

An Outbreak of Measles among adolescents in a Health Care Setting, Bangalore, Karnataka, India

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Abstract

Background: Despite high immunization coverage, outbreaks of measles do occur, but occurrence of measles outbreak among adolescents in a health care institution setting in India, is rather unusual or unreported. **Methods:** On the 21st November 2013, cases of suspected measles among the students were reported at St. John's Medical College, Bangalore. The preliminary investigation using the epidemiological case sheet identified seven suspected cases of measles. This led to a detailed investigation for a suspected outbreak at the campus. The outbreak was notified to the government authority. A measles outbreak investigation case sheet was distributed among the students and a door to door survey was carried out. The laboratory confirmation of suspected measles cases was done at the National Institute of Virology, Bangalore by IgM test for measles specific antibodies, viral culture and RT PCR. **Results:** The outbreak occurred during the months of November and December 2013. A total of 13 confirmed cases of measles were identified with an overall attack rate of 2%. Five cases were confirmed by IgM test for measles antibodies, besides virus isolation and RT PCR was positive for two cases. More than half (54%) of the suspected cases were vaccinated for measles and the rest were unvaccinated (23%) or had an unknown vaccination status (23%). There were no complications or deaths due to measles. **Conclusion:** An outbreak of measles among a group of adolescents in a health care institutional setting who were mostly vaccinated raises a concern about the vaccine effectiveness and the duration of vaccine efficacy after immunization. Along with improving the immunization coverage of two doses of measles vaccine, research is needed to determine the most-effective timing of delivering the second routine dose to bring down the susceptible population.

Key words: Adolescents, Health care setting, India, Measles outbreak, Outbreak investigation

Background

Measles is an acute highly infectious disease caused by a specific virus of the group myxoviruses [1, 2]. It is endemic virtually in all parts of the world [3].

It tends to occur in epidemics when the proportion of susceptible reaches about 40 per cent [4]. Measles is the fifth highest killer disease among children under five years of age in the world [5, 6]. In India measles contributes significantly to the childhood morbidity and mortality. Measles vaccine was introduced into the Universal Immunization Program (UIP) of the country in 1985 and reported number of measles cases has come down from 252,000 cases in 1987 to 36900

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cases in 2007 [5]. Despite the fact that the number of cases and deaths due to measles are declining, it continues to occur both as sporadic cases as well as outbreaks even though scientific studies reveal that measles eradication is technically feasible with available vaccines [6]. The National Family Health Survey (NFHS) data show a gradual increase in the coverage of measles vaccine from 42.2-58.8% [7]. A nationwide coverage evaluation survey which was conducted by UNICEF in 2009 documented 74.1% coverage among children aged 12-24 months in India [8]. However it has not reached the elimination level and outbreaks of measles continue to occur and it is likely that the estimates are much higher as large numbers of cases go unreported. Some studies also show a change in epidemiological pattern of cases among older children because of increase in measles vaccine coverage [9].

In November 2013, suspected cases of measles were reported from St. John's Medical College campus in Bangalore among medical students who were adolescents or young adults. An extensive literature review revealed occurrence of measles outbreak among adolescents in an institutional setting in India, is rather unusual or unreported. Hence, the present measles outbreak investigation was carried out in a systematic manner to identify the high risk groups, to describe the changes in measles epidemiology, to assess the possible reasons for such an outbreak and to recommend control measures for preventing future outbreaks.

Methodology

St. John's Medical College is situated in Bangalore, Karnataka, India. At the time of this outbreak investigation there were 360 MBBS students, 240 Post Graduate Students, 120 Para Medical Students and 700 Nursing Students. The students who join the medical college are from all over India and mostly belong to a higher socio-economic status.

On the 21st November, 2013 cases of suspected measles among the first year medical students were reported to the Department of Community Health (DoCH) at St. John's Medical College. A preliminary investigation was carried out and seven suspected cases were identified using the Integrated Disease Surveillance Project (IDSP) case definition - "Any person with fever and maculopapular rash lasting for more than 3 days and cough or coryza (i.e. running nose) or conjunctivitis (i.e. red eyes)." Vaccination history based on respondent's parent's recall was also elicited. After the preliminary investigation, the suspected measles outbreak was notified to the Surveillance Medical Officer (SMO) of Bangalore Urban District. A laboratory confirmation of these cases was done at National Institute of Virology (NIV), Bangalore. Serological test was done to detect Measles specific IgM antibodies. The measles-specific immunoglobulin M (IgM) antibody assay, the test used most often, is almost 100% sensitive when done 2 to 3 days after the onset of the rash [10, 11]. Measles IgM antibody peaks at 4 weeks after the infection and disappears by 6 to 8 weeks. The students were within 3rd to 17th day of the onset of rash when their IgM test was done. The close contacts of these suspected cases also underwent IgM testing at NIV. Throat swab, urine and fluid from the rash were also collected from the students who were symptomatic at the time of investigation to do a viral culture.

As a next step in the outbreak investigation, an official notice was put up in the St. John's Medical College, St. John's Medical College Hospital, College of Nursing, and in the hostels to inform regarding the outbreak and preventive measures. The notice mentioned any faculty, staff or student with symptoms of fever with rash and cough, coryza or conjunctivitis; have to be examined immediately at the Staff and Occupational Health Services clinic at the hospital. A measles outbreak investigation case sheet was also prepared and was circulated among all the

undergraduate and postgraduate students including medical, paramedical and nursing courses to screen for any suspected cases.

While the survey was going on at the College, the government authorities {Bruhat Bengaluru Mahanagar Palike, (BBMP)} and the National Polio Surveillance Project (NPSP), decided to investigate this unusual outbreak. A field survey was carried out at ward 151, where SJMCH is situated and a population of around 30,000 was screened. It was carried out by 20 teams, each team consisting of a link worker and a medical officer from BBMP. A house-to-house survey was done to find clinical measles cases fitting the case definition that had occurred in the last 3 months and were listed down.

It was also decided that as a part of the protocol, a door-to-door survey would be carried out by BBMP, in the SJMCH hostels. The reason for screening the hostel inmates was that all reported cases of suspected measles was in the adolescent age group – i.e. among the students. A map of the SJMCH campus was prepared and all hostels were demarcated. The total number of hostel inmates was approximately 1500 out of which 1000 could be contacted after 3 visits to each hostels. This effort from government authority identified 6 more suspected cases with symptoms of fever and rash. For the completion of the outbreak investigation, an area inside the campus where the construction workers were residing and the SJMCH staff quarters were also surveyed. No suspected cases of measles were identified among them.

As a final step, the 6 newly identified suspected cases, and the students who screened negative for IgM initially, considering the probability of being in the convalescent period, were also taken to NIV for IgM test.

Results

Index case

The Index case was a first year MBBS student, who had probably acquired measles while traveling to Kerala and developed fever with rash on November 1st, 2013. He reportedly, had been immunized for measles during his childhood.

Clinical Picture

The illness was clinically compatible with measles. Typically, most cases had a 3 to 4 days prodrome with fever, coryza (runny nose), cough, and conjunctivitis (red, irritated eyes) followed by the appearance of a maculopapular (red spots and areas) rash. The temperature usually returned to normal 2 to 3 days after appearance of the rash, while the rash persisted for 5 to 7 days. The most commonly reported symptoms were fever, maculopapular rash, redevyes, cough and coryza and the least was presence of koplik spots. The other symptoms that were reported were vomiting, loss of appetite, fatigue, myalgia, joint pain and lymph adenopathy.

Description of the outbreak

The outbreak began on November 1st, 2013 and lasted till December 9th, a total of 39 days. Thirteen suspected cases were identified of whom 4 were laboratory confirmed by IgM test. One out of the 17 close contacts was also screened positive. Virus isolation and RT PCR was positive for two suspected cases. The rest were epidemiologically linked cases. Out of the thirteen suspected cases, 7(54%) were vaccinated, 3(23%) were unvaccinated and 3(23%) had an unknown vaccination status. All 5 screened positive for IgM were reportedly vaccinated. A total of 1000 students were screened among whom 370(37%) were vaccinated for measles in their childhood, 80(8%) were unvaccinated and the rest (55%) had an unknown status. The students were asked to confirm

their immunization status from their parents as immunization records were unavailable for most of them. The source of the outbreak remains unknown. The attack rate was 2% (Unvaccinated and those who had an unknown vaccination status were considered at risk). There were no complications or deaths due to measles reported. All except one reported seeking

medical treatment for their illness from SJMCH. The BBMP house-to-house survey of around 30,000 population identified 3 suspected cases of measles - a three year old, a ten year old and a twenty nine year old, among whom the ten year old child screened positive for IgM.

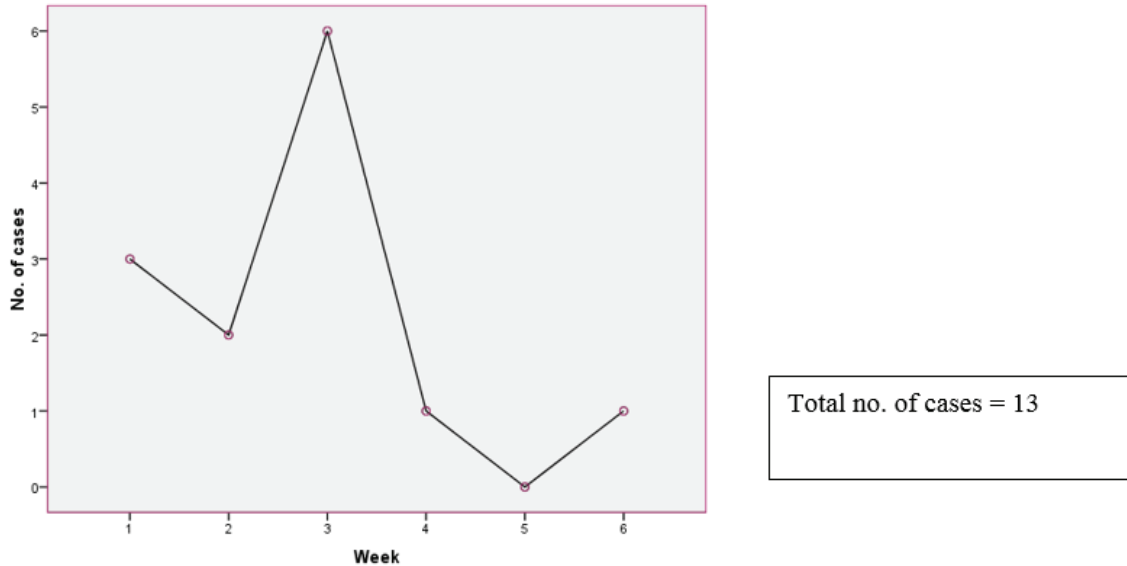


Figure 1: Epidemic curve

The epidemic curve showed that the outbreak started from the 1st week of November and continued until 2nd week of December. Peak of the outbreak was in the 3rd week. No further cases were reported after 2nd week of December.

Table 1: Laboratory tests done at NIV

Number of students tested for IgM antibodies against Measles	30 (13 suspects + 17 contacts)
Serology for IgM antibodies against Measles – Positive	2
Serology for IgM antibodies against Measles - Equivocal	3
Tested positive for Rubella	2
Tested positive for Chikungunya	1

Of the 5 who were screened positive for IgM, one was a close contact.

Discussion

Measles is seasonal. In temperate climates, outbreaks generally occur in late winter and early spring. In tropical climates, transmission appears to increase after the rainy season. In India, the epidemics of measles are more common in winter and early spring (January to April) [4]. This particular outbreak started in the month of November. There were no outbreaks of measles reported in and around the medical college campus during this period. Even the active case search by BBMP, did not identify any outbreak in this area. This leads us to the conclusion that the outbreak started within the campus itself.

The index case in this outbreak, as already mentioned, was a first year MBBS student, who did not report to have visited the hospital or to have had any close contact with a known case of measles during the possible exposure period. So the source of infection for the outbreak remains unclear. He probably would have acquired measles while traveling to Kerala.

While measles commonly occurs in the young child, a shift towards adolescent age group was a striking feature of this outbreak. Most of the cases were reported among medical students aged between 18 and 22 years, who were born between 1991 and 1995. During this period, measles vaccination had already been rolled out in the UIP of all states across India, though the reported coverage for measles vaccine based on the National Family Health Survey (NFHS) data during this period was only 42% [7]. However it is likely that most of these students (from a higher socio economic status) have received either the measles vaccine or the MMR vaccine in their childhood. The probable reasons for such an outbreak among the adolescent age group who had been immunized against measles could be the vaccine efficacy of only 85% for first dose of measles at nine completed months and the questionable duration of vaccine efficacy after immunization [12 - 15]. Most

countries in the African, American, and Asian regions including India are currently focusing on providing a first dose through routine immunization services and a second opportunity to receive measles vaccine through vaccination campaigns or administration of a second routine vaccine dose which provides immunity to 97%–99% of children [13, 14, 16 – 21].

Large college based outbreaks of measles have been reported from a few other parts of the world and they have implemented a standard policy of requiring proof of measles vaccination or immunity to measles at entry to the university [23,24]. To date, in India there are not many such outbreaks reported and there is no such policy in place. With decreasing susceptibility in younger age groups, there is a possibility of an increasing number of nationwide measles cases occurring in older adolescents and young adults. A first step in decreasing transmission in these age groups would be to ensure immunity in known high-risk groups, including medical college students.

Mass immunization with MMR when there is an outbreak in an institutional set up is much debated [23, 24, 25], but in the present outbreak, it was important to assess the cost benefit factors before taking such a step. The outbreak was reported only after 3 weeks of onset and low attack rates, no mortality and fewer complications indirectly reflected the mild nature of the outbreak. The success that could be achieved with outbreak response immunization at that time was questionable. Catch-up vaccinations for those who had not been vaccinated was also not done because of the inability to trace the immunization status of the at risk population.

In India, there is a need to strengthen the reporting system for diseases like measles, especially in private tertiary care institutions. Delayed reporting can result in late recognition of the outbreak and consequent delay in instituting containment measures. Experience from this particular outbreak investigation calls

for a critical need for setting an efficient measles surveillance system within the institution itself. Ongoing education is needed to prompt health care providers to have a high index of suspicion for measles in young adults presenting with rash illness and upper respiratory tract symptoms and also to report it to the government authority.

Certain limitations have to be considered while interpreting the findings of this outbreak. Some of the medical students did not know their vaccination history; therefore we were unable to correctly examine the role of vaccination in the outbreak and it was difficult to determine the precise attack rates, since the denominator which is the at risk population was uncertain.

In conclusion an outbreak of measles among a group of adolescents who were mostly vaccinated raises concern about the vaccine effectiveness and the duration of vaccine efficacy after immunization. Along with improving the immunization coverage of two doses of measles vaccine, research is needed to determine the most-effective timing of delivering the second routine dose to bring down the susceptible population.

Ethical Clearance: Written Informed consent was obtained from each study participants. Ethical clearance not obtained from Institutional Review Board.

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