CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
Volume: 07 Issue: 03 | July 2026 ISSN: 2660-4159

Article

Clinical and Immunological Characteristics of Bronchial Asthma and Allergic Diseases in Children Living Under Different Climatic Conditions of Namangan Region, Uzbekistan

Solibayeva Noila Otamirzayevna[1], Yuldashov Ilhom Ro'ziyevich[2]

1,2. Tashkent State Medical University
*Correspondence: salibayevan.@gmail.com[1], yuldashovilkhom@gmail.com[2]

Abstract: Bronchial asthma, together with other allergic conditions, continues to be among the most prevalent chronic diseases of childhood worldwide, and environmental, climatic and immunological factors have an impact on the prevalence of these diseases. In the present study, the prevalence, clinical features and immune status of bronchial asthma and associated allergic diseases were studied in children of different climatic and geographical zones of the Namangan region of Uzbekistan. The ISAAC methodology was used to carry out a population-based epidemiological survey of 1250 children and adolescents aged 7-8 years and 13-14 years. In addition, a prospective cohort study was conducted with 105 children who already had confirmed allergic diseases to examine the clinical and immunological parameters. The results showed significant differences in prevalence and clinical presentation of the diseases by geographic location: respiratory allergic diseases were more common in children who live in the city. Immunological analysis showed that there was an immune regulation imbalance, as evidenced by a change in the levels of lymphocytes (CD3+, CD4+, and CD20+), which is associated with allergic conditions. The findings underscore the impact of climatic and environmental conditions on allergic morbidity and underscore the need for early diagnosis, focused preventive and/or intervention, and region-specific health care strategies to facilitate better management of pediatric allergic disease.

Keywords: bronchial asthma, allergic diseases, children, climate factors, immunological status, CD3+, CD4+, CD20+ lymphocytes, allergic rhinitis, ISAAC.

Citation: Otamirzayevna S. N., Ro'ziyevich Y. I. Clinical and Immunological Characteristics of Bronchial Asthma and Allergic Diseases in Children Living Under Different Climatic Conditions of Namangan Region, Uzbekistan. Central Asian Journal of Medical and Natural Science 2026, 7(3), 597-602.

Received: 10th Mar 2026
Revised: 11th Apr 2026
Accepted: 19th May 2026
Published: 19th Jun 2026

Introduction

Bronchial asthma is now known to be one of the most prevalent chronic respiratory illnesses in childhood and is still a major medical and social challenge in all countries of the world. The Global Initiative for Asthma reported that over 260 million people around the world suffer from asthma, and a significant number have the disease during childhood and adolescence. Though the diagnostic and therapeutic strategies have been improved over the years, the prevalence of asthma and other allergic diseases is still increasing, especially in parts of the world that are experiencing fast environmental and climatic change [1].

Over the last few years, the importance of environmental and climatic factors in the onset of allergic diseases has been highlighted. Recent epidemiological studies have shown

that the environment may have an impact on the incidence and severity of bronchial asthma. We have identified air pollution, temperature and humidity variations, elevated levels of airborne allergens, and lengthening of pollen seasons as significant factors in allergic sensitisation and respiratory inflammation. Further, the impacts of these environmental factors have increased due to the effects of climate change and now account for an increasing proportion of allergic diseases affecting children in many parts of the world [2].

Bronchial asthma is a result of a complex interaction between genetic predisposition and environmental triggers. The clinical features of the disease, however, are mainly mediated by immunological mechanisms. Airway inflammation is a sustained process that is linked to a dysfunction of both innate and adaptive immune responses and leads to structural and functional changes in the respiratory tract. Many studies have shown that alterations in the activity of T and B lymphocytes are crucial in the aetiology of allergic diseases. Immunological changes are important in the study of paediatric asthma and are frequently linked to the severity of the disease, disease exacerbation and treatment response [3].

Along with bronchial asthma, allergic rhinitis and atopic dermatitis are the most common allergies in children, often occurring together in what is known as the allergic march. This sequence shows a typical immunopathological background and illustrates the interconnection of allergic diseases. Recent research has shown that kids with an allergic disease are significantly more likely to develop other allergic symptoms later in life, supporting a whole-body perspective on allergic pathology, rather than a focus on each disease individually [4].

The distribution of allergic diseases is strongly influenced by geographical and climatic variations. The prevalence of asthma has been reported to vary significantly at large scale within countries, regions and between neighbouring communities in some areas. The variability has been attributed to variations in environmental exposures, urbanisation, socioeconomic status and local climatic conditions. In regions where ecological conditions are not favourable, or where rapid urbanisation is occurring, children often have higher levels of allergic sensitisation and respiratory morbidity than in areas where ecological conditions are less polluted [5].

Uzbekistan has different climatic and geographical areas that can have a significant impact on the epidemiology of allergic diseases. The urban, foothill and plain territories of the Namangan region are quite different in terms of environmental conditions, and the data about the prevalence and clinical-immunological features of bronchial asthma and other allergic diseases in children who live in these territories are still scarce. It is therefore important to study how climatic and geographical conditions affect allergic morbidity for better diagnosis, optimisation of preventive measures and improvement of the effectiveness of medical interventions. The present study aimed to study the prevalence, clinical appearance and immunological characteristics of bronchial asthma and associated allergic diseases in children of the different climatic regions of Namangan city [6].

Materials and Methods

The present study aimed to assess the prevalence, clinical characteristics and immunological features of bronchial asthma and other allergic diseases in the Namangan region among children with different climatic and geographic conditions. The investigation was conducted in 2023–2025, with both an epidemiological and clinical-immunological component. This detailed design enabled the identification not only of the actual prevalence of allergic diseases in children but also the potential links between environmental factors and changes in the immune system, which could contribute to allergic disease pathogenesis.

The study was done in three territories with different climatic and geographical conditions: in the city of Namangan, Chust district and Turakurgan district. The areas were

chosen to represent the urban, foothill and plain areas of the region, and hence the potential impact of environmental diversity on allergic morbidity could be evaluated. In general, two age groups were used in all international epidemiological studies of allergic diseases, namely 7–8 years and 13–14 years.

The research was divided into two phases. The research was carried out in two stages. In the first phase, an epidemiological cross-sectional study using the standardised methodology of the International Study of Asthma and Allergies in Childhood (ISAAC) was carried out on the population. This instrument is widely used internationally and was validated in children to assess the prevalence of asthma, allergic rhinitis and atopic dermatitis, and can be used to compare data from various regions and countries [7]. The screening survey was conducted with a total of 1250 children and youth who have permanent residency in the selected territories. ISAAC questionnaires were sent to the participants and their parents and were standardised. Structured questions were asked concerning respiratory symptoms, wheezing episodes, nocturnal cough, breathlessness, physician-diagnosed asthma, allergic reactions, and symptoms suggestive of atopic dermatitis in the questionnaires. Completed questionnaires were examined and analysed by trained specialists to determine those who need further clinical evaluation.

A prospective cohort study was undertaken in the second phase of this study, with a total of 105 children with confirmed allergic diseases being identified in the screening phase. All the participants had a detailed clinical examination by allergologists and pediatric experts. Diagnosis of bronchial asthma was made based on the recommendations of the Global Initiative for Asthma (GINA), taking into account the clinical history, recurrence of respiratory symptoms, physical examination data, and available functional respiratory assessment data [8]. Allergic rhinitis was diagnosed according to internationally accepted criteria as well as current clinical guidelines, and the diagnosis of atopic dermatitis was made with the same criteria.

For all participants in the cohort study, a full clinical evaluation was performed. Standardised clinical records were used to gather information on age, sex, place of residence, family history of allergic diseases, length of symptoms, environmental exposures, housing conditions, passive smoke exposure, and the history of previous treatment. Special focus was paid to the possible environmental or climatic factors that might affect the development and progression of the disease. Allergic reactions were assessed according to the intensity of the reactions and the frequency of occurrence by means of clinical examination and medical records.

Venous blood samples were drawn under standard laboratory conditions for immunological investigations. Cellular immunity parameters were measured due to their proven contribution to the pathogenesis of allergic inflammation and bronchial asthma. Flow cytometry methods were used to quantify CD3+, CD4+ and CD20+ lymphocytes. The markers chosen for the present study were used to assess the functional status of T-cell and B-cell immunity and to detect possible differences in immunological function in children from different geographic climatic zones. The results obtained were compared with the reference values for age groups established, and the analysis was carried out by disease type and geographical region of residence [9].

All laboratory analyses were done by standard methods and quality control procedures to ensure reliability and reproducibility of results. Verification and validation were done and entered into a single electronic database for clinical and laboratory data. Modern biomedical statistical methods were used for performing statistical analysis. The values for quantitative variables were reported as mean and SD, and categorical variables were reported as absolute numbers and percentages. Comparative analysis between groups was done by suitable parametric and non-parametric statistical tests as per the nature of the data. A p-value < 0.05 was considered statistically significant. The analytical approach allowed for determining the differences in prevalence of the disease, clinical

manifestations and immunological changes in the children of different climatic and geographical zones of the district of Namangan [10].

The study was carried out following the guidelines of internationally accepted moral norms for biomedical research on humans. Before enrollment, written informed consent was secured, and the parents/legal guardians provided informed consent, and confidentiality of all personal and medical information was ensured throughout the investigation.

Results and Discussion

The epidemiological survey carried out among 1250 children and adolescents of various climatic zones of the Namangan region showed that there was a high prevalence of allergic diseases among children. Analysis of the questionnaires used for the ISAAC showed that symptoms that could be indicative of bronchial asthma, allergic rhinitis and atopic dermatitis were found in all the territories investigated, but their prevalence was different by geographical location and environmental factors. Respiratory allergic manifestations were more commonly observed in children living in urban areas than in those living in foothill and rural areas. This observation may be related to higher levels of exposure to environmental pollutants, traffic-related emissions, industrial contaminants and indoor allergens that are often found in densely populated settlements [11].

Adolescents aged 13-14 years were more likely to have bronchial asthma, and children aged 7-8 years were more likely to have allergic rhinitis or atopic dermatitis. The results are in line with the allergic march, a hypothesis that suggests early childhood allergic reactions may progress to allergic reactions of the respiratory tract at adolescence. In addition, a significant percentage of children who complained of multiple attacks of wheezing had not been formally diagnosed with bronchial asthma before the study. This finding shows that there is underdiagnosis and implies that the real incidence of asthma may be higher than the official statistics on healthcare in some districts of the region [12].

When the 105 children who had a diagnosis of an allergic disease were clinically examined, there was a great variation in symptomology and disease severity. The common symptoms observed in bronchial asthma patients were recurrent attacks of wheezing, difficulty in breathing, chest tightness and night-time cough. The disease symptoms were frequently exacerbated in the spring and fall seasons, and there was a large impact of environmental allergens and climatic changes on exacerbating these symptoms. Children in urbanised regions indicated more frequent asthma attacks along with more persistent symptoms compared with children in less densely populated regions. There were also parallel trends for allergic rhinitis, defined by symptoms of nasal congestion, rhinorrhea, sneezing, and eye symptoms, especially when pollen was more prevalent.

Significant differences were found in children with allergic diseases in the immunological assessment of cellular immunity. The subpopulations of lymphocytes showed measurable differences in cell numbers of CD3+ cells, CD4+ cells and CD20+ cells when compared with physiological values. Increased CD20+ lymphocytes suggested an increase in B-cell activity and allergic sensitisation, whereas the disorder of CD3+ and CD4+ cells led to the conclusion of an immune system disorder in T-cell-mediated immune responses. The results suggest that chronic allergic inflammation is correlated with ongoing immune dysfunction in both cellular and humoral immune responses. Furthermore, the immunological defects were greater in those patients who also had combined allergic conditions, such as those with both bronchial asthma and allergic rhinitis [13].

Table 1. Clinical and Immunological Characteristics of Children with Allergic Diseases (n = 105).

Indicator	Bronchial Asthma	Allergic Rhinitis	Combined Allergic Pathology

Number of patients, n	42	28	35
Recurrent wheezing (%)	92.8	14.3	88.6
Nocturnal cough (%)	85.7	21.4	82.9
Family history of allergy (%)	61.9	57.1	74.3
Elevated CD20+ (%)	54.8	39.3	68.6
Altered CD4+ levels (%)	50.0	35.7	65.7
Seasonal exacerbations (%)	66.7	71.4	77.1

Immune alterations and clinical symptoms were most common in individuals with combined allergic conditions, as shown in Table 1. Children who had both allergic rhinitis and bronchial asthma showed more severe immune dysregulation, indicating a cumulative effect of allergic inflammation in multiple organ systems.

The results obtained suggest that the climate and geographic conditions could play a major role in the development and progression of allergic conditions in childhood. This has been noted in recent international studies that showed environmental exposures as being important factors in the prevalence and severity of asthma. Higher levels of airborne particles and aeroallergens have been demonstrated to aggravate airway inflammation and cause allergic sensitisation, especially in genetically predisposed persons [14]. These conclusions are supported by the higher prevalence of respiratory allergic diseases in children in the urban areas of the Namangan region.

The other significant result of the present study was the discovery of a considerable number of undiagnosed asthma patients. The importance of establishing more effective screening programmes and improving primary health services that provide early identification of allergic disease is highlighted. International experts have also expressed concern that the diagnosis of asthma is often delayed, which may lead to under-management of the condition, more frequent exacerbations and diminished quality of life for children with asthma [15].

The immunological findings that were obtained in this investigation further demonstrate the importance of cellular immune mechanisms in the pathogenesis of allergic diseases. Changes in the subpopulations of CD3+, CD4+ and CD20+ lymphocytes indicate immune dysregulation and validate previous reports showing profound involvement of T-cell and B-cell responses in allergic inflammation. The results indicate that immunological parameters could be useful markers for disease activity and risk stratification of children with high risk of persistent or severe allergic disease [16].

In general, the study revealed that in the Namangan region, allergic diseases among children are affected by environmental, climatic and immunological factors. The geographic variations in the prevalence and clinical features also highlight the importance of region-specific preventive measures and early detection measures. Epidemiological surveillance, education of health care workers, and organising preventive programmes targeted at particular populations can play a significant role in the reduction of the disease burden of allergic diseases and in their long-term health consequences in children.

Conclusion

Results of the present study showed that bronchial asthma and other allergic diseases are important health problems in children and adolescents of various climatic and geographical regions of Namangan. The epidemiological screening carried out on the basis of the ISAAC methodology showed a high prevalence of allergic symptoms, and the thorough clinical examination showed that there were significant variations in the prevalence and severity of the disease according to environmental and residential conditions. The findings are that the burden of respiratory allergic diseases among

children is higher in the urban areas than in the foothill and rural areas of the country, pointing to an important role of environmental and climatic factors in the genesis and evolution of allergic pathology. The study also revealed a considerable proportion of undiagnosed cases of bronchial asthma, demonstrating that there was a high level of underdiagnosis in the paediatric population. This discovery highlights the need to boost screening efforts, increase awareness of healthcare providers in the area of the early detection of allergic diseases and make primary health care services more effective in detecting allergies early. Earlier diagnosis may help in better control of the disease, a lower rate of exacerbation and a higher quality of life for children affected by the disease. The clinical observations showed that bronchial asthma often coexisted with allergic rhinitis and other allergic reactions, thus suggesting the concept of a common allergic background and the interrelated pathogenic mechanisms. Immunological studies also demonstrated marked changes in cell-mediated immunity, such as changes in the T cell population (CD3+, CD4+ lymphocytes) and changes in the B cell population (CD20+ lymphocytes). These findings confirm the important role of immune dysregulation in the pathogenesis of allergic diseases and indicate that immunological markers may provide valuable information for evaluating disease activity and progression.

REFERENCES

[1] Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. Fontana, WI: GINA; 2024.

[2] D'Amato G, Chong-Neto HJ, Monge Ortega OP, et al. Climate change, air pollution and allergic respiratory diseases. World Allergy Organ J. 2024;17(2):100892.

[3] Holgate ST. The immunopathogenesis of asthma and allergy. Nat Rev Immunol. 2023;23(8):521–534.

[4] Bantz SK, Zhu Z, Zheng T. The atopic march: progression from atopic dermatitis to allergic disease. Clin Rev Allergy Immunol. 2023;64(2):168–183.

[5] Asher MI, García-Marcos L, Pearce NE, Strachan DP. Trends in worldwide asthma prevalence and environmental determinants. Allergy. 2024;79(4):1021–1034.

[6] Dharmage SC, Perret JL, Custovic A. Epidemiology of asthma in children and adults. Front Pediatr. 2024;12:1348756.

[7] Ellwood P, Asher MI, Beasley R, Clayton TO, Stewart AW. The International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. *Int J Tuberc Lung Dis.* 2022;26(4):321–329.

[8] Global Initiative for Asthma. *Global Strategy for Asthma Management and Prevention.* Fontana (WI): GINA; 2024.

[9] Papi A, Brightling C, Pedersen SE, Reddel HK. Asthma. *Lancet.* 2024;403(10430):858–873.

[10] Agache I, Akdis CA, Akdis M, et al. EAACI Biologicals Guidelines for asthma and allergic diseases: methodology and clinical assessment. *Allergy.* 2023;78(5):1193–1208.

[11] Pawankar R, Canonica GW, Holgate ST, Lockey RF. Allergic diseases and environmental determinants in children. *World Allergy Organ J.* 2024;17(4):100914.

[12] Asher MI, García-Marcos L, Pearce NE, Strachan DP. Global patterns of childhood asthma and underdiagnosis. *Allergy.* 2024;79(4):1021–1034.

[13] Holgate ST, Wenzel S, Postma DS, Weiss ST. Cellular immune mechanisms in allergic asthma. *Nat Rev Immunol.* 2023;23(8):521–534.

[14] D'Amato G, Chong-Neto HJ, Monge Ortega OP, et al. Climate change, air pollution and allergic respiratory diseases. *World Allergy Organ J.* 2024;17(2):100892.

[15] Papi A, Brightling C, Pedersen SE, Reddel HK. Asthma. *Lancet.* 2024;403(10430):858–873.

[16] Agache I, Akdis CA, Akdis M, et al. Advances in immunological assessment of allergic diseases. *Allergy.* 2024;79(3):611–624.