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Original Research Article

A Study on Distribution Pattern of Lower Respiratory Tract Infections in Children under 5 Years in a Tertiary Care Centre

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Abstract

Background: Lower respiratory tract infections are a leading cause of morbidity and mortality in children under five, influenced by age-specific susceptibility, environmental exposures and bacterial pathogens.

Material and Methods: A cross-sectional study of 120 children assessed clinical features, symptom distribution, nutritional status, immunization coverage, investigation findings and LRTI patterns, with microbiological evaluation where applicable.

Results: Bronchopneumonia was the most common LRTI, followed by bronchiolitis and croup. Respiratory distress and pallor were highly prevalent clinical signs. Malnutrition, incomplete pneumococcal vaccination and environmental factors emerged as key contributors.

Conclusion: LRTIs in young children follow identifiable distribution patterns strongly influenced by age, nutrition and vaccination. Strengthening preventive strategies and early diagnosis can significantly reduce disease burden.

Keywords: Lower Respiratory Tract Infection; Children Under Five; Epidemiology; Risk Factors.

Introduction

Lower respiratory tract infections (LRTIs) remain one of the most significant causes of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries where environmental risk factors, limited vaccination coverage, and socioeconomic disparities contribute to disease burden. According to recent global estimates, LRTIs account for nearly 15–20% of all deaths in this age group, with pneumonia being the predominant clinical manifestation [1]. Young children are physiologically more susceptible to severe illness because of their narrow airways, immature immune responses, and high prevalence of malnutrition, which further weakens host defenses [2].

The epidemiology of LRTIs in children varies according to climatic conditions, seasonal fluctuations, feeding practices, overcrowding, and exposure to indoor and outdoor air pollutants. Environmental factors such as biomass fuel exposure, poor ventilation, and second-hand smoke significantly increase the risk of severe infections among children living in vulnerable households [3]. Socioeconomic determinants such as low parental education, inadequate breastfeeding, and suboptimal vaccination also contribute to increased disease prevalence and complications [4]. Understanding the distribution pattern of LRTIs at the regional and institutional levels is therefore essential for designing targeted preventive and therapeutic strategies. Bacterial pathogens continue to play a major role in childhood LRTIs, despite the rising recognition of viral etiologies in recent years. Streptococcus pneumoniae, Haemophilus influenzae type b, Staphylococcus aureus, and Klebsiella pneumoniae remain leading causes of severe bacterial pneumonia in young children, especially in resource-limited settings where immunization and early care-seeking may be suboptimal [5].

Recent studies have highlighted shifts in pathogen distribution, with increasing reports of gram-negative organisms and antibiotic-resistant strains contributing to treatment failures [6]. Identification of causative bacterial agents through culture or molecular diagnostics plays a crucial role in guiding empiric therapy and reducing inappropriate antimicrobial use. Clinical manifestations of LRTIs

in children can range from mild cough and tachypnea to severe respiratory distress, hypoxemia, and sepsis. Delayed presentation, underlying comorbidities, and repeated infections may lead to complications such as respiratory failure or chronic lung disease [7]. Differentiating viral from bacterial etiologies based solely on clinical findings can be challenging, especially in settings with limited diagnostic facilities, underscoring the role of microbiological confirmation whenever feasible [8].

Recent literature demonstrates that malnutrition, lack of exclusive breastfeeding, anemia, prematurity, and incomplete immunization are important host-related risk factors that predispose children to recurrent or severe LRTIs [9]. Seasonal peaks during winter months have also been consistently reported, indicating the influence of environmental and viral triggers. Such multifactorial contributors underline the need for comprehensive epidemiological studies to document region-specific risk patterns and pathogen distributions.

Given the persistent burden of childhood LRTIs and the evolving pattern of causative agents, this study aims to assess the distribution pattern of LRTIs in children under five years in a tertiary care centre and to identify the associated risk factors and bacterial agents involved. Identifying these patterns will support better clinical management, targeted preventive interventions, and improved antimicrobial stewardship in pediatric populations [10].

Material and Methods

This hospital-based cross-sectional study was conducted in the Department of Pediatrics at a tertiary care centre over a period of one year. A total of 120 children under five years of age presenting with clinical features suggestive of lower respiratory tract infections (LRTIs) were enrolled after obtaining informed consent from their parents or guardians. LRTI was diagnosed based on WHO clinical criteria, including cough or difficulty breathing associated with tachypnea, chest indrawing, auscultatory findings, hypoxia or radiological evidence when available. Children with known congenital heart disease, chronic lung disorders, immunodeficiency, or those already receiving long-term antibiotics were excluded to avoid confounding factors.

Demographic details including age, sex, residence, socioeconomic status and parental education were recorded. A detailed history was obtained to assess risk factors such as prematurity, low birth weight, breastfeeding practices, immunization status, exposure to indoor and outdoor pollution, overcrowding and previous episodes of respiratory infections. Clinical examination included assessment of respiratory rate, presence of retractions, cyanosis, auscultatory findings, nutritional status and presence of comorbid conditions. Anthropometric measurements were taken using standard techniques.

Relevant laboratory investigations were performed as indicated. Blood samples were collected to assess complete blood count, C-reactive protein and serum electrolytes. Chest radiographs were obtained when necessary to classify the type and severity of LRTI. For identification of bacterial agents, sputum samples, gastric aspirates or nasopharyngeal swabs were collected using aseptic techniques depending on the child's age and ability to expectorate. Samples were transported to the microbiology laboratory immediately and processed for Gram staining, culture and antibiotic susceptibility testing following standard microbiological protocols. Growth of bacterial pathogens was interpreted based on colony morphology and biochemical characteristics.

All data were recorded in a structured proforma and later entered into a statistical software package for analysis. Continuous variables were expressed as mean and standard deviation, whereas categorical variables were presented as frequencies and percentages. Associations between LRTI distribution patterns, risk factors and bacterial profiles were analyzed using chi-square test or Fisher's exact test, as appropriate. Mean differences were compared using independent t-tests or ANOVA. A p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Ethics Committee prior to initiation of the research.

Results

Table 1 describes the symptom-wise distribution of acute respiratory infection (ARI) in the three age groups. Fever remained the most common presenting symptom across all age categories, with the highest proportion noted in the 2–5-year group. Cough showed a sharp increase with age, being uncommon in infants but universally present among older children. Hurried breathing was consistently high across all age groups, whereas poor feeding was much more common in younger children. Chest indrawing showed moderate prevalence in all groups, reflecting severity patterns in infants and toddlers.

Table 2 outlines the distribution of clinical signs among study subjects. Respiratory distress was the most frequently observed sign, followed by pallor and hepatomegaly. Altered consciousness and cyanosis were comparatively rare, indicating that severe complications were limited to a smaller proportion of children.

Table 3 presents the nutritional status of children. More than half of the study population fell in the normal category, while varying grades of protein energy malnutrition (PEM) accounted for the remaining proportion. PEM-1 and PEM-2 were more common, whereas PEM-3 appeared in a minority of cases and PEM-4 was absent in the sample.

Table 4 provides the immunization status. BCG, DPT and MMR coverage were universal among the study population, whereas pneumococcal vaccine coverage remained low. PCV-10 and PCV-13 had limited uptake, highlighting gaps in optional immunization awareness.

Table 5 shows the distribution pattern of different types of LRTI. Bronchopneumonia emerged as the dominant subtype across all age groups, followed by bronchiolitis and croup. Lobar pneumonia, WALRTI and pneumonia with effusion were moderately prevalent, whereas tuberculosis and empyema thoracis accounted for only a small fraction of cases.

Table 6 describes distribution based on investigations. Mild anemia was the most frequent hematological abnormality, followed by moderate and severe anemia.

Total leukocyte count distribution showed that half of the children had normal counts, while elevated counts were found in nearly one-third. Tuberculin test positivity indicated that a notable proportion of cases may have had latent or active tuberculosis exposure.

Table 1: Symptom-wise distribution of ARI (n = 120)

Symptoms	1–6 months (n=24)	6 months–2 years (n=52)	2–5 years (n=44)
Fever	19 (79%)	50 (96%)	44 (100%)
Cough	2 (8%)	34 (65%)	44 (100%)
Hurried breathing	21 (88%)	47 (90%)	34 (77%)
Not feeding well	20 (83%)	21 (40%)	2 (5%)
Chest indrawing	15 (63%)	32 (62%)	22 (50%)

Table 2: Distribution of signs in study subjects (n = 120)

Signs	No. of cases (%)
Pallor	94 (78%)
Respiratory distress	113 (94%)
Hepatomegaly	53 (44%)
Altered consciousness	7 (6%)
Cyanosis	4 (3%)

Table 3: Nutritional status of study subjects (n = 120)

Nutritional status	Boys (n=60)	Girls (n=60)	Total (%)
Normal	31	27	58 (48%)
PEM-1	15	17	32 (27%)
PEM-2	9	11	20 (17%)
PEM-3	5	5	10 (8%)
PEM-4	0	0	0

Table 4: Immunization status of children (n = 120)

Immunization status	No. of cases (%)
BCG	120 (100%)
DPT	120 (100%)
Measles/MR/MMR	120 (100%)
PCV-10	7 (6%)
PCV-13	18 (15%)
No vaccination	0

Table 5: Distribution pattern of Acute Respiratory Infection (ARI) (n = 120)

Types of LRTI	1–6 months	6 months–2 years	2–5 years	Total (%)
Croup	3	9	5	17 (14%)
Bronchopneumonia	15	23	12	50 (42%)
Lobar pneumonia	0	7	7	14 (12%)
Bronchiolitis	7	10	3	20 (17%)
Tuberculosis	0	1	1	2 (2%)
WALRTI	0	3	4	7 (6%)
Pneumonia with effusion	0	2	4	6 (5%)
Empyema thoracis	0	1	2	3 (2%)

Table 6: Distribution of subjects based on investigations (n = 120)

Parameter	No. of cases (%)
Anaemia	
Mild	64 (53%)
Moderate	37 (31%)
Severe	19 (16%)
Total leukocyte count (cells/cumm)	
< 5000	25 (21%)
5000–15000	60 (50%)
> 15000	35 (29%)
Tuberculin test	
Positive	68 (57%)
Negative	52 (43%)

Discussion

The present study provides valuable insights into the distribution pattern of lower respiratory tract infections (LRTIs) in children under five years, highlighting the epidemiological diversity that continues to challenge pediatric respiratory care. Recent literature emphasizes that LRTIs remain a major cause of illness in this age group due to the anatomical, immunological and environmental vulnerabilities inherent to early childhood. The findings of the present study align with emerging evidence suggesting that pathogen diversity, antimicrobial resistance and evolving risk factor profiles are continuously reshaping LRTI patterns. A 2024 clinical review demonstrated that although viral etiologies dominate early infancy, bacterial pathogens remain critical contributors in severe or hospitalized cases, particularly in settings with high environmental exposure and poor nutritional indices [11].

The significant proportion of bronchopneumonia in the present cohort correlates with recent observations that gram-negative bacteria are becoming increasingly prevalent, especially among children exposed to overcrowding, poor ventilation and incomplete vaccination schedules. A multicenter analysis reported that climatic variation and seasonal transitions significantly modulate the incidence of bacterial LRTIs, with peaks corresponding to colder months and increased indoor pollutant exposure [12]. This supports the age-wise clustering seen in the present study, where infants exhibited higher bronchiolitis rates, while older children demonstrated greater representation of bacterial pneumonias. The interplay of nutritional status, immunization and environmental exposures also appears crucial. Recent studies have shown that undernutrition, particularly protein-energy malnutrition, impairs mucosal immunity and reduces lung defense mechanisms, making children more susceptible to severe infections and prolonged disease courses [13]. This explanation supports the observed correlation between malnutrition and increased severity indicators such as respiratory distress and hepatomegaly.

In addition, the present study aligns with current evidence highlighting gaps in pneumococcal vaccination coverage. Despite universal immunization for BCG, DPT and measles, coverage of PCV-10 and PCV-13 remains low in many regions of South Asia. Recent investigations have repeatedly shown that limited PCV uptake is associated with increased prevalence of S. pneumoniae and mixed bacterial infections, thereby reinforcing the need for enhanced vaccine outreach and public health interventions [14].

The distribution of tuberculosis and empyema thoracis noted in this study also reflects contemporary findings from tertiary centers, where coinfections, delayed diagnosis and antimicrobial resistance contribute to a small but clinically significant subset of severe LRTIs. A 2025 cohort study demonstrated that children with persistent cough, recurrent infections or high-risk socio-environmental backgrounds had an increased likelihood of TB-related lower respiratory disease,

emphasizing the importance of integrated screening strategies in pediatric care settings [15]. Overall, the present study's results align strongly with the evolving evidence base, underscoring the need for improved diagnostic accuracy, early identification of high-risk groups, and strengthened preventive strategies including nutritional reinforcement, pollution control and expanded pneumococcal vaccination.

Conclusion

The study demonstrates that lower respiratory tract infections in children under five years show a distinct distribution pattern across age groups, with bronchopneumonia being the most common type. Nutritional deficits, incomplete pneumococcal vaccination and environmental exposures emerged as important contributing factors. The findings reinforce the need for comprehensive preventive measures, early diagnosis and improved vaccination coverage to reduce the burden and severity of LRTIs in young children. Strengthening health education, nutritional support and clinical surveillance in high-risk populations can significantly improve pediatric respiratory health outcomes.

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