



DECODING WHEEZE: CLINICAL SPECTRUM OF WHEEZE IN UNDER-5 CHILDREN FROM A HIGH-ALTITUDE TERTIARY CARE CENTER: AN OBSERVATIONAL STUDY

Dr. Anika Sharma*¹, Dr. Parveen Bhardwaj², Dr. Ambika Sood³, Dr. Minoo Sharma⁴

¹Junior Resident, Department of Pediatrics, Indira Gandhi Medical College, Himachal Pradesh.

²Professor, Department of Pediatrics, Indira Gandhi Medical College, Himachal Pradesh.

³Assistant Professor, Department of Pediatrics, Indira Gandhi Medical College, Himachal Pradesh.

⁴Associate Professor, Department of Physiology, Indira Gandhi Medical College, Himachal Pradesh.

Orcid ID: ¹<https://orcid.org/0009-0000-3169-7486>, ²<https://orcid.org/0000-0002-4470-4013>, ³<https://orcid.org/0000-0003-1614-2620>, ⁴<https://orcid.org/0000-0002-1797-6638>

Corresponding Author: Dr. Anika Sharma

Junior Resident, Department of Pediatrics, Indira Gandhi Medical College, Himachal Pradesh.

ABSTRACT

Introduction: Wheezing in children under five years is a common and heterogeneous respiratory problem, ranging from transient infection-related episodes to recurrent phenotypes influenced by environmental and developmental factors. Studying its spectrum is important for early clinical classification, risk identification, and prevention planning in tertiary care settings.

Aim and Objective: To study the spectrum and case burden of wheeze in children aged 3 months to 5 years admitted to the Department of Pediatrics at IGMCM Shimla, and to classify wheeze according to clinical profile, etiology, and associated risk factors.

Materials & Methods: This observational cross-sectional study was conducted over one year from November 2024 to October 2025 in a tertiary care center in high altitude setting. A total of 151 children aged 3 months to 5 years admitted with definite wheeze were enrolled after parental consent. Both first episode and recurrent wheezers were included. Children with severe critical illness, structural airway anomalies, major cardiovascular disease, or age outside the study range were excluded.

Results: Wheezing admissions occurred throughout the year, with peaks in April (14.6%), September (13.9%), and July (12.6%). Acute bronchiolitis was the commonest diagnosis (56.29%), followed by pneumonia (24.5%) and asthma (15.23%). Previous wheeze was present in 54.97% of children, while 82% had fewer than three episodes in the previous year. Hypoxemia at admission was seen in 80.79%. Episodic wheeze predominated, and environmental smoke exposure showed an important association with wheeze pattern.

Conclusion: Wheezing illness in under-five children was predominantly infection-driven, with bronchiolitis and pneumonia contributing most cases. Episodic viral wheeze was the dominant phenotype, while smoke exposure, family history of recent URI, emerged as modifiable influences, supporting phenotype-based evaluation and targeted preventive strategies.

Keywords: Wheeze, Under-Five Children, Bronchiolitis, Episodic Viral Wheeze, Hypoxemia.

INTRODUCTION

Wheezing in children under five years of age is one of the most frequent respiratory problems encountered in pediatric practice and remains a major cause of outpatient visits, emergency consultations, and hospital admissions (1) Wheeze is a clinical manifestation produced by multiple underlying conditions, ranging from transient viral-associated airway narrowing to early asthma, allergic airway disease, bronchiolitis-related inflammation, structural airway abnormalities, aspiration, and other less common disorders.

Epidemiological data show that early-life wheezing is extremely common, with about one-third of children experiencing wheeze in the first three years and nearly half having at least one wheezing episode by six years of age. (2).

Young children have small-caliber airways, increased airway compliance, immature immune responses, and enhanced susceptibility to viral lower respiratory tract infections which predispose them to airflow limitation even with relatively modest mucosal edema or secretions (3). Current evidence suggests that early wheeze is not only a symptom burden for families but may also represent the first visible marker of future chronic airway disease in a subgroup of children, especially those with atopy, family history of asthma, or persistent interval symptoms (4).

The term “spectrum of wheeze” is particularly



www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 16-06-2026
Date Acceptance: 23-06-2026
Date of Publication: 22-07-2026

relevant in preschool children because wheezing illnesses vary in trigger pattern, frequency, severity, underlying inflammatory profile, and long-term prognosis. Traditionally, preschool wheeze has been described using clinical phenotypes such as episodic viral wheeze, in which symptoms occur mainly during viral infections with relative wellness between episodes, and multiple-trigger wheeze, in which symptoms are also provoked by allergens, exercise, smoke exposure, laughter, or crying (5). Although this classification has practical clinical value, more recent evidence shows that these phenotypes can overlap and may change over time in the same child, indicating that preschool wheeze is dynamic rather than fixed. (6).

Viral respiratory infections such as respiratory syncytial virus, rhinovirus, influenza, and parainfluenza induce airway inflammation, epithelial injury, mucus hypersecretion, and bronchial narrowing, resulting in expiratory airflow obstruction. (7).

Alongside infections, genetic predisposition, parental asthma, atopy, prematurity, low birth weight, and exposures such as tobacco smoke, air pollution, biomass fuel, damp housing, and overcrowding contribute to recurrent wheezing. (8). Diagnostic evaluation of wheeze in children under five years is predominantly clinical, based on detailed history, recognition of recurrent patterns, identification of triggers, family history, associated atopy, response to therapy, and exclusion of alternative causes. NICE guidance highlights the lack of reliable reference standards in this age group and recommends periodic reassessment with specialist referral in severe or recurrent cases. (9).

Management strategies reinforce that wheeze in under-five children exists as a clinical spectrum. Some children have infrequent, viral-triggered episodes requiring only supportive care and intermittent bronchodilators, whereas others exhibit recurrent symptoms, interval cough, nocturnal disturbance, activity limitation, or atopy suggestive of early asthma, warranting controller therapy such as inhaled corticosteroids. The GINA 2025 Strategy Report emphasizes individualized, evidence-based care with regular review, while preschool wheeze guidelines advocate phenotype-based management and follow-up, underscoring the importance of studying wheeze patterns for risk stratification and long-term care planning (10).

An observational study on wheeze in under-five children is highly relevant, as it clarifies age distribution, clinical patterns, triggers, atopy,

environmental exposures, recurrence, and hospitalization burden. By capturing real-world variability, such studies aids in risk stratification and long-term pediatric respiratory management (2). Furthermore, literature on clinical spectrum in a high altitude setting like ours is limited. Study done by Wang et al in multiple hospitals of US found modest association of severity of bronchiolitis with altitude.(22) There is very limited data on high altitude settings in India.

This study aims to observe the spectrum and case burden of wheeze in children aged 3 months to 5 years admitted to the Pediatrics Department of IGMSC Shimla, a center situated at an average 7476 feet above sea level. It seeks to categorize wheeze types based on clinical profile, etiology, and risk factors, and to evaluate associations between episodic and multiple-trigger wheeze with prematurity, NICU admission, maternal and environmental smoke exposure, feeding practices, atopy, eczema, family history, and socioeconomic status.

MATERIALS AND METHODS

This observational cross-sectional study was conducted in the Department of Pediatrics at Indira Gandhi Medical College, Shimla, over one year (November 2024 to October 2025). Children aged 3 months to 5 years admitted with a definite history of wheeze or wheeze at presentation were enrolled after informed parental consent. Eligible participants included both first and recurrent wheeze cases. Exclusion criteria comprised children below 3 months or above 5 years, those with severe critical illness such as shock, sepsis, respiratory failure, major cardiovascular disease, structural airway anomalies, or lack of consent. Clinical data were recorded at admission and variables included were age, sex, presenting symptoms, personal and family history of wheeze, allergic diseases like asthma, previous hospitalization for respiratory illnesses, maternal smoking, and exposure to environmental smoke.

RESULTS

The present study was conducted in the Department of Pediatrics at Indira Gandhi Medical College, Shimla, including 151 children aged 3 months to 5 years admitted with wheeze. Admissions were recorded from November 2024 to October 2025, with peaks in April (14.6%), September (13.9%), and July (12.6%), and lowest in June (1.3%) and March (2.6%).

Table 1: Distribution of Participants According to Final Diagnosis

Final diagnosis	Frequency	%
Acute bronchiolitis	85	56.29%
Pneumonia	37	24.5%
Asthma	23	15.23%

Acute layngotracheobronchitis	5	3.31%
Heart disease	1	0.66%
Total	151	100%

Acute bronchiolitis was the most common cause of wheeze (56.29%), indicating a predominantly viral etiology in under-5 children. Pneumonia (24.5%) and asthma (15.23%) contributed significantly,

reflecting both infectious and reactive airway causes. Acute laryngotracheobronchitis (3.31%) and heart disease (0.66%) were rare.

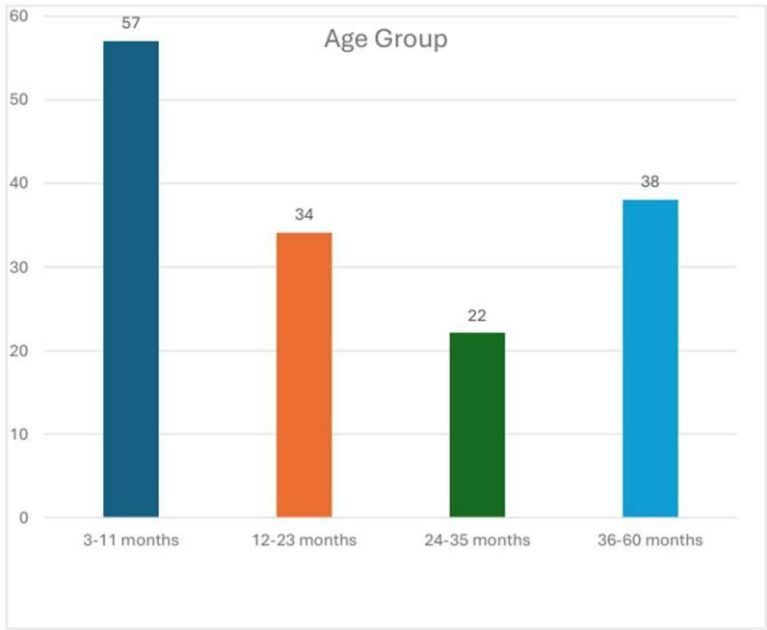


Figure 1: Distribution of Study Participants According to Age Group

The age distribution shows a higher burden of wheeze in younger children, with maximum cases in 3–11 months (57), followed by 36–60 months (38).

A decline is observed in 12–23 months (34) and further in 24–35 months (22).

Table 2: Distribution of Participants According to Previous History of Wheeze

Previous history of wheeze	Frequency	%
Yes	83	54.97%
No	68	45.03%
Total	151	100%

More than half of the children had a previous history of wheeze (54.97%), indicating a significant proportion with recurrent or persistent airway

disease. A substantial number (45.03%) presented with first-time wheezing episodes, reflecting acute or transient causes.

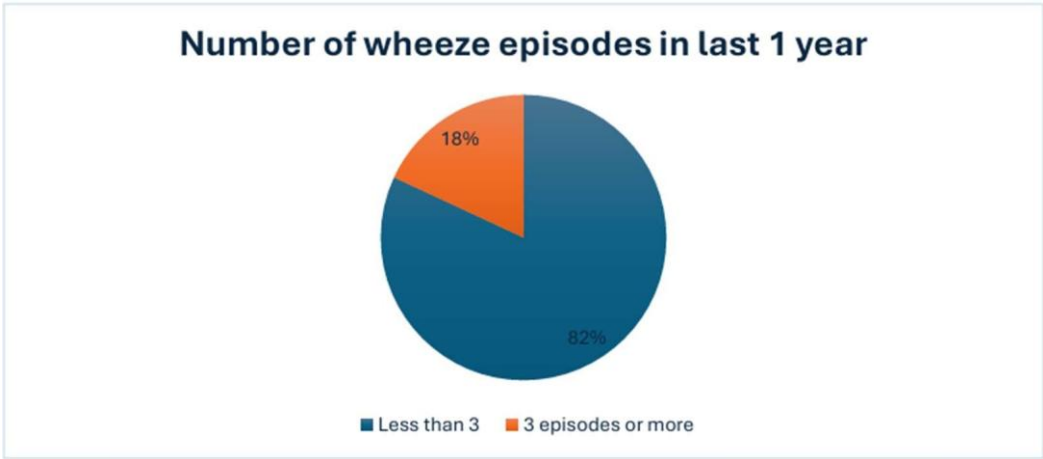


Figure 2: Distribution of Participants According to Number of Wheeze Episodes in the Last One Year

Most children (82%) had fewer than 3 wheeze episodes in the last year, indicating predominantly infrequent or episodic wheezing. A smaller proportion (18%) experienced ≥ 3 episodes, suggesting recurrent or persistent disease.

Table 3: Distribution of Participants According to Seasonal Variation of Symptoms

Seasonal variations	Frequency	%
No	43	51.81%
Yes	40	48.19%
Total	83	100%

Seasonal variation of symptoms was observed in nearly half of the participants (48.19%), while a slightly higher proportion (51.81%) showed no seasonal pattern.

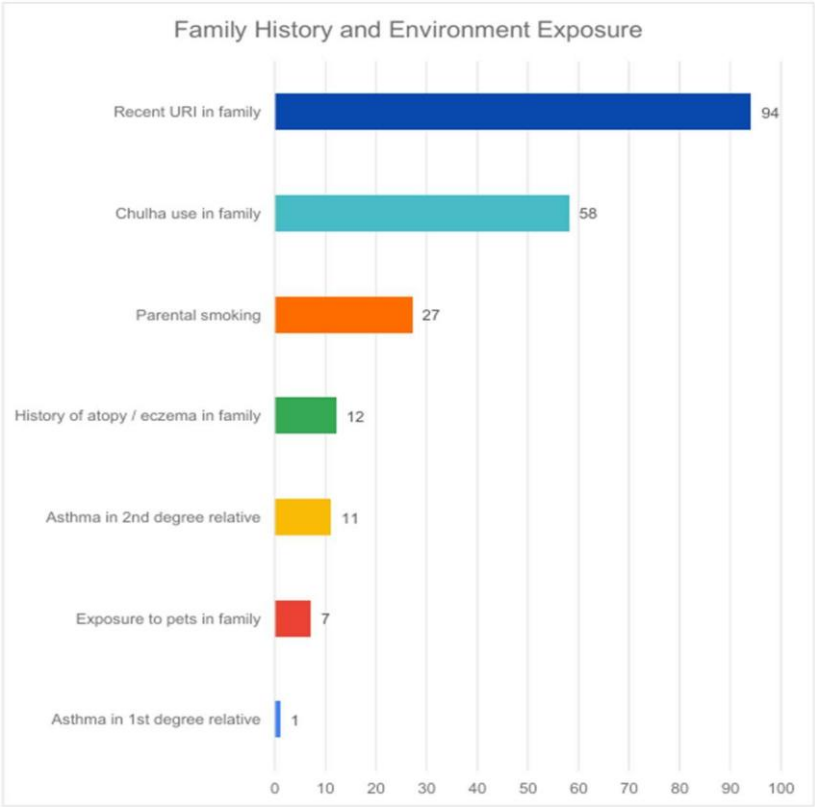


Figure 3: Distribution of Family History and Environmental Exposure Variables

Recent URI in the family was the most common exposure (94), indicating a strong infectious trigger for wheeze. Environmental factors like chulha use (58) and parental smoking (27) were also notable,

suggesting the role of indoor air pollution. Atopic predisposition was relatively lower, with eczema (12) and asthma in relatives (1st degree: 1, 2nd degree: 11).

Table 4: Distribution of Participants According to Hypoxemia at Admission

Hypoxemia at admission	Frequency	%
Yes	122	80.79%
No	29	19.21%
Total	151	100%

A large majority of children presented with hypoxemia at admission (80.79%), indicating significant respiratory compromise in wheezing

episodes. Only 19.21% had normal oxygen saturation, suggesting milder disease.

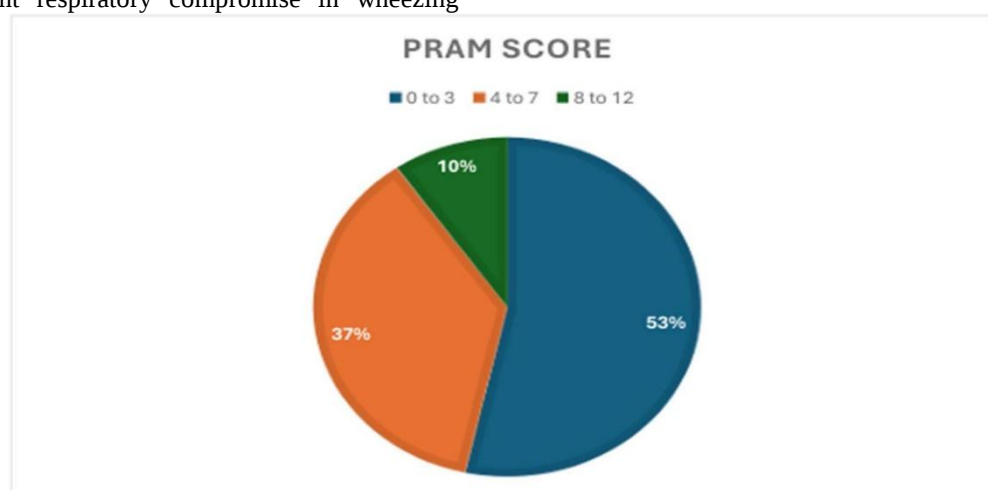


Figure 4: Distribution of Participants According to PRAM Score

Most children had mild PRAM scores (0–3) accounting for 53%, indicating less severe airway obstruction in the majority. Moderate severity (4–7)

was seen in 37%, while only 10% had severe scores (8–12).

Table 5: Distribution of Participants According to Type of Wheeze

Episodic/multitrigger wheeze	Frequency	%
Episodic	73	87.95%
Multitrigger	10	12.05%
Total	83	100%

Episodic wheeze was observed in 73 (87.95%) participants, while multitrigger wheeze was noted in 10 (12.05%) participants.

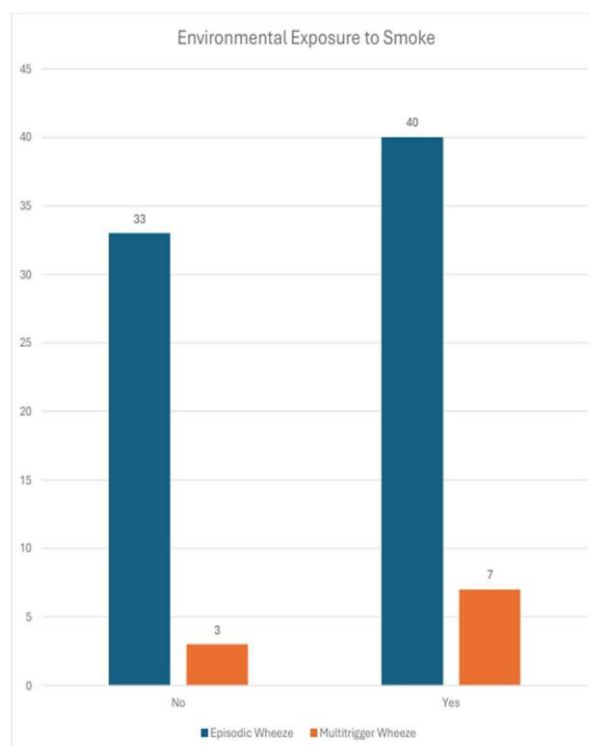


Figure 5: Relationship of Environmental Exposure to Smoke with Episodic and Multi-trigger Wheeze

Both episodic and multitrigger wheeze were more frequent in children exposed to environmental smoke (40 and 7 cases) compared to non-exposed (33 and 3 cases). The rise is more pronounced for multitrigger wheeze.

DISCUSSION

The present hospital-based study comprehensively delineates the heterogeneous spectrum of wheezing illnesses in children under five years, demonstrating a predominantly infection-driven clinical profile with strong environmental and developmental influences. More than three-quarters of wheezing admissions were attributable to infective causes, while asthma represented a minority. Seasonal clustering of admissions, with peaks in April, July, September, and November, aligns with viral epidemiology and environmental triggers, corroborating findings by Grandinetti et al. (2022), Chandrasekhar et al. (2023), who reported 55–70% wheezing episodes during viral or humid seasons (11, 12).

Demographically, nearly 60% of cases occurred below two years, consistent with Castro-Rodriguez and Garcia-Marcos (2008), who highlighted infancy as the peak susceptibility period, while a male predominance (~66%) parallels observations by Zhu et al. (2023) (13). The rural predominance (86%) and high exposure to biomass fuel and tobacco smoke support environmental determinants described by Rajapakse Mudiyansele et al. (2021) and Triasih et al. (2023), indicating the significant role of

environmental and socio-geographical factors in shaping wheeze burden (14, 15).

Most children had fewer than 3 wheeze episodes in the last year, while a smaller proportion (18%) experienced ≥ 3 episodes, suggesting recurrent or persistent disease. Overall, frequency of episodes helps differentiate transient wheeze from chronic airway conditions. The trend of positive family history is consistent with Lau et al. (2023), with evidence supporting genetic and familial predisposition in persistent or multitrigger wheeze phenotypes.(19)

Severity assessment revealed high hypoxemia rates (~81%), reflecting the severity-filtered nature of the hospital-based sample, comparable to findings by Zhu et al. (2023), while most cases remained mild to moderate, consistent with Tualzik et al. (2020). (13,17)

Phenotypically, episodic viral wheeze (87.95%) far exceeded multitrigger wheeze, consistent with Tualzik et al. (2020), Kalyani et al. (2021) (17, 18), reinforcing that early childhood wheeze is largely episodic and infection-linked. Risk factor analysis demonstrated higher trends of atopy and family history in multitrigger wheeze, as supported by Lau et al. (2023) and Zhu et al. (2023), while environmental smoke exposure showed a statistically significant association, emphasizing its role as a key modifiable determinant (13, 19).

The study reinforces that under-five wheeze in this setting is predominantly viral, environmentally influenced, and phenotypically diverse, with

infection, environmental exposure, and developmental factors playing central roles, while atopy and genetic predisposition contribute to a smaller but clinically significant subset with persistent or multitrigger wheeze.

CONCLUSION

The present study demonstrates that wheezing illness in children aged 3 months to 5 years admitted to a tertiary care center is largely infection-driven, with acute bronchiolitis and pneumonia forming the majority of cases, while episodic viral wheeze represents the most common phenotype among recurrent wheezers. Multitrigger wheeze constituted a smaller subset with links to developmental and environmental factors. Exposure to environmental smoke emerged as a key influence on wheeze patterns. These findings confirm that early childhood wheeze is a heterogeneous entity requiring phenotype-based evaluation and targeted preventive strategies.

REFERENCES

- Brand PL, Caudri D, Eber E, Gaillard EA, Garcia-Marcos L, Hedlin G, et al. Classification and pharmacological treatment of preschool wheezing: changes since 2008. *European respiratory journal*. 2014;43(4):1172-7.
- Fainardi V, Santoro A, Caffarelli C. Preschool wheezing: trajectories and long-term treatment. *Frontiers in Pediatrics*. 2020;8:240.
- Hussien NN, Shedeed SA, Soultan NH, Zaitoun NA. Bronchiolitis in the First Year of Life: Evidence-Based Clinical Assessment and Risk Stratification in Primary Care. *Cuestiones de Fisioterapia*. 2024;53(03):7201-12.
- Ducharme FM, Sze MT, Chauhan B. Diagnosis, management, and prognosis of preschool wheeze. *The Lancet*. 2014;383(9928):1593-604.
- Bush A, Nagakumar P. Preschool wheezing phenotypes. *Eur Med J*. 2016;1(1):93-101.
- Saglani S, Bush A. Asthma in preschool children: the next challenge. *Current opinion in allergy and clinical immunology*. 2009;9(2):141-5.
- Makrinioti H, Hasegawa K, Lakoumentas J, Xepapadaki P, Tsoia M, Castro-Rodriguez JA, et al. The role of respiratory syncytial virus-and rhinovirus-induced bronchiolitis in recurrent wheeze and asthma—a systematic review and meta-analysis. *Pediatric Allergy and Immunology*. 2022;33(3):e13741.
- Castro-Rodriguez JA, Wolters AA, Rodriguez-Martinez CE, Biagini JM, Celedón JC, Custovic A, et al. Risk factors and mechanisms leading to preschool recurrent wheeze and asthma. *The Journal of Allergy and Clinical Immunology: In Practice*. 2025.
- Fowler SJ, Sinha I, Doyle M, Joseph S, Mariani A, Sands T. Asthma: diagnosis, monitoring, and chronic asthma management: summary of guidance from BTS/NICE/SIGN. *bmj*. 2025;390.
- Venkatesan P. 2025 GINA report for asthma. *The Lancet Respiratory Medicine*. 2025;13(8):e41-e2.
- Grandinetti R, Fainardi V, Caffarelli C, Capoferri G, Lazzara A, Tornesello M, et al. Risk factors affecting development and persistence of preschool wheezing: consensus document of the Emilia-Romagna Asthma (ERA) study group. *Journal of Clinical Medicine*. 2022;11(21):6558.
- Chandrasekhar V, Banu A, Shami Kumar SM. Prevalence and risk factors associated with wheezing in young children less than 5 years of age: a retrospective study.
- Zhu Y, Chen L, Miao Y, Chen J, Bai M, Gao H, et al. An analysis of risk factors associated with recurrent wheezing in the pediatric population. *Italian journal of pediatrics*. 2023;49(1):31.
- Rajapakse Mudiyansele SIR, Amarasinghe WADL, Yasaratne BMGD, Warnasekara J, Agampodi S. Epidemiology of wheeze among preschool children: a population-based cross-sectional study from rural Sri Lanka. *BMJ open*. 2021;11(7):e046688.
- Triasih R, Setyowireni D, Nurani N, Setyati A. Prevalence, management, and risk factors of asthma among school-age children in Yogyakarta, Indonesia. *Journal of asthma and allergy*. 2023:23-32.
- Bloom CI, Franklin C, Bush A, Saglani S, Quint JK. Burden of preschool wheeze and progression to asthma in the UK: Population-based cohort 2007 to 2017. *Journal of Allergy and Clinical Immunology*. 2021;147(5):1949-58.
- Tualzik L, Chandrasekaran V. Clinical Profile of Episodic Wheezing and Multiple Trigger Wheezing in Preschool Children: A Cross-Sectional Study. *Journal of Child Science*. 2020;10(01):e141-e7.
- Kalyani A, Reddy DM, Priyanka M. Clinical Categorization of Under Five Wheezers. *International journal of scientific study*. 2021;8(12):202-7.
- Lau HX, Chen Z, Van Bever H, Tham EH, Chan YH, Yap QV, et al. Clinical predictors of wheeze trajectories and associations with allergy in Asian children. *Annals of Allergy, Asthma & Immunology*. 2023;131(4):466-

73. e6.
20. Castro-Rodriguez JA, García-Marcos L. Wheezing and Asthma in childhood: an epidemiology approach. *Allergologia et immunopathologia*. 2008;36(5):280-90.
 21. Mondal, Arup & Singh, Ch & Devi, Moirangthem & Laishram, Cindy & Kambiakdik, T.. (2020). Clinical profile of children aged 2 months to 60 months presenting with wheeze in a tertiary medical centre. *International Journal of Contemporary Pediatrics*. 7. 1117. 10.18203/2349-3291.ijcp20201650
 22. Wang VJ, Cavagnaro CS, Clark S, Camargo Jr CA, Mansbach JM. Altitude and environmental climate effects on bronchiolitis severity among children presenting to the emergency department. *Journal of environmental health*. 2012 Oct 1;75(3):8-15.

How to cite this article: Dr. Anika Sharma¹, Dr. Parveen Bhardwaj², Dr. Ambika Sood³, Dr. Minoo Sharma⁴, DECODING WHEEZE: CLINICAL SPECTRUM OF WHEEZE IN UNDER-5 CHILDREN FROM A HIGH-ALTITUDE TERTIARY CARE CENTER: AN OBSERVATIONAL STUDY, *Asian J. Med. Res. Health Sci.*, 2026; 4 (2):2366-2373.

Source of Support: Nil, Conflicts of Interest: None declared.