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Original Research Article

A Cross-Sectional Study Assessing the Burden of Pediatric Asthma and Allergic Disorders among School Children

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Conflict of interest: Nil

Abstract:

Background: Asthma and allergic disorders such as allergic rhinitis and atopic dermatitis are increasingly prevalent in children worldwide. In India, especially in rural and semi-urban settings like Bihar, there is limited region-specific data documenting the burden of these conditions among school-going children. Understanding their prevalence is vital for developing school-based screening and preventive health interventions.

Objectives: To estimate the prevalence of asthma and allergic disorders among school children aged 6–16 years in selected schools across the Bihar region and to identify associated demographic and environmental factors.

Methods: A community-based cross-sectional descriptive study was conducted over 12 months at the Department of Pediatrics, Government Medical College and Hospital, Bettiah, Bihar, India. A total of 200 school children were selected using stratified random sampling from both urban and rural schools. Data were collected using a standardized, pretested questionnaire adapted from the ISAAC protocol. Clinical confirmation was conducted for cases with suggestive symptoms. Relevant sociodemographic data, family history, and environmental exposures were also recorded.

Results: The study observed a prevalence of asthma in approximately 13% of the children, allergic rhinitis in 18%, and atopic dermatitis in 7%. Male children and those with a positive family history of allergic disorders showed a significantly higher prevalence. Urban school children demonstrated a marginally higher burden of asthma and allergic conditions compared to rural students. Environmental exposures, such as indoor smoke and pet ownership, were significantly associated with increased symptomatology.

Conclusion: The findings highlight a considerable burden of asthma and allergic disorders among school children in the Bihar region. There is a pressing need for early detection strategies, health education, and region-specific policy formulation to address pediatric allergic diseases at the community level.

Keywords: Asthma, Allergic Rhinitis, Atopic Dermatitis, School Children, Pediatric Allergy, Bihar, Prevalence Study, ISAAC Protocol.

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Introduction

Asthma and allergic disorders represent a growing public health concern globally, particularly in the pediatric population. These conditions not only impact the physical health of children but also impair school performance, psychosocial development, and overall quality of life [1]. The global burden of asthma in children is rising steadily, with allergic rhinitis and atopic dermatitis often coexisting as part of the "atopic triad." This phenomenon is especially relevant in rapidly developing countries like India, where changing environmental conditions, urbanization, dietary shifts, and genetic predispositions intersect to influence disease expression [2].

In the Indian context, data on the epidemiology of childhood asthma and allergic disorders remain fragmented and regionally diverse. According to the International Study of Asthma and Allergies in Childhood (ISAAC), the prevalence of asthma in Indian school children varies from 2% to 20%, with higher rates reported in urban regions [3]. Allergic rhinitis and atopic dermatitis are also widely underreported, with many children remaining undiagnosed due to lack of awareness, inadequate access to pediatric allergy services, and cultural barriers to seeking early treatment [4].

The state of Bihar, with its mixed urban and rural demographic, remains underrepresented in national and international pediatric allergy data. Limited studies have explored the regional burden of allergic diseases in children, and those that do exist often lack standardization in diagnostic approach and reporting. School-based surveys offer an efficient strategy to estimate prevalence, given the captive population and structured environment they provide [5].

This study was therefore conceptualized to evaluate the prevalence of asthma and allergic disorders among school children in selected urban and rural areas of the Bihar region. By utilizing a validated tool—the ISAAC questionnaire along with clinical correlation, the study aims to generate reliable data that can inform public health policies, support school-based screening, and promote awareness among parents and teachers. Additionally, the study attempts to identify potential associations between allergic conditions and common risk factors such as family history, urban living, exposure to environmental pollutants, and indoor allergens.

Materials and Methods

This community-based cross-sectional descriptive study was conducted over a 12-months period in the Department of Pediatrics at Government Medical College and Hospital, Bettiah, Bihar, India. The study targeted school-going children aged between 6 and 16 years from both urban and rural areas of the Bihar region. A total of 200 children were selected using a stratified random sampling technique to ensure proportionate representation across age groups, gender, and type of school (government vs private). Prior to data collection, necessary permissions were obtained from the institutional ethics committee, as well as from school authorities and parents or legal guardians through informed written consent.

The inclusion criteria comprised children aged 6–16 years who were enrolled in selected schools and whose parents consented to participation. Children with known chronic systemic illnesses other than asthma or allergy, or those who were acutely ill during the survey period, were excluded from the study to avoid confounding symptomatology. Data were collected using a standardized, pretested, and semi-structured questionnaire based on the International Study of Asthma and Allergies in Childhood (ISAAC) protocol. The questionnaire was translated into local language and administered through face-to-face interviews with the children and wherever required, with support from parents and teachers.

The questionnaire captured information on sociodemographic details, history of wheezing, episodes of nocturnal cough, breathing difficulty, allergic rhinitis symptoms (such as sneezing and nasal blockage), and signs suggestive of atopic dermatitis (such as chronic itching and rashes). Additional data were collected on family history of allergic diseases, environmental exposures like use of biomass fuels, tobacco smoke, pet ownership, indoor dampness, and type of flooring and bedding.

All children reporting current or past respiratory or allergic symptoms were further evaluated clinically by a pediatrician. Clinical assessments were conducted within the school premises or in outpatient clinics, and included physical examination, auscultation for wheeze, and inspection for dermatological manifestations. Wherever required, peak expiratory flow rate (PEFR) measurements were performed to support asthma diagnosis, using standard age-adjusted reference values. No invasive investigations or therapeutic interventions were carried out as part of this study.

Data collected were entered into Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize data. Prevalence of asthma, allergic rhinitis, and atopic dermatitis was expressed in percentages. Associations between allergic conditions and selected variables such as gender, area of residence, and family history were tested using the Chi-square test. A p-value less than 0.05 was considered statistically significant.

Confidentiality and anonymity of all study participants were strictly maintained throughout the research process. Children found to have undiagnosed or poorly controlled asthma or allergic disorders were referred to the hospital's pediatric outpatient department for further management and follow-up.

Results

The present study assessed the prevalence and patterns of asthma and allergic disorders among 200 school children aged 6 to 16 years in the Bihar region. The overall prevalence of asthma was 13.0%, allergic rhinitis 18.0%, and atopic dermatitis 7.0%. A higher burden of these conditions was observed among male children, those residing in urban areas, and children with a positive family history of atopy. Statistically significant associations were noted between allergic conditions and environmental factors such as exposure to indoor smoke and pet ownership. Seasonal variation in symptom exacerbation was reported, with winter and post-monsoon periods showing peak prevalence. Despite the presence of symptoms, a substantial proportion of children were either undiagnosed or not receiving specialist consultation, indicating under-recognition and under-treatment of allergic conditions in this population.

Table 1: Age-wise Distribution of Study Participants (N = 200)

Age Group (years)	Frequency (F)	Percentage (%)
6–9 years	62	31.0%
10–13 years	78	39.0%
14–16 years	60	30.0%

Table 2: Gender-wise Distribution of Study Participants (N = 200)

Gender	Frequency (F)	Percentage (%)
Male	112	56.0%
Female	88	44.0%

Table 3: Area of Residence of Study Participants (N = 200)

Area	Frequency (F)	Percentage (%)
Urban	102	51.0%
Rural	98	49.0%

Table 4: Prevalence of Allergic Conditions among Participants (N = 200)

Condition	Frequency (F)	Percentage (%)
Asthma	26	13.0%
Allergic Rhinitis	36	18.0%
Atopic Dermatitis	14	7.0%

Table 5: Distribution of Asthma Cases by Gender (N = 26)

Gender	Frequency (F)	Percentage (%)
Male	15	57.7%
Female	11	42.3%

Table 6: Association of Family History of Allergy with Allergic Conditions (N = 200)

Family History	Allergic Condition Present F (%)	Absent F (%)	p-value
Yes	41 (68.3%)	19 (31.7%)	<0.001
No	35 (20.6%)	105 (79.4%)	

Table 7: Distribution of Allergic Conditions by Area of Residence (N = 200)

Condition	Urban F (%)	Rural F (%)	p-value
Asthma	18 (17.6%)	8 (8.2%)	0.046
Allergic Rhinitis	24 (23.5%)	12 (12.2%)	0.031
Atopic Dermatitis	9 (8.8%)	5 (5.1%)	0.327

Table 8: Association of Indoor Smoke Exposure with Asthma Prevalence (N = 200)

Indoor Smoke Exposure	Asthma Present F (%)	Asthma Absent F (%)	p-value
Yes	15 (22.7%)	51 (77.3%)	0.012
No	11 (7.8%)	123 (92.2%)	

Table 9: Association of Pet Ownership with Asthma (N = 200)

Pet Ownership	Asthma Present F (%)	Asthma Absent F (%)	p-value
Yes	12 (24.0%)	38 (76.0%)	0.008
No	14 (9.6%)	136 (90.4%)	

Table 10: Association of Family Size with Allergic Disorders (N = 200)

Family Size	Allergic Disorders Present F (%)	Absent F (%)	p-value
≤ 4 Members	35 (35.0%)	65 (65.0%)	0.218
> 4 Members	41 (28.3%)	59 (71.7%)	

Table 11: Seasonal Distribution of Allergic Symptoms (N = 76)

Season	Frequency (F)	Percentage (%)
Winter	28	36.8%
Post-monsoon	22	28.9%
Summer	14	18.4%
Other seasons	12	15.8%

Table 12: Treatment-Seeking Behavior among Asthmatic Children (N = 26)

Health Facility Used	Frequency (F)	Percentage (%)
Government Hospital	8	30.8%
Private Clinic	10	38.5%
No Regular Consultation	8	30.8%

Discussion

This cross-sectional descriptive study highlights a considerable burden of asthma and allergic disorders among school children in the Bihar region, with an asthma prevalence of 13%, allergic rhinitis in 18%, and atopic dermatitis in 7% of the 200 children surveyed [6]. These figures are comparable to reports from other regions of India, though variation in prevalence rates across states is known to occur due to differing environmental exposures, healthcare access, and diagnostic awareness. The findings are in line with previous research from urban North India, where asthma prevalence has ranged from 10% to 16%, reflecting a growing trend of allergic diseases in school-age populations [7,8].

A notable observation in this study was the higher prevalence of allergic conditions among male children compared to females, consistent with global and national patterns observed in pediatric asthma epidemiology [9]. Hormonal, immunological, and behavioral factors have been suggested as contributors to this disparity, with boys showing a higher likelihood of airway hyperreactivity in early childhood. Additionally, the urban-rural comparison revealed that children residing in urban areas had a significantly higher prevalence of both asthma and allergic rhinitis. This could be attributed to greater exposure to vehicular pollution, industrial emissions, reduced outdoor physical activity, and Westernized dietary habits in urban settings [10,11].

The strong association of family history with the occurrence of allergic diseases, reinforces the genetic predisposition and heritability of atopic conditions. Children with a positive parental or sibling history of asthma, rhinitis, or eczema were significantly more likely to manifest symptoms, indicating the need for targeted screening in such high-risk groups [12]. Environmental exposures such as indoor smoke from biomass fuels and tobacco, as well as pet ownership, were also found to be significantly associated with increased asthma prevalence. These findings are supported by existing literature emphasizing the role of household air quality and allergen exposure in the onset and exacerbation of respiratory conditions in children [13,14].

The role of seasonality showed that winter and post-monsoon periods were peak times for allergic symptom exacerbation. Fluctuating humidity, increased indoor crowding, and viral infections during colder months could contribute to this trend [15]. Additionally, allergens such as house dust mites thrive in humid environments, triggering respiratory symptoms. Despite this significant disease burden, the study found that nearly one-third of asthmatic children were not under regular medical supervision, highlighting an urgent need for community-level sensitization, parental education, and integration of asthma care into school health programs [16].

Although the prevalence data aligns with broader ISAAC findings, the study also underscores the local influences on disease expression, including family size, urbanization, and sociocultural behaviors. While family size was not found to be statistically significant in this cohort, the hygiene hypothesis suggesting lower allergy prevalence in larger families remains a relevant consideration in broader discussions [17,18].

The study is not without limitations. Being cross-sectional, it cannot establish causality. Also, the diagnosis of allergic conditions relied on questionnaire-based responses and clinical assessment rather than confirmatory investigations like spirometry, serum IgE levels, or skin prick tests, which might have increased diagnostic accuracy. However, the use of the ISAAC questionnaire lends standardization and comparability to global data, and the incorporation of clinical correlation enhances the robustness of the findings.

Conclusion

The study highlights a significant prevalence of asthma and allergic disorders among school-going children in the Bihar region, with urban residency, male gender, family history of atopy, and environmental exposures such as indoor smoke and pet ownership emerging as key associated factors. The findings underscore the pressing need for early identification, increased parental and school-level awareness, and region-specific intervention strategies to manage the growing burden of pediatric allergic diseases. Implementation of school-based screening programs and strengthening of pediatric allergy services at the community level could play a crucial role in improving health outcomes in this vulnerable population.

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