

Clinico-Epidemiological Profile and Risk Factors of Childhood Asthma in a Tertiary Care Centre in Central India: A Cross-Sectional Study

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Abstract

Background: Childhood asthma is a major public health problem with multifactorial aetiology involving genetic, environmental, and socio-demographic factors. Region-specific data are essential for targeted interventions in India. **Material and Methods:** A hospital-based cross-sectional study was conducted over 14 months in a tertiary care centre in Central India. A total of 112 children aged 6–18 years diagnosed with asthma as per GINA 2025 guidelines were included. Data on demographic characteristics, clinical features, and potential risk factors were collected using a structured proforma. Statistical analysis was performed using descriptive statistics. **Results:** The majority of participants were aged 6–8 years (46.4%), with mean age of 9.06 ± 2.16 years, with a male predominance (63.4%). Family history of asthma/atopy was present in 25% of cases. Allergic rhinitis was the most common comorbidity (17%). Most children were delivered vaginally (83%) and exclusively breastfed (88.4%). Environmental and non-genetic factors appeared to play a significant role in disease occurrence. **Conclusion:** Childhood asthma in this region shows a higher prevalence among younger males and is influenced by environmental and clinical factors rather than hereditary predisposition alone. Early identification of risk factors can improve disease control and outcomes.

Keywords: Childhood asthma, epidemiology, risk factors, paediatric asthma, Central India.

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INTRODUCTION

Asthma is a chronic inflammatory airway disorder characterized by reversible airflow obstruction and bronchial hyperresponsiveness.^[1] It remains one of the most common chronic diseases in children, contributing significantly to morbidity worldwide. Globally, asthma affects more than 300 million individuals, and children constitute a substantial proportion of this burden.^[2]

Asthma in children is associated with a wide spectrum of clinical manifestations. The most common symptoms include recurrent wheezing, chronic cough, breathlessness, and chest tightness, often worsening at night or early morning. In younger children, symptoms may be nonspecific and overlap with other respiratory conditions, leading to diagnostic challenges.^[1,3]

The aetiology of paediatric asthma is complex and involves interactions between genetic predisposition and environmental exposures such as air pollution, allergens, and lifestyle factors. Despite global guidelines, regional variability in disease patterns necessitates localized research.^[4-6]

Central India, particularly Madhya Pradesh, lacks sufficient data on the clinico-epidemiological characteristics of childhood asthma. Understanding these patterns is crucial for improving diagnosis, prevention, and management strategies.

Aim and objectives: To assess the clinico-epidemiological profile and associated risk factors of childhood asthma in a

tertiary care hospital in Central India.

MATERIALS AND METHODS

Study Design and Setting: This observational cross-sectional study was conducted over a period of 14 months (from August 2024 to September 2025) in the Department of Paediatrics, Maharaja Yeshwantrao Hospital (MYH) and Chacha Nehru Bal Chikitsalaya (CNBC), Indore, which are tertiary care teaching hospitals attached to Mahatma Gandhi Memorial Medical College (MGMMC), Indore.

Study Population: Children aged 6–18 years attending the paediatric outpatient department (OPD) and inpatient department (IPD) of the study centre diagnosed with bronchial asthma as per GINA 2025 guidelines.

Sample Size and Sampling: A total of 112 children were enrolled using selection criteria. The sample size was determined based on the feasibility of patient availability during the study

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period and previous hospital-based studies on childhood asthma conducted in similar settings.

Inclusion Criteria: Paediatric asthma cases of Age 6–18 years with Clinical diagnosis of asthma and parents willing to give Informed consent.

Exclusion Criteria: Those cases with other co-morbidities like Congenital heart disease, Chronic lung diseases (e.g., cystic fibrosis) etc. and parents refused to give consent.

Data Collection tools: Data were collected using a pre-tested proforma containing Socio-demographic details,

Clinical history and symptoms, Allergic manifestations, Environmental exposures, Feeding practices and birth history. Clinical examination and investigations such as CBC, chest X-ray, PEFr, and spirometry were performed.

Statistical Analysis: Data were entered in Microsoft excel and analyzed using SPSS 25.0 trial version, descriptive statistics were used. Continuous data was expressed in terms of mean and standard deviation. Categorical data was expressed in terms of frequency and percentages.

RESULTS

Table 1: Socio-Demographic profile of subjects

Sl. No.	Variables	Frequency (n)	Percentage (%)
1.	Age group (in years)		
	6–8	52	46.4
	9–11	43	38.4
	12–14	17	15.2
	Mean Age \pm SD		
	9.06 \pm 2.16		
2.	Gender		
	Male	71	63.4
	Female	41	36.6
3.	Socio-economic status		
	Upper lower	46	41.1
	Lower	44	39.3
	Lower middle	18	16.1
	Upper middle	4	3.6
4.	Type of family		
	Nuclear	64	57.1
	joint	48	42.9
5.	Type of house		
	Pucca	105	93.7
	Kachha	7	6.3
6.	Location of house		
	Urban	93	83.0
	Rural	19	17.0
	Total	112	100
7.	Housing conditions		
	Damp dwelling (+)	24	21.4
	Overcrowding (+)	68	60.7

Majority were aged 6–8 years (46.4%), with mean age of the participants 9.06 \pm 2.16 years. Male predominance (63.4%) observed, Majority belongs to upper lower (41.1%) or lower (39.3%) socio-economic class, Majority (83.0%) of them

residing in urban areas. Overcrowding present in majority (60.7%) of subjects' houses. Large proportion (42.9%) of subjects comes from joint families.

Table 2: Relevant previous histories

Sl. No.	Variables	Frequency (n)	Percentage (%)
1.	Family History of Asthma		
	Yes	28	25.0
	no	84	75.0
2.	Allergic rhinitis (+)	19	17.0
3.	Atopic dermatitis (+)	1	0.9
4.	Mode of delivery		
	NVD	93	83.0
	LSCS	19	17.0
5.	Feeding practices		
	Exclusive breastfeeding (EBF)	99	88.4
	Mixed feeding (EBF + Top feed)	7	6.3
	Top feeding	6	5.4
	Total	112	100

Family History Present in 25% of cases, Associated Allergic

Conditions are Allergic rhinitis: (17%), Atopic dermatitis

(0.9%). Majority (83.0%) of them delivered by NVD.

Majority (88.4%) were exclusively breast fed.

Table 3: Nutritional status, severity of asthma and allergen exposure

Sl. No.	Variables	Frequency (n)	Percentage (%)
1.	BMI category		
	Underweight	83	74.1
	Normal	26	23.2
	Obese	3	2.7
2.	Severity of Asthma		
	Intermittent	69	61.6
	Mild persistent	29	25.9
	Moderate persistent	14	12.5
3.	Cooking fuel used		
	LPG gas	96	85.7
	LPG + biomass	15	13.4
	Biomass fuel	1	0.9
	Total	112	100
4.	Pet exposure (+)	9	8.0
5.	Passive smoking (+)	7	6.3
6.	Mosquito coil / agarbatti (+)	23	20.5

Majority of subjects are underweight. Intermittent severity present in majority (61.6%) of episodes. Pet exposure present

in 8.0% participants. In 6.3% subjects passive smoking present and in 20.5% mosquito coil smoke exposure present.

Table 4: Triggers and Clinical Factors (n = 112)

Sl. No.	Factor	Yes - n (%)	No - n (%)
1.	Seasonal variation	64 (57.1)	48 (42.9)
2.	Dust exposure	30 (26.8)	82 (73.2)
3.	URTI	30 (26.8)	82 (73.2)
4.	Play-induced symptoms	23 (20.5)	89 (79.5)
5.	Smoke exposure	19 (17.0)	93 (83.0)
6.	Food allergy	1 (0.9)	111 (99.1)

Some of the triggering factors observed are Seasonal variation (57.1%), Dust exposure (26.8%), URTI (26.8%), Play-induced symptoms (20.5%), Smoke exposure (17.0%), and Food allergy (0.9%).

Key Observations

- Higher burden in younger age group (84.8% in < 11 years)
- Male predominance
- Environmental and clinical factors outweigh genetic predisposition

DISCUSSION

Childhood asthma is a multifactorial condition resulting from complex interactions between genetic predisposition, environmental exposures, and socioeconomic determinants. The present study provides an extensive clinico-epidemiological profile of asthmatic children attending a tertiary care hospital in central India, spotlighting the predominance of modifiable risk factors in disease expression and severity.

The age distribution in this study demonstrated that asthma was more frequently observed in younger children, particularly in the 6–8-year age group, aligns with global epidemiological observations that early childhood represents a critical period for the onset of wheezing disorders and asthma symptoms. Longitudinal cohort study by Martinez FD et al,^[7] have shown that a substantial proportion of early childhood wheezing either resolves or evolves into persistent asthma depending on host and environmental factors. The

relatively lower proportion of older children in this group may reflect either symptom resolution with age or differences in healthcare-seeking pattern.

A clear male predominance was observed, which is consistent with existing literature of Kumar GS et al,^[8] indicating higher asthma prevalence among boys in early childhood. This gender difference has been attributed to smaller airway caliber relative to lung size in boys, increased airway responsiveness, and hormonal influences that change with age. Gupta D et al,^[9] have similarly reported higher prevalence among male children, reinforcing the biological and possibly sociocultural determinants influencing healthcare access.

While Western studies like those by Ober C and Yao TC,^[10] report higher familial aggregation of asthma, Indian studies frequently show comparatively lower rates, indicating heterogeneity in genetic susceptibility and a relatively greater role of environmental triggers in low and middle-income settings. Despite a positive family history of asthma or atopy was present in only one-fourth of cases, the majority lacked hereditary predisposition, underscoring the major contribution of environmental and acquired factors.

Among associated allergic conditions, allergic rhinitis was the most common comorbidity. This finding supports the “united airway disease” concept of ARIA 2008 update,^[11] wherein upper and lower airway inflammations coexist as part of a common pathophysiological continuum. While, the relatively lower prevalence of allergic rhinitis compared to global estimates may reflect under recognition or under reporting of nasal symptoms in clinical settings. Variability in reported prevalence across

studies like Chinnakkannan et al. and Koshy et al,^[12,13] highlights differences in diagnostic awareness and methodology.

Perinatal factors such as mode of delivery didn't show a strong association in this study, with the majority of children being delivered vaginally. Although caesarean section has been associated with increased asthma risk in meta-analysis by Thavagnanam et al,^[14] the findings in the present study and similar Indian cohorts of Maitra et al,^[15] suggest that its contribution may be less pronounced in this population. Similarly, the high prevalence of exclusive breastfeeding observed in this study indicates favourable early-life practices. Despite this, the occurrence of asthma suggests that while breastfeeding may confer partial protection, it does not completely eliminate risk. Previous cohort studies by Oddy WH et al. and Kull I et al,^[16,17] have demonstrated a protective but not absolute effect of breastfeeding on asthma development, likely mediated through immune modulation and microbiome development. Environmental exposures emerged as significant contributors to asthma risk. Exposure to mosquito coil or agarbatti smoke was the major indoor pollutant identified. Combustion of such materials releases particulate matter and toxic compounds that can trigger airway inflammation and exacerbate respiratory symptoms as suggested by Liu W et al.^[18] Although passive smoking and pet exposure were less frequent, their established role in airway sensitization and asthma exacerbation remains clinically relevant as shown in Burke H et al.^[5] These data underline the importance of indoor air quality in paediatric respiratory health.

Socioeconomic status showed a clear association, with the majority of children belonging to lower and upper-lower classes. This is consistent with global and Indian data,^[19,20] indicating higher asthma morbidity among socioeconomically disadvantaged populations. Poor socioeconomic conditions are often linked with overcrowding, poor nutrition, increased exposure to environmental pollutants and inadequate healthcare access, all of which contribute to disease burden. Nutritional assessment revealed a high prevalence of undernutrition in present study, contrasting with Western literature by Forno E and Celedón JC,^[21] where obesity-related asthma is more prominent. Undernutrition may impair immune function, reduce respiratory muscle strength, and hinder lung development, thereby exacerbating asthma severity and control. Similar findings from Sachdev H et al,^[22] highlight the dual burden of malnutrition and chronic respiratory disease in developing countries. A substantial proportion of children lived in overcrowded and damp environments, both of which are known to increase exposure to allergens, molds, and respiratory pathogens. Evidence from systematic review by Fisk WJ et al,^[23] indicates that damp housing significantly increases the risk of asthma and respiratory symptoms. These findings underscore the importance of living conditions as modifiable risk factors by reinforcing the role of environmental determinants. Although LPG was the cooking fuel in most households, a subset of children was still exposed to biomass fuel smoke. Household air pollution from biomass combustion is a well-known risk factor for

respiratory morbidity, particularly in low-resource settings.^[24-26] Even limited exposure may trigger airway inflammation and symptom exacerbation.

Seasonal variation was identified as the most common trigger, followed by dust exposure and upper respiratory tract infections. The study by Johnston SL et al,^[27] shows viral infections as well-recognized precipitants of asthma exacerbations in children, accounting for a substantial proportion of acute episodes. Dust exposure, particularly to indoor allergens such as house dust mites, has also been consistently implicated in symptom exacerbation as suggested by Platts-Mills TA et al.^[28] The observed pattern highlights the interplay between environmental and infectious triggers in disease manifestation.

The severity distribution in current study revealed that the majority of children had intermittent or mild persistent asthma, with relatively few cases of moderate persistent disease and nil reporting of severe cases. This pattern is consistent with community-based studies by Simões SM et al. Zahran HS et al. and Ibraheem AJ et al,^[29-31] where milder forms predominate. The predominance of less severe disease may reflect early diagnosis, healthcare access, or the protective influence of favourable early-life practices such as breastfeeding. While, it may also indicate referral bias, as severe cases may be managed in specialized settings. The strengths of this study include its comprehensive evaluation of multiple risk factors, including demographic, environmental, nutritional, and socioeconomic variables, providing a holistic understanding of childhood asthma in a real-world tertiary care setting. However, certain limitations must be acknowledged. It's a Single-centre study with limited sample size, and it lacks longitudinal follow-up. The cross-sectional design limits causal inference. Selection bias is likely, as the study was conducted in a tertiary care centre predominantly serving lower socioeconomic populations. Overall, the findings of present study emphasise the multifactorial nature of childhood asthma and underline the dominant role of modifiable environmental and social factors in shaping disease patterns in developing country settings.

CONCLUSION

Childhood asthma in the current study was mainly observed among younger male children and was strongly affected by environmental, socioeconomic, and nutritional factors rather than hereditary predisposition alone. This study shows that early-life protective factors like exclusive breastfeeding and vaginal delivery did not completely prevent disease occurrence, underscoring the significant role of postnatal exposures. Indoor air pollution, overcrowding, damp housing conditions, and lower socioeconomic status were identified as key modifiable risk factors, whereas seasonal variation and respiratory infections were major triggers of exacerbations. The high prevalence of undernutrition further highlights the co-existence of chronic respiratory disease with nutritional deficiency in this population. Most children exhibited mild forms of asthma, suggesting opportunities for early intervention and effective disease control. These findings highlight the need for a comprehensive public health strategy that addresses the improvement of living conditions, reduction of environmental exposures, promotion of nutritional health, and enhancement of early diagnosis and

management. Targeted interventions addressing these factors can significantly reduce the burden of childhood asthma and improve long-term respiratory outcomes in resource-limited settings like Central India.

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Conflicts of interest

There are no conflicts of interest.

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