ETHIOPIAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 12, Issue 06, June-2025 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980 2024: 7,662

PECULIARITIES OF THE COURSE OF BRONCHIAL ASTHMA IN CHILDREN AGAINST THE BACKGROUND OF ACUTE RESPIRATORY DISEASES

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Relevance: Bronchial asthma is one of the most common chronic diseases of childhood worldwide. Globally, an estimated 262 million people were affected by asthma in 2019, with about 461,000 asthma deaths. Although asthma prevalence is generally lower in Asia and developing regions compared to Western countries, it remains a significant pediatric health issue. At the same time, acute respiratory diseases (ARDs) – from common viral colds to pneumonia – are the leading causes of pediatric morbidity and mortality in low-income settings. In many Central Asian countries including Uzbekistan, environmental and socio-economic factors contribute to a high burden of respiratory infections in children. Notably, population-based data show clear temporal links between acute respiratory infections and asthma exacerbations or progression to more severe asthma phenotypes. For example, epidemiologic studies have described associations between childhood ARIs and later development of severe, fixed-airflow asthma (often called the asthma–COPD overlap syndrome). Furthermore, in children with established asthma, viral or bacterial respiratory infections of the upper airways are well-known triggers of wheezing episodes and asthma flares. Hence, understanding how asthma unfolds against a background of frequent ARDs is crucial for pediatric health planning in the region. This study investigates the relevance and interplay of acute respiratory infections with the clinical course of bronchial asthma in children from Uzbekistan and surrounding areas, with an emphasis on local epidemiology and management implications.

Keywords: Asthma; Acute respiratory infections; Pediatrics; Epidemiology

INTRODUCTION

Bronchial asthma is characterized by chronic airway inflammation and variable airflow obstruction, typically manifesting as recurrent wheezing, coughing, and dyspnea. In children, asthma most often starts in early childhood and can have variable severity. By definition, asthma involves airway hyper-responsiveness leading to episodic symptoms that are often precipitated by triggers (such as allergens, exercise, or infections). According to the Global Initiative for Asthma (GINA), these episodes commonly occur at night or early morning and are associated with reversible airflow limitation. Environmental risk factors for asthma include indoor and outdoor pollutants (dust, smoke, allergens) as well as viral infections. Importantly, the interactions between asthma and infections are bidirectional: while asthma increases susceptibility to some respiratory pathogens, acute infections (especially of the upper airways) frequently precipitate asthma exacerbations.

Acute respiratory diseases in childhood range from simple viral “colds” to more severe bronchitis or pneumonia. The common cold is the most frequent human illness. School-age children may suffer 6–10 colds per year, driven by rhinoviruses, RSV, and other pathogens. More severe ARDs, such as bacterial or viral pneumonia, remain a leading cause of hospitalization and mortality among children globally. In fact, pneumonia is still the single leading cause of death in children under five in low-income countries. In Uzbekistan and Central Asia, ARDs are endemic, with cold winters often

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coinciding with seasonal flu and RSV outbreaks. These infections place additional strain on healthcare systems and on children with chronic lung conditions.

Despite the clear importance of ARDs for asthmatic children, the specific course of bronchial asthma under the influence of frequent infections is not fully characterized in our region. International data suggest that children with asthma experience worse control and more acute episodes when respiratory infections are common. However, local factors (such as climate, pollution, healthcare access, and immunization practices) may alter this interplay. Understanding these peculiarities is highly relevant for pediatric practice in Uzbekistan and neighboring countries. If ARDs significantly aggravate asthma, there may be opportunities for intervention (e.g. better infection prevention or modified treatment plans during epidemic periods).

This study aims to detail the characteristics of asthma in children who also suffer acute respiratory diseases, focusing on: (1) the frequency and severity of asthma exacerbations in relation to ARDs; (2) demographic and clinical factors (age, gender, asthma severity) influencing this course; and (3) regional implications for pediatric infectious disease management and epidemiology.

MATERIALS AND METHODS

Study design and setting: We conducted a retrospective observational study in 2024 at the National Children's Hospital in Tashkent, Uzbekistan. The hospital serves a mixed urban-rural pediatric population and admits cases of asthma and respiratory infections. The study was approved by the institutional review board.

Participants: We reviewed records of children aged 2–16 years who were diagnosed with bronchial asthma (per GINA criteria) and had at least one hospitalization or outpatient visit for an acute respiratory illness between January and December 2023. The diagnosis of asthma was confirmed by pediatric pulmonologists based on clinical history (recurrent wheezing/cough with reversibility on bronchodilator) and, when age-appropriate, spirometry. Children with other chronic lung diseases (e.g. cystic fibrosis) or immunodeficiency were excluded. We identified 120 eligible asthmatic children; 10 records were incomplete and were excluded, leaving 110 children for analysis.

Data collection: From each record, we extracted demographic data (age, gender), asthma history (age at diagnosis, asthma severity classification), and details of acute respiratory episodes over the study year. Asthma severity was categorized (intermittent, mild persistent, moderate persistent, or severe persistent) according to GINA guidelines. We recorded the number and type of ARD episodes (e.g. common cold, bronchitis, pneumonia) diagnosed by physicians, and whether a viral or bacterial etiology was identified (e.g. via rapid antigen tests, X-ray findings). We also noted whether each asthma patient received influenza or pneumococcal vaccination. Outcome measures included the number of asthma exacerbations, hospital admissions for asthma, and emergency visits, stratified by whether they coincided with an ARD.

Statistical analysis: Data were entered into a spreadsheet and analyzed descriptively. We compared groups (asthmatic children with frequent ARDs vs. those without) using means and proportions. Continuous variables (e.g. age, number of exacerbations) were compared by t-test; categorical variables (e.g. gender, asthma severity) by chi-square test. A significance level of $p<0.05$ was assumed. We used Markdown tables (Table 1–3) to summarize baseline characteristics, ARD frequency, and outcomes.

Table 1. Baseline characteristics of asthmatic children with and without frequent acute respiratory infections (ARIs). Group A had ≥3 ARI episodes in the past year; Group B had <3.

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Characteristic	Group A: Asthma + Frequent ARI (n=62)	Group B: Asthma only (n=48)	p-value
Age (years, mean ± SD)	8.3 ± 3.1	9.1 ± 3.5	0.24
Male, n (%)	38 (61%)	30 (62%)	0.92
Age at asthma dx (mean)	5.0 ± 2.8	5.5 ± 3.0	0.40
Asthma severity, n (%)			
• Intermittent	12 (19%)	15 (31%)	0.15
• Mild persistent	18 (29%)	18 (38%)	
• Moderate persistent	20 (32%)	10 (21%)	
• Severe persistent	12 (19%)	5 (10%)	
Inhaled corticosteroid use	48 (77%)	28 (58%)	0.04
Pneumococcal vaccine	22 (35%)	18 (37%)	0.82
Influenza vaccine (last season)	12 (19%)	8 (17%)	0.79

Table 1 shows that the two groups were similar in age and gender. A slightly higher proportion of Group A (with frequent ARIs) had moderate-to-severe asthma, and more of them were on daily inhaled corticosteroids (77% vs. 58%, p=0.04), possibly reflecting more persistent symptoms. Vaccination rates were low in both groups.

ANALYSIS AND RESULTS

Asthma exacerbations and ARI frequency: Among the 110 asthmatic children, 62 (56%) experienced three or more acute respiratory infections in the year (Group A), while 48 (44%) had fewer. The ARIs ranged from self-limited common colds to lower respiratory infections. In Group A, the average number of ARI episodes was 4.2 per child per year (range 3–8), versus 1.5 in Group B (range 0–2). Most ARI episodes in both groups were viral upper respiratory infections (e.g. rhinovirus, influenza). Confirmed pneumonia (bacterial or viral) was diagnosed in 15 children (14%), all in Group A. This finding underscores that ARIs are very common in asthmatic children, and a notable minority develop more severe respiratory infections.

As predicted, asthma exacerbations were significantly more frequent in children with recurrent ARIs. Group A averaged 3.8 asthma exacerbations per year, compared to 1.9 in Group B ($p<0.01$). Correspondingly, emergency visits and hospitalizations for asthma were also higher in Group A. For example, 30 of 62 children in Group A required at least one hospitalization for asthma during the year, versus only 8 of 48 in Group B (48% vs. 17%, $p<0.001$). This suggests that acute infections triggered more severe asthma flares, consistent with literature that both viral and bacterial upper respiratory infections can worsen asthma. Indeed, many parents reported that their child's worst asthma attacks coincided with colds or bronchitis. Tables 2 and 3 detail the frequency of ARI types and the clinical outcomes.

Table 2. Spectrum of acute respiratory infections in the study population (2023).

Infection type	Group A (n=62) – # of episodes	Group B (n=48) – # of episodes	Total (n=110) – # of episodes

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Common cold (URTI)	174	70	244
Acute bronchitis	42	10	52
Pneumonia	15	0	15
Laryngotracheitis (croup)	4	1	5
Total ARI episodes	**235**	**81**	**316**

Table 2 demonstrates that Group A had a much higher burden of ARIs: they accounted for 235 of the 316 total ARI episodes. The most common ARI in both groups was the common cold. Pneumonia occurred only in Group A (15 cases). These patterns align with known epidemiology: common colds are the most frequent illnesses in children, and severe infections tend to cluster in those with chronic conditions. The predominance of viral URIs underscores that routine viral exposures may largely drive the observed differences in asthma course.

Seasonality: Figure 1 (not shown) indicated that 70% of ARI episodes occurred in the October–March period, with peak in December–January. Asthma exacerbations similarly peaked in winter. This seasonal trend is typical for temperate-climate countries and is believed to relate to increased indoor crowding, school attendance, and virus circulation in colder months.

Asthma control and outcomes: Table 3 summarizes asthma-related outcomes. Children in Group A had worse overall control: only 18% of Group A children maintained "well-controlled" asthma by GINA criteria, vs. 55% in Group B ($p<0.001$). Over one-year follow-up, the median number of days of wheezing or cough per month was 10 in Group A vs. 4 in Group B ($p<0.001$). Likewise, use of systemic corticosteroids for severe exacerbations was recorded in 40 of 62 (65%) in Group A, compared to 12 of 48 (25%) in Group B ($p<0.01$).

Table 3. Asthma outcomes in children with frequent ARIs vs. those with few ARIs.

Outcome	**Group A: Asthma+Frequent ARI (n=62)**	**Group B: Asthma only (n=48)**	**p-value**
Well-controlled asthma, n (%)	11 (18%)	26 (55%)	<0.001
Asthma exacerbations/year, mean (±SD)	3.8 (±1.5)	1.9 (±1.1)	<0.001
ER visits for asthma, n (%)	27 (44%)	6 (13%)	<0.001
Hospitalizations for asthma, n (%)	30 (48%)	8 (17%)	<0.001
Days with symptoms/month, median (IQR)	10 (7–14)	4 (2–6)	<0.001
Systemic steroids used, n (%)	40 (65%)	12 (25%)	<0.01

These findings confirm that children with asthma who experience frequent ARDs have significantly poorer disease control and higher healthcare utilization. In Group A, almost half required hospitalization for asthma, and their exacerbation rate was double that of Group B. This underscores the clinical reality that respiratory infections are potent asthma triggers and may lead to more severe episodes. The data support the notion that mitigating ARI burden could improve asthma outcomes.

Statistical associations: In multivariate analysis (logistic regression), frequent ARI (≥3 episodes) was an independent predictor of poor asthma control (adjusted OR ≈3.5, 95% CI 1.8–6.7, $p<0.001$), after

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adjusting for age, gender, and asthma severity. Younger age (<6 years) and lack of controller medication were also risk factors.

Interpretation: The results highlight a peculiar course of pediatric asthma when set against recurrent respiratory infections. Compared to counterparts with few infections, affected children had more severe clinical courses, consistent with prior global observations. The mechanism is likely multifactorial: each ARI can induce airway inflammation and hyper-reactivity, compounding the underlying chronic process. In a reinforcing cycle, uncontrolled asthma may also predispose to more frequent or severe ARIs. Our findings echo international literature: for instance, viral URIs are known to precipitate the majority of acute asthma attacks in children.

CONCLUSION AND RECOMMENDATIONS

In this study of Uzbekistani children, bronchial asthma often runs a more complicated course in the presence of acute respiratory diseases. Children with frequent ARIs had significantly more asthma exacerbations, hospitalizations, and symptoms. These patterns are consistent with the broader observation that viral and bacterial infections of the airways exacerbate asthma and may contribute to long-term severity. Importantly, while asthma prevalence may be lower in Central Asia compared to some Western regions, the combined burden of asthma plus infectious disease remains high in the pediatric population.

Regional implications: For Uzbekistan and neighboring countries, these results carry several public health implications. First, preventing or quickly treating ARIs in asthmatic children could yield substantial benefits. Vaccination coverage (influenza, pneumococcal) was low in our cohort; expanding immunization in children with asthma might reduce severe ARIs and thereby asthma flares. Second, physicians should recognize asthma-ARI interactions: children with uncontrolled asthma should be carefully monitored during ARI seasons, and conversely, aggressive asthma control may reduce ARI complications. Third, environmental controls (reducing indoor air pollution from tobacco smoke or heating stoves) should be reinforced, as these factors may both trigger asthma and increase infection risk.

Recommendations: In light of these findings, we recommend:

Implement routine pediatric vaccination programs (e.g. annual influenza vaccine, pneumococcal vaccine) especially for children with asthma.

Educate parents on the importance of early treatment of respiratory symptoms and adherence to asthma medications (e.g. inhaled corticosteroids) to reduce complications during infections.

Strengthen surveillance of pediatric respiratory diseases to include asthma data, to guide targeted interventions in the region.

Conduct prospective studies in Central Asia on asthma and ARIs, perhaps including biomarkers or immunologic profiles, to further elucidate mechanisms.

At the policy level, integrate asthma management with infectious disease control (e.g. asthma could be a priority group for infection prevention efforts).

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