

Epidemiological Study on the Prevalence and Risk Factors of Asthma and Allergic Disorders Among School Children in the Bihar Region

Dibya Jyoti¹, Manoj Kumar Singh², Bhupendra Narain³

¹Senior Resident, Upgraded Department of Pediatrics, Patna Medical College and Hospital, Patna, Bihar, India

²Professor, Upgraded Department of Pediatrics, Patna Medical College and Hospital, Patna, Bihar, India

³Professor and HOD, Upgraded Department of Pediatrics, Patna Medical College and Hospital, Patna, Bihar, India

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Corresponding Author: Dr. Dibya Jyoti

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Abstract:

Aim: Asthma is a chronic pulmonary condition that affects 5 million children. Allergy often coexists with asthma as a common comorbidity. The coexistence of these disorders correlates with detrimental health outcomes and diminished quality of life. The objective of this research was to evaluate the prevalence of asthma and allergy diseases among schoolchildren in the Bihar area.

Methods: This cross-sectional study was conducted in the Upgraded Department of Pediatrics, Patna Medical College and Hospital, Bihar, India for one year. All village children aged 2–16 years were enumerated, and those with parental consent were included. Exclusions included cases of pulmonary tuberculosis, pneumonia, rheumatic heart disease, or visible chest deformities. Researchers conducted house visits, identified eligible children, and obtained assent and informed consent.

Results: The study analyzed demographic, medical, and environmental data of participants aged 2–16 years. Most were aged 5–11 years (47.6%) and male (57.1%). Urban residents formed the largest group (47.6%). Asthma was reported by 59.5%, with common symptoms being wheezing (41.7%) and nighttime coughing (35.7%). Allergies affected 45.2% with rhinitis being the most common. Environmental factors included smoking (35.7%), pets (47.6%), and exposure to outdoor pollution (53.6%). Most used LPG/CNG for cooking (59.5%). School and lifestyle factors varied, with 23.8% being highly active and 65.5% following a balanced diet. Awareness and treatment access remained limited (47.6%).

Conclusion: A large number of people had active lives and ate a healthy diet, according to the research. However, asthma treatment and knowledge remain difficult. This suggests that lifestyle and environmental variables, public awareness, and local availability to effective asthma and allergy medications must be prioritized.

Keywords: Disparities, Health outcomes, Pediatrics, Respiratory diseases, Survey research, Trends.

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Introduction

Asthma is a chronic respiratory disorder that poses a significant burden on public health, particularly among children, due to its complex medical management and high prevalence [1]. Globally, asthma affects millions of children, with approximately 5 million active cases reported in the United States in 2019, accounting for about 7% of the pediatric population [2]. Among the various asthma phenotypes, allergic asthma is one of the most common, with around 60% of affected children also reporting associated allergies. The interplay between asthma and allergies reflects a dynamic relationship influenced by genetic, environmental, and immunological factors.

Emerging evidence highlights the importance of epidermal barrier dysfunction in allergic

sensitization, which often precedes the development of asthma, particularly in children with eczema [3]. This phenomenon, known as the "atopic march," describes the progression from eczema to allergic rhinitis and ultimately to asthma. Studies have reported an increase in the prevalence of food and skin allergies among children with asthma between 2001 and 2013, while respiratory allergies showed a decreasing trend during the same period [4]. These shifts in prevalence patterns have been attributed to environmental exposures, urbanization, lifestyle changes, and epigenetic modifications influencing gene expression.

Asthma often coexists with other atopic conditions such as allergic rhinitis, eczema, and food allergies, creating a complex clinical picture [5]. Children

diagnosed with one atopic condition are at a higher risk of developing additional atopic diseases [6]. For instance, airway remodeling associated with allergic rhinitis may worsen asthma symptoms, leading to more severe disease outcomes. Similarly, early food sensitization in infancy has been linked to an increased likelihood of asthma onset later in childhood. These interconnections not only complicate disease management but also amplify the risk of poor health outcomes, including frequent hospital visits, emergency care utilization, and school absenteeism.

The coexistence of asthma with other atopic conditions has profound implications on a child's quality of life, affecting their social interactions, physical activities, and dietary choices. The presence of allergic rhinitis, in particular, has been identified as a risk factor for severe asthma, which may result in suboptimal treatment outcomes and a higher burden on healthcare systems [7]. Moreover, children with concurrent atopic conditions often face challenges in managing their symptoms within school settings, further contributing to academic disruptions and social stigma.

Understanding the epidemiology of asthma and allergies is essential for identifying vulnerable populations and tailoring interventions to address their specific needs. Environmental exposures, such as pollution, allergens, and dietary habits, play a critical role in the onset and progression of these conditions. Recent studies have emphasized the importance of early intervention and integrated management approaches to improve outcomes for children with asthma and allergies [8]. Such strategies include allergen avoidance, optimized medical therapies, and education programs for families and school personnel to foster better disease management and awareness [9,10].

The research emphasizes the significance of tackling the complex issues related to childhood allergies and asthma via this inquiry. Effective preventative actions, better clinical care, and resource allocation targeted at lessening the burden of these disorders on impacted children and their families may be made possible by identifying important risk factors and comprehending their consequences. The purpose of the current research was to determine the prevalence of allergy diseases and asthma among schoolchildren in the Bihar area.

Methods

This cross-sectional study was conducted in the Upgraded Department of Pediatrics, Patna Medical College and Hospital, Bihar, India for one year. A comprehensive list of all children aged 2 to 16 years residing in the hamlet was assembled, and those who agreed to participate, together with their parents or guardians who provided informed permission, were

included into the research. Cases of pulmonary TB, pneumonia, rheumatic heart disease, and neonates exhibiting significant thoracic deformities resulting from congenital heart disorders were excluded from the research. A comprehensive house survey of the whole community was conducted. Children aged 2 to 16 years were identified. Following the elucidation of the study's objective, agreement was acquired from the kid and informed permission was secured from the child's mother or main career.

Survey Data Variables

Self-reported survey answers were made by informed adult proxy (parent or guardian). Answering "yes" to "Has a doctor or other health professional ever told you that [child's name] had asthma?" indicated current asthma. "Does [child] still have asthma?" An asthma attack was counted for a kid with asthma who had one in the last year. A child was thought to have asthma if they had been to the emergency room or an urgent care centre in the past year.

There are two items on the survey that cover all upper respiratory allergens, including hay fever and others. Responses to these two enquiries were considered "respiratory allergy" for our analysis. Finally, four types of allergies were included for the study: hay fever, respiratory, skin, and food allergies that had occurred during the last twelve months. A comprehensive allergy grouping with eight combinations was developed using allergy question responses. These combinations included all three allergies, respiratory and skin, food and skin, respiratory and food, skin and food, no allergy at all, food exclusively, and skin allergy. If a student between the ages of 2 and 16 missed more than one school day in the previous year, their lost school days were added together. Use of a prescription quick-relief inhaler for asthma symptoms during the last three months and use of preventative asthma medication on a daily or near-daily basis were two queries that brought up medication use. A hospitalization for asthma that required an overnight stay occurred during the last year.

Statistical Analysis

The statistical analysis was performed with SPSS software, specifically version 27. For data that adhered to a parametric distribution, the student's t-test was implemented to compare the mean values of the two groups. Categorical data were analyzed using the Chi-square test. If the P-value was less than 0.05, the outcome was considered statistically significant.

Results

The demographic information of the study participants age distribution reveals that the majority of participants (47.6%) were aged between 5 and 11

years, followed by 28.6% in the 12 to 16 years age group. The youngest age group, 2 to 4 years, accounted for 23.8% of the participants. Regarding gender, males formed the majority with 57.1% (48 individuals), while females represented 42.9% (36 individuals). In terms of residential area, 47.6% of the participants resided in urban areas, making it the

largest group. Participants from rural areas accounted for 35.7%, and those from semi-urban areas constituted the smallest proportion, at 16.7%. This demographic distribution highlights a diverse sample in terms of age, gender, and residential background.

Table 1: Demographic Information		
Characteristics	frequency	percentage
Age group		
2-4	20	23.8%
5-11	40	47.6%
12-16	24	28.6%
Gender		
Male	48	57.1%
Female	36	42.9%
Residential Area		
Rural	30	35.7%
Urban	40	47.6%
Semi-Urban	14	16.7%

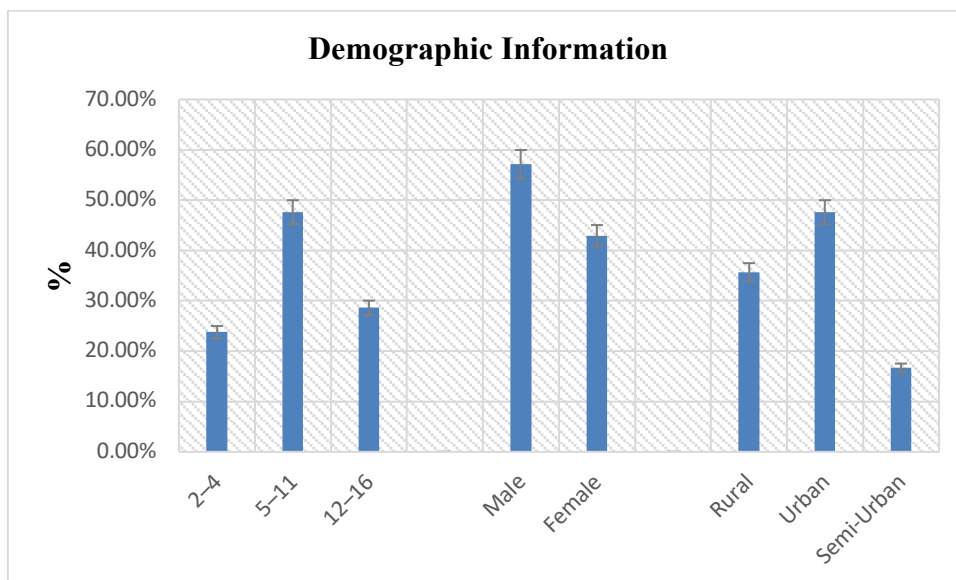


Figure 1. Demographic Information.

An overview of medical history data related to asthma and allergies. Among the respondents, 59.5% (50 individuals) reported being diagnosed with asthma, while 40.5% (34 individuals) were not. Common asthma symptoms included wheezing (41.7%), shortness of breath (33.3%), chest tightness (21.4%), and nighttime coughing (35.7%). Regarding allergic conditions, 45.2% experienced

allergic rhinitis, 23.8% had eczema, 14.3% reported food allergies, and 16.7% listed other allergies. Allergy symptoms occurred daily in 17.9%, weekly in 28.6%, occasionally in 41.7%, and rarely in 11.9% of respondents. Hospitalization or emergency care was required by 26.2%, whereas 73.8% did not need such interventions.

Table 2: Medical History		
Diagnosed with Asthma		
Yes	50	59.5%
No	34	40.5%
Symptoms Experienced		
Wheezing	35	41.7%
Shortness of Breath	28	33.3%

Chest Tightness	18	21.4%
Cough (especially at night)	30	35.7%
Allergic conditions		
Allergic rhinitis	38	45.2%
Eczema	20	23.8%
Food allergies	12	14.3%
Other	14	16.7%
Allergy symptoms occur		
Daily	15	17.9%
Weekly	24	28.6%
Occasionally	35	41.7%
Rarely	10	11.9%
Hospitalization or Emergency Care		
Yes	22	26.2%
No	62	73.8%

The environmental factors that may influence health. In the household environment, 35.7% of respondents reported having smoking family members, 47.6% had pets, and 23.8% lived in damp or moldy areas. Outdoor pollution exposure affected 53.6% of respondents, while 46.4% were not

exposed. Household allergen exposure was evenly split, with 50% reporting exposure and 50% not. Regarding primary cooking fuel, the majority used LPG/CNG (59.5%), followed by firewood (23.8%), coal (9.5%), and other sources (7.1%).

Table 3: Environmental Factors		
Household Environment		
Smoking family members	30	35.7%
Pets	40	47.6%
Damp or moldy areas	20	23.8%
Exposure to Outdoor Pollution		
Yes	45	53.6%
No	39	46.4%
Exposure to Household Allergens		
Yes	42	50%
No	42	50%
Primary Cooking Fuel		
LPG/CNG	50	59.5%
Firewood	20	23.8%
Coal	8	9.5%
Others	6	7.1%

Lifestyle factors, school environment conditions, and parental observations. In school settings, 47.6% of respondents reported adequate ventilation, while 33.3% experienced high dust levels, and 19% noted nearby construction sites. Physical activity levels varied, with 23.8% being very active, 53.6% moderately active, and 22.6% rarely active. A balanced diet was followed by 65.5%, while 34.5% did not maintain one. Processed food consumption

was reported by 42.9%, whereas 57.1% avoided it. A family history of asthma was present in 54.8%, and 59.5% indicated their condition worsened due to environmental factors. Treatments in the past year were evenly divided, with 50% receiving them and 50% not. Awareness and support availability were reported by 47.6%, while 52.4% indicated a lack of such resources.

Table 4: Lifestyle & School and Parental Observations.		
School Environment		
Adequate Ventilation	40	47.6%
High Dust Levels	28	33.3%
Nearby Construction Sites	16	19%
Physical Activity		
Very Active	20	23.8%

Moderately Active	45	53.6%
Rarely Active	19	22.6%
Balanced Diet		
Yes	55	65.5%
No	29	34.5%
Processed Food Consumption		
Yes	36	42.9%
No	48	57.1%
Family History of Asthma		
Yes	46	54.8%
No	38	45.2%
Worsening due to Environmental Factors		
Yes	50	59.5%
No	34	40.5%
Treatments in the Past Year		
Yes	42	50%
No	42	50%
Awareness and Support Availability		
Yes	40	47.6%
No	44	52.4%

Discussion

A total of 84 patients were included, featuring a diverse age distribution, with the majority of participants (47.6%) falling within the 5–11 age group. The gender distribution indicated a male predominance of 57.1%, alongside a significant urban majority of 47.6%. This highlights the widespread nature of asthma and the influence of environmental elements on respiratory well-being. A research endeavour by Pal et al. encompassing 15 epidemiological studies in India has revealed a mean weighted prevalence of 2.74% among children aged 6 to 14 years, and our results are consistent with the prior findings [11]. A multitude of studies carried out over the last twenty years has indicated prevalence rates varying from 0.9% to 15.7% across different urban regions in India [12]. Nonetheless, research undertaken in Bangalore city, India, revealed a prevalence of 19.4%, a figure that markedly exceeds the results from other contemporary studies carried out in diverse urban locales across the nation. A recent study revealed that the incidence of asthma in school-aged children between 11 and 16 years old in a northwestern Indian city stands at 13.1%. The relatively diminished prevalence noted in our investigation could be ascribed to improvements in environmental conditions, differences in the design of ventilated housing, and the emphasis on school-aged children as the demographic under study.

Our study revealed that asthma impacted 59.5% of participants, with prevalent symptoms such as wheezing (41.7%) and nocturnal cough (35.7%). Allergic rhinitis was the most prevalent co-occurring condition, affecting 45.2% of individuals, with

allergy symptoms appearing episodically and frequently triggered by environmental factors. A mere 26.2% necessitated hospitalization, indicating that the majority of cases were effectively managed on an outpatient basis. McHugh et al. shown that pets engaged in close, frequent, and domestic interactions, such as cats and dogs, play a significant role in the development of atopy, eczema, and asthma [13]. Two supplementary studies carried out in India revealed analogous results, underscoring the noteworthy relationship between interaction with pet animals and the incidence of childhood asthma [14]. Alperberg et al. undertook a systematic review that demonstrated that exposure to pet animals in the first two years of life elevates the risk of asthma by 11% [15]. Nevertheless, the ownership of pets encompasses a range of lifestyle elements that may independently influence the development of asthma. Moreover, the temporal nature of this characteristic in human existence and its erratic correlation render the elucidation of this phenomenon within a wider framework of importance more intricate.

Our research indicates that environmental influences play a crucial role in asthma prevalence, with 35.7% of participants exposed to family members who smoke and 47.6% living with pets. Indoor dampness accounted for 23.8%, while outdoor pollution represented a significant 53.6%, and household allergens contributed 50% to the overall issue. Although a majority utilized LPG/CNG (59.5%) for culinary purposes, the dependence on firewood (23.8%) and coal (9.5%) underscored further risks associated with indoor air pollution. In a Brazilian study, Carlos et al. evaluated risk factors for childhood asthma and found correlations with prematurity, maternal asthma, pet exposure during

infancy, antibiotic use during the first six months of life, current rhinitis, sharing a bedroom during the first year of life, and a history of atopy [16]. According to a South Korean investigation, a risk factor analysis regarding the severity of asthma found a strong association with exposure to dog dander, tobacco smoke, and children's absence of a home air purifier [17]. Similarly, exposure to smoking, early-life common colds, indoor cooking, contact with pets, and mould have been linked to substantial risk factors in a study of 999 children in Mexico. Conversely, it was shown that having many siblings in the family, nursing for more than three months, and giving birth via caesarean section were protective factors [18].

Our research revealed that school and lifestyle variables affected asthma management, with 47.6% indicating sufficient ventilation, while 33.3% faced issues from dust and 19% from building sites. Moderate exercise was prevalent (53.6%), but 22.6% were seldom active, perhaps owing to asthma. A balanced diet (65.5%) and genetic susceptibility (54.8%) were major factors, but environmental triggers intensified symptoms in 59.5% of cases. This discovery aligns with the research conducted in northern India by Pokharel et al. [19]. However, there was no association found between asthma and the absence of a smoke outlet in the house, in a study of seventh and eighth graders in Bhopal, India [20].

Despite the prevalence of asthma, only 47.6% expressed knowledge and availability of help, indicating deficiencies in education and resource accessibility for impacted families. Care received in the last year was equally distributed (50%), indicating possible obstacles to obtaining regular treatment or fluctuations in case severity. This highlights the need for enhanced public health measures focused on early diagnosis, consistent treatment, and improved support networks for children with asthma and their caregivers. Hsu et al. [9] founded that missing school days is associated with uncontrolled asthma, asthma flare-ups, and the requirement for urgent or emergency asthma therapy. This suggests that kids with allergies and asthma can also have other health problems that call for more preventive medication to control their asthma symptoms.

Conclusion

The most prevalent symptoms of asthma were wheezing and nocturnal coughing, which were reported by a large proportion of the population. Allergic diseases were common, especially rhinitis. Although most residences used cleaner cooking fuels like LPG/CNG, environmental variables such as smoking, and outside pollution were identified as major causes to respiratory problems. The research found that lifestyle characteristics such as food and

physical activity differed from person to person, with a large proportion living active lives and eating a balanced diet. However, there are still impediments to asthma treatment and education. These results highlight the need of focused efforts to address lifestyle and environmental variables, raise public awareness, and increase local access to effective asthma and allergy treatments.

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