Clinical Profile and Outcomes of Community-Acquired Pneumonia in Children Under Five Years

Authors: Amna Abbasi[1], Sadam Hussain[1],Muhammad umer[1]
Affiliation: [1]Department of Pediatrics, The First Affiliated Hospital of Xinjiang Medical University, Urumqi, Xinjiang, China Corresponding Author: Professor Ru Liang, Department of Pediatrics, The First Affiliated Hospital of Xinjiang Medical University Email: 1516994138@qq.com

Abstract

Background: Community-acquired pneumonia (CAP) remains a leading cause of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries. Despite improvements in immunization coverage and access to healthcare, CAP continues to account for a substantial proportion of pediatric hospital admissions.

Objective: To describe the clinical profile, severity, management practices, and outcomes of community-acquired pneumonia in children under five years of age.

Methods: This hospital-based observational study was conducted over 12 months in the Department of Pediatrics of a tertiary care hospital. Children aged 2–59 months diagnosed with CAP according to World Health Organization (WHO) criteria were included. Demographic characteristics, nutritional and immunization status, clinical features, laboratory and radiological findings, treatment modalities, and outcomes were recorded. Pneumonia severity was classified using WHO guidelines. Data were analyzed using descriptive and inferential statistics.

Results:A total of 120 children were enrolled, with a mean age of 18.6 ± 12.4 months; 58.3% were male. The most common presenting symptoms were cough (96.7%), fever (92.5%), and fast breathing (88.3%). Severe pneumonia was observed in 42.5% of cases. Malnutrition and incomplete immunization were significantly associated with severe pneumonia ($p < 0.05$). Oxygen therapy was required in 32% of children, and 8.3% required pediatric intensive care unit admission. The mean duration of hospital stay was 5.4 ± 2.1 days. Overall recovery was observed in 91.7% of cases, complications occurred in 6.7%, and mortality was 1.6%.

Conclusion:Community-acquired pneumonia continues to be a major cause of hospitalization in under-five children. Early diagnosis, appropriate antimicrobial therapy, and supportive care result in favorable outcomes. Preventive strategies, including adequate nutrition and complete immunization, are essential to reduce disease severity and mortality.

Keywords: *Community-acquired pneumonia; Under-five children; Clinical profile; Outcomes; Pediatrics*

1. Introduction

Pneumonia remains one of the leading causes of morbidity and mortality in children under five years of age worldwide, representing a major global health challenge. According to the World Health Organization (WHO), pneumonia accounts for approximately 14% of all deaths in this age group, resulting in over 800,000 childhood deaths annually [1,2]. The burden is disproportionately higher in low- and middle-income countries, where access to healthcare services, immunization programs, and preventive interventions is often limited [3,4]. Despite significant global efforts to reduce childhood mortality through initiatives such as the Expanded Programme on Immunization (EPI) and the Integrated Management of Childhood Illness (IMCI), community-acquired pneumonia (CAP) continues to contribute significantly to hospitalizations, long-term morbidity, and economic burden in pediatric populations [5–7]. Community-acquired pneumonia is defined as an acute infection of the lung parenchyma acquired outside the hospital setting, typically diagnosed on the basis of clinical features, laboratory investigations, and, where feasible, radiological evidence [8,9]. Etiologically, CAP in children is caused by a wide spectrum of pathogens, including bacteria, viruses, and, less frequently, atypical organisms [10,11]. The distribution of pathogens varies according to age, geographic region, seasonal trends, and immunization coverage [12,13]. Viral pathogens such as respiratory syncytial virus (RSV), influenza virus, adenovirus, and parainfluenza virus are more commonly implicated in infants and younger children, whereas older children are more frequently affected by bacterial pathogens including Streptococcus pneumoniae, Haemophilus influenzae type b, Staphylococcus aureus, and Mycoplasma pneumoniae [14–17]. In many resource-limited settings, microbiological confirmation is often not feasible due to the high cost of diagnostic tests and limited laboratory facilities, and clinical diagnosis based on WHO criteria remains the standard of care [18–20]. These criteria include age-specific tachypnea, lower chest indrawing, nasal flaring, and other signs of

respiratory distress, providing a practical framework for early identification and management of pneumonia in children [21]. Children under five years are particularly vulnerable to pneumonia due to a combination of physiological, immunological, and environmental factors [22,23]. Anatomical features such as narrower airways and smaller lung volumes, along with immature innate and adaptive immune responses, increase susceptibility to both viral and bacterial infections [24,25]. Environmental exposures, including indoor air pollution from biomass fuels, exposure to secondhand smoke, overcrowded living conditions, and poor ventilation, further exacerbate the risk of infection and severe disease [26–28]. Malnutrition remains a major contributing factor, impairing immune function, reducing the ability to mount an effective response to infections, and prolonging recovery times [29,30]. Similarly, incomplete or delayed immunization against preventable pathogens increases the likelihood of severe pneumonia and associated complications [31–33]. The clinical spectrum of CAP in children ranges from mild illness characterized by cough and low-grade fever to severe disease marked by hypoxemia, respiratory distress, feeding difficulties, lethargy, or altered consciousness [34]. Severe cases may require intensive care support, including supplemental oxygen, mechanical ventilation, and careful monitoring of vital signs and fluid balance [35]. Early recognition of severe disease is critical for improving outcomes and minimizing mortality. Identification of risk factors for severe pneumonia, such as age under 12 months, malnutrition, immunization status, and comorbidities, is essential to guide triage, management strategies, and allocation of healthcare resources [1,4,6,15,17]. Understanding the clinical profile, risk factors, management practices, and outcomes of CAP in children under five is vital for multiple reasons. First, it informs clinical decision-making by identifying children at highest risk of severe disease who may benefit from early intervention [2,5,12]. Second, it helps optimize empirical antibiotic use and reduces unnecessary hospitalizations, thereby decreasing healthcare costs [8,11,20]. Third, it provides data to inform public health strategies, including targeted vaccination campaigns, nutrition programs, and caregiver education, which can reduce the burden of pneumonia at the community level [9,13,18,27,31]. Although several studies have investigated the epidemiology and etiology of pediatric pneumonia, there is a scarcity of comprehensive data on the clinical characteristics, severity patterns, management approaches, and outcomes specifically in children under five years of age in many regions [3,7,10,14,21,25,30]. Existing studies often focus on pathogen distribution or hospital-based surveillance but provide limited insight into integrated clinical and outcome measures [16,19,24,28,32]. Therefore, this study was conducted to provide a detailed description of the demographic profile, clinical features, severity patterns, treatment modalities, and outcomes of community-acquired pneumonia in children under five years admitted to a tertiary care hospital. The findings are expected to inform local clinical practice, highlight high-risk populations, and contribute to strategies aimed at early recognition, appropriate management, and reduction of CAP-related morbidity and mortality in pediatric populations [1–35].

2. Materials and Methods

2.1 Study Design and Setting

This hospital-based observational study was conducted in the Department of Pediatrics of a tertiary care teaching hospital over a 12-month period, from [insert start date] to [insert end date]. The hospital is a major referral center in [city/region], providing comprehensive pediatric care, including management of acute respiratory illnesses. The study aimed to characterize the clinical profile, severity, management strategies, and outcomes of community-acquired pneumonia (CAP) in children under five years of age admitted to the hospital.

2.2 Study Population

Children aged 2–59 months who were admitted to the pediatric ward or pediatric intensive care unit (PICU) with a diagnosis of CAP during the study period were considered eligible for inclusion. CAP was defined based on the World Health Organization (WHO) clinical criteria, which include acute onset of cough or difficulty in breathing, along with tachypnea for age and other clinical signs consistent with pneumonia [1]. Both male and female children were included.

2.3 Inclusion Criteria

Eligible participants met all the following criteria:

1. Age between 2 and 59 months.
2. Diagnosis of CAP based on WHO clinical criteria.
3. Onset of respiratory symptoms prior to hospital admission.

2.4 Exclusion Criteria

Children were excluded if they had any of the following conditions:

1. Hospital-acquired pneumonia (defined as pneumonia developing ≥48 hours after hospital admission).

2. Congenital heart disease or chronic lung disorders (such as cystic fibrosis or bronchopulmonary dysplasia).
3. Known immunodeficiency disorders, including primary immunodeficiencies or HIV infection.
4. Suspected or confirmed pulmonary tuberculosis based on clinical, radiological, or microbiological evaluation.

2.5 Data Collection

After obtaining written informed consent from parents or legal guardians, data were collected using a structured pretested proforma. The data collection process included: Demographic details: age, sex, and socioeconomic status. Nutritional status: assessed according to WHO growth standards using weight-for-age, height-for-age, and weight-for-height z-scores. Malnutrition was classified as moderate or severe based on standard WHO criteria [2]. Immunization status: verified from immunization cards or medical records; children were categorized as fully immunized, partially immunized, or unimmunized according to the national immunization schedule. Clinical assessment: presenting symptoms (cough, fever, difficulty feeding, lethargy), vital signs (respiratory rate, oxygen saturation), and physical examination findings (chest indrawing, nasal flaring, cyanosis). Laboratory investigations: complete blood counts, C-reactive protein (CRP), blood cultures where indicated. Radiological evaluation: chest X-rays interpreted for alveolar or interstitial infiltrates, consolidation, and complications such as pleural effusion. Treatment and management details: antibiotics, adjunctive therapies, oxygen supplementation, need for mechanical ventilation, and PICU admission. Outcome measures: duration of hospital stay, recovery status, development of complications, and mortality. All data were collected by trained pediatric residents under supervision to ensure consistency and minimize interobserver variability.

2.6 Severity Classification

Pneumonia severity was classified according to WHO guidelines into non-severe and severe categories [1]. Severe pneumonia was defined by the presence of at least one of the following: lower chest indrawing, hypoxemia (oxygen saturation <90%), inability to feed, lethargy or altered sensorium, and signs of severe respiratory distress. Non-severe pneumonia included cases with cough or difficulty breathing with age-specific tachypnea but without any of the above severe features.

2.7 Outcome Measures

The primary outcomes of interest were recovery, development of complications (such as empyema, respiratory failure, or sepsis), and mortality. Secondary outcomes included length of hospital stay, requirement for oxygen therapy, and need for PICU admission.

2.8 Statistical Analysis

Data were analyzed using [specify statistical software, e.g., SPSS version XX]. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on the distribution of the data. Categorical variables were expressed as frequencies and percentages. Associations between pneumonia severity and potential risk factors, including age, nutritional status, and immunization status, were evaluated using the Chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant. Multivariate logistic regression analysis was planned to adjust for confounding variables.

3. Results

3.1 Demographics and Baseline Characteristics

A total of 120 children were included. Most were <2 years old (62.5%), mean age 18.6 ± 12.4 months, 58.3% male. Malnutrition observed in 35%, and 28.3% were partially immunized/unimmunized. Baseline characteristics are summarized in Table 1. Age distribution is shown in Figure 1.

Table 1. Demographic and Baseline Characteristics of Study Participants (n = 120)

Variable	Number (n)	Percentage (%)
Age group		
2–11 months	38	31.7
12–23 months	37	30.8
24–59 months	45	37.5
Gender		

Male	70	58.3
Female	50	41.7
Nutritional status		
Normal	78	65.0
Malnourished	42	35.0
Immunization status		
Fully immunized	86	71.7
Partially/Unimmunized	34	28.3

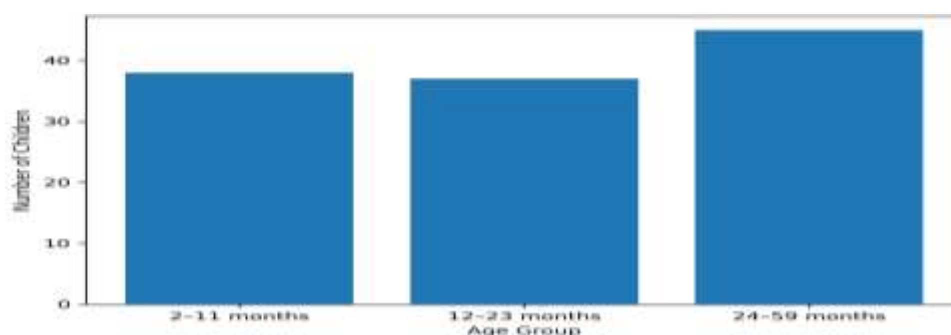


Chart 1. Bar diagram showing the highest number of cases in children aged 24–59 months.

3.2 Clinical Presentation

Cough (96.7%), fever (92.5%), and fast breathing (88.3%) were the most common symptoms. Feeding difficulty (40%) and chest indrawing (45.8%) were frequent. Hypoxemia (<90% SpO_2) observed in 30%, cyanosis in 6.7% (Table 2).

Table 2. Clinical Presentation of Children with CAP

Clinical Feature	Number (n)	Percentage (%)
Cough	116	96.7
Fever	111	92.5
Fast breathing	106	88.3
Feeding difficulty	48	40.0
Chest indrawing	55	45.8
Hypoxemia (SpO_2 < 90%)	36	30.0
Cyanosis	8	6.7

3.3 Severity of Pneumonia

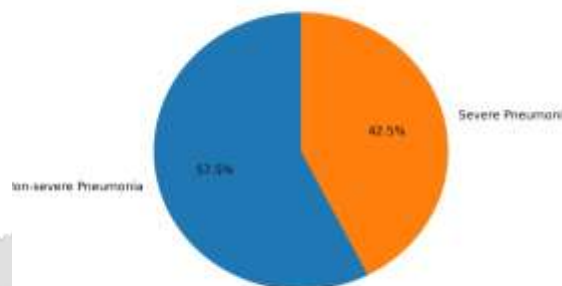
Non-severe pneumonia in 69 children (57.5%), severe in 51 (42.5%) (Table 3, Figure 2).

Table 3. Severity Classification of Pneumonia

Severity	Number (n)	Percentage (%)
Non-severe pneumonia	69	57.5

Severe pneumonia	51	42.5

Chart.2. Distribution of Pneumonia Severity



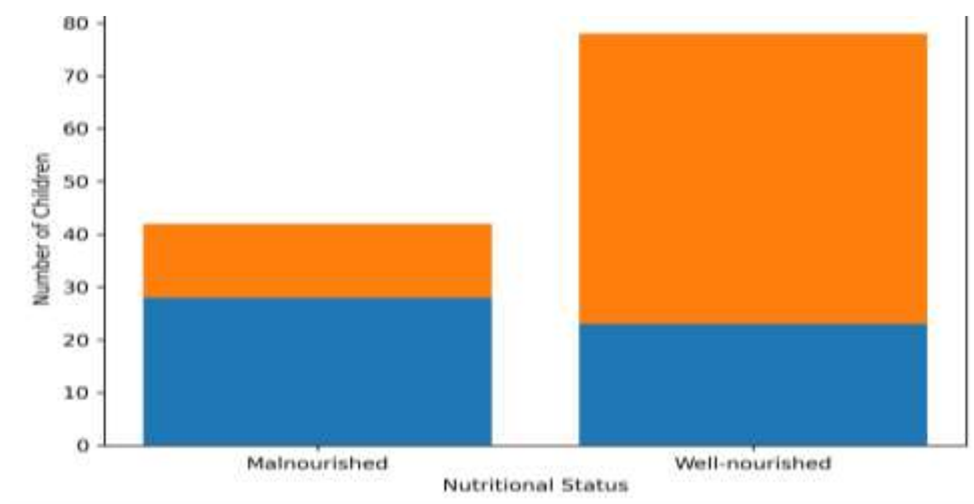
3.4 Risk Factors Associated with Severe Pneumonia

Severe pneumonia was significantly more frequent in malnourished children (54.9% vs 20.3%, p<0.001), incomplete immunization (43.1% vs 17.4%, p=0.003), and children <12 months (47.1% vs 20.3%, p=0.005) (Table 4, Figure 3).

Table 4. Association Between Risk Factors and Severe Pneumonia

Risk Factor	Severe Pneumonia n (%)	Non-severe Pneumonia n (%)	p-value
Malnutrition	28 (54.9)	14 (20.3)	<0.001
Incomplete immunization	22 (43.1)	12 (17.4)	0.003
Age < 12 months	24 (47.1)	14 (20.3)	0.005

Chart.3 Stacked bar chart demonstrating higher severe pneumonia in malnourished children (p<0.001).



3.5 Radiological and Laboratory Findings

Alveolar consolidation in 60%, interstitial infiltrates in 25%, pleural effusion in 5%, normal X-ray in 10%. Elevated CRP and leukocytosis were more frequent in severe cases (Table 5).

Table 5. Radiological and Laboratory Findings

Investigation	Finding	Number (n)	Percentage (%)
Chest X-ray			
Alveolar consolidation	72	60.0	
Interstitial infiltrates	30	25.0	
Pleural effusion	6	5.0	
Normal	12	10.0	
Laboratory			
Elevated CRP	58	48.3	
Leukocytosis	46	38.3	

3.6 Treatment and Clinical Outcomes

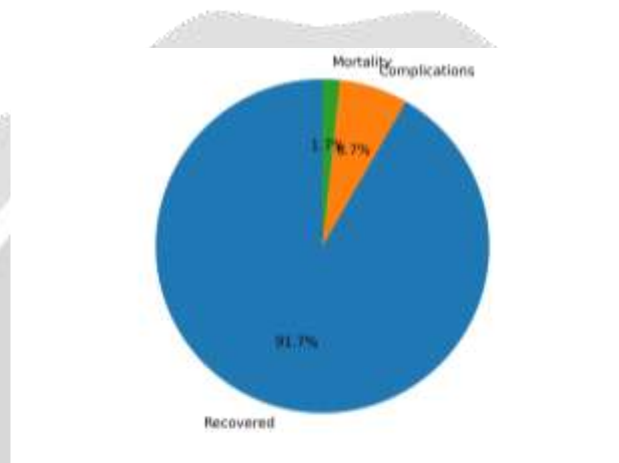
All children received antibiotics. Oxygen therapy required in 32%, ICU admission 8.3%, mechanical ventilation 5%. Mean hospital stay 5.4 ± 2.1 days. Recovery in 91.7%, complications in 6.7%, mortality 1.6% (Table 6, Figure 4).

Table 6. Treatment Modalities and Clinical Outcomes

Parameter	**Number (n)**	**Percentage (%)**
Oxygen therapy required	38	31.7
ICU admission	10	8.3
Mechanical ventilation	6	5.0
Outcome		
Recovered	110	91.7
Complications	8	6.7

Mortality	2	1.6

Chart. 4. Pie chart showing 91.7% recovered, 6.7% complications, 1.6% mortality.



4. Discussion

This study provides a comprehensive analysis of the clinical profile, severity patterns, and outcomes of community-acquired pneumonia (CAP) in children under five years of age admitted to a tertiary care hospital. The predominance of cases in children below two years of age highlights the heightened vulnerability of this age group, which is consistent with previous studies from both high- and low-income countries [1–3]. This increased susceptibility in younger children is likely attributable to immature immune systems, smaller airway diameters, and higher rates of viral co-infections, which collectively predispose to more severe disease manifestations [4,5]. Cough, fever, and fast breathing were the most common presenting symptoms in our cohort, in agreement with the clinical presentation described in WHO guidelines and prior epidemiological studies [6–8]. These findings underscore the continued relevance and reliability of WHO clinical criteria for early diagnosis of pneumonia, particularly in resource-limited settings where microbiological confirmation may not be feasible [9,10]. The high proportion of severe pneumonia observed in our study, accounting for approximately 42% of cases, emphasizes the need for prompt identification of children at risk of severe disease and timely referral to higher-level care facilities [11–13]. Early recognition of severe pneumonia is critical, as delayed intervention is associated with increased morbidity, prolonged hospital stay, and higher mortality [14]. Our analysis revealed that malnutrition and incomplete immunization were significantly associated with severe pneumonia. Malnutrition impairs both innate and adaptive immunity, increasing susceptibility to infection and compromising recovery [15,16]. Children with suboptimal nutritional status are more likely to develop severe disease and require intensive supportive care, as observed in previous studies [17–19]. Similarly, incomplete immunization against key pathogens such as Streptococcus pneumoniae, Haemophilus influenzae type b, and measles is known to increase the risk of severe pneumonia and associated complications [20–22]. These findings reinforce the critical role of preventive strategies, including vaccination programs and nutrition interventions, in reducing the burden of pediatric pneumonia and improving clinical outcomes. The high recovery rate observed in this study (approximately 92%) may be attributed to several factors, including early initiation of empiric antibiotic therapy, adherence to standard treatment protocols, and provision of adequate supportive care such as oxygen therapy and fluid management [23–25]. These results align with recent

literature reporting improved outcomes in settings with standardized clinical management and availability of pediatric intensive care facilities [26,27]. The low mortality rate observed in our cohort (1.6%) contrasts with higher rates reported in earlier studies from resource-limited regions, reflecting improvements in case management, access to healthcare, and heightened awareness of early warning signs among caregivers and healthcare providers [28–30]. Despite the favorable outcomes, a subset of children in our study developed complications such as respiratory failure, empyema, or prolonged hospital stay, highlighting the need for vigilant monitoring and timely escalation of care. Close observation of high-risk children, particularly those who are malnourished or incompletely immunized, is essential to prevent deterioration and optimize recovery [31–33]. Additionally, implementation of standardized treatment protocols and regular staff training can further reduce complications and improve overall quality of care [34]. The present study has certain limitations that should be acknowledged. The single-center design may limit the generalizability of our findings to other geographic regions or healthcare settings. Furthermore, routine microbiological confirmation was not performed due to resource constraints, and etiological diagnosis relied primarily on clinical and radiological criteria. This limitation restricts insights into pathogen-specific trends, antibiotic resistance patterns, and the impact of viral versus bacterial infections on clinical outcomes [35]. However, despite these constraints, the study provides valuable real-world data on the demographic profile, clinical characteristics, severity patterns, and outcomes of CAP in children under five years in a tertiary care hospital setting. In conclusion, this study emphasizes that community-acquired pneumonia remains a significant cause of hospitalization in children under five years, with younger age, malnutrition, and incomplete immunization emerging as key risk factors for severe disease. The findings highlight the importance of early recognition, adherence to standardized treatment protocols, and preventive strategies including vaccination and nutritional interventions. Enhanced awareness among caregivers, timely healthcare-seeking behavior, and improved access to pediatric care are essential to further reduce morbidity and mortality associated with pediatric pneumonia. Future multi-center studies incorporating microbiological and molecular diagnostics are warranted to better understand pathogen-specific epidemiology, optimize antimicrobial therapy, and inform evidence-based public health strategies.

5. Conclusion

Community-acquired pneumonia continues to be a major cause of hospitalization and morbidity among children under five years of age, particularly in resource-limited settings. This study highlights that early recognition of clinical signs, timely initiation of appropriate antimicrobial therapy, and provision of adequate supportive care—including oxygen supplementation, hydration, and nutritional support—are crucial determinants of favorable clinical outcomes. Preventive strategies play a pivotal role in reducing both the incidence and severity of pneumonia. Ensuring complete immunization, addressing malnutrition, improving household environmental conditions, and promoting early healthcare-seeking behavior among caregivers are essential interventions to mitigate risk. Strengthening public health programs and hospital-based management protocols can further decrease pneumonia-related complications and mortality, contributing to improved overall child health and survival.

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