

Original Research Article

Burden and clinical characteristics of measles in pre-vaccination age infants

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ABSTRACT

Background: Measles remains an important cause of childhood morbidity, particularly among infants who are below the routine age for measles-rubella vaccination. These infants may be vulnerable because of declining maternal antibodies and absence of vaccine-derived protection. This study assessed the burden and clinical characteristics of measles among hospitalized children, with particular attention to the pre-vaccination-age group.

Methods: This hospital-based cross-sectional study was conducted in the Department of Pediatrics, Mugda Medical College Hospital, Dhaka, from March 2026 to May 2026. A total of 300 children aged 1 month to 12 years admitted to the measles isolation ward were included. Data on demographic characteristics, age, clinical manifestations, complications, management and outcomes were collected using a structured proforma. Measles was diagnosed according to the WHO clinical case definition.

Results: Males constituted 61.7% of participants, while 38.3% were female. Infants younger than 1 year represented 57.1% of cases, including 102 (34.0%) infants below 9 months. Fever and rash were present in all patients. Cough, coryza and conjunctivitis were reported in 82.7%, 78.9% and 73.7%, respectively. Pneumonia was the most frequent complication, affecting 63.9% of patients, followed by diarrhea (45.1%) and vomiting (30.1%). All patients received supportive care, while 18.8% required oxygen therapy. ICU admission was required in 0.72% and mortality was 1.0%.

Conclusions: Measles caused substantial morbidity among hospitalized children, with pre-vaccination-age infants comprising a considerable proportion of cases. Early recognition, prompt supportive management and strengthened preventive strategies are essential to reduce severe measles-related outcomes.

Keywords: Measle, Infants, Pre-vaccination age, Pneumonia, Clinical characteristics, Vaccination, Children

INTRODUCTION

Measles is a highly contagious acute viral infection caused by the measles virus and remains an important cause of childhood morbidity and mortality, particularly

among young children with incomplete or absent immunization.¹ The disease is transmitted primarily through respiratory droplets and aerosols and its high transmissibility allows rapid spread among susceptible individuals. Following an incubation period, measles

typically presents with fever, cough, coryza, conjunctivitis and a characteristic maculopapular rash.² Although most children recover without serious consequences, measles can produce substantial complications, including pneumonia, diarrhea, otitis media, dehydration, encephalitis and severe respiratory illness.³ The risk of complications is particularly important among infants, malnourished children and those with impaired immunity.

Infants younger than the routine age for the first measles-rubella vaccination represent a vulnerable population because they may remain susceptible to infection during a period when routine immunization has not yet been administered.⁴ Protection during early infancy may depend partly on maternal antibodies, which decline progressively after birth and may not provide adequate protection throughout the entire pre-vaccination period.⁵ Consequently, infants can develop measles despite having no opportunity to receive routine vaccination. Their younger age and immature immune response may also contribute to more severe disease and increased need for hospitalization.⁶

The clinical presentation and severity of measles may vary according to age, nutritional status, vaccination history and underlying health conditions.⁷ Comparing pre-vaccination-age infants with older children can therefore provide important information about differences in presenting features, complications, laboratory abnormalities, treatment requirements and clinical outcomes.⁸ Assessment of vaccination status and demographic characteristics may additionally help identify susceptible groups and potential gaps in immunization protection.⁹

During measles outbreaks, understanding the burden of disease among infants below the routine vaccination age is particularly important for clinical management and public health planning.¹⁰ However, this age group may receive less attention because they fall outside the routine immunization target population. Characterizing their clinical profile and outcomes can help clinicians recognize measles early, anticipate complications and optimize supportive care.¹¹ Therefore, the present study was undertaken to assess the burden and clinical characteristics of measles among pre-vaccination-age infants and to describe their clinical presentation, investigations, management and outcomes in comparison with older children.

METHODS

This hospital-based cross-sectional study was conducted in the Department of Pediatrics, Mugda Medical College Hospital (MuMCH), Dhaka, from March 2026 to May 2026, coinciding with the peak period of the current measles outbreak. The study included children aged 1 month to 12 years who were admitted to the pediatric measles isolation ward. Data were collected

retrospectively from hospital records using a structured data collection proforma, including demographic characteristics, vaccination status, clinical manifestations, laboratory findings, duration of hospital stay, management, complications and clinical outcomes. Measles was diagnosed according to the World Health Organization (WHO) clinical case definition, which includes fever and maculopapular rash accompanied by at least one of cough, coryza, or conjunctivitis. For analysis, participants were categorized into three age groups: <9 months (pre-vaccination age), 9 months to 5 years (standard EPI vaccination age) and >5 years (older children).

Inclusion criteria

Children aged 1 month to 12 years are admitted to the MuMCH pediatrics measles isolation ward. Patients meeting the WHO clinical definition for measles: Fever and maculopapular rash with at least one of (cough, coryza, or conjunctivitis). Willingness of parents/guardians to participate in the study.

Exclusion criteria

Neonates (under 28 days old) to avoid confounding with congenital infections. Children with other confirmed viral exanthems (e.g., Rubella or Dengue rash). Patients with incomplete medical records or those who left the hospital before initial assessment (DAMA).

The collected data were entered, coded and analyzed using appropriate statistical methods. Descriptive statistics were expressed as frequencies and percentages for categorical variables and as mean $\pm$ standard deviation for continuous variables. Appropriate comparative tests were applied to assess differences between age groups and a $p < 0.05$ was considered statistically significant.

RESULTS

Table 1 presents the demographic profile of the 300 study participants. Among them, the majority were male (61.70%), while females accounted for 38.30%. In terms of age distribution, infants under one year comprised the largest group at 57.10%, with a notable subset of 102 infants (34.00%) being under 9 months of age, highlighting the substantial representation of the pre-vaccination-age group in our study. Toddlers aged 1–5 years made up 30.80% and school-aged children above 5 years represented 12.10%. Regarding socioeconomic status, most families belonged to the mid-income bracket (54.10%), followed by low-income (33.10%) and high-income (12.80%) households. Birth history showed that 73.70% of infants were delivered via normal vaginal delivery, whereas 26.30% were born by caesarean section. Additionally, exclusive breastfeeding was practiced in 78.20% of cases, while the remaining 21.80% received mixed or non-exclusive breastfeeding.

Table 2 provides an age-stratified breakdown of the study participants along with the corresponding clinical rationale for each group. The largest proportion of cases (34.00%) was observed in infants below 9 months of age, who fall within the pre-vaccination window and depend solely on declining maternal antibodies for protection.

Another 23.00% were infants aged 9 months to 1 year, who have just become eligible for the first routine measles-rubella (MR1) dose but remain vulnerable if vaccination is delayed. Toddlers between 1 and 5 years constituted 30.80% of cases, representing the "immunity gap" resulting from missed routine doses during 2024–2025. The remaining 12.10% were school-aged children above 5 years (Figure 1).

Table 1: Demographic Profile of Study Participants (n=300).

Variables	Classification	Frequency (N)	Percentage (%)
Gender	Male	185	61.7
	Female	115	38.3
Age group	Infant (<1 year)	171	57.1
	< 9 months	102	34.0
	Toddler (1–5 years)	93	30.8
	School Age (>5 years)	36	12.1
Monthly income (BDT)	Low (<15k)	99	33.1
	Mid (15k–30k)	163	54.1
	High (>30k)	38	12.8
Birth history	Normal Vaginal Delivery (NVD)	221	73.7
	Caesarean Section (CS)	79	26.3
Nutrition	Exclusive Breastfeeding (EBF)	235	78.2
	Non-EBF / Mixed	65	21.8

Table 2: Age classification and frequency breakdown.

Age group	Frequency (%)	Clinical context
Below 9 months	34	Pre-Vaccination Window: These infants are not yet eligible for the routine MR1 vaccine (scheduled at 9 months). They rely entirely on waning maternal antibodies.
9 months to 1 year	23	Early Eligibility: This group has just become eligible for MR1 but remains at high risk if the dose is delayed due to sickness or lack of awareness.
1 year to 5 years	30.8	Toddlers: This group represents the "Immunity Gap," consisting of children who missed their routine doses during previous years (2024–2025).
Above 5 years	12.1	School-Aged: Reflects a shift in the outbreak where susceptibility is extending beyond the under-five demographic.

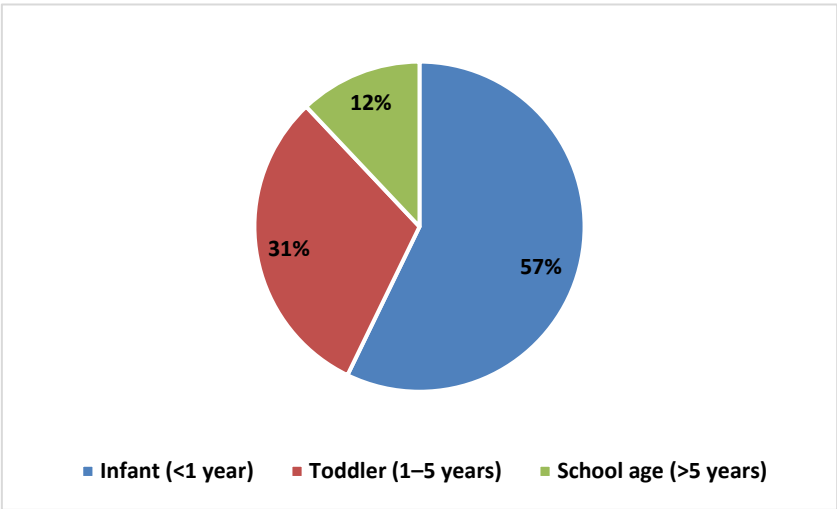


Figure 1: Age distribution of study participants (n=300).

Table 3 summarizes the clinical characteristics observed among the 300 study participants. As expected in measles cases, fever and rash were universally present in all patients (100.00% each). Respiratory symptoms were highly prevalent, with cough reported in 82.70% of cases, coryza in 78.90% and conjunctivitis in 73.70%. Pneumonia, a major complication of measles, was documented in nearly two-thirds of the patients (63.90%). Gastrointestinal manifestations were also common, with diarrhea affecting 45.10% and vomiting occurring in 30.10% of the study population.

Table 4 presents the management strategies and clinical outcomes observed among the 300 study participants. All patients (100.00%) received supportive care as the cornerstone of clinical management. Oxygen therapy was required in 56 cases (18.80%), reflecting the significant burden of respiratory involvement, particularly pneumonia. Intensive care unit (ICU) admission was necessary for 2 patients (0.72%), indicating severe disease requiring close monitoring. The overall mortality rate was 1.00%, with 3 patients recorded as dead-on arrival (DEA) or succumbing to the illness during the study period.

Table 3: Clinical characteristics of patients (n=300).

Clinical feature	Frequency (N)	Percentage (%)
Fever	300	100
Rash	300	100
Cough	248	82.7
Coryza	237	78.9
Conjunctivitis	221	73.7
Pneumonia	192	63.9
Diarrhea	135	45.1
Vomiting	90	30.1

Table 4: Management and clinical outcomes (n=300).

Parameter	Frequency (N)	Percentage (%)
Supportive care	300	100
Oxygen therapy (O₂)	56	18.8
ICU admission	2	0.72
Mortality (Outcome: DEA)	3	1.0

DISCUSSION

The present study highlights the substantial clinical burden of measles among hospitalized children, with particular representation of infants below the routine vaccination age. Of the 300 participants, 102 (34.0%) were younger than 9 months, while infants below one year constituted 57.1% of the cohort. This finding is clinically important because infants below the vaccination threshold depend largely on passive maternal immunity for protection. Ong et al. reported that measles seroprevalence declines substantially during the first year of life in low- and middle-income countries, indicating increasing susceptibility before routine vaccination.¹² Similarly, Nic Lochlainn et al demonstrated that measles vaccination before 9 months can influence subsequent immune responses, emphasizing the immunological vulnerability of this age group.¹³ Early waning of maternal antibodies has also been described by Leuridan et al supporting the susceptibility of young infants to measles infection.¹⁴

The predominance of male children in our study (61.7%) was also observed in several pediatric measles studies. Iqbal et al reported that measles predominantly affected young children and identified young age, malnutrition

and inadequate immunization as important characteristics associated with poorer outcomes.⁴ In our cohort, socioeconomic vulnerability was evident, with 33.1% of families belonging to the low-income group. This is consistent with the findings of Mersha et al who demonstrated that measles burden is strongly influenced by socioeconomic and immunization-related factors.¹⁵ The recent study by Goutam et al from dedicated measles hospitals in Dhaka similarly identified socioeconomic status as an important determinant of vaccination, with unvaccinated children carrying substantially greater odds of complications.¹⁶

The clinical presentation in our study was characteristic of measles. Fever and maculopapular rash were present in all participants, while cough, coryza and conjunctivitis occurred in 82.7%, 78.9% and 73.7%, respectively. These findings are consistent with the classical clinical spectrum described by Misin et al and with pediatric outbreak studies demonstrating a high frequency of respiratory and constitutional manifestations.¹⁷ Iqbal et al similarly reported frequent respiratory symptoms among pediatric measles patients.⁴ The recent outbreak study by Trinidad et al also found substantial respiratory involvement among hospitalized confirmed cases, with pneumonia being the most frequent complication.¹⁸

Pneumonia was the most prominent complication in our cohort, affecting 63.9% of children. This relatively high burden may reflect the hospital-based nature of the study, as children with more severe respiratory manifestations are more likely to require admission. Trinidad et al reported pneumonia in 27.4% of hospitalized confirmed measles cases and supplemental oxygen requirement in 57.5%, demonstrating the important contribution of respiratory disease to measles-related hospitalization.¹⁸ Our findings also showed gastrointestinal involvement, with diarrhea in 45.1% and vomiting in 30.1%, consistent with the multisystem manifestations reported in previous pediatric measles studies.

Management in our cohort was predominantly supportive, with all children receiving supportive care and 18.8% requiring oxygen therapy. Only two children (0.72%) required ICU admission, while three children (1.0%) were recorded as dead-on arrival or died during illness. Although the proportion requiring intensive care was low, the occurrence of mortality emphasizes that measles remains capable of producing life-threatening disease. Iqbal et al likewise reported mortality among pediatric measles patients and emphasized the importance of early recognition and appropriate supportive management.⁴ Our findings reinforce that pre-vaccination-age infants represent an important vulnerable group and that strengthening immunization strategies, maintaining breastfeeding support and ensuring prompt recognition and management of respiratory complications are essential to reducing measles-related morbidity and mortality.

Limitations

This study was conducted in a single hospital and included only admitted children; therefore, the findings may not represent the clinical spectrum of measles in the community. The cross-sectional design also limited assessment of temporal relationships between vaccination status, clinical characteristics, complications and outcomes.

CONCLUSION

Measles imposed a substantial clinical burden, with pre-vaccination-age infants comprising a considerable proportion of hospitalized cases and frequently presenting with respiratory and gastrointestinal manifestations. Pneumonia was the leading complication, emphasizing the need for early recognition, prompt supportive management and strengthened preventive strategies for vulnerable infants.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Leung J, Munir NA, Mathis AD, Filardo TD, Rota PA, Sugerman DE, et al. The effects of vaccination status and age on clinical characteristics and severity of measles cases in the United States in the postelimination era, 2001–2022. *Clin Infect Dis*. 2025;80(3):663-72.
2. Perry RT, Halsey NA. The clinical significance of measles: a review. *J Infect Dis*. 2004;189(Suppl 1):S4-16.
3. Gianniki M, Siahianidou T, Botsa E, Michos A. Measles epidemic in pediatric population in Greece during 2017–2018: Epidemiological, clinical characteristics and outcomes. *PLoS One*. 2021;16(1):e0245512.
4. Iqbal MJ, Islam MM, Islam MA, Sen T, Modak B, Ghosh K. Clinical characteristics and outcomes in pediatric patients at outdoor experiences with measles. *The Insight*. 2025;8(1):143-7.
5. Rahat F, Abiduzzaman MF, Choudhury AM. Clinical characteristics of measles in infancy: A hospital based study. *Dhaka Shishu Hosp J*. 2020;36(1):20-4.
6. Mawlood SD, Al-Ani MM, Al-Ani RM, Alshibib A. Impact of measles vaccination on clinical characteristics and outcomes in children in Ramadi, Iraq. *World J Clin Pediatr*. 2025;14(3):107253.
7. Aljotherapy AH, Baiee HA, Hussein KF, Baiee AH, Abdulameer TS, Hadi AA, et al. Epidemiologic and clinical characteristics of children with measles during the year 2019. *Indian J Forensic Med Toxicol*. 2020;14(3):1399-404.
8. Stein-Zamir C, Shoob H, Abramson D. Measles clinical presentation, hospitalization and vaccination status among children in a community-wide outbreak. *Vaccine*. 2023;41(17):2764-8.
9. Alsulaiman JW, Kheirallah KA, Alrawashdeh A, Abu Sanad Z, Al-Mnayyis AA, Yassin A, et al. Clinical and demographic characteristics of hospitalized pediatric measles cases; the 2023 outbreak in Northern Jordan. *Infect Drug Resist*. 2025;18:1773-83.
10. Domai FM, Agrupis KA, Han SM, Sayo AR, Ramirez JS, Nepomuceno R, et al. Measles outbreak in the Philippines: Epidemiological and clinical characteristics of hospitalized children, 2016-2019. *Lancet Reg Health West Pac*. 2022;19:100334.
11. Jalal MA, Halboot KM, Lami SA, Gumar EA, Al-Delphi MH, Lami F, et al. Epidemiological trends and clinical characteristics of measles in Iraq (2023–2024): a retrospective cross-sectional study. *BMC Infect Dis*. 2025;25(1):487.
12. Ong DS, von Mollendorf C, Mulholland K, Do LA. Measles seroprevalence in infants under 9 months of age in low-and middle-income countries: a systematic review and meta-analysis. *J Infect Dis*. 2025;232(2):316-26.
13. Nic Lochlainn LM, de Gier B, van der Maas N, van Binnendijk R, Strebel PM, Goodman T, et al. Effect

of measles vaccination in infants younger than 9 months on the immune response to subsequent measles vaccine doses: a systematic review and meta-analysis. *Lancet Infect Dis*. 2019;19(11):1246-54.

14. Leuridan E, Hens N, Hutse V, Ieven M, Aerts M, Van Damme P. Early waning of maternal measles antibodies in era of measles elimination: longitudinal study. *BMJ*. 2010;340:c1626.
15. Mersha AM, Braka F, Gallagher K, Tegegne AA, Argay AK, Mekonnen MA, et al. Measles burden in urban settings: characteristics of measles cases in Addis Ababa city administration, Ethiopia, 2004-2014. *Pan Afr Med J*. 2017;27(Suppl 2):11.
16. Goutam A, Hasan A, Khan MAS, Mahid MAH, Masud SB, Babul H, et al. Vaccination status and its association with complications among the patients admitted with measles in the dedicated measles hospitals, Dhaka, Bangladesh. *medRxiv* [Preprint]. 2026: 1-28.

17. Misin A, Antonello RM, Di Bella S, Campisciano G, Zanotta N, Giacobbe DR, et al. Measles: an overview of a re-emerging disease in children and immunocompromised patients. *Microorganisms*. 2020;8(2):276.
18. del Moral-Trinidad LE, Trejo-González PE, Acosta-Aguilar CA, Rubio-Mora BR, Avilés-Martínez KI, Herrera-Godina MG, et al. Hospital burden and clinical features associated with admission among confirmed measles cases during the 2025-2026 outbreak at a tertiary care hospital in Mexico. *IJID Reg*. 2026;20:100965.

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