Research Article

Frequency of Pneumonia and its Associated Factors among Children Presenting at Tertiary Care Hospital, Karachi

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Abstract: Background: Pneumonia is the major cause of morbidity and mortality among under-five children. Several risk factors have been identified. Because of rising prevalence of pneumonia, it is necessary to refresh insights about the contributing factors.

Objective: To determine the frequency and factors associated with pneumonia among children presenting at a tertiary care hospital.

Materials and Methods: This cross-sectional study was carried out at the paediatrics departments of Memon Medical Institute Hospital, Karachi, Pakistan, from October 2025 to February 2026. A total of 177 children aged 1 month to 14 years presenting with fever (>37.50C) and cough for more than 48 hours were analyzed. Demographic and clinical history was noted and their association with the frequency of pneumonia were analyzed. The statistical analysis was performed using IBM-SPSS Statistics, version 26.0.

Result: In a total of 177 children, the median age was 30.0 months and 101 (57.1%) were males. Pneumonia was diagnosed in 58 (32.8%) children. Incomplete vaccination (aOR=2.6, 95% CI:1.3-4.4; p=0.014), no vitamin A supplementation (aOR=2.2, 95% CI:1.4-3.7; p=0.042) and previous pneumonia history (aOR=2.3, 95% CI:1.1-1.4; p=0.049), duration of symptoms (aOR=1.3, 95% CI:1.1-1.4; p=0.002) and MUAC ((aOR=1.2, 95% CI:1.1-1.8; p=0.008) were independently associated with pneumonia.

Conclusion: Pneumonia burden was higher at a tertiary care hospital and remained common among children presenting with fever and cough at this tertiary care hospital. Relatively younger children, incomplete vaccination, poor nutritional status, lack of vitamin A supplementation, recurrent respiratory vulnerability, and delayed presentation were significant predictors of pneumonia among children.

Keywords: Cough, Fever, Malnutrition, Pneumonia, Radiology.

INTRODUCTION

Pneumonia is the major cause of morbidity and mortality among under-five children as it is estimated to affect 900,000 deaths among under-five children [1, 2]. In 2019, nearly 50% of all under-five deaths worldwide were concentrated in five countries, among which Pakistan was a major contributor. Infectious diseases, especially pneumonia, diarrhea, and malaria, continue to account for a substantial proportion of under-five mortality, posing a significant public health challenge in low- and middle-income countries [3]. Children with weak immune systems due to malnutrition, who are not exclusively breastfed under-five children, are at high risk of contracting pneumonia [3]. According to studies, pneumonia is responsible for 21% of child deaths under the age of 5 years in poor countries [4, 5].

Recently, it has been shown that pneumonia continues to impose a heavy burden on those older than five years of age as well. An estimated 86,000 avoidable fatalities occurred worldwide in 2021 as a result of pneumonia and diarrhea, which accounted for 18% of deaths in children aged 5 to 9 years [6]. In the United Kingdom, a recent surveillance study showed that the incidence of pediatric pneumonia has remained high throughout 2023–2024, particularly among children 5-14 years old, due to the resurgence of respiratory viruses such as Mycoplasma pneumoniae following the COVID-19 pandemic [7].

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Additionally, a large long-term surveillance study conducted in Henan Province, China, found that of the 24,359 hospitalized children with community-acquired pneumonia (CAP) from 2015 through 2023, children aged 6-18 years comprised almost half (47.08%) of all hospitalized cases of CAP [8].

Several risk factors have been identified to be associated with pneumonia among under-five children, including nonexclusive breastfeeding, lack of/incomplete immunization, environment, outdoor/indoor pollution, micronutrient and vitamin deficiencies [9-11]. According to Solomon *et al.*, the prevalence of pneumonia among children visiting the Pediatrics Outpatient Department was 30%, and among various factors assessed, location of food cooking within the living room, nonexclusive breastfeeding, absence of Vitamin A supplementation, and incomplete vaccination status were significantly associated with pneumonia [12]. In another study, male gender, lack of toilet facility, children having fever within the last two weeks, lack of maternal antenatal care, and stunting were the most predominant factors linked with pneumonia [13]. According to Naz *et al.*, the prevalence of pneumonia among children was 14.3% in 2006, 16.3% in 2012, and 13.2% in 2017 as indicated in Pakistan demographic Health Survery [14].

In addition to the fact that the high prevalence of pneumonia remains a leading cause of death among children under five years of age, this is also important to highlight that In response to requests from national policymakers and decision-makers, WHO has not yet produced clinical guidelines on the treatment of infectious diseases in children beyond five years of age [6]. Therefore, this study assessed the frequency and factors associated with pneumonia among children presenting at the tertiary care hospital. A precise identification of local burdens and high-risk factors would enhance targeted prevention, early diagnosis, and treatment strategies, ultimately aiming to reduce the high morbidity and mortality rates in children within this age group.

MATERIALS AND METHODS

This cross-sectional study was carried out at the pediatrics department of Memon Medical Institute Hospital, Karachi, Pakistan, from 1st October 2025 to 2nd February 2026, after obtaining approval from the Institutional Review Board (No: IRB/MMIH/2025/24, dated: 25-09-2025). The inclusion criteria were children aged 1 month to 14 years presenting with fever (>37.5oC) and cough for more than 48 hours. The exclusion criteria were known history of cystic fibrosis, with congenital disease, or those who were immunocompromised.

A sample size of 177 was calculated using the OpenEpi sample size calculator, assuming the frequency of pneumonia among children as 13.2% [14], taking the confidence level as 95% and the margin of error as 5%. The non-probability, consecutive sampling technique was adopted. Parents/guardians were asked to provide written informed consent.

The eligible subjects went through documentation of their baseline details and history taking, such as age (months), gender, weight (Kg), height (cm), MUAC (cm), duration of symptoms (days), vaccination status, previous history of pneumonia, and use of vitamin A supplementation. Family residential status, and family monthly income, were also noted. All children diagnosed with suspected pneumonia clinically, based on i) symptoms (cough and/or difficult breathing <4 weeks), ii) clinical examination (respiratory rate >40/min), or iii) lower chest wall in-drawing, underwent chest X-ray evaluation. Diagnosis of pneumonia was confirmed on chest x-ray by the consultant pediatrician with more than 5 years of post-fellowship experience, showing at least one of the features, which included consolidation, infiltrates, or reticular shadowing.

STATISTICAL ANALYSIS

The statistical analysis was performed using IBM-SPSS Statistics, version 26.0. The quantitative variables were reported as mean with standard deviation (SD) or median with interquartile range (IQR), as appropriate according to normality assumption. Assumption of normality was assessed using Shapiro-Wilk test. For assessing the factors associated with pneumonia, binary logistic regression analysis was applied. Effect modifiers such as age, family income, weight, and duration of symptoms were adjusted through multivariable logistic regression analysis. Initially, univariate analysis was performed, and all variables with a p-value <0.25 were included in the multivariable model, and adjusted odds ratios (aOR) and 95% confidence interval (CI) were calculated, taking $p<0.05$ as significant.

RESULT

In a total of 177 children, the median age was 30.0 months (IQR=14.0–66.0), and 101 (57.1%) were males. There

were 109 (61.6%) children who belonged to urban areas of residence. Complete vaccination for age was documented in 110 (62.1%) children. The median duration of symptoms before presentation was 5.0 days (IQR=3.0–7.0). The median weight, height, and MUAC were 11.8 kg (IQR=8.7–17.4), 86.0 cm (IQR=74.0–103.0), and 14.0 cm (IQR=13.0–15.0), respectively. A previous history of pneumonia was noted in 41 (23.2%) children, and 105 (59.3%) had received vitamin A supplementation according to age (Table **1**).

Table 1. Characteristics of Children (n=177).

Characteristic		Value
Age groups (months)	1–12	46 (26.0%)
	13–59	89 (50.3%)
	≥60	42 (23.7%)
Gender	Male	101 (57.1%)
	Female	76 (42.9%)
Residence	Urban	109 (61.6%)
	Rural	68 (38.4%)
Vaccination status	Complete	110 (62.1%)
	Incomplete or no vaccination	67 (37.9%)
Previous history of pneumonia		41 (23.2%)
Vitamin A supplementation received		105 (59.3%)
Monthly family income (PKR)	<50K	79 (44.6%)
	50K to 100K	61 (34.5%)
	>100K	37 (20.9%)

Overall, 58 (32.8%) children had confirmed diagnosis for pneumonia. Among diagnosed cases, consolidation was the commonest finding, seen in 31 (53.4%) children, followed by infiltrates in 19 (32.8%), and reticular shadowing in 8 (13.8%) children. Children with pneumonia were relatively younger than those without pneumonia, with a median age of 24.0 months (12.0–48.0) compared with 36.0 months (IQR 16.0–78.0) among children without pneumonia (p=0.041). Incomplete vaccination (55.2% vs. 29.4%, p=0.001), lack of vitamin A supplementation (53.4% vs. 34.5%, p=0.015), and previous history of pneumonia (34.5% vs. 17.6%, p=0.013), were significantly more frequent among children with pneumonia. Children with pneumonia had a longer duration of symptoms prior to presentation (p<0.001). The median weight among children with pneumonia was 10.1 kg (8.0–14.8) compared with 12.6 kg (9.2–18.5) in those without pneumonia (p=0.009). Median MUAC was 13.4 cm (IQR=12.5–14.2) in children with pneumonia and 14.2 cm (13.4–15.1) in children without pneumonia (p=0.002). Monthly family income was significantly lower among families of children with pneumonia (p=0.021). The comparison of characteristics between children with and without pneumonia is presented in Table **2**.

Table 2. Comparison of Characteristics between Children with and without Pneumonia (n=177).

Variable		Pneumonia (n=58)	No pneumonia (n=119)	p-value
Age (months)	Median (IQR)	24.0 (12.0–48.0)	36.0 (16.0–78.0)	0.041[a]
	1–12, n(%)	20 (34.5%)	26 (21.8%)	0.038[b]
	13–59, n(%)	30 (51.7%)	59 (49.6%)	
	≥60, n(%)	8 (13.8%)	34 (28.6%)	
Male gender, n(%)		36 (62.1%)	65 (54.6%)	0.347[a]
Weight in kg, median (IQR)		10.1 (8.0–14.8)	12.6 (9.2–18.5)	0.009[a]
Height in cm, median (IQR)		82.0 (72.0–97.0)	89.0 (76.0–106.0)	0.057[a]
MUAC in cm, median (IQR)		13.4 (12.5–14.2)	14.2 (13.4–15.1)	0.002[a]
Duration of symptoms in days, median ((IQR)		6.0 (4.0–8.0)	4.0 (3.0–6.0)	<0.001[a]
Residence	Urban, n(%)	30 (51.7%)	79 (66.4%)	0.058[b]
	Rural, n(%)	28 (48.3%)	40 (33.6%)	
Vaccination status	Complete, n(%)	26 (44.8%)	84 (70.6%)	0.001[b]
	Incomplete or no vaccination, n(%)	32 (55.2%)	35 (29.4%)	
Previous history of pneumonia, n(%)		20 (34.5%)	21 (17.6%)	0.013[b]
Vitamin A supplementation received, n(%)		27 (46.6%)	78 (65.5%)	0.015[b]
Monthly family income (PKR)	<50K, n(%)	34 (58.6%)	45 (37.8%)	0.021[b]
	50K to 100K, n(%)	17 (29.3%)	44 (37.0%)	
	>100K, n(%)	7 (12.1%)	30 (25.2%)	

[a:] Mann-Whitney U test was applied for numerical variables. [b:] Chi-square test was applied for categorical variables.

In the final multivariable logistic regression model, incomplete vaccination was independently associated with pneumonia with an adjusted odds ratio (aOR) of 2.6 (95% CI 1.3-4.4; p=0.014). Children without vitamin A supplementation had twofold higher odds of pneumonia (p=0.042). A previous history of pneumonia was independently associated with pneumonia (aOR of 2.3; p=0.047). Each additional day of symptoms before presentation increased the odds of pneumonia by about 30% (p=0.002). Lower MUAC remained a significant anthropometric predictor with an aOR of 1.2 (p=0.008) for each 1 cm decrease (Table **3**).

Table 3. Logistic Regression Analysis for Factors Associated with Pneumonia.

Variable	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age of 1-12 months	3.3 (1.2–8.6)	*0.021	3.1 (1.4–8.4)	0.064
Age of 13-59 months	2.2 (0.9–5.3)	*0.014	2.4 (0.7–5.8)	0.078
Rural residence	1.9 (1.0–3.6)	0.053	1.7 (0.9–3.2)	0.084
Incomplete or no vaccination	3.0 (1.5–5.6)	*0.001	2.6 (1.3–4.4)	*0.014
Absence of vitamin A supplementation	2.2 (1.2–4.2)	*0.017	2.2 (1.4–3.7)	*0.042
Previous history of pneumonia	2.5 (1.2–5.1)	*0.015	2.3 (1.1–4.2)	*0.047
Duration of symptoms, per 1 day increase	1.2 (1.1–1.4)	*<0.001	1.3 (1.1–1.4)	*0.002
Weight, per 1 kg decrease	1.1 (1.0–1.2)	*0.011	1.1 (1.0–1.1)	0.143
MUAC, per 1 cm decrease	1.5 (1.2–1.9)	*<0.001	1.2 (1.1–1.8)	*0.008
Monthly family income < PKR 50,000	2.2 (1.1–4.4)	*0.019	1.4 (0.7–3.4)	0.176

CI: Confidence interval, OR: Odds ratio, *Significant at p<0.05.

DISCUSSION

This study found that almost one third of children presenting with fever and cough had diagnosis of pneumonia (32.8%), and younger age, incomplete vaccination, no vitamin A supplementation, previous history of pneumonia, longer duration of symptoms before presentation, and lower MUAC remained independently associated with pneumonia. These findings place pneumonia within the wider context of delayed care seeking, undernutrition, missed preventive services, and recurrent respiratory morbidity in children attending tertiary care in Karachi, Pakistan. A study from Ethiopia reported a pneumonia magnitude of 33.4% among children attending public hospital outpatient departments which is very close to the burden observed here [15]. A cross-sectional study from western Uganda reported a prevalence of pneumonia as 25.6% [16]. Another study in hospitalized children with severe acute malnutrition reported the frequency of pneumonia to be 28% [17]. These findings may suggest that once a child presents to hospital with fever and respiratory symptoms, pneumonia remains a frequent diagnosis.

A noticeable finding in our study was that a smaller proportion of children of five or above had pneumonia. Another Pakistani study also reported a similar pneumonia rate of 13.4% among children of after ≥60 months [18]. A study from India also reported a lower frequency of pneumonia in children beyond five years of age (7.9%) [19]. A study from Bangladesh reported that out of total 110 admitted pediatric patients with suggestive pneumonia, 55(50%) patients were beyond of 5 years of age [20].

Pneumonia occurred significantly more commonly in younger children than in older age groups, and recent literature shows that early childhood remains the period of greatest vulnerability. Data from other parts of the developing world have also shown that age<6 months was associated with pneumonia with three-fold higher risk (OR=3.2) [16]. WHO also identifies infancy and undernutrition as major contributors to pneumonia susceptibility as immune defenses are still developing during this stage of life [21].

Incomplete vaccination emerged as one of the strongest independent findings in this study. An Indonesian study found that incomplete DPT HB Hib immunization was the dominant predictor of pneumonia with almost 10-fold risk (aOR=9.7) [22]. A systematic review and meta-analysis from East Africa found a pooled aOR of 2.41 for pneumonia among unvaccinated children indicating more than two-fold risk [23]. This is particularly relevant after the global immunization disruption during the COVID-19 period when UNICEF reported that 67 million children missed full or partial routine immunization between 2019-2021 and one in five children worldwide

became zero dose or under vaccinated [24]. The current results reinforce that assessment of vaccine status should not be treated as background history alone.

The association between lower MUAC and pneumonia in this study deserves emphasis because it links respiratory illness with nutritional vulnerability. Recent Global Burden of Disease Scorecard estimated that malnutrition contributed to 83% of all child pneumonia deaths and that 71% of malnutrition related pneumonia deaths were driven by child growth failure [25]. Anthropometric screening should be incorporated into pneumonia risk assessment rather than being deferred to later nutritional review.

Absence of vitamin A supplementation was another independent correlate in this study. A study from Indonesian revealed that lack of vitamin A in the prior six months showed a significant crude association with pneumonia even though it did not remain significant in the final adjusted model [26]. WHO notes that adequate nutrition is central to pneumonia prevention and vitamin A remains a marker of broader micronutrient security and child health service reach [26]. Vitamin A history can serve as a potential signal of cumulative preventive care gaps in a child presenting with respiratory symptoms [27].

Previous history of pneumonia was also independently associated with current pneumonia in this study. Recent studies have reported household respiratory infection history or recent acute respiratory tract infection rather than prior pneumonia specifically [28, 29]. Recurrent respiratory disease may identify children with persistent exposure risks, nutritional compromise, incomplete preventive care, crowded living conditions, or underlying airway vulnerability [30]. Longer duration of symptoms before presentation was another meaningful observation in this study. This may suggest that delay in seeking care could allow progression from a nonspecific respiratory illness to established pneumonia [31].

Cross-sectional design prevents certainty about temporal direction between some exposures and pneumonia. Single tertiary hospital may restrict the generalizability to primary care and other regions. Some variables such as vaccination history, vitamin A supplementation, and income may be affected by caregiver recall. Radiography was performed in clinically suspected cases rather than all enrolled children which mirrors real practice but may miss milder or atypical presentations. A larger multi-center study should be conducted in future for validating the finding of this study.

CONCLUSION

Pneumonia burden was higher at a tertiary care hospital among children presenting with fever and cough at this tertiary care hospital. Relatively younger children, incomplete vaccination, poor nutritional status, lack of vitamin A supplementation, recurrent respiratory vulnerability, and delayed presentation were significant predictors of pneumonia among children. These findings support an integrated approach in which pneumonia prevention and early detection are tied to immunization services, nutrition screening, caregiver education, and earlier access to care. Strengthening these linked areas is likely to be more useful than addressing pneumonia as an isolated acute event.

AUTHORS' CONTRIBUTION

Jamshaid Ahmed: Conceptualization, Study Design, Methodology, Data analysis and interpretation, Writing Draft and Final approval, final proof to be published.

Anila Haroon: Study design, Critical review and revision the manuscript and Final approval, final proof to be published.

Warisha Kiran Khan, Aqsa Rafique and **Fariya Iqbal**: Methodology, Data analysis and interpretation, Writing Draft and Final approval, final proof to be published.

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ETHICAL DECLARATIONS

Data Availability Statement

Data will be available from the corresponding author upon a reasonable request.

Ethical Approval

This cross-sectional study was carried out at the pediatrics department of Memon Medical Institute Hospital, Karachi, Pakistan, from 1st October 2025 to 2nd February 2026, after obtaining approval from the Institutional Review Board (No: IRB/MMIH/2025/24, dated: 25-09-2025).

Consent to Participate

Written consent was sought from parents prior to study commencement.

Consent for Publication

All authors provide consent to publish the work.

Conflict of Interest

Declared none.

Competing Interest/Funding

Declared none.

Use of AI-Assisted Technologies

Language editing and readability improvements were assisted by Google Gemini. The authors retain full responsibility for all intellectual aspects of the work, including design, analysis, and conclusions.

REFERENCES

[1] Marine BT, Mengistie DT. Time to death and its predictors among under-five children with acute pneumonia: A Bayesian parametric survival analysis. Pneumonia (Nathan) 2025; 17(1): 31. doi: 10.1186/s41479-025-00178-8

[2] Hogan DR, Stevens GA, Hosseinpoor AR, Boerma T. Monitoring universal health coverage within the sustainable development goals: Development and baseline data for an index of essential health services. Lancet Glob Health 2018; 6(2): e152-e168. doi: 10.1016/S2214-109X(17)30472-2

[3] Lu Y. Determinants of childhood pneumonia: A retrospective hospital-based analysis. Front Med (Lausanne) 2025; 12: 1709403. doi: 10.3389/fmed.2025.1709403

[4] Tazinya AA, Halle-Ekane GE, Mbuagbaw LT, Abanda M, Atashili J, Obama MT. Risk factors for acute respiratory infections in children under five years attending the Bamenda Regional Hospital in Cameroon. BMC Pulm Med 2018; 18(1): 7. doi: 10.1186/s12890-018-0579-7

[5] Colbourn T, King C, Beard J, Phiri T, Mdala M, Zadutsa B, *et al.* Predictive value of pulse oximetry for mortality in infants and children presenting to primary care with clinical pneumonia in rural Malawi: A data linkage study. PLoS Med 2020; 17(10): e1003300. doi: 10.1371/journal.pmed.1003300

[6] World Health Organization. Guideline on management of pneumonia and diarrhoea in children up to 10 years of age. Geneva: World Health Organization 2024; Available from: https://www.who.int/publications/i/item/9789240103412.[cited 2026 May 25].

[7] Todkill D, Lamagni T, Pebody R, Ramsay M, Woolham D, Demirjian A, *et al.* Persistent elevation in incidence of pneumonia in children in England, 2023/24. Euro Surveill 2024; 29(32): 2400485. doi: 10.2807/1560-7917.ES.2024.29.32.2400485.

[8] Li T, Chen S, Shen Y, Li Z, Han S, Yuan Y, *et al.* Epidemiology and co-infection patterns of community-acquired pneumonia among children from 2015 to 2023 in Henan Province, China: Longitudinal surveillance study. Sci Rep 2025; 15(1): 32347.

[9] Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. Bull World Health Organ 2008; 86(5): 408-16. doi: 10.2471/blt.07.048769

[10] Roomaney RA, van-Wyk VP, Awotiwon OF, Dhansay A, Groenewald P, Joubert JD, *et al.* Epidemiology of lower respiratory infection and pneumonia in South Africa (1997-2015): a systematic review protocol. BMJ Open 2016; 6(9): e012154. doi: 10.1136/bmjopen-2016-012154

[11] Ramezani M, Aemmi SZ, Moghadam ZE. Factors affecting the rate of pediatric pneumonia in developing countries: A review and literature study. Int J Pediatr 2015; 3(6.2): 1173-81.

[12] Solomon Y, Kofole Z, Fantaye T, Ejigu S. Prevalence of pneumonia and its determinant factors among under-five children in Gamo Zone, southern Ethiopia, 2021. Front Pediatr 2022; 10: 1017386. doi: 10.3389/fped.2022.1017386

[13] Mengstie LA. Prevalence of pneumonia and associated factors among children aged 6–59 months in Angolela Tera district, North Shoa, Ethiopia, 2021, community-based cross-sectional study. Bull Natl Res Cent 2022; 46(1): 231. doi: 10.1186/s42269-022-00921-x.

[14] Naz L, Ghimire U. Assessing the prevalence trend of childhood pneumonia associated with indoor air pollution in Pakistan. Environ Sci Pollut Res Int 2020; 27(35): 44540-51. doi: 10.1007/s11356-020-10346-6

[15] Osman RI, Ayehubizu LM, Muse AI, Yohannes SH. Magnitude and associated factors of pneumonia among under-five children visiting outpatient department of public hospitals in Jigjiga city, Somali region, Ethiopia in 2024. BMC Pediatr 2025; 25(1): 903. doi: 10.1186/s12887-025-06270-8

[16] Kiconco G, Turyasiima M, Ndamira A, Yamile OA, Egesa WI, Ndiwimana M, *et al.* Prevalence and associated factors of pneumonia among under-fives with acute respiratory symptoms: A cross sectional study at a Teaching Hospital in Bushenyi District, Western Uganda. Afr Health Sci 2021; 21(4): 1701-10. doi: 10.4314/ahs.v21i4.25

[17] Nambuya H, Mupere E, Nabukeera-Barungi N, Mubiri P, General KJ, Rytter MJH, *et al.* Prevalence, incidence and associated factors of pneumonia among severely malnourished children hospitalized in Mulago National Referral Hospital, Uganda. PLoS One 2025; 20(9): e0331698. doi: 10.1371/journal.pone.0331698

[18] Zeeshan A, Abbas Q, Siddiqui A, Khalid F, Jehan F. Critical illness related to community acquired pneumonia, its epidemiology and outcomes in a pediatric intensive care unit of Pakistan. Pediatr Pulmonol 2021; 56(12): 3916-23.

[19] Mathew JL, Singhi S, Ray P, Hagel E, Saghafian-Hedengren S, Bansal A, *et al.* Etiology of community acquired pneumonia among children in India: Prospective, cohort study. J Glob Health 2015; 5(2): 050418. doi: 10.7189/jogh.05.020418.

[20] Al Mamun ABMMH, Sultana M, Mobarak R. Pattern and presentation of pneumonia in children. Sch Acad J Biosci 2023; 11(7): 259-63.

[21] WHO. Pneumonia in children. 2022; Available from: https://www.who.int/news-room/fact-sheets/detail/pneumonia. [Updated on 11th November, 2022].

[22] Sidabutar E, Ansariadi, Wahiduddin, Bustan N, Stang, Birawida AB. Analysis of risk factor for pneumonia in children less than five years in Makassar. J Educ Health Promot 2024; 13: 16. doi: 10.4103/jehp.jehp_727_23

[23] Beletew B, Bimerew M, Mengesha A, Wudu M, Azmeraw M. Prevalence of pneumonia and its associated factors among under-five children in East Africa: A systematic review and meta-analysis. BMC Pediatr 2020; 20(1): 254. doi: 10.1186/s12887-020-02083-z

[24] Dalton M, Sanderson B, Robinson LJ, Homer CSE, Pomat W, Danchin M, *et al.* Impact of COVID-19 on routine childhood immunisations in low- and middle-income countries: A scoping review. PLOS Glob Public Health 2023; 3(8): e0002268. doi: 10.1371/journal.pgph.0002268

[25] Every Breath Counts. Malnutrition and child pneumonia scorecard. Global Burden of Disease. 2021. Available from: https://stoppneumonia.org/wp-content/uploads/2024/08/Wasting-and-Child-Pneumonia-Scorecard-1.pdf

[26] Knebusch N, Mansour M, Vazquez S, Coss-Bu JA. Macronutrient and Micronutrient Intake in Children with Lung Disease. Nutrients 2023; 15(19): 4142. doi: 10.3390/nu15194142

[27] Cheng X, Li D, Yang C, Chen B, Xu P, Zhang L. Oral vitamin A supplements to prevent acute upper respiratory tract infections in children up to seven years of age. Cochrane Database Syst Rev 2023; 2023(1): CD015306. doi: 10.1002/14651858.CD015306

[28] Abubakar FI, Oche OM, Kaoje AU, Garba BI, Abubakar MJ, Ahmed HK. Prevalence and associated risk factors of acute respiratory tract infections among under-five children in a tertiary hospital in Nigeria. BMC Pediatr 2025; 25(1): 880. doi: 10.1186/s12887-025-06193-4

[29] El-Koofy NM, El-Shabrawi MH, Abd El-Alim BA, Zein MM, Badawi NE. Patterns of respiratory tract infections in children under 5 years of age in a low-middle-income country. J Egypt Public Health Assoc 2022; 97(1): 22. doi: 10.1186/s42506-022-00118-0

[30] Li Y, Huang X, Liu Q, Li W, Yang B, Chen Y, *et al.* Changes in children's respiratory morbidity and residential exposure factors over 25 years in Chongqing, China. J Thorac Dis 2020; 12(10): 6356-64. doi: 10.21037/jtd-19-crh-aq-005

[31] Temsesgen D, Wordofa B, Tesfaye T, Etafa W. Delay in seeking healthcare for pneumonia and associated factors among mothers/caregivers of children aged 2-59 months in public health facilities in Nekemte town, Ethiopia. BMC Pediatr 2023; 23(1): 17. doi: 10.1186/s12887-022-03825-x

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