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# PREVALENCE OF IMMUNIZATION STATUS, COMPLICATIONS AND OUTCOME IN CHILDREN ADMITTED WITH MEASLES TERTIARY CARE HOSPITAL

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**Abstract**

**Background:** The measles is an extremely infectious viral exanthema, caused by Morbilivirus belonging to the family Paramyxoviridae. Prior to the introduction of the measles vaccine, the disease caused millions of fatalities annually around the globe.

**Objective:** To determine the Prevalence of Immunization Status, Complications and Outcome in Children Admitted with Measles tertiary care hospital

**Methodology:** This cross sectional study was conducted at the department of Pediatrics, Combined Military Hospital, Abbottabad - Pakistan. The study duration was of six months from 1st January 2023 to 30th June 2023. A total of 340 patients of either sex from the ages of 3 months to 13 years who presented with measles or its complications were included. Detailed history and physical examination was done and findings entered in a proforma that had been prepared after thorough research of literature. Immunization status of the patients was checked by examining the National Expanded Program on Immunization (EPI) card where available or parental enquiry if EPI card was not available. All the relevant investigations like complete blood count, serum electrolytes and X-ray chest were carried out besides history and clinical examination. Cerebrospinal fluid examination was done where needed. Data regarding age, sex, immunization status, nutritional status, complications and outcome was entered on MS Excel sheet and analyzed by using SPSS version 22 for windows.

**Results:** A total of 340 patients were admitted during the study period with measles and its complications. Male were 193 (56.76%) and 147 (43.24%) were female patients. Based on

vaccination status, Complete vaccination against measles was present in 193 (56.76%) patients, 79 (23.24%) patients were Unvaccinated while partial vaccinated patients were 68 (20%). As expected predominantly pneumonia was the complication in 153 (45%) patients followed by and gastroenteritis in 72 (21.18%) patients While 88 (25.88%) patients had no complications. In terms of outcome, out of 340 patients 8 (2.35%) patients expired. Pneumonia was the leading cause of mortality. Majority of patients, 326 (95.88%) were discharged from Hospital within a week.
**Conclusion:** Our study concludes that a significant number of children are being admitted with measles in the hospitals of our country. A large number of patients developed the disease despite being vaccinated with two doses. Also, a large proportion was either unvaccinated or partially vaccinated. Pneumonia and gastroenteritis are common complications with a high mortality.

**Key words:** Prevalence; Immunization Status; Complications; Outcome; Measles

## Introduction

The measles is an extremely infectious viral exanthema, caused by Morbilivirus belonging to the family Paramyxoviridae. It is capsulated, single stranded RNA virus with 100-300nm diameter (1). Prior to the introduction of the measles vaccine, the disease caused millions of fatalities annually around the globe. In 2008, an estimated 164000 deaths were attributed to measles. The measles vaccine has significantly reduced morbidity and mortality associated with this highly contagious disease. However, there remain significant obstacles to measles control and eventual elimination (2). An infection with measles can result in a variety of complications, including diarrhea, otitis media, pneumonia, CNS infections and sequel, blindness, and hearing losses. Measlesrelated morbidity and death is worse in poor nations due to malnutrition, huge populations, inaccessibility to health care, and lack of vaccination. The CNS is affected by the measles virus both during active infection and after the illness has become inactive. Primary measles encephalitis, subacute sclerosing panencephalitis, measles inclusion body encephalitis and acute post infectious measles encephalomyelitis are the CNS sequel. Neuropathogenesis, immune condition of the host, and clinical situations vary, but all entail brain-virus and immune interactions that result in severe morbidity and mortality, as described in the following section (3). The incidence of confirmed measles infections in Pakistan increased from 24.6 per million cases between 2000 and 2009 to 80.4 per million between 2010 and 2018. Approximately 30-40% of measles patients experience certain complications. Almost every organ in the body is destructed by measles due to damage to mucosal membranes and transitory and profound immunosuppression. This may persist for months following measles, causing complications and may prove fatal (4). Nonimmunization, overcrowding, malnutrition, immunological deficiency, vitamin A deficiency, infection at a young age, lack of healthcare facilities, severe consequences of measles viz pneumonia and encephalitis, are among the prominent risk factors. Although measles is ubiquitous in Pakistan, the country has seen two outbreaks in the last five years, in 2013 and 2017; numerous hospitalized children with complex measles had significant fatality rates (5-6). During 2000-2016 measles vaccine prevented an estimated 20.4 million deaths from occurring. Global measles deaths have decreased by 84% from an estimated 550100 in the year 2000 to 89780 in 2016.The measles vaccine has been in use for over 50 years. It is safe effective and inexpensive. The measles vaccine is often incorporated with the rubella and/or mumps vaccines. It is equally effective in the single or combined form. Two doses of vaccine are recom- mended to ensure immunity and prevent outbreaks as about 15% of vaccinated children fail to develop immunity from the first dose. In 2016 about 85% of the worlds' children received one dose of the measles vaccine by their first birthday through rou- tine health services as compared to 72% in the year 20004.

Pakistan has one of the highest burdens of measles and measles-related deaths in the world. Measles is endemic to Pakistan, with periodic epidemics occurring every two to three years5. The proportion of incompletely immunized children in Pakistan varies from 37-58%, and this has recently resulted in outbreaks of measles (6). In the year 2012, 14000 Pakistani children were reported with measles.

The incidence of measles is increasing even after the use of vaccine for its prevention. It is important to understand the role of "failure to seroconversion" after vaccination and failure of secondary vaccine "waning immunity after seroconversion "for evaluation of measles control programs in Pakistan (7). Countrywide measles outbreaks with over 15,000 cases and several hundred deaths in 2012- 13 underscore sub-optimal Expanded Programme of Immunization (EPI) performance in delivering routine immunizations (8). Pakistan as a member of Eastern Mediterranean Region (EMRO) adopted a resolution in 1997 to eliminate measles from Pakistan in 2010 (9). Low coverage and poor vaccine efficiency is strongly associated with outbreaks of measles and its complications and hence high morbidity and mortality (10). Measles Supplementary Immunization Activities in 2015 achieved 97 per cent coverage, while 61.4% of one-year olds received their first measles immunization, thus helping protect more Pakistani children against this potentially deadly but preventable disease (11). However, despite extensive supplemental immunization campaign, measles outbreaks continue to occur in Pakistan. It is there- fore, important to determine the effectiveness of these measles Supplementary Immunization Activities (SIA) by determining what proportion of children is still seronegative for measles and hence susceptible to this disease. If a significant proportion of children are found to be susceptible, then it would indicate that these SIA against measles need to be repeated and made more effective (12). Adoption of WHO recommended strategies could lead to measles elimination within a short period of time as the experience in Korea (13) and the Americas has indicated (14).

This study was carried out with the objective of evaluating the vaccination status of children hospitalized with measles. Furthermore, the aim was also to determine the frequency of occurrence of measles and its complications in the children. As measles and its complications, still present as a fatal illness even among vaccinated children in our country and epidemics of the disease have been frequently occurring especially over the past few years therefore, keeping in view the magnitude of the problem this study was conducted.

**Materials and methods**

This cross sectional study was conducted at the department of Pediatrics, Combined Military Hospital, Abbottabad - Pakistan. The study duration was of six months from 1st January 2023 to 30th June 2023. A total of 340 patients of either sex from the ages of 3 months to 13 years who presented with measles or its complications were included with non-probability convenient sampling technique. Children less than 3 months of age and more than 13 years old, those with congenital anomalies and chronic medical illnesses were excluded from the study. The sample size estimation was done using the formula $n= (Z2\ P\ (1P))\ /e^2$ for an average measles prevalence of 71%, with margin of error 5%, on a 95% confidence interval (CI).

All children who were hospitalized because of measles and its complications were included in the study. As virtually every measles infection becomes clinically apparent, resulting in some combination of cough, coryza, conjunctivitis, high fever and erythematous maculopapular rash therefore measles was diagnosed in children with these signs and symptoms (15). Pneumonia was diagnosed by using integrated management of childhood illness (IMCI) (16) criteria of increased respiratory rate or infiltrates on chest X-ray.

Central nervous system was considered involved if there was lethargy, unconsciousness, fits, and neurological deficit. Other problems of measles like diarrhea, stomatitis, eye complications, febrile fits and otitis media were also notified in case sheets. Informed consent was obtained from parents or caregivers of all eligible patients prior to data collection and confidentiality of all patients was ensured by a coding system. Detailed history and physical examination was done and findings entered in a proforma that had been prepared after thorough research of literature. Immunization status of the patients was checked by examining the National Expanded Program on Immunization (EPI) card where available or parental enquiry if EPI card was not available. All the relevant

investigations like complete blood count, serum electrolytes and X-ray chest were carried out besides history and clinical examination. Cerebrospinal fluid examination was done where needed. All patients were managed according to the standard protocol of the hospital.

Malnutrition was assessed as per WHO charts and standard deviation was determined for weight for height. The patients were divided into well nourished, moderately malnourished (Weight for Height >3SD) and severely malnourished (Weight for Height <3 SD) or edematous malnutrition.

Data regarding age, sex, immunization status, nutritional status, complications and outcome was entered on MS Excel sheet and analyzed by using SPSS version 22 for windows. The results were expressed as frequencies and percentages for qualitative data and mean and standard deviation for quantitative data.

**Results**

A total of 340 patients were admitted during the study period with measles and its complications. Male were 193 (56.76%) and 147 (43.24%) were female patients (Figure 1). Most of the patients were in the age group 1-3 years 147(43.24%), 68(20%) were between 7-11 months, 44 (12.94%) were between 4-6 years, 34 (10%) were between 3-6 months, 24 (7.06%) were between 7-9 years, 23 (6.76%) were between 10-13 years. (Figure 2) Based on vaccination status, Complete vaccination against measles was present in 193 (56.76%) patients, 79 (23.24%) patients were Unvaccinated while partial vaccinated patients were 68 (20%). (Figure 3) Based on appearance of rashes, rashes between 1-4 day of illness was observd in 279 (82.06%) patients while rashes between 5-12 days were observed in 61 (17.94%) patients. (Figure 4).

Table 1, shows the complications seen in children with measles. As expected predominantly pneumonia was the complication in 153 (45%) patients followed by and gastroenteritis in 72 (21.18%) patients While 88 (25.88%) patients had no complications. In terms of outcome, out of 340 patients 8 (2.35%) patients expired. Pneumonia was the leading cause of mortality. Majority of patients, 326 (95.88%) were discharged from Hospital within a week.

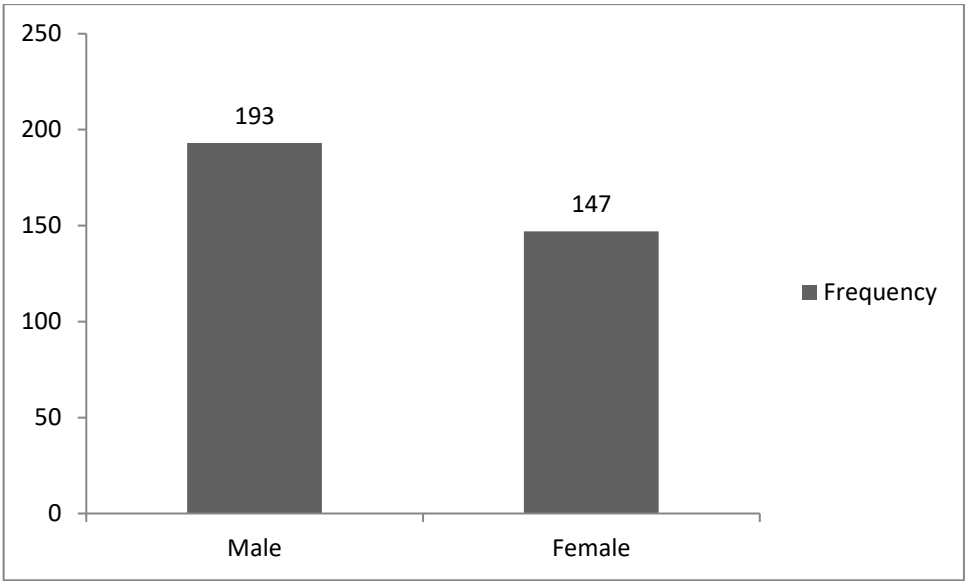


**Figure 1: Gender wise distribution of patients**

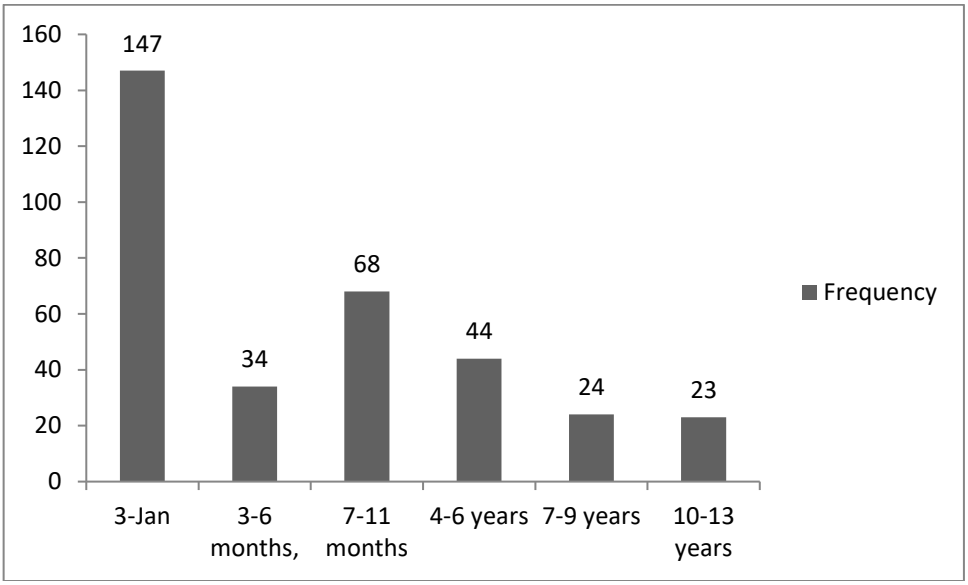


**Figure 2: Age wise distribution of patients**

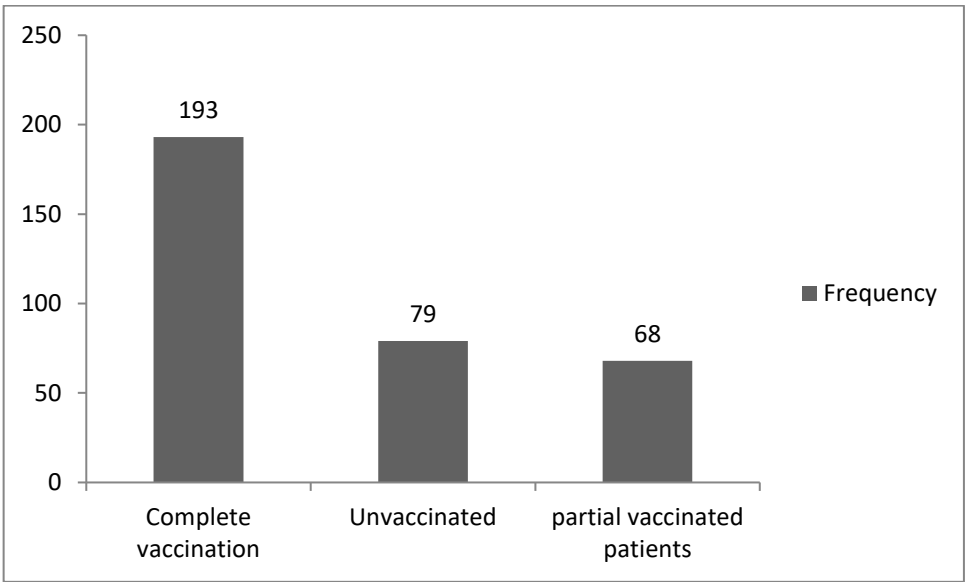


**Figure 3: Vaccination status of the patients**

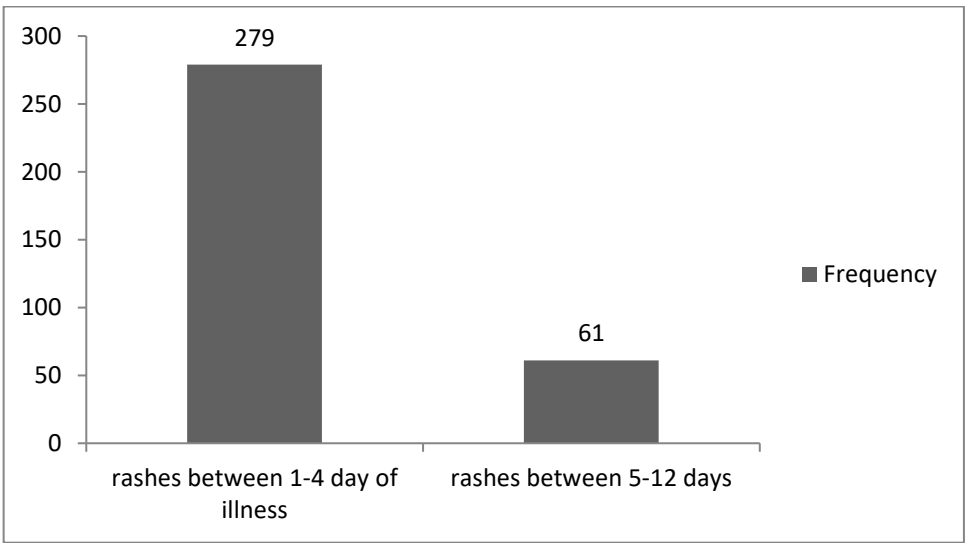


**Figure 4: Distribution of patients based on appearance of rashes**

**Table 1: Clinical complications of measles cases**

| Characteristics | Frequency (%) |
|---|---|
| Pneumonia | 153 (45%) |
| Gastroenteritis | 72 (21.18%) |
| Febrile fits | 00 (00%) |
| Croup | 00 (00%) |
| Otitis media | 5 (1.47%) |
| Conjunctivitis | 00 (00%) |
| Encephalitis | 00 (00%) |
| PCM | 00 (00%) |
| Pneumothorax | 00 (00%) |
| Bronchiolitis | 5 (1.47%) |
| Gastroenteritis + pneumonia | 8 (2.35%) |
| Gatroenteritis+otitis media | 9 (2.64%) |
| No complication | 88 (25.88%), |

## Discussion

Measles epidemics continue to occur time and again in Pakistan resulting in significant morbidity and mortality. In 2013, mortality from measles was nearly 0.14 million-worldwide (17). Since the year 2012 an increasing number of outbreaks of measles have started occurring in Pakistan. A number of factors contribute to the resurgence of measles in the developing part of the world. These include improper vaccine storage, low vaccination coverage, malnutrition, lack of proper health infrastructure and failure to administer a second dose of measles vaccine (18).

In the present study, Most of the patients were in the age group 1-3 years 147(43.24%), 68(20%) were between 7-11 months, 44 (12.94%) were between 4-6 years, 34 (10%) were between 3-6 months, 24 (7.06%) were between 7-9 years, 23 (6.76%) were between 10-13 years. These findings are similar to a local study from Karachi, which reported 11% measles cases to be less than 9 months (19). Another study from Pakistan revealed a maximum number of children with measles to be between 6 months to 3 years of age (20). Also, in a study conducted in Iran in 2015, 46% of the cases were observed to be under 1 year of age (21). A similar study on measles conducted in Nigeria (22) revealed that the infection rate for measles increased across the age groups up to the age of 5 years after which there was a decline in the number of infected children. In the present study too, measles infection was observed to be common in children less than 5 years of age as compared to older children. This is explained by the fact that children in this age group have a high probability of being exposed to the virus due to the endemic nature of the virus in developing countries. In children older than 5 years, life long immunity is conferred in most children thereby making those younger than 5 years old, the target population for measles infection. Furthermore, the increasing occurrence of measles in children less than 9 months of age can be explained by the fact that maternal antibodies against measles provide protection to the infant only up to the first 3 months of life while the first dose of the vaccine is administered at 9 months, thus increasing the susceptibility of the infant to acquire the disease (23). A study from Netherlands indicated that the duration of immunity in infants due to maternal antibodies against measles was until only 3.5-5.5 months after birth, thus making them vulnerable to contract the disease before 9 months of age (24).

In the present study Male were 193 (56.76%) and 147 (43.24%) were female patients. Similar observations have also been made by a few other local studies (20). Male preponderance of measles cases can be explained by the fact that medical advice is sought earlier for males as our society gives the male child preferential treatment. Also, female children have a stronger immune system than males who are more susceptible to infections.

WHO recommends vaccination with two doses of measles vaccine and vaccination coverage up to and above 95% with both doses (25). Despite the avail- ability of free of cost vaccination facility by

the EPI program, a large number of children in our country remains unvaccinated or partially vaccinated. This fact is reflected by the results of the present study, as it was observed that Based on vaccination status, Complete vaccination against measles was present in 193 (56.76%) patients, 79 (23.24%) patients were Unvaccinated while partial vaccinated patients were 68 (20%). This finding is consistent with the observations made by a study from Peshawar where only 52% of the children with measles were completely vaccinated (26). Similarly, according to another local study (19), a large majority (65.5%) of the children were unvaccinated the reason was primarily attributed to a lack of awareness, inaccessibility of health services, false beliefs like religious prohibitions and superstitions regarding vaccines as a cause of infertility in children. These findings there- fore, highlight the significance of conducting mass media campaigns to create awareness among the masses regarding the importance of vaccination. The occurrence of measles in completely immunized children indicates vaccine failure. This could be due to improper vaccine storage or inability to maintain the cold chain. This observation is supported by a study from Lasbela where vaccine failure rate was reported to be over 50% (27). A study from Karachi by Sheikh et al. reported immunization coverage for measles to be 90% but measles antibodies to be present in only 55% of the vaccinated children (28), thus indicating inadequate seroconversion due to immunization failure.

It was also noted in the present study that 80% of the measles cases that were admitted in a private hospital were vaccinated with two doses of measles vaccine while only 20% of cases admitted in a public-sector health facility were completely vaccinated. This finding indicates that the private sector is contributing significantly to immunisation service delivery in developing countries. Another lo- cal study29 has made similar observations with a very large proportion of unvaccinated (60%) children admitted with measles in a public-sector hospital. This suggests that the health infrastructure of public sector especially the EPI needs to be strength- ened.

In this study it was also observed that Based on appearance of rashes, rashes between 1-4 day of illness was observd in 279 (82.06%) patients while rashes between 5-12 days were observed in 61 (17.94%) patients. As expected predominantly pneumonia was the complication in 153 (45%) patients followed by and gastroenteritis in 72 (21.18%) patients While 88 (25.88%) patients had no complications. More or less similar findings have been reported by a few other studies as well (26). However, in a study from Lahore (29), encephalitis was seen in a much higher percentage (34%) of children with measles and the same study also reported a higher mortality (16%) as compared to the present study in which the overall mortality rate was 8 (2.35%). Furthermore, another study from Peshawar (30), Pakistan also reports a much higher mortality of 11% especially in those measles cases with encephalitis. These observations signify the importance of increasing vaccination coverage on an emergency basis in order to prevent epidemics of the disease in future.

There are however, certain important limitations of this study and the results of this study need to be interpreted in the light of these limitations. The study being cross-sectional is not truly representative of the entire population. Since the occurrence of measles in vaccinated children could be due to vaccine failure the results of this study, however, can- not establish whether the vaccine failure was primary or secondary, as serological testing was not undertaken. Also, being good indicators of the disease, the diagnosis of measles was made on the basis of clinical signs and symptoms only and not serological testing. The diagnosis can therefore be affected by the physician's experience and be confused with other diseases causing fever and skin rash. Another limitation was that only a few patients had a vaccination card with them therefore, in majority of the patients verbal parental reporting of vaccination status was done. Hence, further multicenter studies with measles antibody status need to be done.

In order to eradicate this highly contagious disease it is recommended that the EPI program be strengthened and made accessible to the masses especially in the rural areas. Also, mass campaigns to increase awareness among the masses about the importance of immunization be launched more frequently. Apart from routine vaccination campaigns, supplementary immunization activities should be carried out from time to time and should target all children regardless of their previous

measles vaccination or disease status. Catch-up immunization campaigns targeting children aged 8 months to 12 years be launched. Since measles in less than 6 months old infants has been frequently reported by local studies, therefore, it is necessary to administer the first dose of measles vaccine earlier than 9 months of age. Therefore, lowering the age at administration of the first dose of measles vaccine may be recommended.

It is important to create public awareness about the importance of double dose of measles vaccine and to achieve two-dose vaccination coverage to more than 95%. Furthermore, reaching and maintaining measles elimination will require strong political commitment and strengthening of surveillance, so that all suspected cases are re- ported. There is also a need for stricter enforcement of rules requiring assessment of immunization status at school entry. There is a need to conduct further research studies to identify factors leading to vaccine failure and to develop better next-generation vaccines which are more immunogenic and heat stable than the current vaccine.

## Conclusion

Our study concludes that a significant number of children are being admitted with measles in the hospitals of our country. A large number of patients developed the disease despite being vaccinated with two doses. Also, a large proportion was either unvaccinated or partially vaccinated. Pneumonia and gastroenteritis are common complications with a high mortality.

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