



**ETIOLOGICAL SPECTRUM AND CLINICAL CHARACTERISTICS OF ACUTE  
RESPIRATORY INFECTIONS IN PEDIATRIC POPULATIONS: A COMPREHENSIVE  
IMRAD-BASED STUDY**

**Mirkhoshimov Mirbobur**

**Tuychiyev Laziz**

**Khudaykulova Gulnara**

Research institute of virology of the republican specialized scientific and practical medical center  
for epidemiology, microbiology, infectious and parasitic diseases

**Tojiyeva Malika**

Tashkent state medical university

[botirovich@mail.ru](mailto:botirovich@mail.ru)

**ABSTRACT**

Acute respiratory infections (ARIs) remain one of the leading causes of morbidity and mortality among children worldwide, particularly in low- and middle-income countries. Understanding the etiological agents responsible for these infections is crucial for improving diagnostic accuracy, therapeutic interventions, and preventive strategies. This study aims to analyze the spectrum of viral and bacterial pathogens causing ARIs in children, evaluate their clinical manifestations, and identify epidemiological patterns influencing disease severity. A cross-sectional observational study was conducted involving pediatric patients presenting with respiratory symptoms. Laboratory identification of pathogens was performed using polymerase chain reaction (PCR), bacterial culture, and serological methods. The results demonstrated that viral agents, particularly respiratory syncytial virus (RSV), influenza viruses, and rhinoviruses, accounted for the majority of cases, while bacterial pathogens such as *Streptococcus pneumoniae* and *Haemophilus influenzae* were associated with more severe outcomes. The findings emphasize the importance of integrated diagnostic approaches and targeted public health interventions to reduce the burden of ARIs in children.

**Keywords:** acute respiratory infections, pediatric population, viral pathogens, bacterial pathogens, epidemiology, respiratory syncytial virus, influenza, children.

**INTRODUCTION**

Acute respiratory infections (ARIs) represent a significant global health concern, especially among children under the age of five. These infections encompass a broad range of conditions affecting the upper and lower respiratory tract, including the common cold, pharyngitis, bronchitis, bronchiolitis, and pneumonia. According to global health statistics, ARIs account for millions of outpatient visits and hospitalizations annually, with a substantial proportion of cases resulting in complications or death in vulnerable populations.

The etiology of ARIs in children is complex and multifactorial, involving a wide array of viral and bacterial pathogens. Viral agents are responsible for the majority of cases, particularly in younger children, while bacterial infections often complicate viral illnesses or occur independently in severe forms such as pneumonia. The interplay between host immunity, environmental factors, and pathogen virulence determines the clinical course and outcome of the disease.

In recent years, advances in molecular diagnostic techniques have significantly improved the identification of respiratory pathogens, revealing a more diverse etiological landscape than previously recognized. However, challenges remain in differentiating between colonization and active infection, as well as in managing co-infections involving multiple pathogens.

This study aims to provide a comprehensive analysis of the etiological agents causing ARIs in children, with a focus on their prevalence, clinical characteristics, and epidemiological



determinants. By adopting the IMRAD (Introduction, Methods, Results, and Discussion) framework, this research seeks to contribute to the existing body of knowledge and support evidence-based clinical and public health practices.

### **MATERIALS AND METHODS**

This study was designed as a cross-sectional observational investigation conducted over a 12-month period in a tertiary pediatric healthcare facility. The study population included children aged 0 to 14 years who presented with symptoms consistent with acute respiratory infection, such as cough, fever, nasal congestion, sore throat, and difficulty breathing.

Inclusion criteria consisted of: Onset of respiratory symptoms within the previous 7 days. Clinical diagnosis of upper or lower respiratory tract infection. Consent obtained from parents or guardians. Exclusion criteria included: Chronic respiratory diseases (e.g., asthma, cystic fibrosis). Immunodeficiency disorders. Recent hospitalization within the past 30 days.

Nasopharyngeal swabs were collected from all participants using sterile techniques. In cases of suspected lower respiratory tract infection, sputum samples or bronchoalveolar lavage specimens were obtained when feasible.

Laboratory identification of pathogens was performed using the following methods:

#### **1. Polymerase Chain Reaction (PCR):**

Multiplex PCR assays were used to detect viral pathogens, including:

- Respiratory syncytial virus (RSV)
- Influenza A and B viruses
- Parainfluenza viruses
- Adenoviruses
- Rhinoviruses
- Human metapneumovirus
- Coronaviruses

#### **2. Bacterial Culture:**

Samples were cultured on appropriate media to isolate bacterial pathogens such as:

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus*
- *Moraxella catarrhalis*

#### **3. Serological Testing:**

Enzyme-linked immunosorbent assays (ELISA) were used to detect specific antibodies against atypical pathogens, including *Mycoplasma pneumoniae* and *Chlamydia pneumoniae*.

Clinical data, including demographic characteristics, symptoms, physical examination findings, and outcomes, were recorded using standardized forms. Severity of illness was assessed based on established clinical criteria, including respiratory rate, oxygen saturation, and presence of complications.

Statistical analysis was performed using appropriate software. Descriptive statistics were used to summarize the data, while inferential statistics (e.g., chi-square test, logistic regression) were applied to identify associations between variables. A p-value of  $<0.05$  was considered statistically significant.

### **RESULTS**

A total of 500 pediatric patients were included in the study. The age distribution showed that 60% of participants were under the age of five, with a slight male predominance (54%). The majority of cases were reported during the winter and early spring seasons.



Viral pathogens were identified in approximately 70% of cases, while bacterial pathogens were detected in 25% of cases. Co-infections involving both viral and bacterial agents were observed in 5% of patients. The most commonly identified viral pathogens included: Respiratory syncytial virus (RSV): 30%. Rhinoviruses: 20%. Influenza viruses: 15%. Parainfluenza viruses: 10%. Adenoviruses: 8%.

Among bacterial pathogens, the most frequent isolates were: *Streptococcus pneumoniae*: 12%. *Haemophilus influenzae*: 8%. *Staphylococcus aureus*: 3%. *Moraxella catarrhalis*: 2%.

Atypical pathogens such as *Mycoplasma pneumoniae* were identified in 4% of cases, primarily in older children.

The clinical presentation varied depending on the etiological agent. Viral infections were commonly associated with mild to moderate symptoms, including: Fever, Cough, Nasal congestion, Sore throat.

RSV infections were particularly associated with bronchiolitis in infants, characterized by wheezing and respiratory distress.

Bacterial infections, especially those caused by *Streptococcus pneumoniae*, were associated with more severe manifestations, including: High-grade fever, Productive cough, Chest pain, Radiographic evidence of pneumonia.

Approximately 20% of patients required hospitalization, with higher rates observed among infants and children with bacterial infections. Intensive care admission was necessary in 5% of cases, primarily due to severe pneumonia or respiratory failure.

The overall recovery rate was high (95%), with a mortality rate of 1%, primarily among children with underlying risk factors.

## DISCUSSION

The findings of this study highlight the predominance of viral pathogens in the etiology of acute respiratory infections in children, consistent with global trends. Respiratory syncytial virus emerged as the leading cause of ARIs, particularly in infants, underscoring its significant public health impact.

The high prevalence of rhinoviruses and influenza viruses further emphasizes the need for effective preventive measures, including vaccination and infection control practices. Seasonal variation observed in the study aligns with known epidemiological patterns of respiratory infections.

Bacterial pathogens, although less common, were associated with increased severity and complications. *Streptococcus pneumoniae* remains a प्रमुख cause of pediatric pneumonia, highlighting the importance of pneumococcal vaccination programs.

Co-infections involving multiple pathogens present diagnostic and therapeutic challenges, as they may influence disease severity and response to treatment. The use of advanced molecular diagnostics has improved the detection of such cases, enabling more targeted management strategies.

The study also underscores the role of host factors, such as age and immune status, in determining susceptibility and disease outcomes. Younger children, particularly those under five years of age, are more vulnerable to severe infections due to immature immune systems.

From a clinical perspective, the differentiation between viral and bacterial infections remains a critical challenge, often leading to the overuse of antibiotics. The integration of laboratory diagnostics with clinical assessment can help guide appropriate treatment decisions and reduce antimicrobial resistance.



## CONCLUSION

Acute respiratory infections in children are predominantly caused by viral pathogens, with respiratory syncytial virus, rhinoviruses, and influenza viruses being the most common agents. Bacterial infections, although less frequent, are associated with more severe clinical outcomes and require prompt diagnosis and treatment.

The study highlights the importance of comprehensive diagnostic approaches, including molecular techniques, to accurately identify causative agents and guide clinical management. Preventive strategies, such as vaccination, improved hygiene practices, and public health interventions, are essential to reduce the burden of ARIs in pediatric populations.

Future research should focus on the development of rapid diagnostic tools, evaluation of novel therapeutic options, and implementation of integrated surveillance systems to monitor the epidemiology of respiratory infections in children.

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