



Frequency of Pneumonia in Children Presenting with Measles at Bacha Khan Medical College Swabi

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ABSTRACT

Measles remains a leading cause of preventable childhood morbidity and mortality worldwide, particularly in low- and middle-income countries. Despite the availability of an effective vaccine, outbreaks persist due to inadequate immunization coverage and socioeconomic disparities. Pneumonia is one of the most severe complications of measles, significantly contributing to hospitalizations and deaths among children. This cross-sectional study aimed to determine the frequency of pneumonia among children presenting with measles at Bacha Khan Medical Complex, Swabi, from December 2024 to May 2025. A total of 118 clinically and serologically confirmed measles patients aged 1–8 years were enrolled using a consecutive sampling technique. Data were analyzed using IBM SPSS version 25, with significance set at $p \leq 0.05$. Results showed that 52 (44.1%) of the children developed pneumonia. The condition was significantly associated with younger age (≤ 5 years, $p = 0.02$), lack of vaccination ($p = 0.001$), and low socioeconomic status ($p = 0.04$). Radiological evaluation revealed bilateral patchy consolidation in 71.1% of pneumonia cases. These findings indicate that nearly half of the children with measles experienced pneumonia, emphasizing the crucial role of routine immunization and improved socioeconomic conditions in mitigating this burden. Strengthening vaccination programs, enhancing nutritional support, and promoting community-based awareness are essential steps toward reducing measles-related complications and achieving better child health outcomes in resource-limited settings.

INTRODUCTION

Although there is an effective vaccine against measles, it is very contagious and continues to be a serious child worldwide, even with a powerful vaccine (Gastañaduy et al., 2021; Rabaan et al., 2022; Parums, 2024; Branda et al., 2024). It is an infection caused by the measles virus (MeV), which belongs to the family of Paramyxoviridae, and is manifested by high fever, cough, conjunctivitis, coryza, and a maculopapular rash. Despite the fact that due to global vaccination strategies, the rate of mortality caused by measles has decreased by a significant part, the disease still remains a significant public health issue, especially in the low- and middle-income countries (LMICs) (Packham et al., 2024; Adamu et al., 2024; Geremew et al., 2019). In most developing countries, untimely unequal access to healthcare, less than ideal immunization rates, and vaccine hesitancy result in repeated measles outbreaks that in turn expose children to the increased possibility of severe complications.

In the past, with the development of the measles vaccine, it was a leading progress in the field of public health, which significantly reduced morbidity and mortality rates in the world. Nevertheless, in spite of the implementation of routine immunization regimes, measles

outbreaks still happen in the world, and they often affect unimmunized individuals and areas that have immature healthcare systems (Cutts et al., 2021; Conis, 2019). Effective elimination of measles endemic transmission in the United States in 2000 and in the Americas in 2016 proved that elimination is feasible with sustained vaccination coverage (Goodson and Seward, 2015). However, the resurgence in low-vaccinated communities has raised the issues of deficiencies in herd immunity and emphasized the need to reinforce routine immunization regimes.

One of the most commonly occurring and dangerous complications of measles is pneumonia which leads to morbidity and mortality, particularly in children younger than five years of age and immunocompromised people (Kakoullis et al., 2020; Turaiche et al., 2022; Donadel et al., 2021; Perret et al., 2021). Pneumonia caused by measles can either be the direct action of the virus or secondary infection of the bacterial world due to immunosuppression of viruses (Amurri et al., 2022; Cox et al., 2024). In developing countries, where nutritional insufficiency and inaccessibility of healthcare services are common phenomena, pneumonia is one of the leading causes of the

hospitalization and mortality among children with measles (De Benedictis et al., 2020).

One of the leading causes of death in children under the age of five in the entire world is childhood pneumonia, and the complexity of the question hinges on a variety of factors including malnutrition, adverse socioeconomic conditions, overcrowding, and the lack of vaccination (Shan et al., 2019; Ren et al., 2020). The rate of community-acquired pneumonia among the children under 5 years old in China was estimated at 130.08 per 1,000 person-years in a recent cross-sectional study, with the highest prevalence of the community-acquired pneumonia in children below 24 months of age (Qian et al., 2024). The interplay between measles and pneumonia is particularly worrying in those nations that are already resource-deprived; hence, the current risk factors of poor sanitation, malnutrition, inadequate immunization interplay in a manner that increases the prevalence rate of the disease.

Measles is still a significant population health problem facing Pakistan, with widespread reports of outbreaks of the disease in different provinces. Pneumonia is still one of the most common and life-threatening complications of measles infection among children. The pneumonia rates described by Noor et al. (2019) are 45.7 percent among children with measles in their hospital-based study, which highlights the seriousness of the comorbidity among the pediatric population. These alarming statistics are in spite of the fact that there is a scarcity of local data on the Khyber Pakhtunkhwa or Swabi District in relation to the burden of pneumonia in children with measles.

On this basis, the current research was carried out to establish the rate of pneumonia among children who presented with measles in Bacha Khan Medical College, Swabi. This research will help to present some useful information to the clinicians and policymakers to manage the cases of measles better, reinforce immunization, and preventive healthcare services. Moreover, results will be likely to provide the local epidemiological knowledge on the background of measles-related complications and evidence-based interventions in reducing childhood morbidity and mortality.

METHODOLOGY

The study is a cross-sectional study conducted in the Department of Pediatrics at Bacha Khan Medical Complex, Swabi, during 6 months, between 24 December 2024 and 24 May 2025. The main aim of the investigation was to establish the prevalence of pneumonia in the children who came in with measles. The study group consisted of male and female aged 1-8 years children and the inclusion criteria entailed that they were clinically and serologically diagnosed with measles as stipulated in operations criteria. Presence of a maculopapular rash, fever (greater than 38.3o C), conjunctivitis and serum measles-specific IgM antibodies confirmed the diagnosis of measles. To exclude possible confounding factors, children with some congenital heart disease or some congenital lung malformations were excluded of the study.

Participant selection was by a consecutive non-probability selection technique. The WHO sample size calculator was used to calculate the sample size, with the frequency of pneumonia among children with measles

being 45.7 percent, a margin of error of 9 percent and a confidence level of 95. The overall sample size needed was 118 participants. Approval was granted by the institutional ethical review board and Research Department of College of physicians and Surgeons Pakistan (CPSP), Karachi before the study was started. The parents or guardians of all study participants gave informed consent by relying on an explanation of the purpose of the study, and the procedures, and possible benefits. They were assured that it was voluntary and no risk involved.

A structured proforma was used to record demographic data such as age, gender, weight, socioeconomic status and place of residence. Every participant with a confirmed diagnosis of measles was assessed on pneumonia which was considered to have defined itself based on the presence of clinical symptoms of cough, difficulty breathing air, and a temperature of over 38.9 C. Pneumonia was confirmed radiologically using the findings of chest X-ray that included diffuse airspace and bilateral patchy areas of consolidation. In order to guarantee the accuracy and standardization of diagnoses, all assessments and diagnoses were performed under the guidance of a consultant pediatrician having at least five years of post-fellowship.

IBM SPSS Statistics version 25 was used to analyze data. The data was summarized with descriptive statistics. Continuous variables included age and weight and obtained a mean and standard deviation (SD) or median, interquartile range (IQR) based on the assessment of data normality which is Shapiro-Wilk test. The categorical variables such as gender, vaccination status, socioeconomic background, and living area were displayed as frequencies and percentages. Age, gender, vaccination, socioeconomic background and living area stratified the presence of pneumonia to adjust against possible effect modifiers. The Chi-square test or Fisher-exact test was conducted to carry out post-stratification analysis based on specific instances where suitable and a p-value of 0.05 was considered statistically significant. The final findings were provided in the form of tables to give a vivid illustration of the prevalence and distribution of pneumonia among children with measles at Bacha Khan Medical College, Swabi.

RESULTS

This study involved 118 children with measles who were enrolled in the Department of Pediatrics, Bacha Khan Medical Complex, Swabi, between 24 December 2024 and 24 May 2025. The participants included 63(53.4) and 55(46.6) males and females respectively with a mean age of 4.2+2.1 years (range: 1-8 years). The average weight of the children was 15.6 BMI = 4.8 kg. Majority of the sample participants had a low socioeconomic status (61.9%), with 38.1% having middle-income parents. In terms of vaccination, 71 (60.2) unvaccinated children, and 47 (39.8) children with at least one dose of the measles vaccination.

Among the 118 measles cases, 52 (44.10) of the patients had pneumonia and 66 (55.90) patients did not exhibit radiological or clinical indicators of pneumonia. Children of age 38 years (and less than that) were more

likely to have pneumonia (n = 38; 73.1) than children of age 14 years (and more than that) (n = 14; 26.9) with a statistically significant difference (p = 0.02). Likewise, there was a higher rate of pneumonia in unvaccinated children who were 40 out of 56.3 per cent (n = 40; 56.3) versus Angela vaccinated children who were 12 out of 25.5 per cent (n = 12; 25.5, p = 0.001). Children with low socioeconomic position (n = 36 56.3) had a higher chance of having pneumonia than those middle-income (n = 16 35.6, p = 0.04).

Radiological evidence of bilateral patchy consolidation in 37 (71.1) cases of pneumonia was observed and diffuse airspace opacities with 15 (28.9) cases respectively. Children with pneumonia (mean 6.8 2.4 days) had a longer duration of fever and cough than those with no pneumonia (mean 3.9 1.7 days).

These findings supported the view that young age, absence of measles vaccination and low socioeconomic status were key predictors in the occurrence of pneumonia in presented children with measles.

Table 1
Demographic Characteristics of Study Participants (n = 118)

Variable	Categories	Frequency (n)	Percentage (%)
Age (years)	≤5 years	78	66.1
	>5 years	40	33.9
Gender	Male	63	53.4
	Female	55	46.6
Socioeconomic Status	Low income	73	61.9
	Middle income	45	38.1
Vaccination Status	Vaccinated	47	39.8
	Unvaccinated	71	60.2

Figure 1

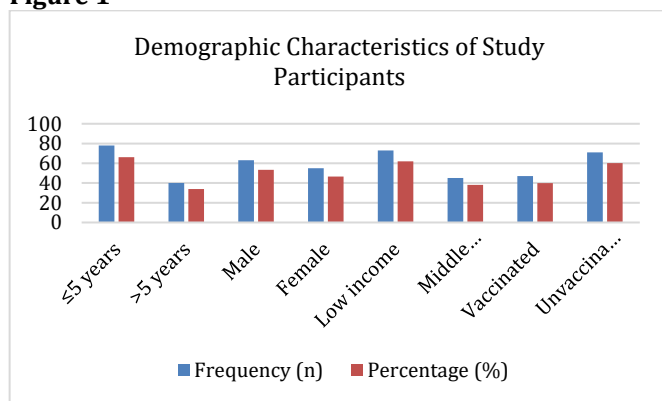


Table 2
Frequency of Pneumonia Among Children with Measles (n = 118)

Pneumonia Status	Frequency (n)	Percentage (%)
Present	52	44.1
Absent	66	55.9

Table 3
Association of Pneumonia with Demographic and Clinical Variables

Variable	Categories	Pneumonia Present n (%)	Pneumonia Absent n (%)	p-value
Age	≤5 years	38 (73.1)	40 (60.6)	0.02*
	>5 years	14 (26.9)	26 (39.4)	
Gender	Male	29 (55.8)	34 (51.5)	0.64
	Female	23 (44.2)	32 (48.5)	
Socioeconomic Status	Low income	36 (56.3)	37 (56.1)	0.04*

Vaccination Status	Middle income	16 (35.6)	29 (43.9)	0.001*
Vaccination Status	Vaccinated	12 (25.5)	35 (53.0)	0.001*
	Unvaccinated	40 (56.3)	31 (47.0)	

*Significant at p ≤ 0.05

The results highlight that close to fifty percent of the children with measles acquired pneumonia, and the need to integrate early vaccination and quality of life to decrease the burden of the complication, which is always preventable.

DISCUSSION

The aim of the present research was to establish the prevalence of pneumonia among children that present with measles in Beth Bacha Khan Medical Complex, Swabi. Respiratory complications were very severe in children with measles as children with pneumonia were found to be infected with measles in 44.1 percent population. This prevalence is in line with the previous study indicating that the most common and severe form of measles to cause a large burden of morbidity and mortality in children to date is pneumonia, particularly in a low-resource setting (Moss, 2017; Perry et al., 2022). The results of this study highlight the importance of prevention vaccination and timely clinical intervention that can lessen these negative outcomes.

Our frequency of pneumonia is similar to the frequency reported by Hussain et al. (2019), who reported that pneumonia occurs in 45.7 percent of children with measles. Nevertheless, regional differences have been noted because, in sub-Saharan Africa and Southeast Asia, higher rates, 50 to 70 percent, have been reported as a result of malnutrition, low vaccination rates, and inadequate access to healthcare (Mulholland, 2020; Girmay & Dadi, 2019). The decreasing prevalence in the study at hand can be due to progressive changes in healthcare systems, vaccination education and reach to pediatric care in Pakistan. However, the rate is still very high, in relation to the world statistics, which highlights the continuous difficulties in the control of measles and the necessity of continuous immunization measures.

The results showed a substantial correlation between the younger age (5 years and older) and the presence of pneumonia, which can be explained by the fact that younger children have weakened immune systems, making them more susceptible to severe infections caused by the virus and bacteria (Nair et al., 2021). The results of the current research revealed that the prevalence of pneumonia among this age group was 73.1% and emphasized the role of preventive and supportive measures which should be a priority in early childhood. In like manner, the correlation between poor socioeconomic status and the prevalence of pneumonia supports other relevant studies that have indicated that poverty, malnutrition, and overcrowding living conditions are strongly associated with susceptibility to respiratory infections (Liu et al., 2020). The lack of good nutrition status undermines the immune system, and insufficient housing and medical care also increase the risk of infection.

The second important result of this research was that a significant connection exists between pneumonia and

the absence of measles vaccination. Unvaccinated children had over twice the chances of developing pneumonia as their vaccinated counterparts. This observation aligns with the reports of WHO and CDC, which stated the disease manifests as measles-related pneumonia and has a high incidence in unvaccinated population (WHO, 2023). No better preventive action is undertaken than vaccination, which is of value in the prevention of primary measles infection, as well as in the prevention of its grave complications. The fact that unvaccinated groups still exist demonstrates that there are gaps in immunization outreach and vaccine hesitancy, especially in rural areas of Pakistan. Specific misinformation-related, accessibility barrier, and community-focused public health interventions would have a significant impact on the reduction of these preventable complications.

The radiological study in the present research showed that most pneumonia cases exhibited bilateral patchy consolidation, which is in agreement with the usual presentation of viral pneumonia caused by measles as described in previous literature (Okada et al., 2019). The clinical burden and delayed recovery of pneumonia patients is further supported by the long term nature of the fever and cough relative to the non-pneumonia cases. Additionally, the fact that the gendered difference is not important in determining pneumonia is in accordance with the worldwide evidence that biological sex has a weak impact on the outcomes of measles-related respiratory infections (Garg et al., 2022).

The (clinical/public health) implications of these findings are both clinical and public health oriented. Clinically, prompt identification of respiratory symptoms in patients with measles is essential in order to achieve prompt initiation of medical support and antimicrobial therapy in the case of a suspected secondary bacterial infection. In a comprehensive health system, strengthening immunization, better nutrition, and alleviation of socioeconomic inequality are some of the strategies to minimize morbidity due to pneumonia. Moreover, the surveillance of the local epidemiological should be enhanced to track the pattern of measles-related complications and take the necessary interventions based on them.

The present research has a number of its strengths such as operational criteria that are clearly defined, the diagnostic assessment performed by experts, and the fact that both clinical and radiological inclusion of pneumonia

are also conducted. Nonetheless, there are some restrictions that have to be considered. The study is a single-center cross-sectional study and thus may not be applicable to the whole population. Also, variables like nutritional condition, passive smoking, and environmental pollution were not determined, which may have affected the pneumonia risk. Multicentric studies involving all these variables are justified in the future to offer a more detailed picture of complications caused by measles in different populations.

To sum up, the present research reveals that the problem of pneumonia in Swabi, among children with measles, is significant, and younger age, insufficient vaccination, and poor socioeconomic status were reported as the main risk factors. The presence of these findings leads to the immediate need to enhance the immunization campaign, ensure greater levels of awareness of the entire population, and enhance the quality of life in order to lessen the morbidity of measles. Community based healthcare enhancement with improvement of healthcare infrastructure and healthcare monitoring will most probably play a critical role in achieving objectives of measles eradication and reduction of pneumonia-related children mortality in developing regions.

CONCLUSION

This paper highlights the prevalence of pneumonia in children with measles in Swabi with over fifty percent of the cases showing respiratory complications. The results indicate that an immature age group, vaccination deficiency, and poor socioeconomic status are major contenders of pneumonia progression. These findings highlight the urgent necessity to reinforce the measles vaccination efforts, especially among the disadvantaged groups, to avoid high-risk complications and minimize child death. Access to healthcare and parental education on the benefits of vaccination and reduction in socioeconomic determinants of health should stem out of the efforts to reduce this preventable disease burden. In addition, surveillance reinforcement and the incorporation of pediatric care involving initial signs of the symptoms that are related to respiratory distress can greatly improve outcomes. To achieve gains in regard to conducting a measles-free area and better respiratory health status of children, vaccination and child health equity should be considered at the forefront of public health policies in the developing area.

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