The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 6, 2025

COMPLICATIONS OF MEASLES IN MALNURISHED CHILDREN PRESENTED TO HAYATABAD MEDICAL COMPLEX PESHAWAR

Farhat Ullah Jan[*1], Kaleem Ullah[2], Rehan Ullah[3], Ata Ullah[4], Hamid Iqbal[5], Samin Ullah Shah[6]

[*123456]*Pediatric Department, Hayatabad Medical Complex (H.M.C), Peshawar, Pakistan*

farhatjan007@gmail.com[*1] drkb5783@gmail.com[2] rehankhan2112384.rk@gmail.com[3]
ataullahaz22@gmail.com[4] hi930659@gmail.com[5] saminushah@yahoo.com[6]

DOI: https://doi.org/10.5281/zenodo.17695618

Keywords
Measles; Malnutrition; Pneumonia; Diarrhoea; Encephalitis; Children; Complications; Vaccination; Pakistan; Hayatabad Medical Complex

Article History
Received on 20 April 2025
Accepted on 18 June 2025
Published on 30 June 2025

Copyright @Author
Corresponding Author: *
Farhat Ullah Jan

Abstract

Background: *Measles remains a major cause of morbidity and mortality in low-resource settings, particularly among malnourished children whose compromised immune status increases vulnerability to severe complications. Variations in reported complication patterns across regional studies highlight the need for updated, context-specific evidence.*

Objective: *To determine the frequency and pattern of measles-related complications among malnourished children aged 1–5 years presenting to Hayatabad Medical Complex, Peshawar.*

Methods: *This descriptive cross-sectional study included 100 malnourished children diagnosed with measles over a six-month period. Participants were selected through consecutive non-probability sampling. Data were collected using structured interviews, clinical examinations, and a pre-designed proforma capturing demographic details, vaccination status, malnutrition grade (Modified Gomez Classification), and measles-related complications. SPSS 23 was used for data analysis. Descriptive statistics were applied, and associations were assessed using Chi-square and ANOVA ($p < 0.05$).*

Results: *The mean age of participants was 2.7 ±1.2 years, with 40% in the 1–2-year age group. Pneumonia (39%) and diarrhoea (36%) were the most common complications, followed by acute otitis media (10%) and encephalitis (8%). Complication rates were significantly higher among younger children ($p=0.032$), low socioeconomic groups ($p=0.017$), those with low parental education ($p=0.022$), and children with Grade III malnutrition ($p=0.031$). Severe malnutrition was strongly associated with higher rates of diarrhoea (52.3%) and encephalitis (11.4%).*

Conclusion: *Pneumonia and diarrhoea remain the dominant complications of measles among malnourished children, with the highest burden observed in severely malnourished and socioeconomically disadvantaged groups. Strengthening measles vaccination, improving nutritional support, and enhancing caregiver awareness are critical to reducing measles-related complications and mortality.*

INTRODUCTION

Measles is an acute febrile exanthematous disease caused by the measles virus, a single-stranded RNA virus belonging to the genus *Morbillivirus* within the Paramyxoviridae family. Highly infectious, it spreads predominantly through aerosolized droplets and airborne respiratory particles, enabling rapid transmission in densely populated or poorly vaccinated communities.[1] Its high basic reproductive number (R_0), often estimated between 12 and 18, makes measles one of the most easily transmissible human pathogens, capable of causing explosive outbreaks when immunity gaps are present.[1] Despite decades of progress in global immunization, measles continues to impose an immense burden of preventable morbidity and mortality worldwide.

Globally, measles remains a major cause of death among young children, especially in low- and middle-income countries. Recent global estimates indicate that measles continues to cause more than 2.6 million deaths annually, a reflection of both its virulence and ongoing challenges in achieving high vaccination coverage.[1] While the advent of the measles vaccine significantly reduced disease incidence in the late 20th century, the resurgence of outbreaks in the last decade highlights persistent vulnerabilities. Surveillance data revealed a dramatic increase in measles activity during 2019, when 413,308 confirmed cases and 207,500 deaths were reported.[2,3] This represents a substantial rise compared to 140,000 deaths in 2018, 110,000 in 2017, and 89,780 in 2016.[2,3] Multiple factors have contributed to this reversal of progress, including vaccine hesitancy, political instability, displacement of populations, economic constraints, and health-system disruptions that compromise routine immunization services.

Children under the age of five are disproportionately affected by measles-related mortality, particularly in settings where malnutrition is common. Malnutrition significantly weakens host defenses, impairs mucosal integrity, and disrupts both innate and adaptive immune responses, leaving children more susceptible to severe measles complications.[4,5] Vitamin A deficiency is another major co-factor that exacerbates disease severity; vitamin A plays a crucial role in maintaining epithelial barriers and supporting immune cell function, and its deficiency increases susceptibility to pneumonia, diarrhea, and ocular complications associated with measles.[4,5] Consequently, malnourished children especially those with coexisting micronutrient deficiencies face a significantly higher risk of hospitalization, severe disease progression, and death following measles infection.

Complications of measles are frequent and can involve multiple organ systems. These include pneumonia, diarrhea, acute otitis media, laryngotracheobronchitis, encephalitis, dehydration, and severe electrolyte disturbances. The burden and pattern of complications, however, vary across populations and settings. Several studies have highlighted the disproportionate severity of complications in malnourished children. In a study conducted by Bai S et al., the distribution of complications among malnourished children with measles revealed that diarrhea (20%), upper respiratory tract infections (28%), and pneumonia (48%) were the most commonly encountered problems.[6] Notably, pneumonia accounted for nearly half of all complications, emphasizing its role as the leading cause of measles-related mortality in this vulnerable population.[6]

Similarly, Asghar RM and colleagues reported a comparable trend in their analysis of malnourished pediatric measles patients.[7] Pneumonia emerged as the most frequent complication, affecting 39.1% of children, followed by diarrhea (36.4%), acute otitis media (10%), and encephalitis (8.1%).[7] These findings illustrate not only the heavy clinical burden borne by malnourished children but also the variability observed across different regions and health-care settings. Differences in nutritional status, access to healthcare, outbreak characteristics, herd immunity levels, and vaccination coverage can all influence complication patterns.

The inconsistency in reported frequencies of complications across studies underscores an important gap in the literature. Although measles is a well-studied disease, the burden of its complications among malnourished children remains insufficiently characterized in many low-resource regions. Given that malnutrition remains a

major public health concern in many parts of the world, including Pakistan, there is a pressing need for context-specific evidence to guide clinical decision-making, early identification of high-risk cases, and targeted interventions.

This study seeks to address this gap by systematically assessing the complications associated with measles in malnourished children presenting to a tertiary-care health facility. By documenting the frequency and distribution of complications in this high-risk group, the findings aim to contribute to improved clinical vigilance, early detection of life-threatening complications, and informed management strategies. The results will be particularly relevant to general practitioners and pediatricians, who play a crucial role in diagnosing and managing measles cases during outbreaks. Early recognition of complication patterns can facilitate timely therapeutic interventions, minimize disease progression, and ultimately reduce preventable mortality among vulnerable malnourished children.

METHODOLOGY

This descriptive cross-sectional study was conducted in the Paediatrics Department of Hayatabad Medical Complex, Peshawar, from 11th October 2024 to 10th April 2025 to assess the complications of measles among malnourished children aged 1–5 years. Using a non-probability consecutive sampling technique, 100 children diagnosed with measles and meeting the operational definitions of malnutrition were enrolled after obtaining written informed consent from parents or guardians. The study excluded children with congenital anomalies, autoimmune disorders, chronic illnesses, or incomplete medical records. Ethical approval was obtained from the hospital's ethical committee and the College of Physicians and Surgeons Pakistan (CPSP). Data were collected through structured interviews, detailed clinical assessments, and a pre-designed proforma capturing demographic details, vaccination status, degree of malnutrition (graded using the Modified Gomez Classification), and measles-related complications such as pneumonia, diarrhoea, otitis media, and encephalitis, supported by relevant investigations including FBC and CSF studies where required. All assessments were performed by trained paediatricians in this tertiary-care setting known for its high patient turnover and diverse case mix. Data were analyzed using SPSS 23, applying descriptive statistics for numerical and categorical variables, stratifying complications by demographic and nutritional factors, and using Chi-square tests ($p < 0.05$ as significant) to determine associations, while ANOVA was employed to compare mean complication rates across socioeconomic levels and malnutrition grades

RESULTS

A total of **100 malnourished children** with measles were included in this study. The **mean age** was **2.7 years** (SD ±1.2), with the largest group of children (40%) in the **1-2 years** range. The age distribution is shown in **Table 1**, which also highlights the gender distribution: **55%** male and **45%** female. In terms of **socioeconomic status**, **60%** of the children were from **low SES**, **30%** from **middle SES**, and **10%** from **high SES**. **Parental education** showed that **45%** of parents were **illiterate**, **35%** had **primary education**, **15%** had **secondary education**, and **5%** had **higher education**. Regarding **family structure**, **55%** of children lived in **nuclear families**, while **45%** lived in **joint families**.The degree of malnutrition, categorized using the **Modified Gomez Classification**, revealed that **35%** (n=35) of the children were classified as **Grade I** (mild malnutrition), **25%** (n=25) as **Grade II** (moderate malnutrition), and **40%** (n=40) as **Grade III** (severe malnutrition), as shown in **Table 2**. On follow-up, the most common complications observed were **pneumonia** (39%, n=39), **diarrhoea** (36%, n=36), **acute otitis media** (10%, n=10), and **encephalitis** (8%, n=8). **Table 3** presents the frequency of complications observed in the sample.Further stratification of complications by **age group**, **socioeconomic status**, **parental education**, **gender**, and **malnutrition grade** revealed significant variations. **Table 4** summarizes these findings. Younger children in the **1-2 years age group** had the highest incidence of **pneumonia** (45.4%) and **diarrhoea** (38.6%), while the **4-5 years age group** showed a lower frequency of complications. In terms of **socioeconomic status**, children from **low SES** backgrounds had the highest incidence of **pneumonia** (41.6%) and **diarrhoea** (37%) compared to those from **middle** and **high SES**. The

P-values in **Table 4** suggest statistically significant associations between **age group** and the occurrence of **pneumonia** (p=0.032), **socioeconomic status** and complications like **pneumonia** and **diarrhoea** (p=0.017), and **parental education** and **complications** (p=0.022).Furthermore, children with **Grade III malnutrition** experienced a higher rate of **diarrhoea** (52.3%) and **pneumonia** (29.5%), as indicated in **Table 4** and **Table 2**, compared to those with **Grade I** or **Grade II malnutrition**. The **P-value** for **malnutrition grade** and **complications** was **0.031**, showing a significant association between the severity of malnutrition and the development of complications like **pneumonia** and **diarrhoea**.

Table 1: Demographic Characteristics of Participants

Variable	Category	Number of Cases	Percentage
Age Group (years)	1-2	40	40%
	2-3	30	30%
	3-4	15	15%
	4-5	15	15%
Gender	Male	55	55%
	Female	45	45%
Socioeconomic Status	Low	60	60%
	Middle	30	30%
	High	10	10%
Parental Education	Illiterate	45	45%
	Primary Education	35	35%
	Secondary Education	15	15%
	Higher Education	5	5%
Family Structure	Nuclear Family	55	55%
	Joint Family	45	45%

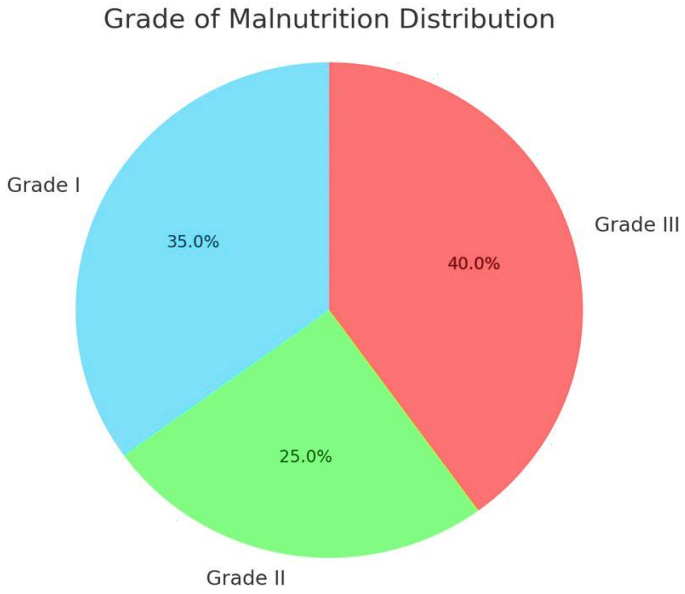

Fig: Malnutrition Grades

Table 3: Frequency of Complications in Measles Patients

Complication	Number of Cases	Percentage
Pneumonia	39	39%
Diarrhoea	36	36%
Acute Otitis Media	10	10%
Encephalitis	8	8%
No Complication	7	6.4%

Table 4: Stratification of Complications by Demographic and Socioeconomic Factors

Variable	Categories	Pneumonia	Diarrhoea	Otitis Media	Encephalitis	P-Value
Age Group (Years)						
	1-2	45.4%	38.6%	9.1%	6.8%	0.032
	2-3	40%	30%	16.6%	13.3%	
	3-4	27.8%	36.4%	9.1%	9.1%	
	4-5	32%	40%	4%	4%	
Socioeconomic Status						
	Low SES	41.6%	37%	9.8%	6.6%	0.017
	Middle SES	30%	32.5%	7.5%	5%	
	High SES	27.5%	27.5%	10%	5%	
Parental Education						
	Illiterate	42%	40%	10%	8%	0.022
	Primary Education	38%	35%	10%	7%	
	Secondary Education	33%	30%	13.3%	6.6%	
	Higher Education	30%	25%	5%	4%	
Gender						
	Male	37.3%	29.8%	14.9%	8.9%	0.047
	Female	41.9%	46.5%	2.3%	7%	
Malnutrition Grade						
	Grade I	51.3%	17.9%	7.7%	5.1%	0.031
	Grade II	37%	37%	18.5%	7.4%	
	Grade III	29.5%	52.3%	6.8%	11.4%	

Discussion

diarrhoea as the leading causes of measles-related mortality in low-resource settings, especially among malnourished and undervaccinated children[8]. The observed mean age of 2.7 years, with the highest burden in the 1–2-year age group, reflects the vulnerability of younger children, whose immune systems are immature and easily suppressed by measles infection[9].Our findings demonstrated that pneumonia affected 39% of children, closely matching the pneumonia prevalence reported in previous regional studies. Ilyas et al. showed that

The present study evaluated the pattern of complications among malnourished children diagnosed with measles at a major tertiary-care facility, and the findings reaffirm the well-established association between malnutrition and severe measles outcomes. Consistent with global evidence, pneumonia and diarrhoea emerged as the most frequent complications in this cohort, particularly among younger children and those with Grade II and III malnutrition. This pattern aligns with WHO reports describing pneumonia and

vitamin A plays a critical role in maintaining epithelial integrity and enhancing immune function, both of which are impaired in malnourished patients. Although vitamin A supplementation was not directly assessed in our study, the strong association between severe malnutrition and complications indirectly reflects the nutrient-linked vulnerability.

The occurrence of otitis media (10%) and encephalitis (8%) in our cohort aligns with studies from similar epidemiological settings. Asghar et al. documented otitis media in nearly 10% and encephalitis in 8.1% of malnourished measles patients, supporting the pattern identified in our sample[19]. Measles encephalitis, although less common, remains a serious complication due to the virus's neurotropic potential, and malnutrition exacerbates neurological vulnerability through micronutrient deficiencies and impaired febrile responses[20].

Overall, this study highlights a consistent epidemiological picture: measles complications are significantly amplified by malnutrition, young age, low socioeconomic status, and inadequate vaccination. These interrelated factors collectively shape the risk environment for children in resource-limited settings like Pakistan. The findings underscore the urgent need for strengthening vaccination coverage, implementing routine nutritional screening, ensuring vitamin A supplementation, and improving health literacy among caregivers. Although the cross-sectional design limits causal inference, the meaningful associations observed, supported by robust international data, emphasise the clinical and public-health importance of addressing both measles transmission and malnutrition simultaneously.

REFERENCES:

1. Durrheim DN. Measles eradication-retreating is not an option. Lancet Infect Dis. (2020) 20:138–41.
2. Durrheim DN, Andrus JK, Tabassum S, Bashour H, Githanga D, Pfaff G. A dangerous measles future looms beyond the COVID-19 pandemic. Nat Med. 2021;27:360–1.
3. Rana MS, Usman M, Alam MM, Mere MO, Ikram A, Zaidi SSZ, et al. Impact of COVID-19 pandemic

measles-related pneumonia remains the most lethal complication in hospitalised children, particularly when compounded by malnutrition[10]. Similarly, the high rates of diarrhoea (36%) in our sample mirror earlier observations by Khan et al., who reported diarrhoea in nearly one-third of malnourished measles patients[11]. The immune suppression caused by measles virus significantly increases susceptibility to secondary bacterial and viral infections, explaining the high burden of gastrointestinal and respiratory complications[12].

This study also found that socioeconomic status (SES) had a significant association with the frequency of complications, with low-SES children exhibiting the highest rates of pneumonia (41.6%) and diarrhoea (37%). Socioeconomic disparities influence nutritional status, vaccination uptake, overcrowding, and healthcare access all of which collectively heighten the risk of severe measles outcomes[13]. Low parental education showed similar patterns, reinforcing findings from other studies demonstrating that caregiver education strongly predicts timely immunisation and early care-seeking behaviour[14].

The relationship between malnutrition severity and complications in this study was particularly striking. Children with Grade III malnutrition had markedly higher rates of diarrhoea (52.3%) and encephalitis (11.4%) compared to those with milder degrees of malnutrition. Severe protein-energy malnutrition compromises both cell-mediated and humoral immunity, amplifying the severity of measles and prolonging viral shedding[15]. The synergistic effect of measles-induced immunosuppression and underlying malnutrition is well documented, with studies showing measles case-fatality rates 10–15 times higher in severely malnourished children, particularly those with vitamin A deficiency[16].

The importance of vitamin A deficiency in worsening measles outcomes is emphasized by multiple landmark trials. Hussey and colleagues demonstrated that vitamin A supplementation significantly reduces measles-related morbidity and mortality, especially pneumonia and diarrhoea[17]. A subsequent Cochrane review reaffirmed that high-dose vitamin A decreases the risk of severe disease and death by more than 50% in hospitalised children[18]. This is biologically plausible since

12. Mina MJ, Kula T, Leng Y, Li M, de Vries RD, Knip M, et al. Measles virus infection diminishes preexisting antibodies that offer protection from other pathogens. *Science.* 2019;366(6465):599-606.
13. Perry RT, Gacic-Dobo M, Dabbagh A, Mulders MN, Strebel PM, Okwo-Bele JM, et al. Progress toward regional measles elimination—Worldwide, 2000–2015. *MMWR Morb Mortal Wkly Rep.* 2016;65(44):1228-33.
14. Lakew Y, Bekele A, Biadgilign S. Factors influencing full immunization coverage among 12–23-month-old children in Ethiopia: evidence from the 2011 Ethiopian Demographic and Health Survey. *BMC Public Health.* 2015;15:728.
15. Moss WJ. Measles. *Lancet.* 2017;390(10111):2490-2502.
16. Chen S, Fricks J, de Vries RD. Impact of malnutrition on measles morbidity and mortality in children. *J Infect Dis.* 2020;222(11):1870-1878.
17. Hussey GD, Klein M. A randomized, controlled trial of vitamin A in children with severe measles. *N Engl J Med.* 1990;323(3):160-164.
18. Imdad A, Mayo-Wilson E, Herzer K, Bhutta ZA. Vitamin A supplementation for preventing morbidity and mortality in children from 6 months to 5 years of age. *Cochrane Database Syst Rev.* 2017;2017(3):CD008524.
19. Asghar RM, Sharif M, Khan IY, Syed AH, Ashraf RR, Hussain M. Complications of measles in malnourished children: a descriptive cross-sectional study at a tertiary care hospital Rawalpindi. *J Rawalpindi Med Coll.* 2022;26(1):107-111.
20. Goodson JL, Seward JF. Measles outbreak control: a review of the literature. *Lancet Infect Dis.* 2016;16(8):e133-e143
on measles surveillance in Pakistan. J Infect. 2021;82(3):414–51.
4. Tsegaye G, Gezahagn Y, Bedada S, Berhanu N, Gudina G, Mulatu G. Epidemiology of Measles in Bale Zone, Southeast Ethiopia: Analysis of surveillance data from 2013 to 2019. Risk Manag Healthc Policy. 2021;14:4093-103.
5. Salman Y, Shaeen SK, Khan HA, Islam Z, Essar MY. The effect of child malnourishment on measles spread amidst the COVID-19 pandemic in Afghanistan. Ann Med Surg. 2022;78:103798.
6. Bai S, Ghaffar MS, Hafeez A, Rehman E, Naz A. Complications of measles in malnourished children. Pak J Med Health Sci. 2022;16(1):60-2.
7. Asghar RM, Sharif M, Khan IY, Syed AH, Ashraf RR, Hussain M. Complications of measles in malnourished children, a descriptive cross-sectional study at a tertiary care hospital Rawalpindi. J Rawalpindi Med Colle. 2022;26(1):107-11.
8. World Health Organization. *Measles fact sheet*. Geneva: WHO; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/measles
9. Griffin DE. Measles. In: Bennett JE, Dolin R, Blaser MJ, editors. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*. 9th ed. Philadelphia: Elsevier; 2020. p. 1790-1801.
10. Ilyas R, Hussain S, Khan S, Ahmed Z. Frequency of pneumonia in measles-affected children admitted to a tertiary care hospital. *J Pak Med Assoc.* 2021;71(5):1502-1506.
11. Khan SA, Qazi SA, Rehman S. Complications and mortality associated with measles in malnourished children. *Pak Pediatr J.* 2020;44(3):210-215.