ Non-compliance with prescribed medications leads to frequent and severe exacerbations with a high risk of hospital and intensive care admissions. These patients use ER services 15 times more and are admitted to hospitals 20 times more than children with mild or moderate asthma.⁸ The higher the rate of hospital admissions due to asthma, the higher the likelihood of having subsequent attacks. It has been suggested that there is 30% likelihood of recurrence after the first hospitalization, 46% after the second one and 59% after the third one.⁹

The implementation of interdisciplinary team care strategies for the follow-up of asthma patients has proven to be very effective at improving long-term asthma control in these children. Inadequate or insufficient drug treatment, poor monitoring during the treatment period, low social and economic level, and age under 5 years are factors that increase the risk of hospital admission of asthma patients that are not part of a supervised follow-up strategy.¹⁰

a. Department of Neumonology.

b. Department of Mental Health.

Hospital Nacional de Pediatría "Prof. Dr. Juan P. Garrahan".
Buenos Aires, Argentina.

E-mail:

Verónica Giubergia, MD:
verogiubergia@hotmail.com

Conflict of interest:
None.

Received: 2-3-2012
Accepted: 5-16-2012

It has been shown that this type of interventions has a direct impact on the frequency of asthma attacks and hospital admissions. A reduction of up to 42% has been observed in the frequency of hospital admissions due to asthma attacks in patients monitored under a special healthcare program.¹¹

The Healthcare Program for Children with Severe Asthma (PANAG, according to its acronym in Spanish Programa de Atención de Niños con Asma Grave) was implemented in the Department of Neumonology of Hospital Garrahan from 2008 with the objective of improving the quality of life of children and reducing asthma exacerbations and hospital admissions. Some of PANAG strategies included the free distribution of medications and the implementation of educational sessions in charge of an interdisciplinary team of professionals.

In this study, the Healthcare Program in Children with Severe Asthma was comparatively assessed to determine its impact on the frequency of asthma attacks and hospital admissions.

MATERIAL AND METHODS

This was a longitudinal (pre- and post-intervention) study. The study hypothesis was based on the fact that a special healthcare program for patients with severe asthma could modify the frequency of exacerbations and hospital admissions due to asthma attacks.

The objective of this study was to compare the frequency of exacerbations and hospital admissions in a group of 20 patients diagnosed with severe asthma who were assigned to two different follow-up strategies in the same hospital: regular follow-up in a public hospital in the city of Buenos Aires (pre-intervention period, retrospective phase) and follow-up based in the PANAG approach (post-intervention period, prospective phase). The study lasted 3 years: pre-intervention period (January 1st., 2007 to July 31st., 2008) and post-intervention period (August 1st., 2008 to December 31st., 2009).

The study included both male and female children with a diagnosis of severe asthma as per the Global Initiative for Asthma (GINA) (These were daily symptoms, frequent exacerbations, usual nocturnal symptoms, limitation of physical activity, forced expiratory volume in the 1st. second $\leq 60\%$ than predicted at the time of diagnosis, and need to use high doses of inhaled corticosteroids [≥ 800 μg of budesonide or a similar drug] to adequately manage the disease).¹²

Patients were followed up at the Department of Neumonology for at least 6 months. Children who were able to perform spirometry, were in follow-up during the 18 months prior to the beginning of the program, and continued the follow-up for the next 18 months, were retrospectively included. Patients with obstructive disorders (i.e., obliterative bronchiolitis, bronchopulmonary dysplasia, cystic fibrosis) and children who discontinued their follow-up in the prospective phase of the study were excluded.

During the pre-intervention period, patients were regularly followed up, once a month or every two months, in an office where the clinical course, frequency and type of exacerbations, and asthma-related hospital admissions were carefully recorded on a specially designed case record form. All the patients had been prescribed IC and long-acting bronchodilators (fluticasone 750/ salmeterol 75 $\mu\text{g}/\text{day}$, DS 250 $\mu\text{g}/\text{day}$). Patients could attend to an ER in case of clinical deterioration. The cost of medications and the metered dose inhaler (MDI) had to be covered by the family.

During the implementation of the program (post-intervention period), patients received free of charge preventive medications at the same dose they previously received (IC and long-acting bronchodilators) and MDIs. Visits took place every month or every two months based on the patient's evolution and they were monitored by a neumonologist and a psychologist. Failure to assist to scheduled visits led to a phone call to the family. Patients could attend the Department of Neumonology from 8 AM to 4 PM, and the ER of the Hospital from 4 PM to 8 AM.

All follow-up visits, exacerbations that required oral corticosteroids for at least 3 days (whether patients attended ER or not), and asthma-related hospital admissions during the retrospective and prospective phases of the study were recorded on the patient's case record forms.

Educational activities were targeted at patients and parents, based on the four recommendations from the U.S. National Institutes of Health (NIH): basic information about the pathophysiology of the disease, correct use of the medication, adequate technique and monitoring of symptoms, and management of symptom-triggering factors.²

Four workshops were held. Parents and patients attended them and developed separate activities. Medical information was provided, as well as psychological approach based on requirements identified on previous anonymous

surveys designed as part of the study protocol. The information focused on fostering children's commitment with their care, creating a space to communicate their fears, fantasies and doubts. The achievement of their children's autonomy with respect to the compliance and commitment with the treatment was promoted among parents who attended the workshop. Adequate information about the disease and treatment was also provided.

Integration games, group discussions, role-playing, poster design, drawings and collages were organized and planned accordingly. The focus was on difficulties related to treatment adherence, forgetfulness to take or dropping medication, underestimation of the severity of the disease, rebelliousness, anger and tiredness as a result of the disease, misinterpretation of medical indications, fear of discrimination, asthma attacks and death. Aspects related to physical activity were also reinforced.

Drugs were provided to patients by the hospital pharmacy.

STATISTICS

The statistical analysis was performed with the software Stata 9.0 (Stata-Corp, College Station, TX). Value distribution within each outcome was described by means of measures of central tendency and scattered plots or categorically, as appropriate.

Categorical outcomes were reported as proportions and compared using the chi-square (χ^2) test. Continuous outcomes were compared with Student's t test for paired data or with Wilcoxon signed-rank test. P values lower than 0.05 were statistically significant.

RESULTS

Twenty children diagnosed with severe asthma were included in this study. Sixteen (80%) out of 20 were females, and their mean age was 13.3 years (SD 3.8). The mean age at the onset of symptoms was 1.5 years (SD 1).

Eight (40%) of these children had been admitted to the intensive care unit because of a severe asthma attack. Five (62%) of them required mechanical ventilation (average 5 days, SD 2) and two underwent a tracheostomy.

At the beginning of the study, patients had adequately controlled severe asthma since they had been treated for at least 6 months. The lung function was within near to normal parameters. Children had mild obstructive ventilatory disorder,

evidenced only by a mild reduction of the forced expiratory volume in the 1st second (FEV1) and forced vital capacity ratio, with FEV1 and mean and maximal forced expiratory flow values within normal parameters. *Table 1* shows the general characteristics of this population.

A reduction in the number of asthma attacks and asthma-related hospital admissions was observed. During the pre-intervention period, 90% of children (n= 18) had 59 attacks. During the PANAG implementation period, 90% of children (n= 18) had 26 asthma exacerbations (p= 0.0002) (*Table 2*). There were no patients with a higher number of attacks during the follow-up period under the program.

In 77% of cases (n= 14), a decrease in the frequency of asthma attacks was observed, and 22% (n= 4) had an identical number of exacerbations (*Figure 1*).

Regarding asthma-related hospital admissions, 20% of the population (n= 4) required to be hospitalized because of an asthma attack during the period previous to PANAG. In the period post PANAG implementation, only one patient required hospitalization (p= 0.02) (*Table 2*). There were no patients who required mechanical ventilation or to be admitted to the intensive care unit during the study period.

TABLE 1. Clinical and functional characteristics of the patients (n= 20)

Outcome variables	
Current age (years)*	13.3 (3.8)
Female (% , n)	80 (16)
Onset of symptoms (years)*	1.5 (1)
Age at which the first attack occurred (years)*	1.0 (0.5)
IgE levels at the start of the study (IU)*	1100 (588)
Eosinophilia at the start of the study*	1351 (221.9)
Baseline lung function# (%)*	
FVC	104.7 (18.3)
FEV1	93.1 (13.4)
FEV1 / FVC	78.7 (9.6)
MMFEF	74.4 (23)

* Mean and SD.

ATS Statement Snowbird workshop on standardization of spirometry. *Am Rev Dis* 1938;127:725-735.

FVC: forced vital capacity.

FEV1: forced expiratory volume in the first second.

FEV1 / FVC: forced expiratory volume in the 1st second and forced vital capacity ratio.

MMFEF: mean and maximal forced expiratory flow.

DISCUSSION

Healthcare programs for patients with severe asthma based on the free administration of medications and the promotion of education are beneficial for the evolution of asthma, with a reduction of symptoms. Similar results were observed in this study. The findings were as expected given the proven efficacy of asthma treatment with IC; it has been now possible to quantify the benefits of a healthcare program in a group of children diagnosed with severe asthma assisted at a public hospital.

Even though it is estimated that only 20% of asthma children progress into a more severe asthma condition, this low percentage of patients has a remarkable impact on all healthcare systems due to the high rate of symptoms they have. Approximately 80% of the resources allocated to asthma treatment are for the management of these

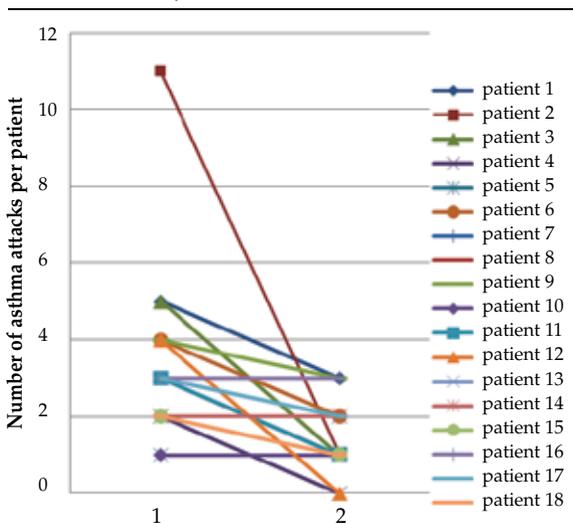
group of patients.¹³ Children with severe asthma have frequent exacerbations and asthma attacks, severe enough to lead to hospitalizations.^{9,14,15} Previous observations have revealed that these attacks would be directly related to the high degree of airway inflammation present in these subjects.¹⁶

The decrease in the frequency of asthma attacks and hospital admissions is the main objective of asthma management programs. Previous experiences in other countries of the region, i.e. Brazil, under-score that the cause of the decrease in the number of hospital admissions is explained by the accessibility to treatment access that these programs offer.^{17,18} Limited access to medication and the irregular follow-up have been related to the unfavorable course of the disease in asthma patients.¹⁰ In this study, it is quite likely that the high rate of exacerbations was related, among other reasons, to the difficult access to medication because of its high cost.

Likewise, these strategies oriented to reinforcing the correct use of the preventive medication and the different devices reduce asthma-related deaths.¹⁹ In this study, during the post-intervention period, compliance, technique and access to medication were thoroughly supervised in each visit. A decrease in the frequency of asthma attacks and hospital admissions was observed, which confirms previously published observations.²⁰

As far as the impact of educational programs on the course of asthma, studies that compared groups with and without intervention showed a decrease in the average of asthma attacks and hospital admissions in those who participated in educational programs. Non-compliance with the treatment and the consequent deceit to the physician concerning the use of medication is frequent even in patients with severe asthma, especially if they are adolescents.²¹ Continuous education is highly important to promote treatment adherence. Adequately informed parents become highly valuable health agents, making it possible

FIGURE 1. Number of asthma attacks per patient. Pre- post-PANAG (n= 18) period



1: Pre-intervention period.
2: Post-intervention period (PANAG).

TABLE 2. Asthma attacks and hospital admissions due to asthma, pre- and post-implementation of PANAG (n= 18)

Outcome variable	Pre-intervention period	Post-intervention period (PANAG)	p value*
Asthma attacks*	n= 59 3.2 (0.07-12.5)	n= 26 1.4 (0.01-5.4)	0.0002
Asthma-related hospital admissions*	n= 4 0.4 (0.02-0.8)	n= 1 0.1 (0.04-0.2)	0.02

PANAG: Healthcare Program for Children with Severe Asthma.
*Mean (95% confidence interval).
The Wilcoxon signed-rank test was used for variable analysis.

for children to adhere to the proposed treatment regimen continuously over time. When dealing with adolescents, information should first be targeted to patients so that they take responsibility for their own health.²¹ It has also been suggested that the stronger the interaction with patients, the better the results that will be obtained. Parents and children are more careful to closely monitor symptoms and implement an early treatment. These approaches can avoid visits to the ER, and possibly, hospitalizations.¹¹

It has been shown that educational activities which include the four items proposed by the NIH are highly effective.²¹ Frequent individual sessions are more effective than isolated group sessions because the information provided is customized and planned taking into account each patient's needs.^{11,22}

Both approaches were used in this study. Based on individual surveys, the information required by each patient was designed and then implemented during the patient's office visits. Concepts were reinforced with workshops every six months, where parents and patients had an active participation.

Cost reduction was not one of the objectives of the study, but due to the significant decrease in the frequency of asthma attacks and hospital admissions observed post PANAG implementation, it is estimated that the amount spent in the program, including medication distribution and the physician-hours used, was less than the expenses incurred by the patients during the pre-intervention period, as previously published.^{18,23}

Some methodological observations should be made. Since the program included the administration of medication free of charge, because of ethical considerations it was not possible to do a prospective, randomized study with a control group that would not be supported by the program. At the onset of the study, patients enrolled were adequately controlled because they had been receiving treatment for at least 6 months. The enrolment of patients with uncontrolled asthma would have biased results favoring the prospective phase.

These findings show that organized care of patients with chronic diseases, as severe asthma, is a proven and highly effective strategy for the management of these disorders. It is a model of care that can be easily put into practice in a public hospital and that requires few human and economic resources for its implementation. This strategy, which included the participation of a psycholo-

gist and neumonologists and the collaboration of other professionals as needed, together with the active participation of the hospital as the medication supplier, has significantly decreased the frequency of asthma exacerbations and asthma-related hospital admissions.

As a result of these favorable findings, this approach has been implemented in a public hospital as a special healthcare program.

Acknowledgements

To Adriana González, Bachelor of Kinesiology, and to Liliana del Valle Rodríguez, Bachelor of Science in Nursing, for their valuable participation in the different activities developed in the Healthcare Program for Children with Severe Asthma (PANAG). ■

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