German measles outbreak bursts in two unvaccinated border hilly districts of Northern Himachal Pradesh, India

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ABSTRACT

Background: We investigated German measles outbreak as a suspected one of measles to confirm diagnosis and recommend for control and prevention. Materials and Methods: We defined a case of German measles as the occurrence of febrile rash in any resident of the eight villages from 20th October to 16th January, 2007. Case patients were line listed and information on age, sex, residence, date of onset, symptoms, signs, traveling, treatment history, vaccination status, and pregnancy status were collected. The outbreak was described by time, place, and person characteristics. Diagnosis was confirmed clinically, epidemiologically, and serologically; first to measles, scrub typhus and later to German measles viruses. Results: We identified 116 cases in eight villages (112/116 clinically and 04/116 laboratory confirmed). The overall attack rate (AR) was 11%; highest in the age group of 11-20 years (range 13% to 44%). Sex specific AR for male was 12%. All case patients were <20 years of age with a median age of 12 years. Complication rate was 05%, but no death reported on account of German measles. No pregnant woman was found to be affected. None of them were immunized against rubella. Four tested positive for immunoglobulin M (IgM) antibodies to rubella out of eight samples. Thirty three percent (38/116) had their treatment of choice to the modern medicine. Conclusion: German measles outbreak was confirmed in unvaccinated populations, which was possibly due to the frequent traveling of Bengali colony vendors’ case patients to other areas. We advised the local health authorities to provide MR vaccination to the unexposed in eight affected and neighboring villages.

Key words: German measles, MR vaccination, northern himachal, outbreak

Introduction

German measles, usually, presents as a mild febrile rash illness in adults and children; however, 30%-50% of infected persons are asymptomatic.[1] It can have severe adverse effects on the fetuses of pregnant women who contract the disease during the first trimester of pregnancy, causing a wide range of congenital defects known as congenital rubella syndrome (CRS).[2] The incidence of congenital rubella was found to be 2.3 times higher in Asian than non-Asian births in England and Wales.[3] German measles was distributed evenly throughout the world. In temperate regions, the incidence was usually highest in late winter and early spring. Outbreaks appeared every six to nine years, with major epidemics occurring at intervals ranging from 10 to 30 years, prior to the introduction of rubella vaccine in 1969.[4] Measles and mumps disease pattern has undergone a change now-a-days due to measles and MMR vaccination.[5] More and more case patients of measles and rubella are being examined in higher age group adolescent children.[6,7] The more vaccination coverage, the more is the time in between the outbreaks, and a shift towards older age groups may be seen as in Thailand and Sri Lanka.[8] In India, states like Himachal Pradesh have achieved the high coverage of measles, a notifiable disease under Universal immunization Program,[9] but not rubella; and hence, no vaccination. The present outbreak was investigated with the objectives of confirming the existence of the outbreak; initiating appropriate measures to reduce morbidity and mortality and formulating recommendations on the basis of the results of present outbreak investigation.

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Materials and Methods

A community leader from Shahpur block on 29th October, 2006, reported the occurrence of cases of fever and rash, with enlarged neck glands, in the village Dramman, [Kangra] and two bordering villages; Thulel and Hattli (Chamba district) of sub center, Thulel, under primary health center, Sinhuta of Samote block, district, Chamba. Later on, it spread in a propagated fashion to far off hilly villages like Gargooin, Rirakmaar, and Sperrah, under sub center, Boh [Kangra] of Shahpur block, and the other interior villages, Banoli and Hathora (Chamba district) of sub center, Thulel, under primary health center, Sinhuta of Samote block, district, Chamba. From Shahpur block [Kangra] to sub center, Thulel, it is 4 km away, and from Samote block to Thulel, it is 23 km, and the sub center is distanced 140 km away to district head quarters, Chamba. From Shahpur block to sub center, Boh, under primary health center, Darini, it is 24 km. The road is semi-metallic and accessible to the public and beneficiaries, but the interior is zigzag, and most of the way, it is on foot surveying. The forenamed three affected panchayats have the population of 3498, with 27 small villages under sub center, Thulel, and under sub centreh, Boh; the total population is 1929, with 13 villages interiorly placed hilly to mountainous villages. But under sub center, Thulel, the affected five villages, Banoli, Hathora, Dramman, Thulel, and Hattli, have the total population (1428) with break up as 180 with 27 houses; 166 with 31 houses; 62 with 13 houses; 519 with 72 houses and 531 with 93 houses, respectively. The villages, Dramman and Bengali Colony slum (Hattli village), are located in the semi hill area, while Thulel and rest part of Hattli village with Hathora and Banoli are located at hill area of the district. The rural slum, Bengali colony, with a population of 98 with 19 muddy slum houses also lies in Hattli Panchayat. So, the sample size of the affected three villages; Gargooin, Rirakmaar, and Sperrah falling in the age group of 0-20 years under sub center Boh was 206 and that of the rest of five villages under sub center, Thulel, Dramman, Banoli, Hathora, Hattli Bengali colony, and Thulel, was 804. It totaled to 1010 [Table 1]. The rest of 22 villages under sub center, Thulel, and 10 villages under sub center, Boh, were left unsurveyed and uninvestigated, as they were not affected.

Having lodged First-hand Information Report [FIR] to the district health authorities telephonically, the outbreak was investigated on 8th November, 2006, with the rapid response team. The team comprised of a district health officer, an epidemiologist, and a pediatrician from the local health system. Ethical committee review was not indicated, since this investigation was conducted in the context of a public health response to an outbreak. Written informed consent from the mothers of children in local language for interview schedule, physical examination, and also for laboratory samples was obtained. The analysis coding for the participants to maintain confidentiality was employed and the data was analyzed by MS-excel sheet using Epi info version. For all P values less than 0.05 or 0.001 was considered significant.

A case of German measles was defined as the occurrence of a febrile rash with without coryza or conjunctivitis or lymphadenopathy in the residents of the affected villages under sub center, Boh, of Shahpur block, and bordering affected villages of Thulel, under sub center, Thulel, since 14th October to mid January, 2007 (Clinically confirmed).

Table 1: Age and sex specific attack rates of German measles case patients (n=116) in bordering villages of Northern Himachal Pradesh, India

<table>
<thead>
<tr>
<th>Name of the village</th>
<th>Age group in years</th>
<th>Cases/total</th>
<th>Attack rate (%)</th>
<th>Age group in years</th>
<th>Cases/Total</th>
<th>Attack rate (%)</th>
<th>Age group in years</th>
<th>Cases/total</th>
<th>Attack rate (%)</th>
<th>Age group in years</th>
<th>Cases/total</th>
<th>Attack rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gargooin</td>
<td>&lt;5</td>
<td>00</td>
<td>00</td>
<td>5-10</td>
<td>02/14</td>
<td>14</td>
<td>11-20</td>
<td>04/9</td>
<td>44</td>
<td>0-20</td>
<td>6/34</td>
<td>18</td>
</tr>
<tr>
<td>Rirakmaar</td>
<td>&lt;5</td>
<td>00/18</td>
<td>05</td>
<td>5-10</td>
<td>06/21</td>
<td>29</td>
<td>11-20</td>
<td>04/14</td>
<td>29</td>
<td>0-20</td>
<td>10/53</td>
<td>19</td>
</tr>
<tr>
<td>Sperrah</td>
<td>&lt;5</td>
<td>02/40</td>
<td>05</td>
<td>5-10</td>
<td>08/47</td>
<td>17</td>
<td>11-20</td>
<td>12/32</td>
<td>38</td>
<td>0-20</td>
<td>22/119</td>
<td>18</td>
</tr>
<tr>
<td>Dramman</td>
<td>&lt;5</td>
<td>00/12</td>
<td>00</td>
<td>5-10</td>
<td>02/10</td>
<td>20</td>
<td>11-20</td>
<td>03/15</td>
<td>20</td>
<td>0-20</td>
<td>05/37</td>
<td>14</td>
</tr>
<tr>
<td>Banoli</td>
<td>&lt;5</td>
<td>01/18</td>
<td>05</td>
<td>5-10</td>
<td>02/22</td>
<td>09</td>
<td>11-20</td>
<td>03/14</td>
<td>21</td>
<td>0-20</td>
<td>6/54</td>
<td>11</td>
</tr>
<tr>
<td>Hathora</td>
<td>&lt;5</td>
<td>02/17</td>
<td>12</td>
<td>5-10</td>
<td>03/20</td>
<td>15</td>
<td>11-20</td>
<td>06/13</td>
<td>46</td>
<td>0-20</td>
<td>11/50</td>
<td>22</td>
</tr>
<tr>
<td>Hattli Bengali colony</td>
<td>&lt;5</td>
<td>03/169</td>
<td>02</td>
<td>5-10</td>
<td>11/70</td>
<td>16</td>
<td>11-20</td>
<td>25/90</td>
<td>28</td>
<td>0-20</td>
<td>39/329</td>
<td>12</td>
</tr>
<tr>
<td>Thulel</td>
<td>&lt;5</td>
<td>00/189</td>
<td>00</td>
<td>5-10</td>
<td>04/44</td>
<td>09</td>
<td>11-20</td>
<td>13/101</td>
<td>13</td>
<td>0-20</td>
<td>17/334</td>
<td>05</td>
</tr>
<tr>
<td>Individual total up to 20 years</td>
<td>&lt;5 8/474</td>
<td>2.0</td>
<td>5-10</td>
<td>38/248</td>
<td>15</td>
<td>11-20</td>
<td>70/288</td>
<td>24</td>
<td>0-20</td>
<td>116/1010</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

Sex

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group in years</td>
<td>64/556</td>
<td>12</td>
</tr>
<tr>
<td>Age group in years</td>
<td>52/454</td>
<td>11</td>
</tr>
</tbody>
</table>
**Laboratory confirmed**: A case that meets the clinical case definition and that is laboratory confirmed or linked epidemiologically to a laboratory confirmed case.

Active case search was initiated by visiting house to house to identify case patients that meet the case definition in affected aforesaid eight villages with the population of 1428. To accomplish this exercise, two teams of health workers were formed. Each team has two health workers; one male and one female, supervised by one male health supervisor. The mother of the every case patient or the next elder available member of the family was interviewed for 20 minutes with the semi structured questionnaire in Hindi language. As the team was not oriented in carrying out outbreak investigation previously, two trained senior medical officers supervised the whole team.

In the third week of the ongoing outbreak, we collected (i) eight randomly collected 5 ml of blood for each specimen observing universal safety precautions. We crystallized, separated the sera, and refrigerated under +4 to +8°C, for testing specimens for IgM/ IgG antibodies using enzyme-linked immunosorbent assay (ELISA); (ii) six samples of nasopharyngeal swabs in Virus Transport Media (VTM) for virus isolation and genotyping of the strain, and similar number 50 ml each of urine samples for culture/sensitivity using sterile equipment in Virus Transport Media. We assigned international identification numbers and labeled other epidemiological details on all the samples. We transported the specimen to National Institute of Virology (NIV), Pune, in reverse cold chain. The laboratory tested specimens for IgM antibodies using ELISA and Weil Felix test for Scrub typhus. The samples were taken from those who were willing, while the reluctant/refusing populations were dropped. We line listed the case patients and described them in terms of person, place, and time characteristics. We also collected information about age, sex, symptomatology, and date of onset of illness, treatment taken, travel history, any outsiders/foreigner visiting the place; pregnancy status; immunization status of case patients and susceptible population by mothers’ interviews and; assessment of reverse cold chain system.

We mapped the villages by location of households to show the distribution of the cases by residence. The attack rate of cases by age group, sex groups using population data obtained from the block/primary health center/sub center health authorities were calculated. The dynamic of the outbreak was examined through the construction of an epidemic curve. We made the action plan with local authorities to suitably manage the cases.

**Results**

In our study results, we identified a total of 116 (112/116 clinically and 04/116 laboratory confirmed case patients) case patients from a study population of 1010 in the affected age group of 0-20 years under both the sub centers. Under the sub center, Boh, attack rate was 18% (38/206), while under sub center Thulel, it was 10% (78/804). The overall attack rate is 116/1010 (11%, [Table 1]). The attack rate was at its maximum in the age group of 11-20 years, which ranges from 13% to 44%. The sex-specific attack rate was 64/556 (12%), in male, and 52/454 (11%), in the female. Median age of the case patients was 12 years, and the age range was from 1 year to 20 years. Complication rate was 05%, but no death reported on account of German measles. A measles outbreak was reported in this area, nine to ten years ago. The severity of the symptoms of the outbreak was less among the younger cases, and more towards the older ones, 65/116 (56%), particularly in the lower socio-economic strata; scheduled castes Vs others (P<0.04). The history of the fever was 116/116 (100%) in all case patients, while 115/116 (99%) cases have maculo-papular rash [Table 2]. Five percent case patients have complications in the form of diarrhea.

Under primary health center, Sinhuta, there were six sub centers, and the total numbers of the pregnant ladies at that given period, were 17, but in one of the sub centers named as Chhalarra, there was one still birth delivered in the month of March, 2007. But under affected sub centers, Thulel and Boh, there were seven pregnant ladies in eight villages at the time of investigation of outbreak and no pregnant female was affected by German measles in the outbreak, and the outcome of the pregnancies were normal. As per the mothers’ interviews, of 116 case-patients, 113 (98%) were immunized against measles, while proportions of children vaccinated for measles were 93% (939/1010), and none of them who suffered were immunized.

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**Table 2: Symptomatology of German measles case patients (n=116) in bordering villages of Northern Himachal Pradesh, India**

<table>
<thead>
<tr>
<th>Signs and symptoms</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>116</td>
<td>100</td>
</tr>
<tr>
<td>Rash</td>
<td>115</td>
<td>99</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>90</td>
<td>78</td>
</tr>
<tr>
<td>Cough</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>Arthralgia</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>Loose motions</td>
<td>06</td>
<td>05</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>00</td>
<td>00</td>
</tr>
</tbody>
</table>
against rubella including five (4%) who had MMR immunization privately. The reverse cold chain was observed to be satisfactory in the field.

Sporadic distribution of the cases with maximum concentration of the cases 39/329 (11.9%) existed in Hattli Bengali colony [Figure 1]. The index case identified in the Bengali colony (a traveling community) was reported on 20th October, 2006. The outbreak started in Hattli/Bengali slum colony and nearby Dramman village and then spread further to Thulel, Hattli and other higher hilly villages, owing to the frequent traveling of the Bengali community for selling their edible commodities in those villages. The epidemic curve suggested that there were number of generations of cases with a propagated outbreak peaking around 28th November, 2006. The number of cases declined during third week of January, 2007 [Figure 2].

The case patients were treated from the nearby first referral unit at Shahpur and also at Dr. Rajinder Prasad govt. medical college hospital, Dharamshala. A minority of cases were treated at the primary health centers, Sinhuta or Darini. Twenty three percent (27/116) of the cases went for the traditional treatment of Vannan bushes (medicinal herbal plant) which included repeated movements of the bushes upon the chest and face of the patients from nearby local chelas/faith healers (Traditional healers Vs modern medicine, \( P < 0.049 \)) and diet rich in seul (a herbal plant with small granules, more so in Bengali slum area, Sperrah and Gargooni villages and [restricted diet Vs Nutritious diet, \( P < 0.005 \]), while 33% (38/116) had their treatment of choice to the modern system of medicine. Still majority of the case patients, i.e., 44% (51/116), believed the treatment in both ways; traditional conservative one first and then later on switched onto the modern one.

All the samples (six out of eight) were negative for IgM antibodies for measles and two out of eight were negative for scrub typhus, as we had history of outbreak of scrub typhus in district Solan three years back; but four out of six were IgM positive for rubella virus. Six samples of nasopharyngeal swabs for virus isolation and equal number of urine samples were destroyed while in transportation, and hence, no result was available for them.

**Discussion**

The outbreak of German measles struck the bordering villages under sub center, Boh of Shahpur block (Kangra), and that of Thulel of Samote block of district Chamba, in the 3rd week of October, 2006 to mid January, 2007. It was reported by a local community leader, and our existing surveillance system failed to detect it. Initially, we investigated this propagated outbreak on the provisional diagnosis of measles, as there were two more laboratory confirmed outbreaks of measles in the adjoining blocks of district. However, the serology proved IgM negative for measles and scrub typhus, as the case patients of tick typhus were also detected to be laboratory confirmed in another far off block of the district; but it confirmed four out of eight samples were IgM positive for rubella viruses. Symptoms frequency also supported the laboratory diagnosis. The index case identified in the Bengali colony of the Hattli village was reported on 20th October, 2006. The outbreak started in Bengali migratory rural slum and spread to the Dramman village and then to other hilly villages in a propagated fashion. Although the case patients in the outbreak were centralised in the rural slum of the Bengali colony and belonged to the lower socio-economic strata, yet the duration of illness was five to
eight days. The severity of the symptoms was mild and fleeting in nature. Majority of the case patients in all the eight villages belonged to the older age group (11-20 years), suggesting an obvious shift to the higher age group, and more male in higher age group were afflicted. Majority of cases were immunized against measles, but only minor cases for rubella; low attack rates, no mortality, mild complications in the form of diarrhea, and no involvement of the pregnant lady reflected the mild nature of the outbreak, which in turn was because of better awareness and availability of health services.\textsuperscript{[6-9,10]} The outbreak ceased after three months in the last week of January, 2007, after nil report for two incubation periods.

Rubeola is a notifiable disease in this country, but not rubella; hence, cases with maculopapular rash are often misdiagnosed as measles instead of German measles, which lead to misnotification as seen in this outbreak setting. It was not surprising, as rubella is a mild disease, and often, 30\textendash;50\% of infected people may not notice any symptoms at all.\textsuperscript{[11]} Similar findings have also been reported by others workers.\textsuperscript{[10,12]}

It is critical to note that no supplementary immunization activities like MMR during the outbreak were done and the case patients themselves took the treatment from different specialized centers. Traditional beliefs and barriers about the German measles/measles do not foster healthy behaviors\textsuperscript{[13,14]} in the population, more so in the cases of Bengali colony slums, Sperrah, and Gargoone village, reducing the diet intake to the minimum with \textit{Seul rich diet} and VANNAN bushes movement as part of help seeking behavior before or with modern medicines later on forms the mainstay of the treatment. The diet rich in \textit{seul} [a herbal plant with small granules], thought to be hot in nature by the local community members and they are supposed to facilitate the eruption of measles; these granules are also roasted for eating as well as smoked fumes are placed underneath the cot of the ailing patients. That is why, the least number of the cases have been reported to sub center, Thulel or Boh. Hence, the sensitivity of the health care facilities is more or less nil, and so is the weakness of the existing surveillance system. At present, there was a lack of trained persons in the specimen collection and transportation. Logistics for specimen collection is poorly available.

\textbf{Limitations}

Sero-surveillance in the study area could not be carried out due to funds and time constraints.

\textbf{Conclusion}

An outbreak of German measles was confirmed clinically, epidemiologically, and serologically in unvaccinated populations. No supplementary immunization/MMR to the susceptible was provided in the affected cases of the areas, especially in the slum areas. Weak surveillance system was in place; medical human resource available was untrained with inadequate logistics support and supply. Traditional beliefs and barriers form the mainstay of the treatment part.

\textbf{Recommendations}

On the basis of investigation, we proposed a number of recommendations:

1. Vaccinate MR to the susceptible. 2. Identify outreach strategies to cover slum and remote villages. 3. Ensure IEC activities aggressively at all the fronts, especially for pregnant women and the susceptible 4. Strengthen surveillance system and other logistics for specimen collection and transportation.

\textbf{Acknowledgements}

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\textbf{References}

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