

Assessment of asthma treatment adherence in children: the influence of specialized care

Avaliação da adesão ao tratamento da asma em crianças: a influência do atendimento especializado

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ABSTRACT

Background: Asthma is the most common chronic disease in childhood. Disease control is challenging but critical to prevent severe exacerbations and long-term damage. Studies in adults have shown that poor adherence to medication and environmental control practices has an impact on disease control. **Objective:** To determine pediatric asthma treatment adherence and associate it with disease control and other clinical variables. **Methods:** This was a cross-sectional observational study of 104 patients with asthma followed up at the Pediatric Allergy, Immunology and Pulmonology Service of the Hospital de Clínicas Complex of the Federal University of Paraná, south of Brazil. Participants were interviewed using questionnaires about medication adherence, environmental control, and popular myths about asthma. **Results:** There was a positive correlation between patients who believed in 1 or more myths about asthma and poorer medication adherence ($p=0.025$). There was also a significant association between good medication adherence and total asthma control ($p=0.038$) measured by the 25-point Asthma Control Test. Good and excellent adherence to environmental control practices was reported by 51% of respondents. **Conclusion:** Medication adherence and environmental control were satisfactory in the population of asthmatic children from a specialized outpatient clinic. Popular beliefs influenced adherence and asthma control in these patients. The findings highlight the importance of assertive communication between physicians and patients, as well as of pediatric asthma education programs.

Keywords: Asthma, child, drug therapy, treatment adherence and compliance.

RESUMO

Introdução: A asma é a doença crônica mais prevalente na infância. O controle da doença é desafiador, porém fundamental para evitar exacerbações graves e danos em longo prazo. Estudos em adultos já mostraram que a baixa adesão medicamentosa, bem como aos cuidados do ambiente, impactam no controle da doença. **Objetivo:** Conhecer a adesão ao tratamento da asma na população pediátrica e associá-lo ao controle da doença e outras variáveis clínicas. **Métodos:** Trata-se de um estudo observacional transversal onde foram incluídos 104 pacientes com asma, acompanhados no Serviço de Alergia, Imunologia e Pneumologia Pediátrica do Complexo Hospital de Clínicas da Universidade Federal do Paraná. Foram realizadas entrevistas com base em questionários sobre adesão ao uso de medicação, controle ambiental e crenças populares sobre a asma. **Resultados:** Foi possível identificar uma correlação positiva entre pacientes que acreditavam em um ou mais mitos sobre a asma e pior adesão ao uso da medicação ($p = 0,025$). Também foi possível identificar uma relação significativa, entre uma boa adesão à medicação e o controle total da asma ($p = 0,038$) medido pelo *Asthma Control Test* (ACT) de 25 pontos. Cinquenta e um por cento dos participantes entrevistados relatou boa e ótima adesão ao controle de ambiente. **Conclusão:** A adesão e o controle de ambiente avaliados foram satisfatórios na população de crianças asmáticas de um ambulatório de referência. As crenças populares mostraram influência na adesão e no controle da asma dos pacientes entrevistados. Os achados reforçam a importância da comunicação assertiva entre médico e paciente, bem como do papel da educação da asma também voltada para a população pediátrica.

Descritores: Asma, criança, tratamento farmacológico, adesão à medicação.

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Introduction

Asthma is a heterogeneous, multifactorial, and highly prevalent disease. It is characterized as chronic inflammation of the airways and presents with recurrent respiratory symptoms such as wheezing, cough, chest tightness, and shortness of breath.¹ As in other chronic diseases, adequate treatment requires following pharmacological and non-pharmacological recommendations in the long term, which requires discipline by the patient and a good relationship with the medical team.^{1,2}

The increased prevalence of chronic non-communicable diseases around the world draws attention to a relevant problem, namely poor adherence to drug treatment.³ In the pediatric population there are special situations that influence treatment adherence, such as the fact that children, especially preschoolers and schoolchildren, depend on an adult to take care of them, who is not always able to adequately follow medical recommendations.⁴

Misinformation, popular myths, and beliefs can directly contribute to the number of exacerbations, low adherence to the proposed treatment, and the consequent increase in the number of patients who seek medical services and use health care.⁵ Another major factor is environmental control, defined as the set of measures to reduce the number of allergens and other substances that are harmful to the airways. Environmental control is one aspect of the non-pharmacological treatment of asthma, and neglecting this practice can lead to a lack of control and exacerbations of the disease.⁶

In recent years, instruments have been created to facilitate the assessment of treatment adherence for chronic diseases. The MARS (Medicine Adherence Rate Scale) is a questionnaire with significant reliability and reproducibility, validated for use in non-specific chronic diseases and translated into Portuguese.^{7,8}

The questionnaire comes in two versions, with 10 questions (original version) and with 5 questions, MARS-5, with proven efficiency in determining the degree of adherence.^{7,8}

A set of measures that include adequate environmental control, adherence to the prescribed treatment, and the correct use of the inhaler device is expected to optimize asthma control in the pediatric population as well. Therefore, the scarcity of studies quantifying these aspects in the pediatric population was the motivation for developing the present study.

Method

Participants

This is an observational, cross-sectional study. Participants included patients who attended the Pediatric Allergy, Immunology, and Pulmonology Outpatient Clinic of the Complex of the Hospital de Clínicas Universidade Federal do Paraná (CHC).

The inclusion criteria were children diagnosed with asthma, aged between 2 and 14 years, who used continuous medication, were under regular monitoring for at least 6 months, where both the caregivers and the children themselves agreed to participate. The participants whose caregivers reported not knowing about the treatment used, or data on the environmental conditions of the home, were excluded.

Procedures

Patients were approached by the research team at the outpatient clinic, after their scheduled medical appointment. In the outpatient clinic itself, the researchers explained and collected the signature of the caregivers on the Informed Consent Form (ICF) and of the adolescents on the Informed Agreement Form (IAF). The questionnaires were applied to the caregivers when it came to schoolchildren and, in the case of adolescents to the patients themselves, with complementation of the caregivers' answers, if necessary. In this case, if there were divergent answers, they were excluded from the analysis.

During the outpatient clinic visits, we also tested the technique of inhaled medication in practice, classifying it as correct, partially correct (only one error), or incorrect (more than one error).

The study was approved by the Research Ethics Committee of the Hospital de Clínicas da Universidade Federal do Paraná, under approval number 29628220.4.0000.0096.

Instruments

The interviews consisted of the administration of 3 questionnaires: The first about "Environmental control recommendations to be followed in asthma treatment" (Appendix 1),⁶ with 15 questions on a Likert scale, with answers "I always do it, I do it sometimes and I never do it"; then, about "Myths and truths about asthma" (Appendix 2),⁴ with 6 questions containing simple "yes and no" answers; and, finally, the MARS-5 questionnaire (Medication Adherence Rating Scale

- Appendix 3)⁷ that includes 5 questions on a Likert scale, with the answers: “Never, rarely, sometimes, often or always.”

The MARS-5 scale, a shorter form of the MARS-10 scale, comprises items that describe some non-compliant behaviors, formulated in a non-threatening and non-judgmental way, with a response scale that allows categorization of patients into “adherence dimensions” and not just based on a dichotomous “yes/no” or “high/low” response, providing greater detail and differentiation between individuals.⁸

In order to evaluate asthma control in the 30 days before the consultation, we used the ACT (Asthma Control Test),⁹ which includes 5 questions, with scores ranging from 5 to 25 points. Total control is considered when the score is 25, controlled asthma when the score is between 25 and 20 points, and uncontrolled asthma when the sum is below 20 points.

In addition, data on asthma severity classification, values of serum levels of total IgE, eosinophils, and prick test results were obtained from medical records.

The diagnosis of asthma, as well as the classification of asthma severity, were based on criteria described by the Global Initiative for Asthma – GINA,¹ applied in the first visit and reviewed at each scheduled outpatient visit. Moderate/severe asthma meant it required an additional step in the treatment, besides those described in steps 1 and 2 for the age group.¹ All laboratory tests were conducted in the Clinical Analysis Laboratory of the CHC, the presence of eosinophils above 400 was considered peripheral eosinophilia, while high IgE meant the values were above 150 kU/L.¹⁰

The immediate reading allergy skin test by puncture is routinely performed in the service and the allergens tested include positive control (histamine), *Dermatophagoides pteronyssinus*, *Blomia tropicalis*, *Blatella germanica*, *Canis familiaris*, *Felis domesticus*, *Lolium multiflorum*, and negative control (saline solution at 0.9%). It is considered positive, proving sensitization to a particular allergen, if it shows a reaction with the presence of a papule with a diameter greater than or equal to 3 mm, without considering the area of erythema, and when the negative control does not show a reaction.¹¹

Results

Ninety-eight children and adolescents with asthma were included. There was a predominance of boys

(68%), and the majority of the sample was composed of schoolchildren (73%). The mean age was 8.9 years (± 3.68). In 84% of the outpatient clinic visits, the mother was the only caregiver present.

The predominant asthma severity was moderate and severe (82%). Sixty-seven percent of the participants used therapy with more than one drug, and in all cases, inhaled corticosteroids were associated with a second choice (long-acting beta 2 and/or another drug). Inhaled corticosteroid + long-acting beta2 was the most frequent therapeutic option. The median serum eosinophilia was 710 cells/mm³ (70 – 2.311), and the geometric mean IgE was 1.172 kU/L. Eighty participants had a positive skin test for at least one of the allergens (81%), and most (72%) were polysensitized (Table 1).

When the questionnaire on environmental control was administered, 44% said they had no control over the use of plush toys in the child’s room, 41% said they did not avoid cleaning around the child, and in 36% of the cases, respondents said they smoked rather often at home. When asked about physical activity, 63% reported that the child/adolescent practiced physical activity regularly.

When the theme “Myths and Truths” was explored, 74% of the respondents answered positively on at least one of the six questions, showing that they believed at least one myth/belief about the disease. Twenty-one percent were suspicious about the safety of the inhalation device, 29% reported being afraid of corticosteroid use, and 45% believed that the use of the inhaler can make the patient addicted.

Eighty percent of the respondents showed good adherence to continuous treatment, according to the MARS-5 questionnaire (score greater than or equal to 20 points), with a mean of 21.7 points (± 3.68) (Figure 1). The questions “I forget to take my medication” and “I only take my medication if I am feeling sick” were the most frequent questions in the respondents with low scores, determining low adherence.

Eighty-two (83%) showed correct technique in the use of inhaler devices, and incorrect or partially correct use accounted for 17% of the sample.

In the association between adherence to treatment and clinical variables, asthma control, reliance on myths and beliefs, and technique in the use of inhalers, we found that none of the respondents in the group with good adherence to treatment reported fear in the use of the inhaler and those who responded positively to the greatest number of

popular myths and beliefs had lower adherence to treatment according to the MARS-5 questionnaire. Both findings were statistically significant ($p = 0.012$ and 0.0256 , respectively) (Table 2).

There was a positive correlation between total disease control (maximum ACT score) and good treatment adherence ($p = 0.038$) (Table 2).

Table 1
Frequency description of the respondents' clinical variables (n = 98)

Variables	n (%)
Positive skin test	80 (81%)
Polysensitized	(71%)
Monosensitized	9 (9%)
Asthma severity	
Severe/moderate	(71%)
Mild	21 (22%)
Atopic comorbidities	
None	44 (44%)
Rhinitis	32 (32%)
Rhinoconjunctivitis	14 (14%)
Atopic dermatitis	8 (8%)
Asthma control (ACT)	
Full control (ACT = 25)	18 (19%)
Control (ACT entre 20-24)	60 (61%)
Uncontrolled (ACT < 20)	20 (20%)
Maintenance treatment	
Inhaled corticoid alone	32 (33%)
Inhaled corticoid + associations	66 (67%)
Eosinophils in peripheral blood [median (range)] ^a	710 (70-2311)
Total IgE (geometric mean in kUL/mL) ^b	1172

^a Number of participants who collected sample for analysis of peripheral blood eosinophils = 67.

^b Number of participants who collected sample for total IgE analysis = 69.

Discussion

The present study brings an evaluation of the profile of children and adolescents with asthma seen in a specialized outpatient clinic, focusing on the understanding of patients and families about the disease, the degree of confidence in popular beliefs and myths, adherence to environmental control measures, and adherence to pharmacological treatment and level of adequacy of the technique for using inhalation devices.

Chapman et al.¹² emphasize the practice of environmental control measures, valuing the care of household dust, hair and feathers, pollutants, pollens, and other irritants as important in reducing crises in sensitized patients. Kuster et al.¹³ suggested measures in the asthmatic child's room, such as the use of protective plastic for the bed and the removal of carpets. Only 3% of our interviewees said they used plastic protection. Other measures, such as avoiding plush in the bedroom and using wool in blankets and coats, were demonstrated by just over half: 56% and 52% respectively, in a population with a high sensitization index (81%), with over 70% being sensitive to more than one aeroallergen tested. Only half (51%) showed excellent or good environmental control, signaling the need for an emphatic, clear, and

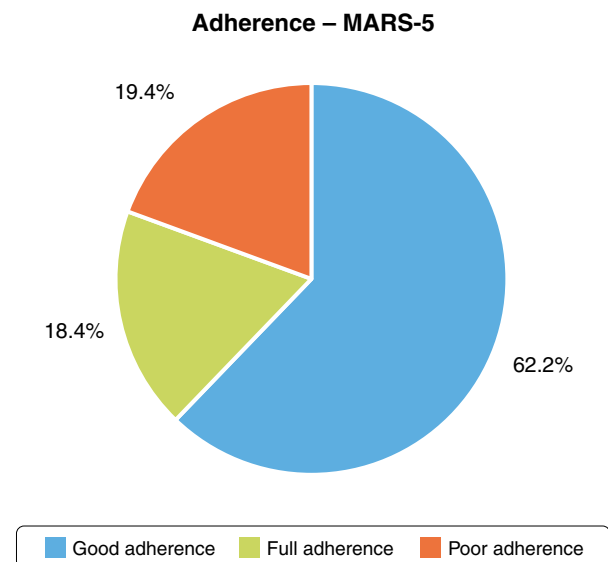


Figure 1
Distribution of MARS-5 questionnaire findings with stratification using the maximum score (25 points) n = 98

Table 2

Adherence to treatment versus clinical variables and popular myths/beliefs (n = 98)

Variables	Good adherence MARS >20	Poor adherence MARS < 20	p ^a
Age range			
Schoolchildren	62 (63%)	7 (8%)	0.06
Adolescents	16 (17%)	12 (12%)	
Asthma control (ACT)			
Full control (ACT = 25)	20 (20%)	0	0.03
Controlled and uncontrolled (ACT < 25)	63 (64%)	(15) 16%	
Inhalation device technique			
Correct	66 (68%)	15 (15%)	0.19
Partially correct	6 (6%)	0	
Incorrect	7 (7%)	4 (4%)	
Myths			
Any fear or concern of using inhalers	0	8 (8%)	0.01
Do you think the inhaler can be addictive?	34 (35%)	9 (10%)	0.45
Concern about using inhaled CTC	20 (21%)	8 (8%)	0.16
Number of myths and beliefs			
None	24 (25%)	1 (1%)	0.02
1	24 (25%)	6 (6%)	
2	18 (19%)	6 (6%)	
3	0	3 (3%)	
4	4 (4%)	1 (1%)	
5	1 (1%)	1 (1%)	
6	1 (1%)	1 (1%)	

^a Chi-square test.

understandable approach to environmental control measures in follow-up consultations.

In 2016, Roncada et al.⁴ studied myths about asthma in a pediatric population in southern Brazil and found that most parents thought that the use of nebulizers was preferable to the inhaler/spray because it was “more natural” and “less harmful” to the child, the same data found by Zhangcols.¹⁴ in 2005. Only 12% of the respondents in this study reported thinking

that the nebulizer was better than the metered-dose inhaler (pump), probably because this device has been adopted and encouraged as the choice for children with more severe asthma, with maintenance and relief medications, and, gradually, doubts were resolved and fears were attenuated. In the sample studied, patients with more myths had lower adherence to treatment, which further reinforces the importance of correct guidelines and continuous and periodic clarification about the disease.

Adherence to treatment has been studied in recent years, especially in adult patients with chronic diseases.^{4,15,16} Leite & Vasconcellos defined good adherence as the use of at least 80% of the prescribed medications or indicated procedures,¹⁵ also reporting that poor adherence corresponds to a real public health problem worldwide, and is considered an “invisible epidemic.”¹⁵

It is estimated that the worldwide adherence to treatment of chronic diseases is 50%;⁴ however, most studies focus on the adult population and on diseases such as hypertension and diabetes mellitus, which are more prevalent than asthma in the pediatric population.⁴ The ADERE study¹⁶ was the first in Brazil to analyze the adherence to asthma treatment in different regions of Brazil and showed an adherence rate of 51.9% in adults with a mean age of 44 years. In this study, using the MARS-5 questionnaire as an instrument, we found a treatment adherence rate of 80.6%, higher than that of the general population. The care of the pediatric population is usually enhanced when compared to adults; medications and other measures are administered by the guardians and caregivers, who are usually more concerned when the disease carrier is their children or tutored.¹⁵ Most of the patients included had moderate and severe asthma, which leads to scheduled appointments at shorter intervals and in a specialized outpatient clinic with medical students, residents, and professors, where, as part of the teaching, they spend time explaining the disease, the importance of the regular use of medications, and guiding the technique of using inhaler devices at each visit. It should be noted that the study was developed during the period of the COVID-19 pandemic when parents and children stayed indoors longer. In the same line of thought, the high number (83%) of children and adolescents performing the proper technique of the inhalation devices tested is understood.

Boulet et al.¹⁷ reported instruments used to assess medication adherence in asthma patients, such as self-report, inhaler device weighing, pharmacy dispensing records, and electronic monitoring, and they consider the latter to be the gold standard. The instrument used in this study was a questionnaire that behaves like a self-report, described as a limitation in some studies.^{8,17}

Although electronic monitoring of adherence is considered the gold standard method, it is expensive and fails to identify the types of non-adherence (intentional or unintentional), and in certain situations,

valid and reliable methods to capture this information, such as patient self-reporting, are recommended.⁸

Children with fully controlled asthma (ACT 25) showed complete adherence to pharmacological treatment determined by MARS-5, corroborating the idea that the correct and regular use of the proposed asthma drugs reflects in good control of the disease in children and adults.

The impacts of uncontrolled asthma on public health in Brazil are enormous. Cardoso et al.¹⁸ studied the repercussions of asthma in Brazil, showing costs of over 168 million dollars between 2008 and 2013 in asthma hospitalizations, with an average of 120,000 asthma hospitalizations in the period. In 2013 alone, there were 2,407 deaths, representing an average of 5 deaths per day.¹⁸ In Brazil, since 2009, there has been a free corticosteroid and short-acting bronchodilator supply program in Health Units and pharmacies registered by the Ministry of Health.¹⁹

In 2007, Ponte et al.²⁰ analyzed the impact of a public health policy program on health system costs for asthma patients in the state of Bahia. PROAR (Asthma and Allergic Rhinitis Control Program in Bahia) is a program of assistance, teaching, and research that offers patients with severe asthma free medication, medical and psychological care, pharmaceutical assistance, and asthma education.²⁰ A reduction in the number of days absent from school and work, emergency room visits, hospitalizations, and use of systemic corticosteroids was observed after one year of the program, and it was estimated that 7,000 emergency room visits and 300 hospitalizations were avoided in the period studied.²⁰

Reminder methods in the form of text messages, automated phone calls, and audio-visual reminder devices have been tested to increase medication adherence in patients with chronic diseases, including asthma, with good results on adherence despite not impacting the quality of life and clinical outcomes.²¹

Asthma requires special attention not only because it is the most prevalent chronic disease in pediatrics, but also to avoid exacerbations, hospitalizations, mortality, and loss of quality of life, as well as the consequences of the disease in adult life. Adherence to treatment in the most global sense is a fundamental factor to guarantee all these aspects and should be sought by physicians and the multiprofessional team, patients, and family members.²²

Asthma education measures should be prioritized and adopted, not only in specialized outpatient clinics but in all services that treat children with asthma, in

the public and private spheres, seeking the control of this prevalent disease with great social and economic impact.

Appendix 1

Environmental Control Questionnaire: "Recommendations to be followed in the treatment of asthma"⁶

Answer with "Always, sometimes, or never."

1. Cover the pillow and mattress with plastic material.
2. Not using wool blankets or sweaters.
3. If another person must sleep in the same room, also protect the bed.
4. Not allowing play with rugs or sofa. Avoid plush, fur, or wool toys.
5. Not applying insecticide.
6. Avoid active odors, such as perfume, wax, gasoline, and smoke.
7. Avoid house dust, avoid dusting, sweeping, or tidying the bed in the presence of the child. Clean the room every day.
8. Apply anti-mildew where susceptible.
9. Avoid humid environments and handling objects that have been stored for a long time.
10. Not smoking nearby.
11. Having an outdoor life.
12. Practice sports, especially swimming.
13. Take cold baths.
14. Sleep in a ventilated room.
15. Not making use of a fan.

Appendix 2

Questionnaire on "Myths and truths about asthma"⁴

Answer with "yes or no."

1. Do you have any concerns or fears about using the inhaler/spray as a form of asthma treatment for your child?
2. Do you have any concerns or fears about using inhaled corticosteroids for the treatment of asthma in your child?
3. Do you think that the inhaler/spray can be addictive to people who use it as a form of asthma treatment?
4. Do you use a nebulizer as a form of asthma treatment for your child?
5. Do you consider the use of nebulizer more efficient than the use of "inhaler/spray" to treat your child's asthma?
6. Do you think that the practice of physical activities can help your child's asthma treatment?

Appendix 3Questionnaire: “Medication Adherence Report Scale” – MARS-5⁷**Answer “always, almost always, sometimes, rarely, never”, where:**

always = 1, almost always = 2, sometimes = 3, rarely = 4, and never = 5.

Full adherence = 25 points.

Good adherence > 20 points.

Low adherence < 20 points.

1. Have you ever forgotten to take your medication?
2. Are you sometimes careless in taking your medication?
3. When you feel better, do you sometimes stop taking your medication?
4. Occasionally, if you feel worse when you take your medication, do you stop taking it?
5. Do I only take my medication when I feel sick?

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