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Beyond The Inhaler: Environmental Exposures And Asthma Control Among Children Aged 5–12 Years – A Cross-Sectional Study In A Tertiary Care Hospital.

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Abstract

Background: Childhood bronchial asthma is a common chronic respiratory disorder associated with significant morbidity. Although inhaled corticosteroids and appropriate controller medications remain the cornerstone of management, some children continue to experience inadequate symptom control despite pharmacological treatment. Environmental exposures, including household dust, passive smoking and pet-related allergens, may contribute to persistent respiratory symptoms. Associated conditions such as allergic rhinitis may further complicate asthma management. Objective: To describe environmental exposures among children aged 5–12 years with bronchial asthma and evaluate their relevance to asthma control. ***Methods***: A hospital-based cross-sectional study was conducted over one year (2024–2025) in a tertiary care hospital. Eighty children aged 5–12 years with physician-diagnosed bronchial asthma were included. Asthma symptom control was assessed using Global Initiative for Asthma (GINA)-based criteria over the preceding four weeks. Environmental exposures, including household dust, passive smoking and pet exposure, were documented using an environmental exposure assessment questionnaire. The presence of allergic rhinitis was also recorded. Medication adherence and inhaler technique were assessed as additional clinical factors. ***Results***: Among the 80 children included, 29 (36.3%) had poorly controlled asthma, 25 (31.3%) had partly controlled asthma and 26 (32.5%) had well-controlled asthma. Household dust exposure was the most frequently reported environmental exposure, affecting 52 children (65%). Allergic rhinitis was documented in 44 children (55%), while passive smoking exposure was reported in 31 (38.8%). Pet exposure was present in 18 children (22.5%). These findings demonstrate a substantial burden of potentially modifiable environmental and associated clinical factors among children with asthma. However, exposure-specific associations with asthma-control categories were not quantified. ***Conclusion***: Environmental exposures and associated allergic conditions are common among children with bronchial asthma. Routine assessment of the home environment, passive smoking and allergic rhinitis should complement pharmacological management. A comprehensive approach extending beyond inhaler prescription may help identify modifiable contributors to inadequate asthma control.

Keywords: Childhood asthma, environmental exposure, household dust, passive smoking, allergic rhinitis, asthma control, children.

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INTRODUCTION

Bronchial asthma is one of the most common chronic respiratory diseases in childhood and represents an important public health concern worldwide. It is characterized by chronic airway inflammation, variable respiratory symptoms and variable expiratory airflow limitation. Children with asthma may present with recurrent episodes of wheezing, cough, breathlessness and chest tightness, which can interfere with sleep, physical activity, school attendance and overall quality of life.

The management of childhood asthma has evolved considerably with the availability of inhaled corticosteroids and other controller medications. Inhaled corticosteroid-containing treatment remains the cornerstone of asthma management, with treatment tailored according to symptom control, risk factors and individual patient characteristics. Regular assessment of medication adherence and inhaler technique is essential to achieving optimal disease control.

However, despite appropriate pharmacological treatment, a proportion of children continue to experience persistent symptoms and recurrent exacerbations. In clinical practice, inadequate asthma control is often attributed to poor medication

adherence, incorrect inhaler technique or insufficient controller therapy. Although these factors are important, the child's environmental surroundings may receive comparatively less attention.

Children spend a substantial proportion of their time in indoor environments, where exposure to allergens and irritants may occur repeatedly. Household dust, dust mites, tobacco smoke, indoor air pollutants, dampness and pet-related allergens are potential environmental triggers that may aggravate airway inflammation and respiratory symptoms. Exposure to environmental tobacco smoke is particularly important because children are unable to independently control or avoid many household smoking exposures.

Allergic rhinitis is another frequently encountered comorbidity in children with asthma. The coexistence of upper and lower airway allergic inflammation may contribute to increased symptom burden and difficulties in achieving optimal asthma control. Therefore, recognition and appropriate management of allergic rhinitis should form an integral part of childhood asthma care.

The Global Initiative for Asthma (GINA) emphasizes an individualized approach to asthma management, incorporating assessment of symptom control, risk factors, comorbidities, medication adherence, inhaler technique and modifiable environmental exposures.

In this context, the present study was undertaken to describe the environmental exposure patterns among children with bronchial asthma and examine their clinical relevance in relation to asthma control.

The concept of "Beyond the Inhaler" emphasizes that effective asthma management requires more than pharmacological intervention. Understanding the environment in which a child lives, plays and sleeps may provide additional opportunities for improving asthma care.

AIM

To evaluate the association between environmental exposures and asthma control among children aged 5–12 years.

OBJECTIVES

1. To describe the frequency of household dust exposure, passive smoking and pet exposure among children with bronchial asthma.
2. To determine the prevalence of allergic rhinitis among children with bronchial asthma.
3. To compare environmental exposure patterns across well-controlled, partly controlled and poorly controlled asthma categories.
4. To identify potentially modifiable factors that can be addressed during routine paediatric asthma follow-up.

MATERIALS AND METHODS

Study design

A hospital-based cross-sectional observational study.

Study setting

Department of Paediatrics, Sree Mookambika Institute of Medical Sciences (SMIMS), Tamil Nadu, India.

Study duration

One year, from 2024 to 2025.

Study population

Children aged 5–12 years attending the paediatric department with a physician-diagnosed history of bronchial asthma.

Sample size

A total of 80 children were included in the study.

Inclusion criteria

- Children aged 5–12 years.
- Children with physician-diagnosed bronchial asthma.
- Children whose parents or legal guardians provided informed consent.

Study procedure

Eligible children were evaluated after obtaining parental or guardian consent. Relevant demographic and clinical information was collected.

Asthma control was assessed based on GINA symptom-control criteria over the preceding four weeks. Based on symptom assessment, children were categorized into three groups:

1. Well-controlled asthma.
2. Partly controlled asthma.
3. Poorly controlled asthma.

Environmental exposure history was obtained from parents or caregivers. The assessment included household dust exposure, passive smoking and the presence of pets in the household. The presence of associated allergic rhinitis was also documented.

Medication adherence and inhaler technique were assessed as additional clinical factors that could influence asthma control.

Study variables

Primary outcome variable:

- Asthma symptom-control category.
- Environmental exposure variables:
- Household dust exposure.
- Passive smoking.
- Pet exposure.
- Allergic rhinitis.

Additional clinical variables:

- Medication adherence.
- Inhaler technique.

Statistical analysis

The collected data were summarized using descriptive statistics. Categorical variables were expressed as frequencies and percentages. Further comparative analysis of environmental exposures across asthma-control categories would be required to establish statistical associations.

Ethical considerations

Written informed consent was obtained from the parents or legal guardians before inclusion in the study.

RESULTS

1. Distribution of asthma control

A total of 80 children aged 5–12 years with physician-diagnosed bronchial asthma were included.

Among the study population:

- 26 children (32.5%) had well-controlled asthma.
- 25 children (31.3%) had partly controlled asthma.
- 29 children (36.3%) had poorly controlled asthma.

Poorly controlled asthma constituted the largest category in the study population.

Household dust was the most frequently reported environmental exposure, followed by allergic rhinitis and passive smoking.

Environmental factor	Number (n=80)	Percentage
Household dust	52	65.0%
Allergic rhinitis	44	55.0%
Passive smoking	31	38.8%
Pet exposure	18	22.5%

Household dust exposure was reported in nearly two-thirds of the study population. More than half of the children had associated allergic rhinitis. Passive smoking exposure was documented in approximately two-fifths of the children, while pet exposure was reported in approximately one-fifth.

3. **Overall findings**

The study demonstrated that potentially modifiable environmental exposures were frequently reported among children with bronchial asthma. In addition, more than one-third of the study population had poorly controlled asthma.

These findings highlight the importance of considering environmental and associated allergic factors during routine asthma evaluation.

DISCUSSION

Childhood asthma is a multifactorial respiratory disorder in which disease control is influenced by pharmacological, environmental, behavioural and host-related factors. While appropriate controller medication is essential, optimal asthma management requires identification and modification of additional factors that may contribute to persistent symptoms.

The present study, conducted among 80 children aged 5–12 years, highlights the frequency of environmental exposures and associated allergic conditions in children with bronchial asthma.

Asthma control in the study population

In the present study, 36.3% of children had poorly controlled asthma, while 31.3% had partly controlled asthma and 32.5% had well-controlled asthma.

The finding that more than one-third of children had poor symptom control highlights the continuing challenges in achieving optimal asthma management in routine paediatric practice.

Poor asthma control may result from several factors, including inadequate medication adherence, incorrect inhaler technique, insufficient treatment, environmental exposures and associated comorbidities. Therefore, assessment of symptom control should be accompanied by a systematic evaluation of these contributing factors.

Household dust exposure

Household dust was the most frequently reported environmental exposure, affecting 65% of the children in the present study.

Indoor dust may contain a mixture of house dust mite allergens, animal-derived particles, fungal components and other irritants. Exposure to relevant indoor allergens may contribute to airway inflammation and aggravation of asthma symptoms, particularly among sensitized children.

The high frequency of household dust exposure in the present study emphasizes the importance of obtaining a detailed household environmental history during asthma follow-up.

Practical preventive measures may include regular cleaning, reducing dust accumulation, improving ventilation where appropriate and addressing dampness or visible mould. Environmental recommendations should be individualized according to the child's actual exposure and clinical history rather than providing blanket advice.

Allergic rhinitis and childhood asthma

Allergic rhinitis was documented in 55% of the study population, making it an important associated clinical finding.

The coexistence of allergic rhinitis and asthma is well recognized. Both conditions involve inflammatory processes affecting the respiratory tract, and inadequately controlled upper airway symptoms may contribute to overall respiratory morbidity.

Identification and appropriate treatment of allergic rhinitis are important components of comprehensive asthma management. Routine screening for nasal obstruction, sneezing, rhinorrhoea and nasal itching should therefore be incorporated into the clinical assessment of children with asthma.

The high frequency of allergic rhinitis in the present study reinforces the need for an integrated approach to upper and lower airway disease.

Passive smoking exposure

Passive smoking was reported in 38.8% of children in the present study.

Environmental tobacco smoke is an important preventable respiratory exposure in childhood. Children exposed to tobacco smoke may experience increased respiratory symptoms and a greater burden of asthma morbidity.

The presence of passive smoking exposure in more than one-third of the study population emphasizes the importance of counselling caregivers regarding the adverse respiratory effects of tobacco smoke.

A completely smoke-free home and vehicle should be encouraged. Smoking in another room, near a window or outside the immediate presence of the child should not be considered an adequate substitute for a smoke-free environment.

Pet exposure

Pet exposure was documented in 22.5% of the study population.

Animal-derived allergens may be present in dander, saliva and other materials and can contribute to respiratory symptoms in sensitized individuals. However, the presence of a household pet alone does not establish that the animal is responsible for asthma symptoms.

Clinical assessment should include the relationship between exposure and symptoms, and further evaluation of sensitization may be considered when clinically indicated. Recommendations regarding pets should therefore be individualized.

Clinical significance: Looking beyond pharmacological treatment

An important implication of the present study is the need to incorporate environmental assessment into routine paediatric asthma management.

In clinical practice, a child with persistent symptoms should not be evaluated solely on the basis of the prescribed inhaler. A structured assessment should include:

- Household dust, dampness and possible mould exposure.
- Smoking exposure within the home and vehicle.
- Presence of pets and any relationship with respiratory symptoms.
- Symptoms suggestive of allergic rhinitis.
- Medication adherence.
- Correct inhaler technique.

This approach may help clinicians identify modifiable contributors to inadequate asthma control and provide more meaningful counselling to caregivers.

Environmental counselling should be practical, affordable and individualized. The objective is not simply to identify exposures but to translate the findings into achievable interventions and reassess their relevance during subsequent follow-up.

Strengths of the study

The study addresses an important and potentially modifiable aspect of childhood asthma management. It evaluates multiple household environmental exposures and an associated allergic condition in a real-world tertiary care setting.

By considering environmental factors alongside medication adherence and inhaler technique, the study highlights the importance of a comprehensive approach to asthma assessment.

Limitations

The study has certain limitations.

First, the cross-sectional design does not establish a temporal relationship or permit causal inference between environmental exposures and asthma control.

Second, the study was conducted at a single tertiary care centre, which may limit the generalizability of the findings.

Third, environmental exposure information was obtained through caregiver reporting and may be subject to recall and reporting bias.

Fourth, objective environmental measurements, such as indoor particulate matter or allergen concentrations, were not documented.

Finally, the sample size was relatively small, and exposure-specific statistical comparisons between asthma-control categories were not available in the presentation dataset. Consequently, the independent contribution of individual environmental exposures to poor asthma control could not be established.

Larger multicentric prospective studies incorporating objective exposure measurements and appropriate statistical analysis are needed to further explore these relationships.

CONCLUSION

The present study highlights the importance of environmental assessment in the comprehensive management of childhood bronchial asthma. Among the 80 children studied, more than one-third had poorly controlled asthma. Household dust exposure was the most frequently reported environmental factor, followed by allergic rhinitis, passive smoking and pet exposure. These findings emphasize that childhood asthma management should extend beyond pharmacological treatment alone. Routine evaluation of the child's home environment, identification of passive smoking and recognition of associated allergic conditions may provide additional opportunities for improving asthma care. Appropriate controller therapy remains the cornerstone of treatment. However, identifying and addressing relevant environmental exposures, together with assessment of adherence and inhaler technique, should form an integral part of routine paediatric asthma follow-up. The inhaler treats the disease, but understanding the child's environment helps identify what may be keeping the disease uncontrolled.

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