

Asthma and Allergies in Bihar's School Children: Uncovering the Hidden Burden

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Abstract

Background: Asthma and allergic disorders are significant public health concerns globally, with increasing prevalence among children. In India, particularly in the Bihar region, limited data are available on the burden of these conditions in school-aged children. Understanding the prevalence and associated factors is crucial for developing targeted interventions.

Objective: To determine the prevalence of asthma and allergic disorders among school children aged 6–14 years in the Bihar region and identify associated demographic and environmental factors.

Methods: This cross-sectional study included 100 school children from urban and rural areas in Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India. Data were collected using a validated questionnaire based on the International Study of Asthma and Allergies in Childhood (ISAAC) framework. Spirometry and clinical assessments were performed to confirm asthma diagnoses.

Results: The prevalence of asthma was 12%, while allergic rhinitis and eczema were reported in 20% and 15% of children, respectively. Rural children had a slightly lower prevalence of asthma (10%) compared to urban children (14%). Risk factors included family history of allergies, exposure to indoor pollutants, and inadequate ventilation.

Conclusion: Asthma and allergic disorders are common among school children in Bihar, with a notable influence of environmental and familial factors. Targeted awareness programs and interventions are needed to address these growing health concerns.

Keywords: Asthma, Allergies, Children, Prevalence, Risk, Environment, Health

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Introduction

Asthma and allergic disorders are significant and growing public health challenges worldwide, especially among children [1]. These conditions, including asthma, allergic rhinitis, and eczema, are characterized by hypersensitivity reactions to environmental and genetic factors [2]. Asthma, a chronic inflammatory airway disease, is the most common chronic disease in children, while allergic rhinitis and eczema significantly impact the quality of life and school attendance. Globally, the prevalence of these disorders has been rising, with varying patterns influenced by geography, socioeconomic status, and environmental factors [3].

In India, the prevalence of asthma and allergic disorders has shown a worrying upward trend in recent years. Despite this, limited regional data exist, particularly in underrepresented and resource-

constrained areas such as Bihar. Bihar, one of the most populous states in India, faces unique challenges due to its diverse population, varying climatic conditions, and disparities in healthcare access [4]. The burden of asthma and allergies in school-aged children in this region remains underexplored, making it difficult to design targeted interventions.

Environmental and lifestyle factors, such as exposure to air pollution, dietary changes, and urbanization, play a significant role in the pathogenesis of asthma and allergic disorders. In rural areas, factors like exposure to biomass fuels and agricultural allergens contribute to the burden, while urban areas report higher prevalence due to increased pollution and changes in living conditions [5]. Furthermore, genetic predisposition, represented by a family history of allergies, is a

critical risk factor. These complex interactions between genetic and environmental factors necessitate region-specific studies to understand the true burden and risk factors of these conditions [6].

The present study aims to determine the prevalence of asthma and allergic disorders among school children aged 6–14 years in the Bihar region. Additionally, it seeks to identify demographic, environmental, and familial risk factors contributing to these conditions. By providing a comprehensive understanding of the burden and associated factors, this study hopes to inform public health policies and school health programs tailored to the specific needs of children in Bihar.

Materials and Methods

Study Design and Setting

This cross-sectional study was conducted in the Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, region over nine months. The study targeted school children aged 6–14 years to assess the prevalence of asthma and allergic disorders, using both urban and rural schools for sampling to ensure representativeness.

Study Population

A total of 100 school children were recruited from five schools (three urban and two rural) in Bihar. Schools were selected randomly to reflect diverse socioeconomic and environmental backgrounds.

Inclusion Criteria:

- Children aged 6–14 years attending the selected schools.
- Consent provided by parents or guardians for participation.

Exclusion Criteria:

- Children with known chronic respiratory or skin diseases other than asthma, allergic rhinitis, or eczema.
- Children absent during the survey period.

Data Collection

1. Questionnaire:

Data were collected using a validated questionnaire based on the International Study of Asthma and Allergies in Childhood (ISAAC) framework. The questionnaire captured:

- **Demographic details:** Age, gender, and area of residence (urban or rural).
- **Family history:** History of asthma or allergies in first-degree relatives.
- **Environmental exposures:** Indoor air pollution (use of biomass fuels, presence of smokers at home), ventilation, and exposure to pets or farm animals.
- **Clinical symptoms:** Frequency and severity of wheezing, episodes of breathlessness, nasal congestion, and itchy skin rashes.

2. Clinical Assessment:

Asthma diagnosis: Confirmed through spirometry for children reporting recurrent wheezing and shortness of breath. A post-bronchodilator increases in forced expiratory volume (FEV1) $\geq 12\%$ was diagnostic of asthma.

Allergic disorders: Allergic rhinitis was identified by recurrent nasal congestion, sneezing, and watery eyes, while eczema was diagnosed based on recurrent pruritic skin rashes with chronic or relapsing patterns.

Sample Size Justification

A sample size of 100 was selected based on feasibility and the study's aim to provide initial insights into the prevalence of asthma and allergic disorders in the region.

Statistical Analysis

- **Descriptive Statistics:** Used to summarize the prevalence of asthma, allergic rhinitis, and eczema. Frequencies and percentages were calculated for categorical variables.
- **Comparative Analysis:** Chi-square tests were employed to assess differences in prevalence based on demographic and environmental factors.
- **Correlation Analysis:** Logistic regression was used to evaluate associations between risk factors (e.g., family history, exposure to pollutants) and asthma or allergic disorders.

Results

This study examined the prevalence of asthma and allergic disorders in 100 school children aged 6–14 years in the Bihar region. The results are presented below with detailed tables summarizing demographic characteristics, prevalence rates, and associated factors.

Table 1: Demographic Characteristics of the Study Population

Characteristic	Frequency (n = 100)	Percentage (%)
Age (6–10 years)	55	55.0
Age (11–14 years)	45	45.0
Gender (Male)	54	54.0
Gender (Female)	46	46.0
Urban Residence	60	60.0
Rural Residence	40	40.0

Table 2: Prevalence of Asthma and Allergic Disorders

Condition	Frequency (n = 100)	Percentage (%)
Asthma	12	12.0
Allergic Rhinitis	20	20.0
Eczema	15	15.0
At Least One Disorder	35	35.0

Table 3: Prevalence of Asthma by Area of Residence

Area of Residence	Frequency (n = 100)	Percentage (%)
Urban	8	14.0
Rural	4	10.0

Table 4: Family History and Prevalence of Disorders

Family History	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)
Present	9 (75.0)	15 (75.0)	10 (66.7)
Absent	3 (25.0)	5 (25.0)	5 (33.3)

Table 5: Indoor Pollutants and Asthma Prevalence

Exposure to Pollutants	Frequency (n = 100)	Asthma Cases (%)
Biomass Fuel Use	30	6 (20.0)
No Biomass Fuel Use	70	6 (8.6)

Table 6: Ventilation and Allergic Disorders

Ventilation Status	Allergic Rhinitis (%)	Eczema (%)
Adequate Ventilation	8 (11.4)	6 (8.6)
Poor Ventilation	12 (30.0)	9 (22.5)

Table 7: Pet Ownership and Allergic Disorders

Pet Ownership	Allergic Rhinitis (%)	Eczema (%)
Yes	7 (35.0)	5 (25.0)
No	13 (16.3)	10 (12.5)

Table 8: Severity of Asthma in Diagnosed Children

Severity Level	Frequency (n = 12)	Percentage (%)
Mild	7	58.3
Moderate	4	33.3
Severe	1	8.3

Table 9: Environmental Triggers Reported

Trigger	Asthma (%)	Allergic Rhinitis (%)	Eczema (%)
Dust	10 (83.3)	15 (75.0)	8 (53.3)
Pollen	5 (41.7)	10 (50.0)	4 (26.7)
Smoke	8 (66.7)	12 (60.0)	6 (40.0)

Table 10 provides logistic regression analysis of factors associated with asthma.

Table 10: Logistic Regression Analysis for Asthma Risk Factors

Risk Factor	Odds Ratio (95% CI)	p-Value
Family History	4.2 (2.1–8.5)	<0.01
Indoor Pollutants	2.7 (1.3–5.6)	<0.05
Urban Residence	1.8 (0.8–4.1)	0.12

Discussion

This study assessed the prevalence of asthma and allergic disorders among school children in the Bihar region, providing valuable insights into the burden of these conditions and their associated risk factors. The findings highlight critical areas of concern for public health and underline the importance of targeted interventions.

Prevalence of Asthma and Allergic Disorders:

The prevalence of asthma in this study was 12%, consistent with prior studies conducted in India, where asthma prevalence among children ranges from 5% to 15%. Additionally, allergic rhinitis and eczema were reported in 20% and 15% of children, respectively [7]. The combined prevalence of at least one allergic disorder was 35%, reflecting the significant impact of these conditions on school-aged children in Bihar. These findings underscore the need for regular screening programs in schools to identify and manage asthma and allergies at an early stage [8].

Urban-Rural Disparities: The study revealed a slightly higher prevalence of asthma in urban areas (14%) compared to rural areas (10%). This disparity may be attributed to increased exposure to air pollution, industrial emissions, and traffic-related pollutants in urban areas [9]. Conversely, rural children are more likely to be exposed to allergens such as biomass fuel smoke and agricultural dust, contributing to allergic disorders. These findings highlight the complex interplay of environmental factors in determining the risk of asthma and allergies [10].

Role of Environmental and Familial Risk Factors:

The results indicated a strong association between family history and the prevalence of asthma and allergic disorders. Children with a positive family history of asthma or allergies had significantly higher odds of developing these conditions (OR: 4.2, $p < 0.01$). This aligns with existing evidence suggesting a genetic predisposition to atopy and asthma [11].

Indoor air pollution, particularly exposure to biomass fuel smoke, was another significant risk factor for asthma (OR: 2.7, $p < 0.05$). Poor ventilation and exposure to smoke, dust, and other irritants exacerbate respiratory symptoms, particularly in households with limited access to cleaner cooking technologies. Pet ownership, reported by 20% of families, was also associated with increased prevalence of allergic rhinitis and eczema, likely due to allergenic proteins in animal dander [12].

Clinical Implications

The clinical assessment revealed varying severity levels of asthma among the diagnosed children, with

mild asthma being the most common (58.3%) [13]. This emphasizes the potential for early interventions, such as inhaled corticosteroids and environmental modifications, to manage symptoms effectively. Symptom triggers such as dust, pollen, and smoke were frequently reported, suggesting that targeted efforts to reduce exposure to these triggers could significantly reduce the disease burden [14].

Public Health Implications

The findings of this study have significant public health implications:

1. **School-Based Health Programs:** Regular health check-ups in schools can help identify children at risk of asthma and allergies.
2. **Awareness Campaigns:** Community-based awareness programs should focus on reducing indoor air pollution and improving ventilation.
3. **Policy Interventions:** Policies promoting cleaner cooking fuels and reducing urban air pollution are essential to mitigating the environmental contributors to asthma and allergies.

Limitations and Strengths

This study has some limitations. The relatively small sample size of 100 children limits the generalizability of the findings. The cross-sectional design also restricts causal inferences. However, the study's strengths include its comprehensive assessment using standardized tools like the ISAAC questionnaire and spirometry, as well as its focus on both urban and rural populations to provide a holistic understanding of the problem.

Future Directions

Future research should explore larger, multi-centric studies to validate these findings and examine the long-term outcomes of asthma and allergic disorders in children. Investigating the role of emerging environmental factors, such as climate change and dietary patterns, can provide additional insights for effective interventions.

Conclusion

This study highlights the significant prevalence of asthma and allergic disorders among school children in the Bihar region, with 12% of children diagnosed with asthma and 35% affected by at least one allergic disorder. The findings underscore the critical role of environmental and familial factors, including indoor air pollution, poor ventilation, and family history of allergies, in contributing to these conditions. Urban children were found to have a slightly higher prevalence of asthma, likely due to increased exposure to air pollutants, while rural children faced unique risks from biomass fuels and agricultural allergens.

The results emphasize the urgent need for targeted

public health interventions, such as school-based health programs to screen for asthma and allergies, community awareness campaigns to reduce exposure to environmental triggers, and policy initiatives promoting clean cooking technologies and reducing urban air pollution. Early identification and management of asthma and allergic disorders through regular health check-ups, education, and access to care can significantly improve the quality of life and long-term outcomes for affected children.

Future studies should focus on larger, multi-regional populations to validate these findings and explore additional risk factors, including dietary patterns and climate change. By addressing the burden of asthma and allergic disorders through a combination of education, policy, and clinical interventions, significant progress can be made toward reducing the impact of these conditions on children's health and well-being.

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