

Post-COVID-19 Resurgence of Measles in Ahmedabad: A Study of 657 Cases in a Tertiary Care Center

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ABSTRACT

Aims and background: Measles has made an unwelcome comeback as a resurgent infection and India is one of the worst-hit countries. The present study was undertaken to study clinicodemographic profile of measles and the reason for nonvaccination due to COVID-19 lockdown as risk factor for recent outbreak of measles.

Materials and methods: This was a hospital-based cross-sectional study carried out in the pediatric ward of Shardaben Hospital, which is a tertiary care center. Patients between 1 month and 12 years of age admitted to hospital between April 2022 and January 2023 were included in the study. Measles was clinically defined according to the World Health Organization (WHO) criteria. Detailed history was taken, physical examination was done, and the outcome was studied. The data was analyzed and descriptive statistics were presented using percentages.

Results: It was observed that out of the total admitted cases 4,893, there were 657 cases of measles with prevalence is 13.4%. From the table, it is suggested that highest attack rate of measles is 63.92% and more in children between 9 months and 5 years. Maximum number of cases is 67.57%, found in lower and lower middle socioeconomic classes and also 76.56% in urban slums. Measles is more in people residing in overcrowding, 37.2%. Number of cases of measles peaked in October (134 cases) and declined in January (34 cases). It was found that 78.34% of cases are partially or unvaccinated. Around 21% cases had documented history of having taken two doses of measles-containing vaccine. COVID-19 pandemic and its lockdown were responsible for 67.2% of cases of nonvaccination. Other reasons not to be vaccinated are also mentioned. Postmeasles complication like pneumonia is seen in 384 patients, out of which 74.2% were unvaccinated or partially vaccinated. Majority of the patients had either moderate acute malnutrition (264 cases) or severe acute malnutrition (371 cases).

Conclusion: There is an urgent need to strengthen not only our Measles–Rubella (MR) vaccine drive but also overall routine immunization; otherwise, another vaccine-preventable disease like whooping cough may stare at us in 2023 too.

Clinical significance: Resurgence of measles in Ahmedabad was restricted to malnourished, unvaccinated/partially vaccinated, and poor children living in slums/chawls with overcrowding. Intensified MR vaccination campaign in these pockets seems to be a sure-shot way to prevent measles outbreaks.

Keywords: Coronavirus 2019 pandemic, Complication of measles, Malnutrition, Measles, Measles–Rubella campaign, Reasons for unvaccination.

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INTRODUCTION

Measles has made an unwelcome global resurgence, and the worst of it seems to be happening across India.

During the COVID-19 pandemic, measles cases in India dropped to the lowest in many years, with 5,700 cases in 2021 and 5,604 in 2020, as compared to 30,168 cases in 2015.¹ Thanks to the success of robust MR vaccination campaign aided by the fact that the airborne viral infection could not spread with children staying at home during the pandemic, measles elimination seemed an achievable target.

According to the Centers for Disease Control and Prevention, United States (US), India had the largest number of cases in the world between April and September 2022, with Pakistan seventh on the list and the US had 33 cases.² The ambitious 2020 deadline for measles elimination remained a pipedream. Every month, about four to five lakh children are born in India. Even if we missed vaccinating for a few months, the number of unvaccinated pools is huge; about two crore children missed measles shot in India in 2021 alone in India.³

The increase in measles incidence is postulated to be caused by decreasing vaccination coverage worldwide, and this event has triggered public and scientific interest.

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Postulated reasons for resurgence of measles after quietening of COVID-19 pandemic:

- Routine vaccination took a massive beating during the lockdown period.
- Social distancing and masking might have reduced exposure during the pandemic, perhaps the reason behind low transmission in the past 2 years.

Over the past few months, several states in India, notably Maharashtra and Kerala, have seen outbreaks of hundreds of cases of measles. As of 12th December 2022, Maharashtra recorded 199 confirmed cases of measles and 19 deaths. States like Gujarat, Jharkhand, and Bihar have also seen an upsurge in cases.⁴

Thus, with vaccination rates down by 42% since the start of the pandemic, with increased strain on healthcare and increasing malnutrition, the measles situation threatens to spiral out of control.⁵ The present study was undertaken to study the clinicodemographic profile and outcome of measles infection in the post-COVID-19 era and to study the impact and reason for nonvaccination due to COVID-19 lockdown as a risk factor for recent outbreak of measles in measles-hit areas of Ahmedabad.

MATERIALS AND METHODS

This was a hospital-based cross-sectional study carried out in the pediatric ward of Shardaben Hospital, which is a tertiary care center in Saraspur, Ahmedabad. Patients between 1 month and 12 years of age admitted to the pediatric ward between April 2022 and January 2023 with clinically diagnosed measles were included in the study. Anonymity of patients was maintained at all stages. Measles was clinically defined according to WHO criteria.

Any person in whom a clinician suspects measles infection:

- Fever with maculopapular rash.
- Either cough/coryza (running nose) or conjunctivitis (red eyes).⁶

Those patients whose family members did not give informed consent were excluded from the study.

Informed consent was obtained from relatives of the cases. The cases were then studied in detail, including detailed history in the form of demographic data, clinical presentation, vaccination status, reasons for nonvaccination, and history related to complications. Detailed physical examination was done and the outcome was studied. Few definitions used in the study:

- Socioeconomic status was defined according to modified Kuppuswamy scale.⁷
- Overcrowding was defined using WHO standards.⁸
- Unvaccinated children were considered those who had received not a single dose of measles-containing vaccine. Partial vaccination was defined as children who had taken one dose of measles-containing vaccine. The vaccination data was checked using immunization cards, and in cases where they were not available, history was taken.

Standard WHO criteria were used to define moderate acute malnutrition and severe acute malnutrition.

The data was tabulated in an Excel sheet and appropriate statistical analysis was done, including percentage calculation and *p*-value, using standard statistical software.

RESULTS

It was observed that out of the total admitted cases 4,893, a total of 657 patients had measles at presentation, accounting for a prevalence of 13.4%. The highest attack rate was seen in children in age-group of 9 months–5 years, but even children <9 months accounted for 9.89% of the total cases. Female children (50.68%) were marginally more affected than male children (49.31%) (Table 1).

It was found that maximum numbers of measles cases were found in lower middle and lower socioeconomic class households

Table 1: Distribution of cases based on age, gender, and socioeconomic class

Parameter	No. of cases (%)
Based on age	
<9 months	65 (9.89)
9 months–5 years	420 (63.92)
>5 years	172 (26.17)
Total	657
Based on gender	
Male	324 (49.31)
Female	333 (50.68)
Total	657

Table 2: Socioeconomic status and area of residence

Parameter	No. of cases (%)
Socioeconomic status	
Upper class	39 (5.9)
Upper middle	57 (8.6)
Middle class	117 (17.8)
Lower middle	190 (28.91)
Lower class	254 (38.66)
Area of residence	
Rural	154 (23.43)
Urban chawls	503 (76.56)
Urban high-rise buildings	0

(67.57%). Also, the attack rate was highest in urban slums (76.56%) (Table 2).

In the present study, measles was always associated with overcrowding, with maximum number of cases occurring in people residing in <50 sq feet dwellings (37.2%) (Table 3). Around 20% of cases lived in houses larger than 100 sq feet.

The number of cases peaked in October (134) and then declined dramatically in January (34) (Table 4). Thanks to the MR vaccination drive in 6 months–5 years age-group undertaken by Amdavad Municipal Corporation in measles-hit pockets of Ahmedabad.

It was found that almost 78.34% of cases of measles occurred in children who were either partially vaccinated or unvaccinated for measles-containing vaccines or had no documentation of vaccination. A mere of 21% cases had documented history of having taken two doses of measles-containing vaccine (Table 5).

Out of a total of 357 cases who were either partially vaccinated or unvaccinated, a variety of reasons could be elicited from history, the foremost one being nonvaccination due to COVID-19 pandemic and its subsequent lockdown (67.2%). Other factors were forgetting the dose, being out of station, fear of side effects, and others (Table 6).

Out of the 657 patients, one patient expired during hospitalization due to measles-related complications. Postmeasles pneumonia as a complication occurred in a total of 384 patients, out of which 74.2% were unvaccinated or partially vaccinated. (*p*-value < 0.00001 at confidence interval (CI) 95% by applying 2 × 2 Chi-squared test). Similarly, prolonged hospital stay was also significantly higher in unvaccinated or partially vaccinated children (*p*-value < 0.00001 at CI 95%) (Table 7).

Majority of the patients had either moderate acute malnutrition or severe acute malnutrition (Table 8).

Table 3: Overcrowding and measles

Total area	Maximum number of persons recommended	Actual number of persons residing	Cases of measles (%)
110 sq feet	Two	5 and half	66 (10)
90–100 sq feet	One and half	4 and half	75 (11.41)
70–90 sq feet	One	3 and half	98 (14.91)
50–70 sq feet	Half	2 and half	173 (26.33)
<50 sq feet	Nil	2 and half	245 (37.2)

Table 4: Month-wise distribution of measles cases

Month	Number of cases
April	35
May	43
June	59
July	56
August	57
September	51
October	134
November	113
December	75
January	34

Table 5: Vaccination status and measles

Vaccination status	Number of cases (%)
Vaccinated and documented	142 (21.6)
Vaccinated but not documented	152 (23.1)
Unvaccinated	151 (22.98)
Partially vaccinated	212 (32.26)

Table 6: Reasons for nonvaccination

Reasons for nonvaccination	Number of cases (%)
COVID-19-fear or lockdown	244 (67.2)
Forgot	52 (14.32)
Out of station	91 (25)
Side effects of vaccination	67 (18)
No specific reason	212 (32.26)

DISCUSSION

Measles, also known as rubeola, is a highly infectious disease that can be prevented with immunization. It has the potential for eradication but is still responsible for high mortality among children, particularly in developing nations like India. It is one of the most contagious infectious diseases, with at least a 90% secondary infection rate in susceptible domestic contacts.⁹

In the last few years, measles has joined the list of “re-emerging infections.” In areas where measles was near-elimination, alarming outbreaks have started to occur.¹⁰ The reason behind these outbreaks needs to be thoroughly investigated.¹¹

As the world in general and India, in particular, emerges from the ravages of COVID-19 pandemic, measles virus is emerging as an important cause of morbidity and accounts for a high percentage of hospital admissions. Low immunization coverage is postulated to be an important reason behind the rise in number of cases. Measles requires 92–94% population coverage for herd immunity to be effective.¹² The low vaccination rates have been attributed to low

Table 7: Based on morbidity and mortality

Complication	Vaccinated	Unvaccinated/partially vaccinated child	Expiry
Postmeasles pneumonia	94 (25.8)	290 (74.2)	1
Prolonged hospital stay (>5 days)	68 (18.7)	310 (85.3)	

Table 8: Based on nutritional status

Nutritional status	Number	Percentage
Normal	22	3.44
Moderate acute malnutrition	264	40.31
Severe acute malnutrition	371	56.25

transmission in developed countries and the COVID-19 pandemic—the scare and the lockdown in high transmission areas like India.

In the present study, out of the 4,893 admissions during the study period, a total of 657 patients were admitted with measles as the primary presenting illness, taking the prevalence to around 13%. This figure is quite high in an area where measles was near-elimination owing to high immunization coverage and MR campaign in the pre-COVID-19 era.

The study shows an age prediction for children between 9 months and 5 years (63.92%). It is an established fact that maternal immunity wanes by 9 months, and hence, measles is more common after 9 months. Similar results have been shown in study by Bendale et al., which shows 56.7% of children affected in 1–5 years age-group.⁹ Similar result was also seen in study by Babita et al. and associates in Bihar.¹³ However, the present study also shows almost 10% of cases to be occurring in children <9 months which is a worrisome trend.

In line with the established risk factors for occurrence of measles, the present study found maximum attack rate of measles in children belonging to lower and lower middle socioeconomic class (77.57%). Bendale et al., from Maharashtra, reported 52% of cases from lower socioeconomic status. Measles is a highly infectious condition with secondary attack rate of >90%; hence, overcrowding is an important risk factor and determinant of severity of the infection.¹⁴ The present study shows overcrowding in the homes of all cases of measles. Maximum attack rate was in households with <50 sq feet area.

As regards the month-wise distribution of cases, the season started with 35 cases in April which progressively increased and peaked in October with 134 cases. After that, the number of cases dramatically declined to 34 in January 2023. In response to the measles outbreak, mass revaccination campaign was started by the municipal corporation in areas with high number of cases in October 2022. So, apart from the natural seasonal decline in number of cases, mass revaccination may also have had a favorable effect on reducing the transmission of measles.

In the present study, 78% of the total cases of measles occurred in children who were not vaccinated for measles or had received a single dose of measles-containing vaccine, or had no documented evidence of vaccination. Only 21% of cases occurred in children who had definitely taken two doses of vaccine. A statistically significant difference was found in rate of complications occurring due to measles. These complications, in the form of postmeasles pneumonia and prolonged hospital stay of >5 days duration, were much more common in children who were unvaccinated or partially vaccinated as compared to those who received two doses of measles-containing vaccine ($p < 0.0001$). Thus, increasing immunization coverage can lead to a significant reduction in number of cases, as well as mortality and morbidity due to measles in developing countries. More than 56% of patients had severe acute malnutrition, and 40% had moderate acute malnutrition, making it a highly important risk factor for measles and its hospital admission. Similar results have been found in study by Bendale et al.⁹

In response to questions about reasons for nonvaccination against measles, most of the respondents (67%) stated COVID-19 pandemic as the major reason for not taking vaccine. The COVID-19 pandemic has disrupted health systems worldwide. The timeliness and coverage of routine immunization suffered a setback in India, as documented by the National Family Health Survey.¹⁵

The survey concluded that children in India experienced lower immunization coverage and greater delays in immunization during the COVID-19 pandemic. Whether the recent measles outbreaks are a direct result of this disruption or the natural epidemiological course of the disease is responsible for them remains a matter of conjecture.

CONCLUSION

Let us hope that 2022 was a blip caused by the pandemic and that the decade-long pattern of falling measles cases will continue with the vaccination drive.

There is an urgent need to strengthen not only our MR vaccine drive in the measles-hit pockets but also overall routine immunization; otherwise, another vaccine-preventable disease like whooping cough may stare at us in 2023 too.

Clinical Significance

Resurgence of measles in Ahmedabad was restricted to malnourished, unvaccinated/partially vaccinated, and poor children living in slums/chawls with overcrowding. Intensified MR vaccination campaign in these pockets seems to be a sure-shot way to prevent measles outbreaks.

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