



The Program for the Prevention of Childhood Asthma: a specialized care program for children with wheezing or asthma in Brazil

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ABSTRACT

Objective: To present the *Programa Infantil de Prevenção de Asma* (PIPA, Program for the Prevention of Childhood Asthma) and the characteristics of the patients followed in this program. **Methods:** Implemented in the city of Uruguaiiana, Brazil, PIPA has as its target population children and adolescents (< 18 years of age) with asthma or suspected asthma. Patients either enroll in PIPA spontaneously or are referred by pediatricians or primary care physicians. In this retrospective study, we use a standardized protocol to assess PIPA patients. **Results:** By the end of the study period, 646 patients were being followed. Of those, 298 (46.1%) were ≤ 3 years of age. In this group of patients, recurrent wheezing was identified in 60.7%, and the first episode of wheezing occurred in the first six months of life in 86.0%. Severe wheezing was identified in 29.5% and 45.4% in the children ≤ 3 and > 3 years of age, respectively. Physician-diagnosed asthma was reported in 26.5% and 82.2%, respectively. In the sample as a whole, the prevalence of passive smoking was high (> 36%), occurring during pregnancy in > 15%; > 40% of the patients had been born by cesarean section; and 30% had a mother who had had < 8 years of schooling. **Conclusions:** A prevention program for children with asthma is an effective strategy for controlling the disease. Knowledge of local epidemiological and environmental characteristics is essential to reducing the prevalence of the severe forms of asthma, to improving the use of health resources, and to preventing pulmonary changes that could lead to COPD in adulthood.

Keywords: Asthma/prevention and control; Asthma/epidemiology; Patient care.

INTRODUCTION

Asthma is a public health problem worldwide and is one of the most common chronic diseases in childhood. It is highly prevalent, impairs the quality of life of patients and their families, and incurs high costs to the health care system and society.⁽¹⁾

The current level of asthma control in Latin American countries falls far short of the goals set forth by current international guidelines.⁽²⁾ Asthma is one of the twenty most common reasons for primary care visits in Brazil, being the third leading cause of hospitalization within the Brazilian Unified Health Care System.^(3,4)

The mean prevalence of asthma among children and adolescents in Brazil is estimated to be 20%.⁽⁵⁾ In the state of Rio Grande do Sul, Brazil, respiratory diseases are the leading cause of hospitalization in those aged under 19 years, and asthma ranks second among these diseases.⁽⁴⁾

There is as yet no curative treatment for asthma; the primary goal of treatment is disease control. However, despite advances in asthma treatment and in the implementation of guidelines for asthma management, the disease remains poorly controlled.⁽⁶⁾

Possible explanations for this failure include lack of patient access to health care, lack of diagnosis of asthma, inappropriate treatment, and not taking the prescribed medication properly, whether because of lack of understanding or lack of adherence, despite instruction.⁽⁷⁾

Adherence to treatment is one of the most important factors in ensuring treatment success. Many factors, such as knowledge of the disease, cultural standards, socioeconomic factors, lack of perception of asthma symptoms, adverse events, and ability to use inhalers, can influence adherence to treatment and asthma control.⁽⁸⁾

Poor adherence is a serious problem among patients with chronic respiratory disease in developing countries, a problem that is often due to limited access to health care; therefore, in addition to prescription and provision of pharmacological treatment that is appropriate to the level of disease severity, education on self-management is an aspect that must be addressed.⁽⁸⁾

Asthma education for patients so that they know all they need about their disease is not only a right but also an effective strategy of asthma control in the short, medium and long term.⁽⁹⁾ Thus, the need to tailor knowledge of asthma education to clinical practice and make it accessible at a public outpatient clinic specializing in

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asthma motivated the development of the *Programa Infantil de Prevenção de Asma* (PIPA, Program for the Prevention of Childhood Asthma) in the city of Uruguaiiana, Brazil, in order to decrease the morbidity and mortality of childhood asthma in that city.

The objective of the present study was to present PIPA and the characteristics of the patients followed in this program.

METHODS

This was a retrospective study of children (< 18 years of age) with asthma or suspected asthma who enrolled in PIPA spontaneously or were referred by pediatricians or primary care physicians. PIPA was established in April of 2012 in the city of Uruguaiiana, which has a population of approximately 120,000 inhabitants, in southern Brazil.

After being admitted to PIPA, patients underwent the following treatment protocol: a) a medical visit; b) ancillary tests; c) clinical diagnosis; d) functional diagnosis; e) treatment planning; f) follow-up and monitoring of asthma control; and g) a nursing visit and nursing instruction.

At the medical visit, the parents or legal guardians of the patients completed standardized questionnaires, the use of which depended on patient age and the characteristics of the cross-cultural validation of the questionnaire for use in Brazil. For the youngest patients (those aged up to 3 years, 11 months, and 29 days), we used the International Study of Wheezing in Infants (EISL) written questionnaire,⁽¹⁰⁾ whereas for those aged over 4 years, we used the International Study of Asthma and Allergy in Childhood (ISAAC) questionnaire⁽¹¹⁾ together with the ISAAC phase II questionnaire on risk factors,^(11,12) in addition to the Children's Sleep Habits Questionnaire,⁽¹³⁾ which began to be used in January of 2014, for those aged between 2 and 12 years. Following the initial interview, patients underwent a detailed physical examination, including assessment of nutritional status (weight and height), physical examination of the upper airways, cardiopulmonary auscultation, etc.

Ancillary tests included blood workup; quantitative determination of total serum IgE (ImmunoCAP® RAST; Thermo Fisher Scientific Inc., Waltham, MA, USA); determination of 25-hydroxyvitamin D by chemiluminescent microparticle immunoassay; skin prick tests to airborne allergens (*Dermatophagoides pteronyssinus*, *D. farinae*, *Blomia tropicalis*, cockroach mix, *Alternaria sp.*, dog dander, and cat dander),⁽¹⁴⁾ and parasitological examination (direct method).⁽¹⁵⁾

Depending on age and clinical history, patients underwent imaging assessment, which included a chest and/or sinus X-ray.

In this phase, the clinical diagnosis of asthma was made in accordance with the Global Initiative for Asthma (GINA) criteria.⁽¹⁾ For the children aged under 2 years who were referred with suspected asthma, we

employed the Asthma Predictive Index (API),⁽¹⁶⁾ and for those aged over 2 years, we employed the modified API, which includes sensitization to airborne allergens as a prognostic factor of disease progression.⁽¹⁷⁾

The diagnosis of allergic rhinitis was made in accordance with the criteria established by the Third Brazilian Consensus on Rhinitis⁽¹⁸⁾ and by the Allergic Rhinitis and its Impact on Asthma initiative.⁽¹⁹⁾

The children aged over 6 years who were able to perform the expiratory maneuvers required for functional assessment underwent objective measurements of pulmonary function, whether by spirometry or by determination of maximum peak expiratory flow, with the use of a Spirolab III® spirometer (Medical International Research, Rome, Italy). American Thoracic Society acceptability criteria—values from at least the three best maneuvers were selected—and reproducibility criteria were used.⁽²⁰⁾ Following the initial spirometric assessment, patients underwent bronchodilator testing with albuterol aerosol (400 µg) administered with a valve spacer, and the spirometric parameters were measured again 15 minutes later.⁽²¹⁾

Maximum peak expiratory flow was determined with a Mini-Wright® Peak Flow Meter (Clement Clarke International, Essex, UK), especially in patient follow-up and monitoring of the response to the treatment regimen.⁽²¹⁾

After completion of the clinical and functional assessment and before establishment of a treatment plan, patients were classified with respect to level of asthma control, as well as to the presence of acute exacerbation, as recommended by GINA.⁽¹⁾

On that basis, patients received a written treatment plan for maintenance control and possible exacerbations, as recommended by GINA⁽¹⁾ and by the Brazilian Thoracic Association Guidelines for Asthma Management.⁽³⁾ The medications available through PIPA are as follows: albuterol (metered dose inhaler; 100 µg/puff); and beclomethasone (metered dose inhaler; 250 µg/puff); both of which are distributed free of charge at all "aqui tem farmácia popular" facilities of the Brazilian Popular Pharmacy program.⁽²²⁾

For patients with moderate or severe asthma, montelukast (tablets of 5 and 10 mg) and the combination of albuterol (25 µg/puff) and fluticasone dipropionate (125 µg or 250 µg/puff) metered dose inhaler or dry powder inhaler (Diskus® 50 µg/250 µg) are available free of charge through the Uruguaiiana City Hall.

After being admitted to PIPA, patients were followed and reassessed over 1-3 months, as determined by asthma severity and control.⁽¹⁾

In addition to medical follow-up, patients were followed by nurses who are specialists in asthma care and who are part of the team of professionals involved in PIPA, as recommended by other groups and by international consensus guidelines.^(23,24) The responsibilities of these nurses included the following: a) administer quality-of-life questionnaires at the first

nursing visit and 6 months later to assess patient's response to treatment⁽²⁵⁾; b) emphasize, to family members, the importance of identifying symptoms of uncontrolled disease early; c) always review the (written) action plan⁽²⁶⁾ with the following aims—1) recognition of asthma-related symptoms; 2) treatment adjustment based on the medical prescription; and 3) identification of when and where to seek medical attention, for patients with poor disease control with the initial treatment⁽²⁵⁾—d) check proper use of inhaled medication at all visits; e) encourage adherence to maintenance treatment and provide instruction regarding the difference between treatment of asthma attacks and maintenance treatment; f) address aspects of environmental control, habits such as smoking, and other triggers; and g) encourage regular visits (every 3 months) even if the patient is asymptomatic.⁽¹⁾

The study was approved by the Research Ethics Committee of the Uruguiana Municipal Department of Health, Brazil.

RESULTS

Since the creation of PIPA, 646 patients have been enrolled, all of whom were being followed at this writing. Of those, 46.1% were aged 3 years or younger (Table 1). Most of the patients aged up to 3 years (> 80%)

had a history of recurrent wheezing (three or more episodes), which had started early, before 6 months of age. Episodes of severe wheezing were identified in nearly 30% of these patients, more than half of whom had been hospitalized for wheezing. Of all patients aged up to 3 years, 26.5% had physician-diagnosed asthma, 53.0% had been born by cesarean section, and only 29.0% had been exclusively breastfed for at least 6 months (Table 1). Passive exposure to tobacco smoke was reported by 39.5% of the parents/legal guardians of these patients, with exposure occurring during pregnancy in 15.4% of the cases and the smoker being the mother in 18.7% (Table 1). Attending day care was identified in 38.2% of the cases, presence of household mold was identified in 44.6%, and presence of pets in the household was identified in 73.0% (mainly dogs). A maternal education level of less than 8 years was identified in 35.6% of the cases (Table 1).

Among the older patients (those aged over 3 years), it is of note that wheezing in the previous year was reported in 88.7% of the cases, wheezing was severe in 45.4%, and hospitalization for wheezing was required in 8.0% (Table 1). Physician-diagnosed asthma was identified in 82.2% of the cases, and, in most of them, asthma had been classified as uncontrolled. In addition, concomitant rhinoconjunctivitis was reported in 74.4% of

Table 1. Patients followed in the *Programa Infantil de Prevenção à Asma* (PIPA, Program for the Prevention of Childhood Asthma) since its establishment, by clinical characteristics and age group – Uruguiana, Brazil, 2014.^a

Characteristic	Follow-up patients	
	≤ 3 years (N = 298)	> 3 years (N = 348)
Wheezing ever	298 (100.0)	336 (96.5)
Wheezing in the first year of life	256 (86.0)	-
Recurrent wheezing in the first year of life ^b	181 (60.7)	-
Wheezing in the previous 12 months	-	308 (88.7)
First episode before 6 months of age	247 (82.8)	-
More than 4 attacks of wheezing in the previous year	-	155 (44.5)
Wakes up at night because of wheezing	-	200 (57.5)
Severe wheezing	88 (29.5)	158 (45.4)
Hospitalization for wheezing/asthma	50 (16.7)	28 (8.0)
Physician-diagnosed asthma	79 (26.5)	286 (82.2)
Rhinoconjunctivitis	-	259 (74.4)
Pneumonia	58 (28.5)	-
Hospitalization for pneumonia	42 (14.0)	90 (25.8)
Exclusive breastfeeding until 6 months of age	86 (29.0)	218 (62.6)
At least one smoker in the household	117 (39.5)	127 (36.4)
Maternal smoking	56 (18.7)	50 (14.6)
Maternal smoking during pregnancy	46 (15.4)	61 (17.5)
Birth by cesarean section	158 (53.0)	141 (40.5)
Attended day care in the first year of life	114 (38.2)	206 (59.1)
Exposure to household mold	133 (44.6)	168 (48.2)
Exposure to pets	217 (73.0)	275 (79.0)
Dogs	190 (64.0)	163 (47.0)
Cats	71 (23.8)	21 (6.0)
Maternal education level of less than 8 years	106 (35.6)	168 (48.4)

^aValues expressed as n (%). ^bMore than three episodes.

the cases. Exclusive breastfeeding for at least 6 months was reported in 62.6% of the cases; however, passive exposure to tobacco smoke and maternal smoking during pregnancy were reported in 36.4% and 17.5% of the cases, respectively (Table 1). Nearly 60.0% of the patients attended day care in the first year of life, and presence of pets in the household was reported in 79.0% of the cases (most often dogs). A maternal education level of less than 8 years was reported by 48.4% of the respondents (Table 1).

DISCUSSION

The high prevalence rates of asthma in children (9 to 11 years of age) and recurrent wheezing in infants (12 to 15 months of age) identified in Uruguiana by the ISAAC⁽¹²⁾ and by the International Study of Wheezing in Infants⁽²⁷⁾ prompted the local managers to establish PIPA.

As can be seen in Table 1, most of the children aged up to 3 years followed in the program experienced symptom onset in the first year of life, and the first episode of wheezing occurred before 6 months of age, as reported by other researchers.⁽²⁸⁾ In addition, a significant number of children in the two groups studied had severe wheezing.

Recent studies have increasingly shown that COPD has its origins in severe childhood asthma; therefore, identifying these children and the risk factors leading to more severe asthma is of the utmost importance for public health.⁽²⁹⁾

Pre- and postnatal exposure to cigarette smoke has been identified as one of the most important risk factors for the development of wheezing in infants and asthma in older children.⁽³⁰⁾ Among the patients enrolled in PIPA, the prevalence of passive smoking was significant, since, in approximately 40% of the cases, there was at least one smoker in the household, and, in approximately 15%, the smoker was the mother. To this we must add prenatal exposure to tobacco smoke, which was identified in more than 15% of the cases. Knowledge of these factors and of their magnitude is very important, because exposure so early in life can cause epigenetic changes in lung development that may extend to future generations.⁽³¹⁾ A recent study also pointed out that exposure to tobacco smoke during pregnancy increases the risk of asthma and wheezing in adolescence, and that pulmonary function changes in these children would be related to potential epigenetic effects of tobacco smoke rather than to immune function changes or atopy.⁽³²⁾

Another finding worthy of note in this population was the large number of children who had been born by cesarean section, which is identified as a risk factor for developing asthma later in life, especially if associated with a family history of asthma.⁽³³⁾

Maternal education level, especially in populations in developing countries, has been associated with the development of asthma. A significant proportion of the patients evaluated here had a mother who had

had less than 8 years of schooling. Previous studies conducted in Brazil have related a low level of education to an increased risk of asthma or wheezing in children aged under 5 years.⁽³⁴⁾ This is possibly due to poor understanding of the disease by mothers, unawareness of the possibility of obtaining free controller medications, poor adherence to the asthma action plan, and, in particular, the lack of a bond between mothers and a specific facility where they can feel supported and welcomed if their children experience an acute asthma exacerbation.

For greater success in establishing an asthma program, the following should be taken into consideration: a) get to know the local situation, through a local or regional epidemiological survey, so as to properly adjust the health policies needed for optimal care of the target population; b) build the foundations of the program upon the major consensus guidelines on the different aspects to be addressed in an asthma program^(1,3,24,28,35); c) get different categories of professionals, such as primary care physicians, nurses, physical therapists, social workers, physical education teachers, and community health agents, involved in the program,⁽³⁶⁾ thus preventing the program from being focused on a single person⁽⁹⁾; d) pharmaceutical care should be seen as a set of tasks performed by the pharmacist and other health professionals, in which medications are the essential material and which involve selecting, scheduling, purchasing, distributing, and dispensing medications, as well as ensuring the quality of the products and services and the follow-up and assessment of their use, with a view to achieving concrete results and improving the quality of life of the population⁽³⁷⁾—understanding this concept is of paramount importance, since, often times, medications are distributed regardless of the fulfillment of the necessary criteria for the rational and safe use of these products⁽³⁸⁾; e) get the population involved through the use of advisory boards, associations, and the media; f) get managers^(9,36) involved and keep them permanently informed about the results of the program; and g) make the asthma program known through the media, television, or new communication tools (such as the Internet), which offer innovations in physician-patient communication and in knowledge and recommendations about the disease.⁽³⁸⁾ PIPA has a page on Facebook through which it has achieved greater communication and integration with patients and their families, as well as allowing the general public to get acquainted with the activities of the program.

In conclusion, considering that Brazil is a country with many “types of asthma”,⁽³⁹⁾ the establishment of regional asthma programs, based on epidemiological and environmental differences, would facilitate the implementation of appropriately targeted prevention, early diagnosis, and treatment measures, so as to allow proper allocation of financial resources, as occurs in other successful programs in Brazil for adults.⁽⁴⁰⁾

Therefore, there would be appropriate disease follow-up from symptom onset and a consequent reduction in the number of emergency room visits and hospitalizations,

especially in patients with undiagnosed, undertreated, or poorly controlled asthma, thus preventing pulmonary changes that could lead to COPD in adulthood.

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