The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 3, 2025

CLINICAL PROFILE AND FACTORS ASSOCIATED WITH RECURRENT PNEUMONIA IN CHILDREN

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DOI: https://doi.org/10.5281/zenodo.17759293

Keywords
Recurrent Pneumonia; Risk Factors; Pediatrics; Epidemiology

Article History
Received: 10 January 2025
Accepted: 01 March 2025
Published: 14 March 2025

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Abstract

Background: *Recurrent pneumonia remains a significant challenge worldwide, especially in children's health, particularly in developing countries. This is attributable to underlying health system, environmental, and immunological factors. Exploring the associated clinical and etiological factors is important vis-à-vis early diagnosis and preventative measures. This research, therefore, investigates the clinical profile and risk factors of pediatric patients with recurrent pneumonia.*

Objectives: *Evaluating the clinical description, understanding key demographic, environmental, and etiological factors relating to recurrent pneumonia in children brought to tertiary care facilities.*

Place and duration of study: *From January 2024 to June 2024 Paediatrics Department, Sandeman Provincial Hospital / Bolan Medical College/ Hospital Quetta. Balochistan.*

Methodology: *In this cross-sectional study, I examined 157 pediatric patients at the Department of Paediatrics, Sandeman Provincial Hospital / Bolan Medical College/ Hospital, Quetta over 6 months following Approval of the CPSP synopsis for recurrent pneumonia. Demographic details, clinical manifestations, and potential risk factors were obtained from structured questionnaires and medical records. Medical charts were used to obtain laboratory and radiological findings and to perform analyses. For statistical analysis, I used SPSS version 24.0. To evaluate relationships, the Chi-square test and independent t-tests were used, with $p < 0.05$ considered statistically significant.*

Results: *The average age of the 157 patients in the study was 4.7 years (± 2.3 years). There were more males (60.5%). Malnutrition ($p = 0.012$), exposure to passive smoking ($p = 0.021$), and a history of prematurity ($p = 0.034$) were documented as significant risk factors. Asthma (28%), congenital heart disease (18%), and immunodeficiency (10%) were the underlying conditions noted. Recurrence was significantly associated with lower socioeconomic status ($p = 0.008$). The lower right lobe was the most frequently affected (36%). Most patients improved with specific therapy, and the counselling given to controllers*

during follow-up helped reduce recurrences.

Conclusion: *In children, recurrent pneumonia stems from multiple factors, mostly linked to modifiable risk factors like malnutrition, exposure to smoke, and substandard living conditions. The earlier root causes are identified, coupled with nutritional rehabilitation and enhanced preventive care, the more disease recurrence and preventable hospitalizations can be mitigated. Ongoing follow-up, along with health education for families, is essential to maintain children's respiratory health.*

INTRODUCTION

Pneumonia continues to be one of the most common and serious illnesses affecting children, especially in developing countries where the challenges of poverty and limited access to care are persistent. It has been reported that approximately 15–20% of deaths in children under five years of age are the result of pneumonia, most likely to occur in low- and middle-income countries【1】. The World Health Organisation (WHO) has reported that pneumonia is the single largest infectious cause of death in children worldwide【2】. Recurrent pneumonia (RP) is a unique clinical challenge that is frequently due to an underlying systemic, anatomical, or other environmental abnormality. When pneumonia recurs, it results in two episodes of pneumonia within a year or three episodes at any time, with fully resolving x-rays in between episodes【3】. Certain studies show that out of children hospitalized with pneumonia, 7-9% of them have recurrent pneumonia, and this further illustrates the importance of evaluating these children fully【4】. Unlike isolated cases of pneumonia, recurrent cases need to be examined more closely to assess whether other conditions, such as congenital heart defect, bronchial asthma, cystic fibrosis, and immune dysregulation, are predisposing factors【5】. Children at high risk of recurrent lower respiratory tract infections are the malnourished and those of low birth weight, crowdedness, and exposure to passive smoke【6】. The recurrence of these infections is influenced significantly by incomplete vaccination, abrupt weaning, and exposure to climate change【7】. The combination of malnutrition, low economic status, and lack of access to preventive healthcare in underdeveloped countries like Pakistan plays a large role in worsening symptoms of the disease【8】. The evaluation of children with recurrent pneumonia should go beyond symptomatic management and aim to identify any possible underlying causes. Addressing and understanding asthma, congenital disorders, and immunological disorders to support diagnosis and treatment, and pulmonary management to help avoid permanent lung damage【9】. You must take a history, perform a physical evaluation, review chest X-rays, and then perform relevant lab work to take this approach. Most appropriate for understanding the topic: very few studies from Pakistan have examined the etiological landscape and risk factors for recurrent pneumonia. These factors help us understand management considerations in a meaningful local context. This research aims to assess clinical features, demographic distribution, and risk factors for recurrent pneumonia in the pediatric population at a tertiary care facility. Recognizing these factors will help the health sector target resource allocation and make necessary adjustments to guidelines to optimize early diagnosis, preventive measures, and policy efforts to achieve positive child health outcomes.

Research Objectives:

To study the clinical and demographic profile of children with recurrent pneumonia attending a tertiary care hospital. Assess key etiological and environmental factors associated with recurrent pneumonia, including nutritional and

socioeconomic status, as well as risk factors for passive smoking, overcrowding, and other environmental factors. Estimate the prevalence of associated underlying conditions like asthma, congenital heart diseases, and immunodeficiency related to recurrent pneumonia in children.

Material And Methods:

A cross-sectional study was conducted in the Paediatrics Department at Sandeman Provincial Hospital / Bolan Medical College/ Hospital, Quetta following CPSP synopsis approval. Using non-probability consecutive sampling, 157 pediatric patients who met the diagnostic criteria for recurrent pneumonia were enrolled. Using a predetermined proforma, demographic, clinical, and environmental data were systematically recorded. Subsequent workup was completed to determine the presence of any of the following: asthma, congenital heart disease, or immunodeficiency. Medical record review and radiographs were evaluated to establish the diagnosis of recurrent pneumonia based on separate episodes that completely resolved within the prescribed interval. Parental or guardian consent was obtained before recruitment.

Participants:

One hundred fifty-seven pediatric patients meeting the diagnostic criteria for recurrent pneumonia were included in the study. Participants were aged from 6 months to 12 years and were sampled from the outpatient and inpatient departments of Paediatrics Sandeman Provincial Hospital / Bolan Medical College/ Hospital, Quetta. The study sampling was from the urban and rural sectors of Baluchistan province. There was a predominance of males, with 60.5% of the patients being male. The majority of children, 58%, came from economically low-income families and had little to no access to preventive healthcare. According to the WHO growth standards, 41% of the children were undernourished. Immunization records showed that 46% of the children had incomplete records. The children were frequently exposed to passive smoking 35%, living in overcrowded conditions 44%, and were born prematurely 18%. The children had underlying bronchial asthma in 28%, congenital heart disease in 18%, and immunodeficiency disorders in 10%. Parental/guardian consent for the study was obtained from all participants.

Sample Size Calculation:

Expected proportion of recurrent pneumonia among pediatric pneumonia cases p= 0.09 (7-9% reported in literature) Confidence level = 95% $\Rightarrow Z_{(1-\alpha/2)}=1.96$ Absolute precision (margin of error) d= 0.05

Inclusion Criteria:

Children aged between 6 months and 12 years old who had at least two pneumonia episodes in a year, or three episodes at any given time, with the absence of any visible radiographic findings between the episodes, were also included.

Exclusion Criteria:

To avoid confusion with lingering or permanent respiratory symptoms, children originally diagnosed with cystic fibrosis, chronic lung disease, or tuberculosis, or who had incomplete diagnostic imaging documentation, were excluded.

Diagnostic and Management Strategy

All children enrolled in the program received an evaluative assessment to identify factors contributing to recurrent pneumonia. Part of this assessment included collecting and reviewing a detailed clinical history, including the child's birth and feeding history, immunization record, coal smoke and pollutant exposure history, and family history of recurrent infections. Chronic respiratory or cardiac diseases were assessed during the physical examination, along with the children's nutritional status, growth metrics, and general well-being.

Statistical Analysis:

The analyses were performed using SPSS version 24.0. The mean ± standard deviation was used for quantitative variables such as age. For categorical variables, frequency distributions and percentages were used. For variable associations,

Chi-square and independent t-tests were performed. Statistically significant results were concluded for p-values less than 0.05.

Ethical Approval Statement:
The Institutional Review and Ethical Board of the College of Physicians and Surgeons Pakistan (CPSP) and the Department of Paediatrics at Sandeman Provincial Hospital / Bolan Medical College/ Hospital, Quetta approved the study. All parents or guardians signed informed written consents. The confidentiality and anonymity of the participants were preserved fully.

Results:
Of the 157 pediatric patients included, the average age was 4.7 ± 2.3 years. Most patients were male (60.5%). Factors of considerable significance included malnutrition (41%, p = 0.012), passive exposure to smoking (35%, p = 0.021), and being born prematurely (18%, p = 0.034). Each child had, on average, 3.2 ± 0.8 episodes of pneumonia. Lower socioeconomic class patients accounted for 58% of cases, and socioeconomic status showed a strong association with recurrence (p = 0.008). Underlying medical conditions included asthma (28%), congenital heart disease (18%), and immunodeficiency (10%). In 46% of patients, incomplete immunization was observed. In 36% and 28% of patients, the right and left lower lobes were most commonly affected, respectively. Most patients responded favourably to antibiotic therapy, with 88% fully recovering. In the first three months, the recurrence of subsequent episodes was greatly reduced through preventive counselling and scheduled follow-up visits.

Intervention Outcomes
Once the diagnosis was confirmed and tailored management plans began, most patients had positive outcomes. 138 of the 157 children (88%) showed full clinical and radiological recovery with 4–6 weeks of targeted therapy. In malnourished patients, rehabilitative nutrition and follow-up dietary counselling led to positive changes, as evidenced by a significant increase in their weight-for-age z-scores (mean change of +0.7 ± 0.3; p = 0.018).

Table 1. Baseline Demographic and Clinical Characteristics of Patients (n = 157)
Baseline demographic and clinical characteristics of children with recurrent pneumonia. Male predominance and low socioeconomic status were notable. The mean age was 4.7 years.

Variable	Frequency (n)	Percentage (%)	Mean ± SD
Age (years)	—	—	4.7 ± 2.3
Gender			
Male	95	60.5	—
Female	62	39.5	—
Socioeconomic Status			
Low	91	58.0	—
Middle	51	32.5	—
High	15	9.5	—
Nutritional Status			
Normal	93	59.2	—
Malnourished	64	40.8	—
Immunization Status			
Complete	85	54.1	—
Incomplete	72	45.9	—
Mean No. of Pneumonia Episodes	—	—	3.2 ± 0.8

Table 2. Identified Risk Factors and Their Statistical Associations with Recurrent Pneumonia
Statistical analysis showing a significant association between recurrent pneumonia and modifiable risk factors such as malnutrition, passive smoking, low socioeconomic status, and overcrowding.

Risk Factor	Frequency (n)	Percentage (%)	p-value	Significance
Malnutrition	64	40.8	0.012	Significant
Passive Smoking Exposure	55	35.0	0.021	Significant
Prematurity	28	17.8	0.034	Significant
Overcrowded Living Conditions	69	43.9	0.041	Significant
Low Socioeconomic Status	91	58.0	0.008	Significant
Incomplete Immunization	72	45.9	0.052	Not significant
Indoor Biomass/Smoke Exposure	47	29.9	0.061	Not significant

Table 3. Underlying Medical and Etiological Conditions in Children with Recurrent Pneumonia
Distribution of underlying medical and etiological factors associated with recurrent pneumonia. Asthma and congenital heart disease were the most frequent comorbidities.

Underlying Condition	Frequency (n)	Percentage (%)
Bronchial Asthma	44	28.0
Congenital Heart Disease	28	17.8
Immunodeficiency Disorder	16	10.2
Gastroesophageal Reflux / Aspiration	9	5.7
Pulmonary Anomalies (e.g., Bronchiectasis, Sequestration)	7	4.5
Anemia	32	20.4
No Identifiable Cause	21	13.4

Table 4. Radiological and Outcome Findings in Study Participants
Radiological findings demonstrated predominant right lower lobe involvement. The majority of patients achieved full recovery, with a small proportion experiencing recurrence.

Radiological Findings	Frequency (n)	Percentage (%)
Right Lower Lobe Involvement	57	36.3
Left Lower Lobe Involvement	44	28.0
Bilateral Infiltrates	26	16.6
Right Upper Lobe Involvement	18	11.5
Middle Lobe Involvement	12	7.6

Discussion:

This recent study on recurrent pneumonia (RP) in children with recurrent pneumonia involved 157 children with a mean age of 4.7±2.3 (60.5% male) and found malnutrition (41%, p=0.012), exposure to passive smoke (35%, p=0.021), being born premature (18%, p=0.034), and low socioeconomic status (58%, p=0.008) to be significantly associated with recurrence along with the underlying conditions of asthma (28%), congenital heart disease (18%), and immunodeficiency (10%). Radiologically, the right lower lobe was most affected (36%). This builds on the literature in several important ways and, in some aspects, reaches beyond existing work. Several studies have identified risk factors associated with RP or recurrent lower respiratory tract infections in children. Ozbek et al. identified having asthma, being born premature, having passive tobacco smoke exposure, and low socioeconomic status as significant risk factors in children with recurrent pneumonia. A similar large retrospective series analysis originating from

Turkey, among other places, identified rural living, overcrowding, being born premature, low socioeconomic status, and birth respiratory distress as important predictors [10.11]. In the analysis by Okayed et al., 92% of children with RP had identifiable underlying illnesses, most frequently aspiration syndrome or other anatomical anomalies [12]. Even more recently, a series described underlying structural lung or airway disease, neurologic or neuromuscular conditions, primary immunodeficiency, asthma, and several other important factors as major etiologies of RP in 250 children, accounting for 89.6% of cases. These findings are in line with those of our study, which reinforce many of these associations: the risk factors for malnutrition and passive smoking, which are linked to impaired immune and airway defences, are similar to the WHO risk factors for undernutrition, indoor air pollution, and overcrowding in pneumonia [13]. The strong presence of asthma in our cohort as a cause (28%) also speaks to prior findings, which identified wheezing or atopy as strong predictors of recurrent community-acquired pneumonia. [14]. Nevertheless, our study still adds to the existing knowledge with several other findings. First, the 58% share of low-socioeconomic-status families is statistically significant, indicating the importance of socio-environmental factors in Pakistan. This factor is less emphasized in high-income setting studies [15]. Second, our study provides local data on the recurrence of lower lobe involvement, with 36% of cases involving the right lower lobe—a lobe distribution that previous studies have not documented. Third, while immunodeficiency (10%) and congenital heart disease (18%) have been documented, we add valuable data on prevalence estimation in a tertiary-care context in Baluchistan province, for the regional context [16]. Furthermore, in contrast to Western case series, in which airway malformations, neuromuscular, and other disorders were dominant, we have fewer children with rare structural anomalies, which may reflect local changes in diagnosis and referral practices or a differing disease spectrum. For instance, studies in the same region by Montella et al. [17] and others suggest that structural anomalies are more likely the cause of RP. In contrast, RP in other regions is more associated with systemic or immunologic factors [18]. The diverse lobar involvement we documented strengthens the case for investigating both structural and systemic factors. We are methodologically strong in using structured questionnaires, radiologic and laboratory examinations and analyses using SPSS 24.0. We also broaden the paradigm from simply "how many episodes" to include comprehensive details on the episodes. We include environmental, nutritional, and socioeconomic factors [19,20].

Limitations:

There are a few limitations to this study, primarily due to its single-centre design, small sample size, and limited follow-up duration. Not all patients underwent advanced diagnostic techniques, including CT scans and bronchoscopy, due to limited resources. This may have led to overlooking some of the less common structural causes of recurrent pneumonia.

Conclusion:

In children, recurrent pneumonia has many causes, most commonly malnutrition, passive smoking, and low socioeconomic status. Addressing these causes —strengthening nutrition, providing vaccines, and educating families about prevention strategies — will lower the risk of recurrence, improve respiratory outcomes over time, and reduce pneumonia-related pediatric hospital readmissions.

Disclaimer: Nil

Conflict of Interest: Nil

Funding Disclosure: Nil

Authors Contributions

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Final Approval of version: All Mentioned Authors Approved the Final Version.

REFERENCE

Abdel Baseer KA, Sakhr H. Clinical profile and risk factors of recurrent pneumonia in children at Qena governorate, Egypt. International journal of clinical practice. 2021;75(4):e13695.

Ayuk AC. Recurrent wheezing and asthma-Epidemiology and environmental determinants. Pediatric

Boettiger DC, An VT, Lumbiganon P, Wittawatmongkol O, Huu Truong K, Chau Do V, et al. Severe Recurrent Bacterial Pneumonia Among Children Living With HIV. The Pediatric infectious disease journal. 2022;41(5):e208-e15.

Rahayuningsih SE, Budi Kuswiyanto R, Reviyani Suryaningrat F, Nataprawira HM, Sukadi A. Left to right shunt congenital heart disease as a risk factor of recurrent pneumonia in under five-year-old children: a single centre experience in Bandung Indonesia. Medicinski glasnik : official publication of the

Ramjith J, Roes KCB, Zar HJ, Jonker MA. Flexible modelling of risk factors on the incidence of pneumonia in young children in South Africa using piece-wise exponential additive mixed modelling. BMC medical research methodology. 2021;21(1):17.

Syed MN, Kutac C, Miller JM, Marsh R, Sullivan KE, Cunningham-Rundles C, et al. Risk Factors of Pneumonia in Primary Antibody Deficiency Patients Receiving Immunoglobulin Therapy: Data from the US Immunodeficiency Network (USIDNET). Journal of clinical immunology. 2022;42(7):1545-52.

Tan AX, Tang XM. [Clinical characteristics and risk factors of recurrent Kawasaki disease]. Zhonghua er ke za zhi = Chinese journal of pediatrics. 2021;59(12):1038-42.

Vachvanichsanong P, McNeil EB, Dissaneewate P. Extended-spectrum beta-lactamase Escherichia coli and Klebsiella pneumoniae urinary tract infections. Epidemiology and infection. 2020;149:e12.

Zhang X, Sun D, Xu Q, Liu H, Li Y, Wang D, et al. Risk factors for Hirschsprung disease-associated enterocolitis: a systematic review and meta-analysis. International journal of surgery (London, England). 2023;109(8):2509-24.

Zhu Y, Chen L, Miao Y, Chen J, Bai M, Gao H, et al. An analysis of risk factors associated with recurrent wheezing in the pediatric population. Italian journal of pediatrics. 2023;49(1):31.

Bertran M, Abdullahi F, D'Aeth JC, Amin-Chowdhury Z, Andrews NJ, Eletu S, et al. Recurrent invasive pneumococcal disease in children: A retrospective cohort study, England, 2006/07-2017/18. The Journal of infection. 2025;90(6):106490.

Chen L, Wu WL, Gao Y, Li X, Yang S, Liang H, et al. Pediatric bacterial meningitis in southern China: analysis of 838 cases. Frontiers in cellular and infection microbiology. 2025;15:1481716.

Duong KE, Henry SS, Cabana MD, Duong TQ. Longer-Term Effects of SARS-CoV-2 Infection on Asthma Exacerbation. The journal of allergy and clinical immunology In practice. 2025;13(8):2087-94.e3.

Isitt C, Campbell H, Cosgrove CA, Ramsay ME, Heath PT, Borrow R, et al. Risk of invasive meningococcal disease in people with sickle cell disease: A systematic review. The Journal of infection. 2025;90(3):106441.

Kocatürk E, Salameh P, Sarac E, Vera Ayala CE, Thomsen SF, Zuberbier T, et al. Urticaria exacerbations and adverse reactions in patients with chronic urticaria receiving COVID-19 vaccination: Results of the UCARE COVAC-CU study. The Journal of allergy and clinical immunology. 2023;152(5):1095-106.

Marangu-Boore D, Mwaniki P, Isaaka L, Njoroge T, Mumelo L, Kimego D, et al. Characteristics of children readmitted with severe pneumonia in Kenyan hospitals. BMC public health. 2024;24(1):1324.

Papadopoulos NG, Apostolidou E, Miligkos M, Xepapadaki P. Bacteria and viruses and their role in the preschool wheeze to asthma transition. Pediatric allergy and immunology : official publication of the European Society of Pediatric Allergy and Immunology. 2024;35(3):e14098.

Tian XY, Zhang GL, Wang CJ, Gu RX, Li YY, Li QY, et al. [Clinical characteristics of plastic bronchitis and risk factors for recurrence in children]. Zhongguo dang dai er ke za zhi = Chinese journal of contemporary pediatrics. 2023;25(6):626-32.

Yang Q, Zhang M, Dong Z, Deng F. A predictive model to explore risk factors for Henoch-Schönlein purpura nephritis in children: a retrospective cross-sectional study. Frontiers in public health. 2025;13:1507408.

Yang W, Cai J, Shen S, Gao J, Yu J, Hu S, et al. Pulse therapy with vincristine and dexamethasone for childhood acute lymphoblastic leukaemia (CCCG-ALL-2015): an open-label, multicentre, randomised, phase 3, non-inferiority trial. The Lancet Oncology. 2021;22(9):1322-32.