

# Measles Infection and Vaccination Status against Measles in Children during 2019-2020: A Hospital Based Study in Chattogram

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## Abstract

**Background:** Despite widespread availability of a safe and cost-effective vaccine, Measles outbreak is reported from different regions of Bangladesh in the recent past. This study was aimed to identify the related features of Measles infection in children during the upsurge of Measles infection in Chattogram during 2019-2020, when Bangladesh was about to achieve Measles elimination.

**Materials and methods:** This prospective observational study included all the Measles infected children admitted in the Pediatric Ward of Chittagong Medical College Hospital, Chattogram during the period from September 2019-February 2020. In this hospital patients up to 12 years after neonatal period are admitted. Patients whose guardian did not give consent were excluded. Measles cases were diagnosed clinically according to case definition criteria by WHO. Demographic, clinical features, Measles vaccination status of both affected children & their mother and associated complications were recorded in a predesigned form. Data were analyzed and results were given in a tabulated form. The aim of this study was to evaluate the characteristics of Measles infection and their vaccination status in children during its upsurge in 2019-2020.

**Results:** Affected children 13(20%) were suffered in spite of vaccination. Among the 65 affected children 44 (67.6%) were below one year of age, youngest one was 2 months old. Male to female ratio was 1.8:1. 80% (n=52) children were not vaccinated, 35 of them not yet attained the age of vaccination. 17 children attained the age but vaccination was delayed due to cough and cold, fever, bronchopneumonia or Measles itself. Complications were common among them, Bronchopneumonia 47 (72.3%) and Purulent conjunctivitis 38 (58.5%). There was no case fatality.

**Conclusion:** Children are being affected by Measles before attaining the age of first dose of vaccination and incompletely vaccinated or unvaccinated children have a role in the upsurge of Measles.

**Key words :** Children; Measles infection; Vaccination status.

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## INTRODUCTION

Measles is a highly contagious serious infection which is preventable and can be eliminated by vaccine. Before the introduction of Measles vaccine in 1963 and widespread vaccination, major epidemics occurred worldwide approximately every 2-3 years and Measles caused an estimated 2.6 million deaths each year.<sup>1</sup> The Measles vaccine has changed the epidemiology dramatically and annual number of Measles cases has notably dropped.<sup>2</sup> Endemic transmission has been interrupted in many countries where there is widespread vaccine coverage. In Bangladesh, EPI

introduced one dose of Measles vaccine in 1989 for children aged completed 9 months with an intention that maternal antibody will not interfere acquired immunity at this age and will provide immunity to the maximum number of infants. To reach the goal of elimination of Measles, Bangladesh has taken several initiatives like introduction of second dose of Measles vaccine at 15 months of age (Since 2012) in the national immunization program, strengthening the case-based surveillance system and additional supplementary immunization activities. Though, Bangladesh has done well to reduce Measles cases and Measles-related deaths over the past decade, there are some issues that challenge to achieve the goal of elimination. Small outbreaks have occurred in Sylhet and Cox's Bazar districts on 2016. For such occurrence 9 children died in Sitakundu of Chattogram on 2017. The new challenge in Bangladesh is Rohingya refugees where 60% are children below the age of 18.

Annual incidence of confirmed Measles cases per million was increased alarmingly to 22 on 2017.<sup>3</sup> Recent reports also showed an increase in the number of Measles cases in several regions of the world, with a record number of cases in Europe in 2018.<sup>2,4-6</sup> A large proportion of cases (Range,15.9%–32.0%) were reported in infants <1 year of age, a group of them were at high risk for the development of Measles-related complications and mortality.<sup>7-11</sup>

Measles outbreaks can serve as a tracer indicator of health inequities and can help identify gaps in immunization programs and primary health care systems.<sup>12</sup> Measles outbreaks are occurring after years where countries have failed to achieve and maintain 95% coverage with two doses of Measles vaccine at national and subnational levels.<sup>13-16</sup> More evidence is needed to understand which population groups are affected and their reasons for sub-optimal vaccination. Research is necessary to identify gaps in program barriers to achieve Measles elimination. During the upsurge of Measles cases in 2019 number of Measles cases had increased at a great extent among the hospitalized patients in the pediatric department. Keeping in view the current scenario, this study was conducted among the Measles affected children. The aim of this study was to evaluate the characteristics of Measles infection and their vaccination status in children during its upsurge in 2019-2020.

#### METHODS AND MATERIALS

It was a prospective observational study conducted in Pediatric Wards of Chittagong Medical College Hospital from September, 2019 to February, 2020. In this hospital patients up to 12 years after neonatal period are admitted. Patients having signs and symptoms of Measles were included in this study. Measles was diagnosed clinically according to case definition criteria by World Health Organization.<sup>17</sup> Patients whose guardian did not give consent were excluded. After getting approval from ethical review committee of Chittagong

Medical College, information including age, sex, vaccination status, complication, outcome of children and age, vaccination status of mother were recorded in a predesigned form. Data were processed and analyzed and results were given in tabulated form.

#### RESULTS

Age range was from 2 months to 12 years. Among them 44 (67.6%) were below one year of age. 13 (20%) were below 6 months. Male to female ratio was 1.8:1 (Table I).

Among the Measles affected children 13(20%) suffered in spite of vaccination, 5 received 1 dose and 8 received 2 doses of MR vaccine. 52(80%) children were unvaccinated. Out of them 35 were underage for vaccination and remaining 17 cases attained the age (Table II).

Although attained the age of vaccination, 17 children were not vaccinated on time due to minor illness like cough and cold, low-grade fever, bronchopneumonia and unawareness (Table III).

Among the Measles affected children 9 had history of contact with Measles patient from family, hospital and community (Pie chart 1).

Age range of mother 16 to 40 years. Most of the mother (35.4%) of the Measles infected children reported to have a history of previous Measles infection and only 6 (9.2%) mothers reported to be vaccinated against Measles in their childhood (Table IV).

Bronchopneumonia 47 (72.3%) was the most common complications, followed by purulent conjunctivitis 38 (58.5%), deep and extensive oral ulcer 19 (29.3%), oral candidiasis 17 (26.2%).

Malnutrition was present in 30 (46.2%). Mortality was nil. (Table V).

**Table I** Age and sex distribution of the Measles cases (n=65)

Variables	Category	Frequency (%)
Age, month		
	0-6 months	13 (20%)
	>6 – 9 months	22 (33.8%)
	>9-12 months	9 (13.8%)
	>12-60 months	11 (16.9%)
	>60 months	10 (15.4%)
Sex		
	Male	42 (64.6)
	Female	23 (35.4)

*Source : CMCH Records.*

**Table II** Measles/ MR vaccination status of the Measles cases (n=65)

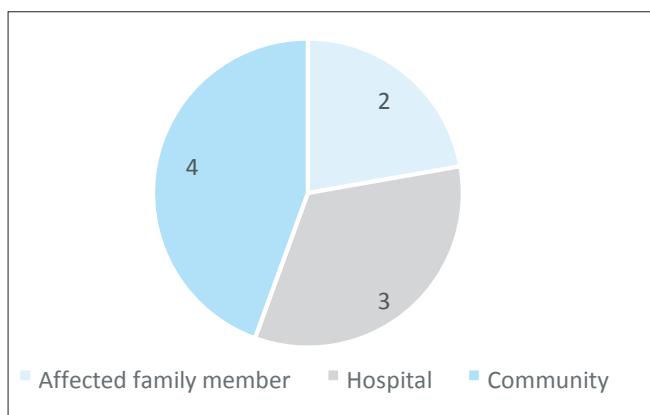
MR vaccination status	Number of cases
Before attainment of vaccination age	35(53.8%)
After 1 dose of vaccination age	5(7.7%)
After 2 dose of vaccination age	8(12.3%)
Never vaccinated	17(26.1%)

Source : CMCH Records.

**Table III** Reasons of non-vaccination (n=17)

Reasons of non-vaccination	Number of children (%)
Cough and cold	5(29.41)
Fever	5(29.41)
Bronchopneumonia	3(17.65)
Unaware	4(23.53)

Source : CMCH Records.

**Pie chart 1** Children having history of contact with Measles cases (n=9)**Table IV** Age and vaccination status of the mothers of the Measles cases (n=65)

Variables	Category	Frequency (%) / Mean age (Years)
Age, years	≤20 years	11 (16.9)
	21-30 years	35 (53.8)
	>30 years	19 (29.2)
	Mean age	26.9(±6.025)
Measles status of mother	Vaccinated against Measles	6 (9.2)
	Previously affected	23 (35.4)
	Not known	20 (30.8)
	None	16 (24.6)

Source : CMCH Records.

**Table V** Complications of Measles (n=65)

Complications	Frequency (Percentage)*
No	3 (4.6)
Bronchopneumonia	47 (72.3)
Purulent conjunctivitis	38 (58.5)
Deep and extensive oral ulcer	19 (29.3)
Oral candidiasis	17 (26.2)
Clouding of cornea	2 (3.1)
Acute watery diarrhea	2 (3.0)
Encephalitis	1 (1.5)
Malnutrition	30 (46.2)
Mortality	0

Source : CMCH Records.

## DISCUSSION

This study evaluated the age distribution and Measles vaccination status of the Measles affected children and their mother during the period of present upsurge of Measles cases. Among the admitted Measles cases around 54% infants (35/65) were below 9 months of age, 13 (20%) were below 6 months and the youngest one was 2 months old. In a recent study from Bangladesh found, 36% of infant had measles before 8 months of age.<sup>18</sup> Other studies also suggested that Measles tends to affect the younger infants worldwide particularly in outbreak settings due to contact with Measles cases in low coverage area.<sup>8,19,20</sup>

Unfortunately, 80% (52) affected children were unvaccinated. Most of them 35 (54%) have not attained the age of vaccination. There is 13 (20%) cases aged below 6 months. During 2011-2016, cases <6 months age comprised 4.3% of all confirmed cases in European regions/South East Asian regional countries.<sup>21</sup> According to recommendation during an outbreak setting, a supplementary dose which would be considered as zero dose may be given in addition to 2 EPI scheduled doses to the infants of 6 month or below to prevent Measles infection at this age.<sup>22</sup> ‘Cases were more likely than controls to be non-immunized’-stated by Akramuzzaman SM et. al<sup>23</sup>

Among the unvaccinated child, 26% (17) attained the appropriate age for vaccination. Many of them were suffering from minor illnesses and vaccination was deferred. In some cases, parents were not aware of timely vaccination. This observation is in accordance with the study by Rahat et al.<sup>18</sup> These children could be protected if they were vaccinated on time.

In this study, 13(20%) children were affected by Measles despite vaccination, Among the affected children, 8 were fully immunized by 2 doses and 5 children got one dose. Measles infection after immunization is thought to largely arise from vaccine failure. Reported primary vaccine failure is 5%–10% after 1 dose and 1% after a second dose.<sup>24</sup> The causes may be

failure of the cold chain, inadequate viral dose, and host immune factors, such as persistence of passively acquired maternal immunity.<sup>25</sup> Secondary vaccine failure may develop after an initial but inadequate immune response to vaccination and reported in 5% of children after the age of 10 to 15 years.<sup>24</sup> Erdman also observed Measles infection with a prior history of vaccination.<sup>26</sup> Higher vaccine failure i.e. 20% was observed in this study.

Previous study observed that seroconversion is slightly lower in children who received the first dose of Measles vaccine before 15 months of age (87% at 9mo, 95% at 12 mo and 98% at 15 mo). As in our country 1<sup>st</sup> dose is given at 9 months of age, according to the recommendation 2 additional doses at the age of 12-15 mo and 4-6 yr may give better protection.<sup>27</sup>

2 children were vaccinated according to previous schedule when 2<sup>nd</sup> dose of MR was not introduced in the EPI schedule. As per recommendation a 2nd dose likely to be considered for these older children.

Regular campaigns for a period of at least 3 consecutive years is needed to achieve high population immunity with vaccination coverage >90-95% for both 1<sup>st</sup> and 2<sup>nd</sup> dose.<sup>28</sup>

In this study 9 (13.8%) patient had positive contact history from different sources which is similar to the observation by Akramuzzaman SM et al.<sup>23</sup> Appropriate contact management is difficult in our hospital setting due to bed sharing. Exposed individual especially infants younger than 6 months of age needed to be protected from infection either by vaccine administration within 72 hour of exposure or with Ig within 6 days of exposure.<sup>27</sup>

Recent studies revealed that protection from maternal antibody is short lived and wanes much sooner before 6 month of age.<sup>29,30</sup> Leuridian et al. reported that positive antibody level is detected in only 7.14% infants at 8 months of age.<sup>30</sup> Other studies also reported that maternal antibody formed by maternal infection persist in infant for longer duration than antibody formed by maternal vaccination.<sup>16</sup> In our study, mother's age suggests that most of them would have the vaccine as per national EPI schedule. Due to lack of proper information, it was not possible to assume the expected immunization status of mother whether it is vaccine induced or infection induced. Measles infection in infants below 9 month indicate the inadequacy of maternal antibody to give protection. Studies showed that the maternal antibody level is significantly higher in cord blood of the baby whose mother were revaccinated before pregnancy.<sup>18</sup> So revaccination before pregnancy at child bearing age may be considered in our country to prevent infection in the infant who has not attained the age of vaccination.<sup>16</sup>

Bronchopneumonia was the most common complication (72.3%), followed by Purulent conjunctivitis (58.5%), Malnutrition (26.2%) deep and extensive oral ulcer (29.3%), oral candidiasis (26.2%). According to Rahat et al. pneumonia was the most common complication (78.13%), followed by oral ulcer (65.62%) and diarrhoea (40.63%).<sup>17</sup> Different study showed otitis media as an important complication of Measles.<sup>19,20</sup> In this study only one case of encephalitis was observed but it was not possible to confirm through the detection of anti-Measles antibodies in cerebrospinal fluid of the patient.

During the year 2017 there was a small outbreak of Measles in Sitakundu, Chattogram where some families were not brought under the coverage of immunization due to their custom. There 9 children died of Measles who were also suffering from malnutrition. In this study 30 children were malnourished. There was no death in this study. Timely intervention reduced the disease severity and accelerated favorable outcome.

In endemic areas more than 95% vaccine coverage is required to interrupt transmission of Measles.<sup>5</sup> So, routine immunization with maintenance of proper cold chain and timely instituted outbreak immunization response can halt Measles progression.

## LIMITATIONS

The study included small number of cases which makes it difficult to generalize the results. Moreover, Measles cases were not confirmed by quantitative determination of antiMeasles antibodies (IgM) in patients' sera.

## CONCLUSION

A number of children are being affected by Measles before attaining the first dose of vaccination and they develop complications. Considerable proportions of incompletely vaccinated or unvaccinated children have led to the upsurge of Measles in Bangladesh with reported close-to-elimination rates.

## RECOMMENDATIONS

To avoid future Measles outbreaks, high vaccination coverage should be achieved. As well as closing immunity gaps in the population by ensuring the existing recommendations and high-quality Measles surveillance. More studies are imperative in order to explore the role of immune paresis in Measles and the scope of better outcome by rescheduling the existing vaccination schedule against Measles.

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