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Clinical Characteristics, Complications, Outcomes, and Vaccination Status of Hospitalized Measles Patients During the 2026 Nationwide Outbreak in Bangladesh: A Prospective Study from a Tertiary Care Hospital

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Abstract

Background

Bangladesh is experiencing a significant measles outbreak that increased sharply in March 2026, placing an overwhelming demand on pediatric inpatient care. Comprehensive hospital-based data on the clinical features, complications, and vaccination status of affected children are lacking, yet are essential for effective outbreak management strategies.

Methods

We conducted a prospective observational study of all children aged < 18 years admitted to the pediatric ward of Faridpur Medical College Hospital (FMCH), Bangladesh, in April 2026, who fulfilled the WHO clinical case definition for measles. We used standardized data collection forms to collect patient demographic, clinical presentation, vaccination, and hospital outcome data.

Results

In April 2026, 314 children were admitted to the FMCH with measles. Vaccine-ineligible infants aged < nine months constituted the largest age group (53%). The classical clinical triad of cough (98%), conjunctivitis (74%), and coryza (80%) was observed in the majority of patients, and Koplik's spots were documented in 66% of cases. Pneumonia was the most common respiratory complication, affecting 38% of the admitted children. Other frequent manifestations included oral stomatitis (59%), acute diarrhea (38%), and neurological involvement, including lethargy (6%) and seizure (3%). Among the 148 children eligible for vaccination under the national Expanded Programme on Immunization (EPI) schedule, 65% were unvaccinated. Of the 51 vaccinated children, only 12% of caregivers were able to provide an immunization card at admission. Within the preceding six months, 33% of the children had received vitamin A supplementation. The in-hospital case fatality rate was 3.2% (10/314), and 90% of the surviving patients were discharged with medical advice.

Conclusions

During the 2026 measles outbreak, hospitalized children at a tertiary center in Faridpur were predominantly vaccine-ineligible infants and unvaccinated young children. Pneumonia complicated more than one-third of admissions. The in-hospital case fatality rate of 3.2% is almost certainly an underestimate, since children discharged before recovery were not followed. Only one-third of patients had received vitamin A supplementation in the six months before admission. These findings point to compounding failures in routine immunization, micronutrient delivery, and health system preparedness.

1. Introduction

Measles is one of the most highly contagious infectious diseases, infecting up to 90% of susceptible individuals following close household exposure [1, 2]. Despite the availability of a safe, highly effective, and inexpensive two-dose live-attenuated vaccine for over six decades, the pathogen continues to impose a heavy burden of morbidity and mortality on children in low- and middle-income countries, particularly where routine immunization has been compromised [3–6]. The WHO estimated approximately 10.3 million cases and 107,500 deaths globally in 2023, reflecting a significant viral resurgence [5]. Case severity and mortality risk are strongly modulated by nutritional status, vitamin A deficiency, and immunological competence [2, 4, 7, 8].

Bangladesh established one of South Asia's strongest childhood immunization programs after the nationwide expansion of the Expanded Programme on Immunization (EPI), which was initiated in 1985 [9, 10]. By the mid-2010s, national measles coverage reached 88%, and full vaccination coverage among children aged 12–59 months was estimated to be 86–89% [9, 11]. In 2014, a landmark measles-rubella (MR) mass campaign reached approximately 52 million children aged 9 months to 14 years, achieving coverage of over 90% [12, 13]. These programmatic achievements drove a sustained decline in measles incidence over the three decades preceding the 2026 outbreak [14].

However, this progress showed signs of reversal in the 2023 Coverage Evaluation Survey (CES), which reported declines in valid first-dose MR (MR1) coverage from 84% in 2019 to 82% in 2023 and valid second-dose MR (MR2) coverage from 89% to 81%, both below the 93–95% population immunity threshold needed to interrupt sustained transmission [3, 4, 10, 15]. These gaps were compounded by a nationwide MR vaccine stockout during 2024–2025, leaving an estimated 500,000 children with missed scheduled doses, approximately 5 million incompletely immunized, and 70,000 entirely unvaccinated by early 2025 [14, 16, 17]. With no nationwide supplementary immunization activities since 2020 and only one of two planned vitamin A supplementation rounds completed in 2025, declining routine coverage, interrupted campaigns, supply failures, and disrupted micronutrient delivery collectively created a large and expanding pool of susceptible children [14, 16, 17]. These vulnerabilities led the Government of Bangladesh to declare a nationwide measles outbreak on April 4, 2026 [18]. At the time of declaration, 9,883 suspected cases, 1,398 laboratory-confirmed cases, and at least 128 suspected deaths had been reported [14, 19]. By May 3, 2026, the outbreak had expanded to 61 of 64 districts, with 40,491 suspected cases, 5,313 confirmed cases, 244 suspected deaths, and 50 laboratory-confirmed deaths [18, 20, 21]. Children under five years of age accounted for approximately 72% of cases, while infants under nine months, who are not eligible for routine MR vaccination, represented 28–33% of national cases [14, 21]. Faridpur, a high-burden district in the Dhaka division, ranked 46th out of 64 districts for valid full vaccination coverage in the 2023 CES and was classified as low-performing under the National Equity Strategy on EPI [15, 22]. The clinical profiles of hospitalized measles patients during the 2026 outbreak have not yet been prospectively described. During the 2026 surge, sentinel surveillance at the Infectious Diseases Hospital (IDH) in Dhaka recorded an in-hospital CFR of 3.9%, rising to 4.7% for March 2026 admissions [16] —substantially above the national suspected-case CFR of 0.9-1.0%, which reflects the

concentration of high-severity cases in referral hospitals [14, 16]. This study prospectively described the sociodemographic profile, clinical presentation, complication spectrum, vaccination and vitamin A supplementation status, and hospital outcomes of children hospitalized at FMCH in April 2026, and contextualized these findings within the broader framework of the national immunization emergency.

2. Methods

2.1 Study design and setting

We conducted a prospective observational cohort study in the pediatric ward of the FMCH from April 1 to 30, 2026. Faridpur Medical College Hospital (FMCH) is a 750-bed government teaching facility serving a predominantly rural catchment population across the Faridpur district and adjacent areas of the Dhaka and Khulna divisions. The pediatric ward saw a sharp rise in measles admissions from March 2026. Throughout April 2026, the pediatric ward provided management to more than 200 inpatient children on any given day. The study period coincided with the peak inpatient surge during the 2026 nationwide measles outbreak.

2.2 Eligibility criteria and enrolment

Children admitted to the pediatric ward between 1 and April 30, 2026, were eligible if they presented with a clinical diagnosis meeting the WHO case definition for measles: a generalized maculopapular rash lasting three or more days, documented fever ≥ 38.3°C (101F), and at least one of the following: cough, coryza, or conjunctivitis [23]. Koplik's spots were recorded when present as a pathognomonic feature to strengthen the diagnostic certainty. Laboratory confirmation by serology or RT-PCR was unavailable during the outbreak surge and was therefore not required for enrollment, consistent with the WHO guidance for resource-limited outbreak settings [23]. Informed written consent was obtained from the legal guardians of all enrolled patients.

2.3 Data collection

Trained physicians from the Child Health and Mortality Prevention Surveillance (CHAMPS), Bangladesh work administered a pre-tested structured data collection form to the primary caregiver within 24 hours of admission. The clinical data were cross-verified against the hospital patient records and nursing observation charts. CHAMPS has been conducting mortality surveillance at FMCH since 2017, and this study leveraged the expertise of the CHAMPS hospital surveillance team. The instrument was pretested on ten cases before the study. No items were removed; however, the sequencing of clinical examination fields was revised for workflow efficiency. The variables captured included sociodemographic information (age, sex, weight), clinical features (fever onset and peak temperature, rash onset and origin, cough, coryza, conjunctivitis, Koplik's spots, and complications), vaccination history and vitamin A supplementation status, and hospital outcomes, including length of hospital stay (LOS).

Vaccination status was classified into four categories following the Bangladesh national EPI schedule: (i) vaccine-ineligible, under 9 months; (ii) eligible and completely unvaccinated, aged ≥ 9 months with no

MR dose received; (iii) partially vaccinated, one MR dose received; and (iv) fully vaccinated, two MR doses received. Vitamin A supplementation was recorded as received or not received in the six months preceding admission, consistent with the national twice-yearly supplementation cycle.

2.4 Outcome and case definitions

The primary outcome was the in-hospital case fatality rate (CFR), defined as the proportion of enrolled patients who died before discharge. Secondary outcomes included the prevalence of pre-specified complications (pneumonia or bronchopneumonia, acute diarrhea, oral stomatitis, purulent otitis media, seizures, and lethargy or altered consciousness), LOS in days, and distribution of discharge dispositions.

Nosocomial measles was defined as the onset of maculopapular rash > 14 days after the index hospital admission in a child with no known community measles exposure during the incubation period. Hospital discharge was classified as (i) in-hospital death, (ii) referral to a higher-level facility, (iii) discharge with a risk bond (DORB, a locally used administrative category in which the family acknowledges in writing that the child is leaving before the treating physician considers it medically safe), and (iv) discharge with advice (DA, departure with physician authorization).

2.5 Statistical analysis

Continuous variables were descriptively assessed and summarized as mean ± standard deviation (SD) or median (interquartile range). Categorical variables were summarized using absolute frequencies and their corresponding percentages. Given the descriptive nature of the study and the absence of a priori hypotheses for group-level comparisons, no inferential statistical tests were performed.

3. Results

3.1 Sociodemographic characteristics and perinatal history

A total of 314 children with measles were admitted to the pediatric ward of Faridpur Medical College Hospital (FMCH) in April 2026 (Table 1). Of these, 188 were male (60%). The median age was 8.9 months (IQR: 7–20 months), with admissions concentrated predominantly among infants. Children younger than 9 months, who were not yet eligible for measles-rubella (MR) vaccination under the national immunization schedule, accounted for 166 (53%) admissions. An additional 37 children (12%) were aged 9–11 months and were therefore eligible only for the first MR dose.

3.2 Clinical presentation

At admission assessment, the mean duration of fever was 6.4 ± 4 days. Among 258 children with a documented peak temperature, 72 (28%) had hyperpyrexia exceeding 103°F. The classical clinical triad of measles was observed in the vast majority of patients: persistent cough in 306 (98%), conjunctivitis in 232 (74%), and coryza in 251 (80) %. Koplik's spots were observed in 206 patients (66%). The maculopapular rash had been present for a mean duration of 3.2 ± 2 days before assessment and originated on the face or head in 243 cases (77%). Most cases were community-acquired (91% of

cases). However, 27 children (9%) developed rash onset during an ongoing hospitalization for an unrelated condition, meeting the criteria for nosocomial measles.

Table 1
Sociodemographic characteristics, perinatal history, and clinical presentation of 314 hospitalized measles patients, Faridpur Medical College Hospital, April 2026

Characteristic	n (%)
Demographic characteristics	
Sex: Male	188 (59.9%)
Sex: Female	126 (40.1%)
Age (median, IQR)	8.9 months (7–20)
Age group	
< 9 months	166 (52.9%)
9–11 months (MR-1 eligible only)	37 (11.8%)
12–59 months	89 (28.3%)
≥ 5 years	22 (7%)
Clinical presentation and symptoms	
Fever duration, days (mean ± SD)	6.4 ± 4
Hyperpyrexia (peak temperature > 103°F)	72 (27.9%)[†]
Persistent cough	306 (97.5%)
Conjunctivitis	232 (73.9%)
Coryza	251 (79.9%)
Koplik's spots	206 (65.6%)
Maculopapular rash duration, days (mean ± SD)	3.2 ± 2
Rash originating from face or head	243 (77.4%)
Community-acquired	287 (91.4%)
Nosocomial onset	27 (8.6%)

[†]Calculated among the 258 patients with available temperature data.

3.3 Complications and admission diagnoses

Respiratory involvement was the predominant manifestation. Dyspnea was documented in 107 patients (34%), and head nodding was observed in one patient (0.3%). The primary admission diagnosis was measles complicated by pneumonia or bronchopneumonia in 118 children (38%). Among extrapulmonary complications, oral stomatitis was the most frequent, occurring in 184 (59%) patients. Neurological involvement was observed in 27 patients.

3.4 Vaccination status and vitamin A coverage

Of the 314 admitted children, 166 (53%) were ineligible for MR vaccination according to the national EPI schedule. Among the remaining 148 vaccine-eligible children, 96 (65%) had not received an MR dose, 21 (14%) were partially vaccinated with one dose, and 30 (20%) were fully vaccinated with two doses. Six caregivers presented a physical immunization card on admission; the vaccination history of all patients relied entirely on verbal recall. Only 101 of the 302 respondents (33%) reported receiving vitamin A supplementation in the preceding six months, and 12 caregivers were unable to recall their supplementation history.

Table 2
Complications, admission diagnoses, vaccination status, and vitamin A coverage (N = 314)

Variable	n (%)
Respiratory complications	
Dyspnea	107 (34.1%)
Tachypnoea	38 (12.1%)
Chest indrawing	19 (6.1%)
Head nodding	1 (0.3%)
Neurological complications	
Lethargy or altered consciousness	18 (5.7%)
Convulsions or seizures	9 (2.9%)
Other complications	
Oral stomatitis	184 (58.6%)
Acute diarrhea	120 (38.2%)
Purulent otitis media	11 (3.5%)
Primary admission diagnosis	
Measles with pneumonia or bronchopneumonia	118 (37.6%)
Uncomplicated measles	24 (7.6%)
Vaccination status	
Vaccine-ineligible (age < 9 months)	166 (52.9%)
Eligible; completely unvaccinated	96 (64.9%)‡
Partially vaccinated (1 dose)	21 (14.2%)‡
Fully vaccinated (2 doses)	30 (20.3%)‡
Immunization card available on admission	6 (11.8%)§
Vitamin A supplement	
Received vitamin A in preceding 6 months	101 (33.4%)¶
‡Calculated among 148 vaccine-eligible children	
§Calculated among 51 vaccinated children	

¶Twelve caregivers were unable to recall the supplementation history.

3.5 Outcomes and length of hospital stay

Ten children died in the hospital, yielding a CFR of 3.2%. Eleven patients (3.5%) were referred to a higher-level facility, and 21 (7%) were discharged with risk bonds (DORB). Median LOS was 4 days. Most patients stayed for 3–7 days (61%), and 40 (13%) had a prolonged stay exceeding 7 days.

Table 3
Clinical outcomes and length of hospital stay (N = 314)

Outcome	**n (%)**
Discharge disposition	
In-hospital death	10 (3.2%)
Referred to higher-level facility	11 (3.5%)
Discharged with risk bond (DORB)	21 (6.7%)
Discharged with advice (DA)	272 (89.5% of survivors)
Length of hospital stay (LOS)	
LOS, days (median, IQR)	4 (2–6)
< 3 days	83 (26.4%)
3–7 days	191 (60.8%)
> 7 days	40 (12.7%)

4. Discussion

Our findings from 314 consecutively admitted children at FMCH in April 2026 during the nationwide measles resurgence in Bangladesh highlight four key clinical and epidemiological features of this outbreak. First, severe disease occurred predominantly among children who were not yet eligible for MR vaccination under the national EPI schedule, suggesting heightened vulnerability in the setting of declining population-level immunity. Second, pulmonary and mucosal complications were common, reflecting the high clinical severity reported among hospitalized measles cases during the outbreak [16]. Third, the observed in-hospital CFR of 3.2% likely represents a conservative estimate of mortality, as a substantial proportion of acutely ill children left the hospital before complete clinical recovery. Finally, the cohort demonstrated major gaps in preventive child health services: only 12% of the caregivers presented a physical immunization card at admission, and most children had not received vitamin A supplementation before illness. A high proportion of admitted children aged < nine months was a central epidemiological finding of this cohort. This age group accounted for 53% of hospital admissions, compared with approximately 28–33% of nationally reported measles cases during the same period [14,

21], suggesting a relative over-representation among hospitalized patients. This pattern is consistent with the increased risk of severe measles outcomes during early infancy [14, 24].

Infants younger than nine months are not eligible for routine MR vaccination under the national EPI schedule and therefore depend largely on maternally derived passive immunity and population-level protection against measles and rubella. However, passive immunity may be less durable among infants born to vaccinated mothers, who generally transfer lower and more rapidly waning measles-specific IgG titers than mothers with immunity acquired through natural infection [4, 8, 25]. In the context of routine immunization coverage below the 93–95% threshold required to prevent sustained transmission, compounded by service disruptions and vaccine stockouts, this protective barrier was likely further reduced [4, 14, 16, 25]. Accordingly, the emergency MR campaign launched on April 5, 2026, which lowered the eligibility to six months of age, was appropriately directed toward this highly vulnerable population [14, 18, 23].

Pneumonia or bronchopneumonia was the primary complication in 38% of patients with measles. This was broadly consistent with the 53–78% prevalence reported in other hospital-based cohorts in Bangladesh [24, 26, 27]. In earlier studies, pneumonia was found to be the leading cause of measles-related deaths in hospitalized children [2, 4, 28]. The present cohort reflected this severity: 34% of patients presented with dyspnea and 6% with chest indrawing, indicating that many children arrived in an active state of respiratory compromise requiring immediate intervention.

The observed in-hospital case fatality rate (CFR) of 3.2% (10/314) should be interpreted with caution. In early May 2026, WHO estimates reported a national suspected-case CFR of 0.9-1.0% [14], but these figures included all suspected cases and therefore systematically underestimated mortality among hospitalized patients [14, 16]. In comparison, the Institute of Diseases of the Hospital (IDH) in Dhaka recorded an in-hospital CFR of 3.9% during the same outbreak, rising to 4.7% for admissions in March 2026 [16]. Importantly, the 3.2% CFR in this cohort represents a conservative minimum, as children who deteriorated after discharge, particularly those with residual pneumonia or neurological complications, were not included. Considering that the WHO surveillance definition of measles-related death includes any death occurring within 30 days of rash onset [29], the true 28-day CFR is likely to be higher.

During periods of outbreak, tertiary hospitals can also function to identify and act on gaps in immunization [16, 23]. An admission of a measles case can trigger screening, contact tracing, and opportunistic vaccination of susceptible household contacts [16, 23]. In this cohort, however, only six (12%) admitted children had a physical immunization card at the time of presentation. Caregivers often reported leaving vaccination cards at home during acute illness, even when cards exist, making bedside verification and targeted vaccination unfeasible. The 2023 Coverage Evaluation Survey reported a national card retention rate of 57% [22]. Although Bangladesh's DHIS2 infrastructure offers a technical platform for individual-level electronic birth cohort tracking, these systems have not yet been implemented to provide point-of-care digital immunization records accessible during clinical emergencies [15, 22].

Among the vaccine-eligible children in this cohort, 65% had not received an MR dose based on caregiver recall. This finding aligns with national surveillance data, indicating that most measles cases occurred in unvaccinated individuals [14]. The local context underscores the significance of this finding. In the Faridpur district, valid MR1 and MR2 coverage were reported at 85% and 84%, respectively, in the 2023 Coverage Evaluation Survey, both below the herd immunity threshold of ≥95% [8, 22]. These gaps were further exacerbated during the 2024–2025 vaccine stockout, leaving children who aged into eligibility without immunization [14, 16].

Vitamin A supplementation in the six months before admission was reported by only 33% of the enrolled children. This was far below the nationally reported coverage of 73–74% for children under five [9] and suggests that children in the highest-risk strata are missing both routine vaccination and essential micronutrient prophylaxis [24]. Subclinical vitamin A deficiency (VAD) affects approximately 21% of preschool children nationally and rises to 38% in urban slum populations [30]. VAD compromises epithelial barrier integrity in the respiratory and gastrointestinal tracts, amplifying susceptibility to secondary infections responsible for most measles deaths [4, 23, 31]. The 2025 disruption of the national supplementation program removed a critical layer of individual protection at the precise moment when population immunity was already eroding [14, 16].

The observed nosocomial transmission rate of 9% must be understood in this context. During the surge, the pediatric ward at the FMCH managed over 200 daily admissions. Given that measles can be transmitted through minimal shared airspace, nosocomial spread under high-burden conditions is effectively inevitable [23, 26]. All 272 survivors (90%) were discharged with physician advice (DA) after a median hospital stay of four days. In South Asian public pediatric wards, early discharge during infectious disease surges is commonly influenced by caregivers' concerns about nosocomial cross-infection [32, 33]. Additional drivers include perceived clinical improvement as the rash resolves, extreme overcrowding that diminishes the perceived benefit of continued hospitalization, and substantial indirect costs associated with extended hospitalization [23, 33, 34].

4.1 Strengths and Limitations

The principal strengths of this study were its prospective design, consecutive enrollment of all 314 admitted cases during the peak surge month, standardized data collection using a pre-tested instrument administered within 24 hours of admission, and granular outcome ascertainment. However, several limitations should be acknowledged. First, all diagnoses were clinical, as laboratory confirmation was largely unavailable during the surge. Although the characteristic cephalocaudal rash and epidemic context reduce the likelihood of misclassification, a small proportion of cases may be indistinguishable from rubella, roseola, or enteroviral exanthems based on clinical grounds alone. Second, vaccination history was based solely on caregiver recall without card verification, which introduced potential recall bias. Third, outcome ascertainment was limited to the hospital ward; post-discharge events among patients discharged with physician advice or referred to higher-level facilities remain unknown, rendering the observed 3.2% CFR a conservative estimate of the true CFR. Fourth, as a single-center tertiary

referral study, the cohort is likely enriched for more severe cases and may not be generalizable to community or primary care settings in the future. Fifth, detailed anthropometric or nutritional data beyond admission weight were not collected, precluding the assessment of malnutrition as a potential mediator of complications.

5. Conclusions

The 2026 measles outbreak in Bangladesh disproportionately affected vaccine-ineligible infants and unvaccinated young children, highlighting the critical consequences of declining routine immunization and interrupted vitamin A supplementation. Hospitalized cases experienced high rates of pulmonary and extrapulmonary complications, and the in-hospital case fatality rate of 3.2% likely underestimates true mortality. Structural and programmatic gaps, including incomplete vaccination coverage, limited documentation, and crowded hospital conditions, facilitated community and nosocomial transmission. These findings underscore the urgent need for sustained high-coverage MR vaccination campaigns, strengthened vitamin A supplementation, robust infection prevention and control measures, and the implementation of electronic immunization records to protect vulnerable children and prevent future outbreaks.

Declarations

Ethics statement: This prospective observational study was approved by the Institutional Ethical Review Board (IERB) of Faridpur Medical College, Faridpur, Bangladesh (approval date: 29 March 2026). Written informed consent was obtained from the legal guardians of all enrolled patients, and the study was conducted in accordance with the Declaration of Helsinki and institutional ethical guidelines.

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Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

AFMP, MZH, and RB conceptualized and planned the study. AFMP and RB contributed to the manuscript writing and field implementation of the study. GUA, ASL, IH, MRM, MMMS, MLM, MLM, SAS, DY, SP, and MA were responsible for data collection, patient examination, pretesting, primary analysis, and manuscript review. RB, TT and SK contributed to data analysis and reporting. AFMP, MZH, and RB supervised the study and critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Data availability

The de-identified dataset supporting the conclusions of this article is available from the corresponding author upon reasonable request, subject to ethical approval.

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