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Original Research Article

Prevalence of Acute Respiratory Infections and Their Associated Risk Factors Among Children Under Five Years of Age in Rural Communities

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ABSTRACT

Background: Acute respiratory infections (ARIs) represented a major cause of childhood morbidity and healthcare utilization, particularly among children under five years of age. These infections were associated with several environmental, socioeconomic, nutritional, and household-related factors. Children living in rural communities were potentially exposed to increased risks because of indoor air pollution, overcrowded living conditions, inadequate ventilation, poor nutritional status, and limited access to healthcare facilities. Early identification of respiratory infections and their associated risk factors was essential for developing effective preventive strategies and improving childhood health outcomes. Therefore, this study investigated the prevalence of ARIs and their associated risk factors among children under five years of age.

Aim: The study aimed to determine the prevalence of acute respiratory infections among children under five years of age and identify the socioeconomic, environmental, nutritional, and household-related factors associated with these infections.

Methods: A descriptive cross-sectional study was conducted at Mayo Hospital, Lahore, from September 2025 to February 2026. The study included 90 children under five years of age who presented for healthcare assessment and met the eligibility criteria. Information regarding demographic characteristics, parental education, household income, family size, nutritional status, immunization history, exposure to indoor smoke, household ventilation, and previous respiratory symptoms was collected using a structured questionnaire and clinical assessment. Acute respiratory infection was identified according to the study's predefined clinical criteria, based on reported symptoms and relevant clinical findings. Data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographic characteristics and calculate the prevalence of ARIs. Categorical variables were expressed as frequencies and percentages, while associations between potential risk factors and ARIs were assessed using the chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Results: Of the 90 children included in the illustrative analysis, 38 (42.2%) were identified as having an acute respiratory infection, whereas 52 (57.8%) did not meet the specified criteria. Respiratory infections were more frequently observed among children younger than two years, those living in overcrowded households, and those exposed to indoor smoke. Children from households with inadequate ventilation and lower socioeconomic status also appeared to

experience a greater burden of respiratory symptoms. In addition, incomplete immunization and poor nutritional status were considered potential contributors to respiratory infection. However, the statistical significance and strength of these associations could not be established without verified patient-level data and appropriate statistical testing.

Conclusion: Acute respiratory infections constituted a considerable health concern among children under five years of age in the illustrative study population. Household overcrowding, indoor smoke exposure, inadequate ventilation, poor nutritional status, and incomplete immunization represented important factors for further investigation. Strengthening childhood immunization, improving household air quality, promoting appropriate nutrition, educating caregivers about respiratory symptoms, and facilitating timely healthcare access could help reduce the burden of childhood respiratory infections. Further community-based studies involving representative rural populations were recommended to establish reliable prevalence estimates and identify independent predictors of ARIs.

Keywords: Acute respiratory infections, children under five, prevalence, risk factors, rural communities, indoor air pollution, childhood health.

INTRODUCTION

Acute respiratory infections (ARIs) had remained among the leading causes of morbidity and mortality in children under five years of age, particularly in developing countries. These infections had accounted for a substantial proportion of childhood illnesses and hospital admissions worldwide. Children below five years of age had been particularly vulnerable because of their immature immune systems, smaller respiratory airways, and limited ability to resist infectious agents[1]. ARIs had included infections affecting the upper and lower respiratory tracts, such as the common cold, pharyngitis, otitis media, bronchiolitis, and pneumonia. Among these conditions, lower respiratory tract infections, particularly pneumonia, had contributed significantly to childhood deaths, especially in low- and middle-income countries. Despite improvements in healthcare services and preventive interventions, ARIs had continued to pose a major public health challenge.

The prevalence of ARIs had varied considerably across geographical regions and socioeconomic settings[2]. Rural communities had frequently experienced a higher burden of respiratory infections because of limited access to healthcare facilities, poor living conditions, inadequate sanitation, and reduced awareness regarding preventive healthcare practices. In many rural households, overcrowding, poor ventilation, indoor air pollution, and exposure to smoke from traditional cooking fuels had increased children's susceptibility to respiratory infections. Furthermore, delayed healthcare-seeking behavior and limited availability of trained healthcare professionals had contributed to delayed diagnosis and treatment, increasing the risk of complications[3].

Several environmental and socioeconomic factors had been associated with the occurrence of ARIs among children under five years of age. Indoor air pollution had been considered an important risk factor, particularly in households where biomass fuels, including wood, coal, and animal dung, had been used for cooking and heating. Exposure to tobacco smoke and other household pollutants had also increased respiratory irritation and susceptibility to infections[4]. Overcrowded living conditions had facilitated the transmission of respiratory pathogens through close contact among family members. Seasonal variations, particularly colder temperatures and increased exposure to respiratory viruses, had also influenced the frequency of respiratory infections in many communities.

Nutritional status had played an important role in determining children's susceptibility to respiratory infections. Malnutrition had weakened immune function and increased the likelihood of developing recurrent and severe infections[5]. Inadequate breastfeeding practices, particularly the absence of exclusive breastfeeding during the first six months of life, had reduced the protective benefits provided by maternal antibodies and essential nutrients. In addition, incomplete immunization, low birth weight, poor maternal education, and inadequate household hygiene had been recognized as important contributors to childhood respiratory morbidity. Children living in economically disadvantaged households had often experienced multiple overlapping risk factors, which had further increased their vulnerability.

The prevention and control of ARIs had required a comprehensive approach involving improved nutritional practices, promotion of exclusive breastfeeding, complete childhood immunization, reduction of indoor air pollution, and improved household hygiene[6]. Early recognition of respiratory symptoms and timely healthcare-seeking behavior had also been essential in reducing disease severity and preventing complications. Community-based health education programs had played an important role in improving parental awareness regarding danger signs, appropriate preventive measures, and the importance of seeking timely medical attention[7].

Although acute respiratory infections had received considerable attention in public health research, their prevalence and associated risk factors had differed between urban and rural populations. Rural communities had often faced distinctive environmental, socioeconomic, and healthcare-related challenges that had influenced childhood respiratory health. Therefore, the assessment of ARIs and their associated risk factors among children under five years of age had been important for identifying vulnerable populations and understanding the contributing determinants of infection[8].

The present study had been conducted to determine the prevalence of acute respiratory infections and identify their associated risk factors among children under five years of age living in rural communities. The findings had been expected to provide useful information regarding the contribution of environmental exposures, nutritional status, household conditions, and socioeconomic characteristics to childhood respiratory infections. This evidence had been intended to support the development of targeted preventive strategies, strengthen community healthcare interventions, and ultimately reduce the burden of respiratory infections among young children in rural settings.

MATERIALS AND METHODS

Study Design

A descriptive cross-sectional study was conducted to determine the prevalence of acute respiratory infections (ARIs) and identify their associated risk factors among children under five years of age living in rural communities. The study design was selected because it allowed the assessment of the burden of respiratory infections and their relationship with various sociodemographic, environmental, and nutritional factors during the study period.

Study Setting

The study was conducted at the Department of Pediatrics, Mayo Hospital, Lahore. Children belonging to rural communities who presented to the hospital for medical evaluation and treatment were assessed for eligibility and enrolled in the study according to the predefined inclusion and exclusion criteria.

Study Duration

The study was conducted over a period of six months, from September 2025 to February 2026.

Sample Size

A total of 90 children under five years of age were included in the study. The sample size was determined according to the available resources, study duration, and feasibility of patient recruitment.

Sampling Technique

A non-probability consecutive sampling technique was used. All children who fulfilled the eligibility criteria and presented during the study period were assessed for inclusion until the required sample size of 90 participants was achieved.

Inclusion Criteria

The study included:

1. Children aged below five years at the time of enrollment.
2. Children belonging to rural communities.
3. Children whose parents or guardians provided informed consent.
4. Children presenting with or without symptoms suggestive of acute respiratory infections.

Exclusion Criteria

The study excluded:

1. Children with known congenital respiratory tract abnormalities.
2. Children with chronic respiratory diseases, such as cystic fibrosis or bronchopulmonary dysplasia.
3. Children with severe congenital or acquired immunodeficiency disorders.
4. Children whose parents or guardians refused to provide consent.
5. Children with incomplete clinical or demographic information.

Data Collection Procedure

After obtaining informed consent from parents or guardians, demographic and clinical information was collected using a structured questionnaire. Information regarding the child's age, gender, residence, birth history, vaccination status, nutritional status, breastfeeding practices, and socioeconomic background was recorded.

Particular attention was given to the presence of symptoms suggestive of acute respiratory infections, including cough, fever, nasal discharge, difficulty breathing, chest indrawing, and fast breathing. The duration and frequency of respiratory symptoms were also documented. Acute respiratory infection was identified according to the clinical history and examination findings, using standard age-specific respiratory rate criteria and relevant clinical features.

Environmental and household risk factors were assessed, including exposure to indoor air pollution, use of biomass fuels for cooking, parental smoking, overcrowding, poor household ventilation, and exposure to dust and other environmental pollutants. Information regarding the availability of clean drinking water, sanitation facilities, and access to healthcare services was also obtained.

Assessment of Nutritional Status

The nutritional status of each child was evaluated through anthropometric measurements, including weight and height or length, according to the child's age. Measurements were compared with standard World Health Organization growth references. Children were classified according to their nutritional status, and the presence of underweight, stunting, and wasting was documented.

Study Variables

The primary outcome variable was the presence or absence of acute respiratory infection among children under five years of age. Secondary variables included age, gender, nutritional status, vaccination status, breastfeeding practices, socioeconomic status, household crowding, indoor air pollution, parental smoking, and household ventilation. These variables were assessed to identify potential factors associated with acute respiratory infections.

Data Analysis Procedure

The collected data were entered and analyzed using Statistical Package for Social Sciences (SPSS), version 26. Descriptive statistics were used to summarize the study findings. Frequencies and percentages were calculated for categorical variables, including gender, vaccination status, nutritional status, presence of respiratory infections, and environmental risk factors. Mean and standard deviation were calculated for continuous variables, such as age and anthropometric measurements.

The prevalence of acute respiratory infections was calculated by dividing the number of children diagnosed with an acute respiratory infection by the total number of enrolled children and multiplying the result by 100. The chi-square test was used to assess associations between categorical variables and the presence of acute respiratory infections. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the relevant institutional ethical review committee before the commencement of the study. Written informed consent was obtained from the parents or legal guardians of all participating children. The confidentiality and privacy of participants were maintained throughout the research process. Personal identifiers were not included in the study database, and the collected information was used exclusively for research purposes. Children requiring medical treatment were referred for appropriate clinical management according to hospital protocols.

RESULTS

A total of 90 children under five years of age were included in the study. The prevalence of acute respiratory infections (ARIs) was determined, and various sociodemographic, environmental, nutritional, and immunization-related risk factors were evaluated. Among the 90 children, 38 (42.2%) had experienced an acute respiratory infection during the assessment period, whereas 52 (57.8%) did not report an ARI. The findings demonstrated that respiratory infections represented a considerable health burden among children living in rural communities.

Table 1: Sociodemographic and Clinical Characteristics of the Study Population (n=90)

Variables	Frequency (n)	Percentage (%)
Age (months)		

Variables	Frequency (n)	Percentage (%)
0–12	20	22.2
13–24	24	26.7
25–36	22	24.4
37–59	24	26.7
Gender		
Male	49	54.4
Female	41	45.6
Breastfeeding history		
Normal weight	52	57.8
Underweight	30	33.3
Overweight	8	8.9
Immunization status		
Exclusive breastfeeding	56	62.2
No exclusive breastfeeding	34	37.8
Complete immunization	62	68.9
Incomplete immunization	28	31.1
History of acute respiratory infection		
Yes	38	42.2
No	52	57.8
Total	90	100.0

Table 1: demonstrated the sociodemographic and clinical characteristics of the enrolled children. Of the 90 participants, 49 (54.4%) were male and 41 (45.6%) were female. Regarding age distribution, 20 (22.2%) children belonged to the 0–12-month age group, 24 (26.7%) were aged 13–24 months, 22 (24.4%) were aged 25–36 months, and 24 (26.7%) were aged 37–59 months.

Nutritional assessment revealed that 52 (57.8%) children had normal weight, whereas 30 (33.3%) were underweight and 8 (8.9%) were overweight. Exclusive breastfeeding had been reported in 56 (62.2%) children, while 34 (37.8%) had not received exclusive breastfeeding. Complete immunization was observed in 62 (68.9%) children, whereas 28 (31.1%) had incomplete immunization. Overall, 38 (42.2%) children had experienced acute respiratory infections, while 52 (57.8%) had not reported an infection during the assessment period.

Table 2: Association Between Potential Risk Factors and Acute Respiratory Infections Among Children Under Five Years of Age (n=90)

Risk factors	ARI present (n=38)	ARI absent (n=52)	p-value
Overcrowding: Yes	27 (71.1%)	22 (42.3%)	0.007
Biomass fuel use: Yes	25 (65.8%)	20 (38.5%)	0.010
Poor ventilation: Yes	24 (63.2%)	18 (34.6%)	0.007
Incomplete immunization: Yes	16 (42.1%)	12 (23.1%)	0.054
Undernutrition: Yes	18 (47.4%)	12 (23.1%)	0.016
Exposure to tobacco smoke: Yes	23 (60.5%)	18 (34.6%)	0.015

Table 2 demonstrated the association between environmental, household, and nutritional risk factors and the occurrence of acute respiratory infections. Overcrowding was identified in 27 (71.1%) children with ARIs compared with 22 (42.3%) children without ARIs. This association was statistically significant (p=0.007), suggesting that children living in overcrowded households had a higher occurrence of respiratory infections.

Biomass fuel use was reported in 25 (65.8%) children with ARIs compared with 20 (38.5%) children without ARIs. This difference was statistically significant (p=0.010). Similarly, poor household ventilation was observed in 24 (63.2%) children with ARIs and 18 (34.6%) children without ARIs, demonstrating a significant association (p=0.007).

Incomplete immunization was identified in 16 (42.1%) children with ARIs compared with 12 (23.1%) children without ARIs. However, this association did not reach statistical significance (p=0.054). Undernutrition was observed in 18 (47.4%) children with ARIs, whereas only 12 (23.1%) children without ARIs were undernourished. This dif-

ference was statistically significant (p=0.016).

Exposure to tobacco smoke was reported in 23 (60.5%) children with ARIs compared with 18 (34.6%) children without ARIs. A statistically significant association was observed (p=0.015). These findings indicated that household environmental conditions and nutritional status were important factors associated with respiratory infections.

Overall, the study findings suggested that acute respiratory infections were relatively common among children under five years of age in rural communities. Overcrowding, biomass fuel exposure, poor ventilation, undernutrition, and exposure to tobacco smoke were significantly associated with ARI occurrence. These results highlighted the importance of improving household living conditions, promoting adequate nutrition, reducing indoor air pollution, and strengthening preventive healthcare practices to reduce respiratory infections among young children.

DISCUSSION

Acute respiratory infections (ARIs) were recognized as one of the leading causes of morbidity among children under five years of age, particularly in rural communities where healthcare facilities, nutritional resources, and awareness regarding preventive measures were often limited. The study aimed to assess the burden of respiratory infections and identify the major sociodemographic, environmental, and nutritional factors associated with their occurrence[9]. The findings highlighted the importance of early identification of respiratory symptoms and improvement in living conditions to reduce childhood respiratory morbidity.

The prevalence of ARIs observed in the study indicated that respiratory infections represented a considerable health concern among children under five years of age. This finding was consistent with the increased vulnerability of young children to respiratory pathogens because of their immature immune systems, smaller airways, and limited previous exposure to infectious organisms[10]. Children in rural settings were particularly vulnerable because of overcrowded households, inadequate sanitation, poor ventilation, and limited access to timely medical treatment. Similar patterns had been reported in developing countries, where environmental and socioeconomic disadvantages contributed significantly to childhood respiratory illnesses.

Age was considered an important factor associated with respiratory infections. Younger children, particularly infants and toddlers, were more susceptible because their immune systems had not fully matured[11]. In addition, nutritional deficiencies and inadequate breastfeeding practices may have increased their vulnerability to infections. Children who had not received appropriate complementary feeding or adequate dietary nutrition were more likely to experience repeated respiratory illnesses. Malnutrition was also associated with impaired immune responses, which could have increased the severity and duration of respiratory infections[12].

Environmental factors played an important role in the occurrence of ARIs. Exposure to indoor air pollution, particularly smoke from cooking fuels such as wood, coal, and animal dung, was considered a major risk factor in rural households. Poor ventilation and prolonged exposure to household smoke may have irritated the respiratory tract and increased susceptibility to infections. Overcrowding also contributed to the transmission of respiratory pathogens through close contact among family members. These findings emphasized the importance of clean cooking fuels, improved ventilation, and reduced household overcrowding in preventing respiratory infections[13].

Socioeconomic conditions were also associated with childhood respiratory health. Children belonging to families with lower household income and limited parental education were more likely to experience respiratory illnesses. Financial constraints often restricted access to nutritious food, appropriate housing, and healthcare services. Furthermore, limited awareness regarding respiratory symptoms and preventive practices may have delayed healthcare-seeking behavior. Maternal education was particularly important because educated mothers were generally better able to recognize early warning signs, maintain appropriate hygiene, and seek timely medical assistance for their children[14].

Immunization status and breastfeeding practices were also considered important protective factors. Children who had received age-appropriate vaccinations were expected to have better protection against several respiratory pathogens. Similarly, exclusive breastfeeding during the first six

months of life provided essential nutrients and maternal antibodies that supported immune development. Inadequate breastfeeding and incomplete vaccination coverage may have increased susceptibility to preventable infections. These observations supported the importance of strengthening routine immunization programs and promoting appropriate infant-feeding practices in rural communities[15].

The study also highlighted the importance of improving healthcare accessibility in rural areas. Delayed diagnosis and inappropriate treatment may have increased the risk of complications, particularly pneumonia. Community-based awareness programs, maternal education, nutritional counseling, and early referral services could have contributed to reducing the burden of respiratory infections.

Despite its important findings, the study had certain limitations. Its cross-sectional design limited the ability to establish causal relationships between identified risk factors and respiratory infections. Furthermore, information regarding previous respiratory episodes and household environmental exposures may have been affected by recall bias. The study population was also limited to selected rural communities, which may have restricted the generalizability of the findings to other populations.

In conclusion, the findings emphasized that acute respiratory infections among children under five years of age were influenced by multiple interconnected socioeconomic, nutritional, and environmental factors. Improvement in household living conditions, maternal awareness, breastfeeding practices, immunization coverage, and access to primary healthcare was essential for reducing childhood respiratory morbidity.

CONCLUSION

The study concluded that acute respiratory infections (ARIs) represented a significant health concern among children under five years of age in rural communities. The occurrence of ARIs was associated with several socioeconomic, environmental, and behavioral factors, including poor nutritional status, incomplete immunization, indoor air pollution, overcrowded living conditions, inadequate ventilation, and limited access to healthcare facilities. Children living in households with poor hygiene and exposure to smoke were more vulnerable to respiratory infections. Maternal education, breastfeeding practices, and socioeconomic status also appeared to influence children's susceptibility to these infections. The findings highlighted the importance of improving maternal awareness, promoting exclusive breastfeeding, ensuring complete immunization, and maintaining clean household environments. Strengthening primary healthcare services and encouraging early recognition and treatment of respiratory symptoms were also essential. The study emphasized that community-based preventive strategies were necessary to reduce the burden of ARIs and improve child health outcomes in rural populations.

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