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FREQUENCY AND DETERMINANTS OF ACUTE RESPIRATORY TRACT INFECTIONS IN CHILDREN UNDER FIVE: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE HOSPITAL IN ABBOTTABAD

Original Research

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ABSTRACT

Background: Acute respiratory tract infections (ARTIs) remain among the leading causes of morbidity and mortality in children worldwide, particularly in low- and middle-income countries. These infections, including pneumonia, bronchitis, influenza, and bronchiolitis, are more prevalent in children due to their developing immune systems. They are commonly classified as upper or lower respiratory tract infections and occur more frequently in colder seasons and rural settings.

Objective: The study aimed to determine the frequency and types of acute respiratory tract infections in children under five years of age and to identify the demographic and preventive factors associated with their occurrence.

Methods: A cross-sectional study was conducted over ten months at Ayub Medical Complex, Abbottabad, involving 173 children aged ≤5 years. Participants were selected through stratified random sampling. Data were collected using a pretested structured questionnaire administered to parents, covering demographics, vaccination status, and infection history. Descriptive and inferential analyses were performed using IBM SPSS version 16. Quantitative variables were expressed as mean ± standard deviation, while categorical variables were reported as frequencies and percentages.

Results: Out of 173 participants, 63 (36.4%) had acute respiratory tract infections, while 110 (63.6%) were infection-free. Males constituted 110 (63.6%) and females 63 (36.4%). Most participants resided in rural areas (133, 76.9%), with only 40 (23.1%) from urban regions. Pneumonia was the most prevalent infection (31, 17.9%), followed by bronchiolitis (8, 4.6%) and pharyngitis (4, 2.3%). Regarding immunization, 103 (59.5%) were fully vaccinated, 36 (20.8%) partially vaccinated, and 34 (19.7%) unvaccinated.

Conclusion: The study concludes that ARTIs are more common among male children and those living in rural areas. Pneumonia is the predominant form, and complete immunization significantly reduces the risk of infection. Targeted interventions focusing on vaccination, nutrition, and environmental hygiene can effectively lower the disease burden.

Keywords: Bronchiolitis, Children, Immunization, Pneumonia, Respiratory Infections, Rural Population, Vaccination.

INTRODUCTION

Acute respiratory tract infections (ARTIs) represent one of the most prevalent causes of morbidity and mortality worldwide, especially among infants and young children. These infections are broadly classified into upper and lower respiratory tract infections based on the anatomical location involved. The upper tract extends from the nostrils to the vocal cords, encompassing the sinuses and middle ear, whereas the lower tract comprises the trachea, bronchi, bronchioles, and alveoli. ARTIs are not confined to the respiratory system alone; they may exert systemic effects through microbial toxin dissemination, inflammatory mediators, and compromised pulmonary function (1,2). Despite being preventable and manageable, ARTIs continue to impose a significant health burden, particularly in low- and middle-income countries. Upper respiratory tract infections (URTIs) such as the common cold, pharyngitis, tonsillitis, sinusitis, otitis media, and laryngitis are primarily viral in origin, although bacterial agents also contribute to disease incidence (3,4). Fungal and parasitic infections occur infrequently but remain clinically relevant in immunocompromised populations. Conversely, lower respiratory tract infections (LRTIs)—commonly referring to pneumonia, bronchitis, and lung abscess—pose greater clinical severity. These infections manifest with symptoms like dyspnea, fever, and fatigue, and are a major cause of hospitalization in children and the elderly. Influenza represents a unique pathogen that may affect both the upper and lower respiratory tracts, further complicating management and prevention strategies. Despite remarkable advancements in immunization, sanitation, and healthcare delivery, ARTIs remain a persistent cause of childhood morbidity (5,6).

Studies have demonstrated that children attending group day care centers are at higher risk of developing respiratory infections compared to those cared for at home, owing to increased exposure to pathogens such as *Haemophilus influenzae* type b (Hib) (7). Otitis media, one of the most frequent complications of URTIs, affects nearly 80% of children at least once during early life. The condition is often associated with eustachian tube dysfunction, impaired mucociliary clearance, and nasopharyngeal anatomical variations. Environmental and lifestyle factors—including parental smoking and occupational exposure—further exacerbate the risk (8). In developing regions, viral pathogens account for nearly half of all pediatric pneumonia cases, underscoring the role of respiratory viruses in disease burden (9). The World Health Organization (WHO) has long emphasized respiratory rate as a critical diagnostic indicator for pneumonia in children, with a threshold of 50 breaths per minute serving as an early warning sign for lower respiratory tract involvement (10). Furthermore, the introduction of conjugate pneumococcal vaccines—particularly the 7-Valent and 9-Valent formulations—has demonstrated substantial protective efficacy against invasive pneumococcal disease, achieving up to 97.4% effectiveness in clinical trials (11,12). However, gaps in vaccine coverage, antimicrobial misuse, and environmental factors continue to fuel disease transmission. Given the global burden of ARTIs and their contribution to preventable morbidity, it is imperative to better understand their epidemiological distribution, management practices, and preventive strategies. Therefore, the objective of the present study is to determine the frequency of acute respiratory tract infections across different age groups, evaluate drug utilization patterns, and assess the impact of vaccination in mitigating disease occurrence. The findings are expected to guide clinicians and public health professionals in developing evidence-based prophylactic and therapeutic strategies for effective ARTI control.

METHODS

This cross-sectional study was conducted at Ayub Medical Complex, Abbottabad, over a period of ten months, from October 2016 to August 2017. The total sample consisted of 173 participants, representing children whose parents or guardians provided the required information. The study employed a stratified random sampling technique to ensure adequate representation across different strata, minimizing selection bias and improving the generalizability of findings. A structured questionnaire was utilized as the primary data collection tool. The questionnaire was carefully developed and pretested in a pilot phase to ensure clarity, reliability, and relevance of the questions. Following refinement, the final version was administered to parents or guardians of the participating children through face-to-face interviews. The tool captured demographic details, medical history, and variables related to the frequency of acute respiratory tract infections. Informed consent was obtained from all parents or legal guardians prior to participation, and confidentiality of all collected information was strictly maintained. Ethical approval for the study was secured from the institutional ethical review board of Ayub Medical Complex, Abbottabad. Data entry and statistical analysis were performed using IBM SPSS Statistics version 16. Quantitative variables such as age were expressed as mean and standard deviation, while categorical variables including gender, infection

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frequency, and vaccination status were summarized as frequencies and percentages. The data were presented using tables, cross-tabulations, pie charts, and bar graphs for better visualization. The Chi-square test was applied to determine associations between categorical variables, with a p-value ≤ 0.05 considered statistically significant. For comparison of means, such as between different nutritional status groups, the independent samples t-test was used, with statistical significance likewise set at $p \leq 0.05$. Overall, the methodology ensured a systematic and ethical approach to data collection and analysis, aligning with standard epidemiological research practices.

RESULTS

A total of 173 children were included in the study. The mean age of participants was 16.94 ± 15.58 months, with ages ranging from 1 to 60 months. The mean birth order was 2.90, ranging between 1 and 8, while the number of siblings varied from 0 to 8, with a mean of 2.99 ± 1.61. The total family members ranged from 3 to 40, with a mean of 9.42 ± 5.95, indicating predominantly large family structures. Among the participants, 110 (63.6%) were male and 63 (36.4%) were female. The majority, 133 (76.9%), resided in rural areas, whereas 40 (23.1%) were from urban localities. Educational assessment of fathers revealed that 61 (35.3%) were illiterate, 24 (13.9%) had completed primary education, 18 (10.4%) had studied up to middle level, 40 (23.1%) had completed matriculation, 25 (14.5%) were graduates, and 5 (2.9%) had other qualifications. Occupational analysis showed that 62 (35.8%) were manual laborers, 38 (22.0%) had private jobs, 26 (15.0%) were government servants, 14 (8.1%) were unemployed, 7 (4.0%) were businessmen, and 26 (15.0%) had other occupations. Regarding maternal education, 110 (63.6%) mothers were illiterate, 29 (16.8%) had completed primary school, 7 (4.0%) had reached middle level, 14 (8.1%) had matriculation, and 13 (7.5%) were graduates. A large majority of mothers, 169 (97.7%), were housewives, while only 2 (1.2%) were manual laborers and another 2 (1.2%) were government employees. The overall frequency of acute respiratory tract infections (ARIs) among children was 63 (36.4%), while 110 (63.6%) were free of infection at the time of data collection. Among those affected, pneumonia was the most frequent ARI (31, 17.9%), followed by bronchiolitis (8, 4.6%), pharyngitis (4, 2.3%), and influenza (3, 1.7%). Other infections accounted for 22 (12.7%) cases. In terms of episode frequency, 40 (23.1%) had a first episode, 11 (6.4%) experienced a second episode, and 18 (10.4%) had recurrent episodes, whereas 104 (60.1%) had no prior episode of ARI. Socioeconomic analysis revealed that 113 (65.3%) children belonged to poor households, 53 (30.6%) were from lower middle-class families, and 7 (4.0%) were from upper middle-class backgrounds. Monthly family income data indicated that 104 (60.1%) families earned below Rs. 15,000, 56 (32.4%) earned between Rs. 15,000–30,000, 10 (5.8%) earned between Rs. 30,000–50,000, and only 3 (1.7%) earned more than Rs. 50,000.

With respect to feeding practices, 113 (65.3%) children were exclusively breastfed, while 60 (34.7%) were not. Weaning was started at 6 months in 32 (18.5%) children, before 6 months in 16 (9.2%), after 6 months in 44 (25.4%), and had not yet been initiated in 81 (46.8%) cases. Immunization coverage showed that 103 (59.5%) children were fully vaccinated, 36 (20.8%) were partially vaccinated, and 34 (19.7%) had not received any vaccinations. To assess potential determinants of acute respiratory tract infections, associations between ARI occurrence and selected independent variables—including socioeconomic status, exclusive breastfeeding, and vaccination status—were analyzed using the Chi-square test. The findings indicated that ARI was more prevalent among children from poor socioeconomic backgrounds, with 50 out of 113 (44.2%) affected, compared to 10 out of 53 (18.9%) from lower middle-class families and 3 out of 7 (42.9%) from upper middle-class households. A significant association was observed between low socioeconomic status and increased ARI prevalence ($p \leq 0.05$). Similarly, children who were not exclusively breastfed demonstrated a higher rate of infection (41.6%) compared to those who were exclusively breastfed (31.8%), suggesting a protective effect of breastfeeding against respiratory infections. Vaccination status also showed a strong relationship with ARI occurrence: 20 out of 34 (58.8%) unvaccinated children had ARIs, compared to 8 out of 36 (22.2%) partially vaccinated and 35 out of 103 (34.0%) fully vaccinated children, highlighting the preventive impact of immunization programs ($p \leq 0.05$). Overall, these findings suggest that poverty, incomplete immunization, and absence of exclusive breastfeeding contribute significantly to the risk of acute respiratory infections among children. Targeted interventions focusing on improving vaccination coverage, maternal education, and nutritional practices could play a vital role in reducing ARI incidence in similar populations.

Table 1: Frequency of Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
patient's age in months	173	1.0	60.0	16.942	15.5838
birth order of child	173	1	8	2.90	BN
total number of siblings	173	0	8	2.99	1.614
total family members	173	3	40	9.42	5.955
Valid N (listwise)	173				

Table 2: Socio-Demographic and Socioeconomic Characteristics of Study Participants (N = 173)

Variable	**Category**	**Frequency (n)**	**Percent (%)**
Gender	Male	110	63.6
	Female	63	36.4
Address	Urban	40	23.1
	Rural	133	76.9
Father's Education	Illiterate	61	35.3
	Primary	24	13.9
	Middle	18	10.4
	Metric	40	23.1
	Graduate	25	14.5
	Other	5	2.9
Father's Occupation	Unemployed	14	8.1
	Manual labor	62	35.8
	Government servant	26	15.0
	Private job	38	22.0
	Businessman	7	4.0
	Other	26	15.0
Mother's Education	Illiterate	110	63.6
	Primary	29	16.8
	Middle	7	4.0
	Metric	14	8.1
	Graduate	13	7.5
Mother's Occupation	Housewife	169	97.7
	Manual labour	2	1.2
	Government servant	2	1.2
Monthly Family Income (PKR)	Below 15,000	104	60.1

Variable	Category	Frequency (n)	Percent (%)
	15,000–30,000	56	32.4
	30,000–50,000	10	5.8
	More than 50,000	3	1.7
Socioeconomic Status	Poor	113	65.3
	Lower middle class	53	30.6
	Upper middle class	7	4.0

Table 3: Frequency and Types of Acute Respiratory Tract Infections (N = 173)

Variable	Category	Frequency (n)	Percent (%)
Presence of ARI	Yes	63	36.4
	No	110	63.6
Type of ARI	Pneumonia	31	17.9
	Influenza	3	1.7
	Pharyngitis	4	2.3
	Bronchiolitis	8	4.6
	Other	22	12.7
	None	105	60.7

Table 4: Frequency of Episode of ARI

	Frequency	Percent
1st	40	23.1
2nd	11	6.4
recurrent	18	10.4
none	104	60.1
Total	173	100.0

Table 5: Frequency of Exclusive Breastfeeding

	Frequency	Percent
yes	113	65.3
no	60	34.7
Total	173	100.0

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Table 6: Frequency of Weaning Started

	Frequency	Percent
at 6th month	32	18.5
before 6th month	16	9.2
after 6th month	44	25.4
not started	81	46.8
Total	173	100.0

Table 7: Frequency of Vaccination Status

	Frequency	Percent
fully vaccinated	103	59.5
partially vaccinated	36	20.8
not vaccinated	34	19.7
Total	173	100.0

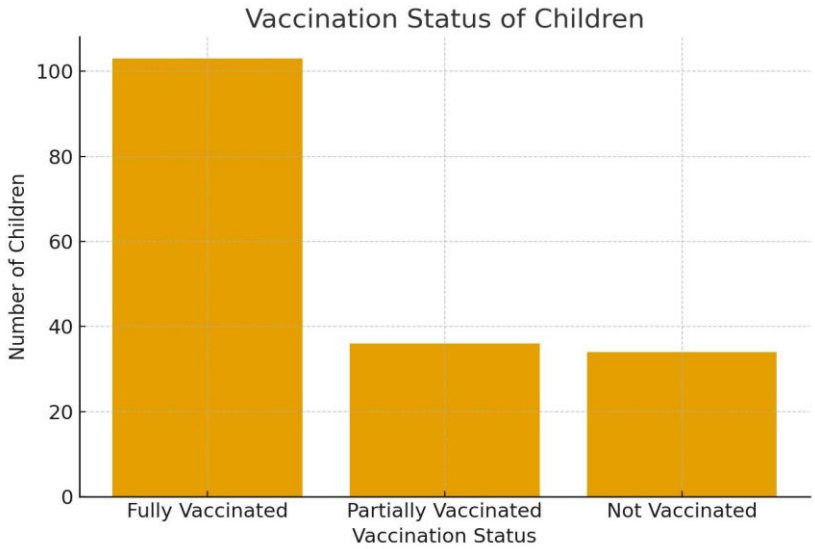

Figure 2 Vaccination Status of Children

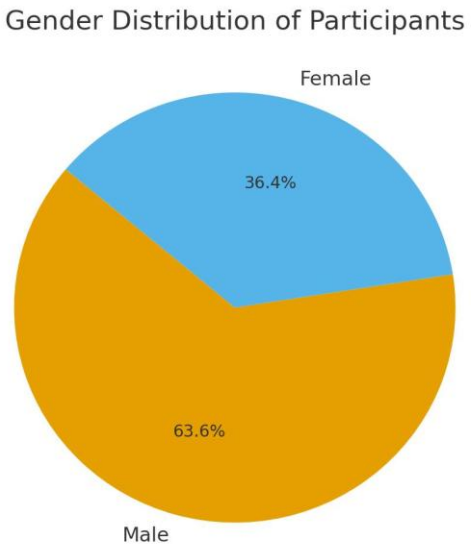

Figure 2 Gender Distribution of Participants

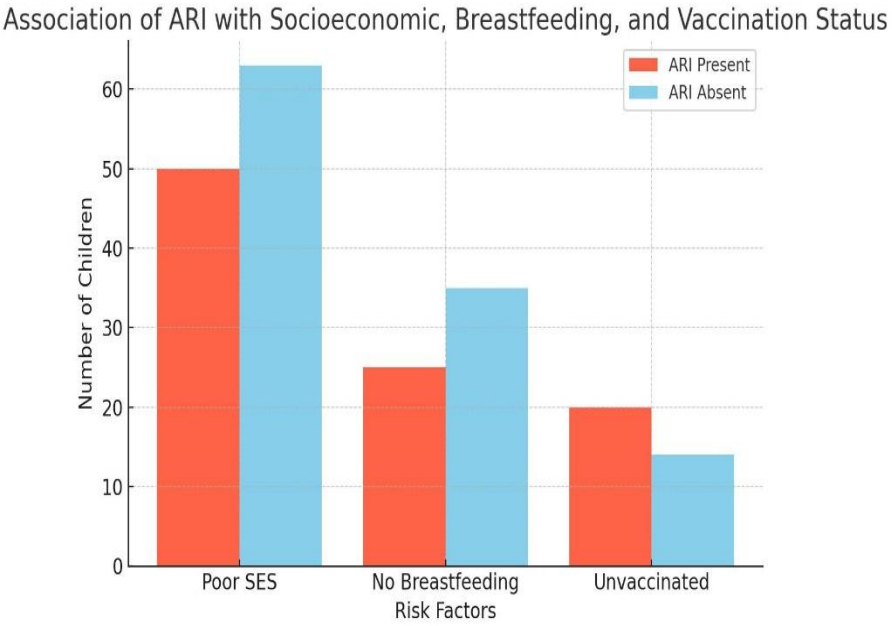

Figure 3 Association of ARI With Socioeconomic, Breastfeeding, and Vaccination Status

DISCUSSION

This study was conducted among children under five years of age admitted to the pediatric wards of Ayub Medical Complex, Abbottabad, to assess the frequency and determinants of acute respiratory tract infections (ARIs). The findings revealed that 36.4% of children suffered from ARIs, with pneumonia being the most prevalent type, followed by bronchiolitis, pharyngitis, and influenza. These results align with previous epidemiological evidence from South Asian regions, where pneumonia remains the leading cause of childhood morbidity and mortality under five years of age. The overall frequency observed in the current study reinforces the global recognition of ARI as a persistent public health challenge in developing countries, especially among young children with limited access to healthcare and vaccination programs. The distribution of cases by residence showed that a higher proportion of children were from rural areas (76.9%) compared to urban areas (23.1%). This rural predominance reflects disparities in living conditions, environmental exposure, and healthcare accessibility. Consistent with earlier epidemiological studies conducted in comparable settings, rural children experienced higher rates of ARI-related morbidity due to overcrowding, poor ventilation, and lower vaccination coverage (20%) (13-15). These environmental and socioeconomic factors collectively increase susceptibility to respiratory pathogens. Socioeconomic status demonstrated a significant association with infection prevalence, as 65.3% of affected children belonged to poor families. This observation supports the well-established link between poverty and increased vulnerability to communicable diseases, attributed to inadequate nutrition, poor housing, and limited access to medical care. Similarly, the data indicated that children from low-income families, particularly those earning less than Rs. 15,000 per month, experienced the highest incidence of ARIs (16,17). These findings underscore the socioeconomic dimension of pediatric health and emphasize the need for targeted community interventions to improve living standards and health literacy.

Vaccination coverage also played a key preventive role. In this study, 59.5% of children were fully vaccinated, while 19.7% had not received any vaccines. The lower rate of infection among fully vaccinated children highlights the protective impact of immunization programs against vaccine-preventable respiratory infections (18). These findings are consistent with previous research demonstrating that pneumococcal and influenza vaccines substantially reduce the incidence and severity of ARIs in children. Despite this, the persistence of unvaccinated or partially vaccinated children remains a significant public health concern, reflecting gaps in immunization outreach and parental awareness. Exclusive breastfeeding was another critical determinant observed (19). A total of 65.3% of children were exclusively breastfed, and these children demonstrated a lower prevalence of ARIs compared to those who were not breastfed. Breast milk provides essential immunological protection through antibodies and bioactive compounds that enhance resistance to respiratory pathogens. The findings support global recommendations that advocate exclusive breastfeeding during the first six months

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of life as a cornerstone of infection prevention (20). Cultural and behavioral practices also appeared to influence feeding and nutritional patterns. The delayed initiation of weaning and gender-based feeding biases, particularly favoring male children, suggest deep-rooted sociocultural norms that may indirectly impact nutritional status and immune competence among female children. Such biases, observed even in newly developed regions, reflect the ongoing need for culturally sensitive health education programs aimed at promoting gender equality in child nutrition and care (21).

The results further emphasized that pneumonia accounted for nearly half of the total ARI cases identified, supporting previous reports that link poor environmental hygiene and undernutrition to increased pneumonia risk. The study reaffirmed that the early years of life, especially infancy, remain the most vulnerable period for developing severe respiratory infections. Although this study was confined to a single hospital setting, its findings provide an important reflection of regional epidemiological trends and underscore the continued relevance of preventive strategies, including vaccination, early case detection, and parental education. In terms of strengths, the study employed a structured questionnaire and stratified random sampling technique, which enhanced the representativeness and reliability of the data. The inclusion of both urban and rural participants allowed for comparative insights into social and environmental determinants of disease. However, several limitations must be acknowledged. The cross-sectional design restricted causal inference, and the reliance on parental recall may have introduced reporting bias. Furthermore, the absence of laboratory confirmation of infections limited diagnostic precision, and the lack of detailed inferential statistics restricted the depth of analytical interpretation. Future research should employ longitudinal designs to better capture temporal patterns of infection and recovery, and incorporate microbiological diagnostics to validate clinical observations. Expanding the study to multiple healthcare facilities would also improve generalizability. Interventions aimed at improving vaccination compliance, strengthening nutritional programs, and reducing environmental risk exposures could substantially mitigate the burden of ARIs in similar low-resource settings (22). In conclusion, the study reaffirmed that acute respiratory tract infections continue to represent a major health concern among children under five years of age. Socioeconomic deprivation, incomplete immunization, and inadequate feeding practices remain the principal contributing factors. Strengthening preventive healthcare, promoting maternal awareness, and ensuring equitable access to vaccination services are essential strategies for reducing the incidence and impact of ARIs in this population.

CONCLUSION

This study highlights acute respiratory tract infections as a major contributor to childhood morbidity in Abbottabad, particularly among children under five years of age. It underscores the multifactorial nature of these infections, influenced by demographic, socioeconomic, environmental, and behavioral factors. The findings reaffirm the vital role of complete immunization, adequate nutrition, and breastfeeding in safeguarding children's respiratory health. They also emphasize the need for improving healthcare access and awareness, especially in rural communities, where limited resources and lower vaccination coverage increase vulnerability. Strengthening preventive strategies through vaccination drives, parental education on hygiene and feeding practices, and community-level interventions can substantially reduce the burden of respiratory infections and enhance child health outcomes in similar low-resource settings.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Hashim	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Adnan Bashir	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Sajid Raza*	Substantial Contribution to acquisition and interpretation of Data

Author	Contribution
	Has given Final Approval of the version to be published
Sufyan Siraj	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Aima Zahra	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hafsa Abdul Malik	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Umair	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Abid Hussain	Writing - Review & Editing, Assistance with Data Curation
Tayyaba Inayat	Writing - Review & Editing, Assistance with Data Curation
Laiba Inayat	Writing - Review & Editing, Assistance with Data Curation

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