Original Article

Clusters of Varicella Zoster in the Tribal-dominated District of Western India : An investigation Report

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Background : Chickenpox is an infectious disease caused by the Varicella Zoster Virus (VZV). It is very contagious and spreads by inhaling infected droplets. It is generally found in epidemic waves, the most common victims are school-going children but outbreaks of chickenpox are also reported in adulthood.

Objectives : The outbreak investigation in two different age groups were investigated to identify the agent, the source of infection and to propose recommendation for control measures.

Methods : In the present investigation, we are analyzing the epidemiological determinants of two chickenpox clusters reported from the tribal-dominated district of the Union Territory of Dadra and Nagar Haveli and Daman and Diu, India.

Results : Both clusters have single-pick, confirmed clinically as well as in the laboratory as per the protocol. All the cases of clusters were self-limiting and recovered within 4-5 days.

Interpretation and Conclusion : The study emphasizes the quality disease surveillance mechanisms can play a critical role in providing accurate and timely information to authorities, allowing for early intervention and outbreak management.

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Key words **: Varicella-zoster, Chickenpox, Outbreak, Disease Surveillance.**

Chickenpox is a contagious acute viral disease caused by Varicella Zoster Virus (VZV) of the Herpesviridae family[1]. It is generally found in epidemic waves[2]. It is transmitted by direct contact or airborne. The shedding of pathogen happens from the nasopharynx via droplets and aerosols and also from skin lesions[3]. The mild skin lesions or skin rash is the main symptom of the disease but hospitalization and death can also be occurred due to complications such as pneumonitis, encephalitis, and secondary bacterial infections[4]. The disease is usually self-limiting and can be cured in 5 to 10 days without complications[5]. The risk of complications from varicella is more in the high-risk groups (eg, immunocompromised persons, cancer patients, pregnant women, and neonates whose mothers are not immune). The incubation period of the disease is usually 14-16 days. The contagious period starts from 1-2 days before the onset of symptoms and appears up to 5-7 days. In the absence of vaccination, the incidence of varicella in tropical countries is encountered 13-16 cases per 1000 people annually[6]. The highest incidence occurs in pre-school and school children between the age of 1 to 6 years but can also occur in adults[5,7,8]. Seroconversion of Varicella-Zoster Virus can occur in late adulthood in the tropical countries[9]. Various researchers has document that the outbreaks of chickenpox globally are in school going children[7,10]. However, Country like India the outbreaks can be occurred in adulthood [11,12] and also in the school going children[13-16]. For the prevention of the chickenpox, the Indian Academy of Pediatrics have recommended the vaccination of chickenpox with two doses, one at the age of 15 months and the second between 4 to 5 years of age[17]. But in India, the vaccination of Chickenpox is still optional and not included in the National Immunization Schedule under Universal Immunization Programme. In the present investigation, we are investigating the epidemiological determinants of two Chickenpox

Editor's Comment :

- The present study is a lesson to learn that the Chickenpox vaccine should be considered for inclusion in the routine immunization schedule.

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clusters which are reported from the tribal-dominated district of Dadra and Nagar Haveli of the Union Territory of Dadra and Nagar Haveli and Daman and Diu.

Materials and Methods

Study Area :

The district of Dadra Nagar Haveli (D&NH) is situated (Latitude, 20°54'41" N to 20°21'36" N and Longitude– 72°54'41" N to 73°13'13" N) in the Western Ghat of India. The 487 sq km area is a forest hill area, occupied mainly by tribes (population 4.5 lakh) in 72 villages and one town. Due to the subsidies in taxes, a large number of industries have been established in this district in the last decades. As a result, around 2.5 lakh of skilled and unskilled workforce migrate to D&NH from different states of India for the employment. The present incidences were reported from the tribal-dominated village of Surangi (located at 20°09'19.1"N,73°00'43.7"E.) and Dapada (20°11'10.64"N, 73°1'10.61"E) of the district D&NH. In both the villages, along with the tribal majority population, due to industrial units migratory population also exists together especially in chawls / overcrowded residence. The Primary health facilities for the residents of these villages are provided by Health and Wellness Centres (HWCs) and the Primary Health Centres (PHCs) which is located in the village itself. The total geographical area of the village Surangi and Dapada is 1012.97 and 856.41 hectares and the total population of these two areas is 5,016 and 5713 respectively. The locations of hot spot are showing in the Fig 1.

Diseases Surveillance Mechanism :

The portal-based, three-tier surveillance of Chickenpox under Integrated Diseases Surveillance Programme (IDSP) was going on since the year 2009. In this system, both active and passive surveillance was done. During active Surveillance, the grass root level workers do syndromic surveillance from house to house and the information about the patients are entered in to the portal. Apart from this, the Clinicians are involved in the presumptive surveillance and the information about clinically suspected Chickenpox patients who visit to their dispensary are recorded and shared with the portal. Chickenpox can be defined as "An acute illness with diffuse (generalized) macular/ papular vesicular rash and Epidemiologic linkage to another probable or confirmed case or Laboratory confirmation by VZV-specific IgM antibodies detection or VZV DNA detection by PCR or isolation of Chickenpox Virus from a clinical specimen." This definition was used for the surveillance of chickenpox and is investigated by the Medical Officer working at the PHC and also by Rapid Response Team (RRT) during the outbreak or during period of early warning. The similar case definition was used to identify chickenpox among children and adults (≥15 years). The samples (ie, serum, blister/skin swab, urine and throat swabs) from the clinical suspected cases were collected and referred to the laboratory for the confirm / final diagnosis.

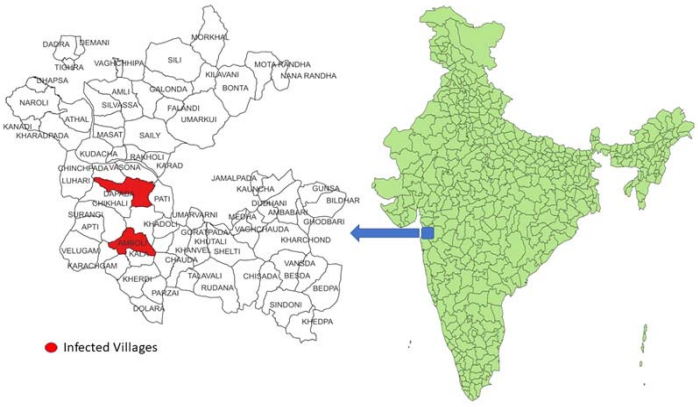

Fig 1 — The GIS Map is showing the location of Clusters reported from the District Dadra Nagar Haveli

Cluster Investigation :

As the early warning signal/cluster was identified, the RRT of the district visited the hot spot and initiates the investigations. The survey was conducted among the affected population to find each suspect / probable case as per the standard case definition. All the patients having symptoms of an acute illness with diffuse (generalized) macular/papular vesicular rash were examined by the clinician and they were purposefully isolated from each other to prevent transmission. Furthermore, the passive data of indoor and outdoor patients along with laboratory results were collected from the concerned health institutions. Daily surveillance was conducted in adjoining areas and all the epidemiological information was recorded in standard case investigation form. The high-risk groups (eg, immuno-compromised persons, cancer patients, pregnant women and neonates whose mothers are not immune) were also identified and sensitized about the preventive aspect of the disease. The surveillance was conducted daily for 6 weeks from the date of the last reported case.

Laboratory Investigation :

Twenty serum samples were obtained from the symptomatic patients (7 samples were collected from village Dapada and 13

samples were collected from the village Amboli) after oral consent from the patients or guardians and sent to the National Institute of Virology Pune for laboratory investigation and confirmation of by ELISA IgM antibody. The results were documented as per the cut of values of titer prescribed on the kit.

Results

Cluster 1 :

A few cases of Chickenpox were reported from Surangi village of Amboli PHC during routine surveillance by health workers on 22/02/2022. The report was in-depth studied and the rapid response team was activated on the same day by IDSP. The hotspot was an industrial Chawl with 37 rooms (typically low-quality housing). A total of 250 migratory laborers residing in this Chawl had come from other states of India to work. This chawl had the facilities of common toilets and bathrooms. Most of the residents were young men and lived in a room with 5-8 people. Only 4 people lived with their families. The index case was reported on dated 30/01/2022, he was a 5-year-old male with having travel history and came from the northern part of India. The rest of the positives were close contacts of the index case. Total 23 cases with the same symptoms were counted from 30/01/2022 to 21/02/2022, out of the total 91.30% (21 cases) belonged to the age group of > 15 years and 8.70% (2 cases) belong to the age group of 0-5 years. All cases were male. All patients were clinically stable, treated on the basis of symptoms, no one required hospitalization and were cured without any complication. The vaccination status of residents was unknown. A total of seven serum samples were collected from the affected area as per the protocol of the IDSP and sent to the referral laboratory for lab confirmation.

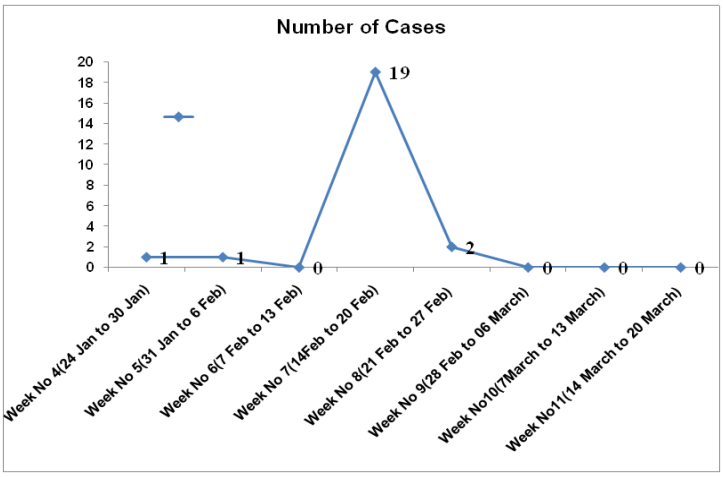

Fig 2 — Showing the timeline of onset of symptoms in Cluster 1 reported from the Surangi Village

All samples were found positive in the laboratory through ELISA IgM antibody. Active surveillance was conducted in the village and adjoining areas through grassroots health workers, but no more suspected cases were found. The area was kept under surveillance till the completion of the double incubation period of diseases. The timeline of cluster 1 is described in Fig 2 and the variables of the cluster are explained in Table 1.

Cluster 2 :

The notification of the second cluster was received on 08/07/2022 from the village Dapada, PHC Dapada by the Principal of the residential school. As per the protocol of IDSP, the Rapid response team visited the affected area on the same day, along with the concerned Medical Officer and Health Workers. It was a hostel with two separate buildings, 120 girls lived in one building. 117 boys lived in the second building. 4-6 students were staying in each room. The toilet and bathrooms of the students were separate in each

Table 1 — *Showing the determinates of the Clusters of Varicella Zoster reported from the D & NH*

Particulars	Cluster 1, Village-Amboli					Cluster-2, Village-Dapada				
	Age			Sex		Age			Sex	
	0-5 Year	6-15 Year	≥15 years	Male	Female	0-5 Year	6-15 Year	≥15 years	Male	Female
Total Population of Village	402	774	3480	2362	2294	365	959	4729	3305	2745
Population at risk	8	9	233	237	7	0	166	71	117	120
Total Incidence	2	0	21	23	0	0	12	27	28	11
Attack rate/100 population	25.00	0.00	9.01	9.70	0.00	0.00	7.23	38.03	23.93	9.17
Persons with specimens collected	0	0	7	7	0	0	0	13	9	4
Laboratory confirmation	0	0	7	7	0	0	0	4	3	1
Need of Treatment	2	0	19	21	0	0	8	19	21	6
Hospitalization	0	0	0	0	0	0	0	0	0	0
Mild Symptoms	0	0	2	2	0	0	4	8	7	5
Moderate Symptoms	2	0	19	21	0	0	8	19	21	6
Severe Symptoms	0	0	0	0	0	0	0	0	0	0
Vaccination Status	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Average Duration of Illness	4.5 days	0	4.90 days	4.87 days	0	0	4.75 days	4.85 days	4.82 days	4.81 days

building. All students used the common kitchen to eat the food. On 8th July 2022, all the children living in the hostel were examined by the concerned Medical Officer, in which a total of 18 more children were found with similar symptoms. After that, sporadic cases were encountered till 26th July, 2022. The timeline of Cluster 2 is shown in Fig 3. The children who were symptomatic were immediately isolated for at least 7 days from the date of onset. The children and the hostel warden were made aware of the symptoms, mode of transmission, serious conditions of the disease and methods of prevention of this disease. The active surveillance in the surrounding areas was conducted by the grassroots level health workers but no more case with similar symptoms was encountered.

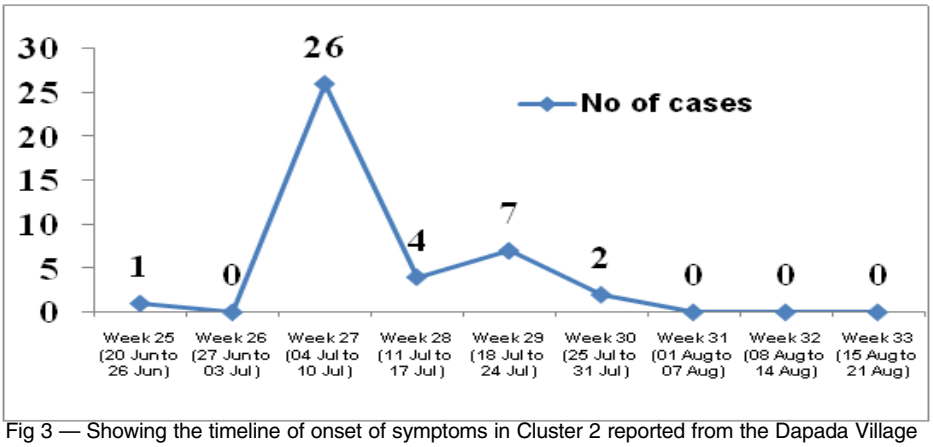

Fig 3 — Showing the timeline of onset of symptoms in Cluster 2 reported from the Dapada Village

During the investigation, it was found that a 12-year-old boy, who had traveled to Maharashtra, first showed signs of Chickenpox. Therefore, he was considered an index case. It was a single-pick outbreak and restricted up to a hostel in which, 69.23% of cases belonged to the age group of 5 to 9 years and 30.77% of cases were belong to the age group of 10 to 15 years. The last case from this place was reported on 26/07/2022. Therefore, the area was kept under surveillance till the completion of the double incubation period of diseases as per the protocol of IDSP. All the patients were treated symptomatically; no patient required hospitalization, and all the cases were cured without any complications. Total 13 serum samples were collected from the clinically confirmed patients and sent to the referral Laboratory for lab confirmation. Out of the total samples, 4 samples were confirmed Varicella Zoster through the IgM ELISA method. The epidemiological variables of both clusters prescribe in Table 1.

Discussion

The present study describes above the epidemiological determinants of the Chickenpox clusters encountered in the tribal district of Dadra & Nagar Haveli in the year 2022. The Cluster 1 was noted from the industrial area (Chawl) and the Cluster 2 was encountered from the student's residential hostel. Due to prompt identification, investigation and control measures, it was possible to restrict these clusters to limited areas, smaller sizes and shorter duration. Both clusters were confirmed by the clinically and the Laboratory reports. A significant difference was observed in the age of the infected persons in both the clusters. In the Cluster 1, most of the infected person belong to the age group of above15 years, whereas in the Cluster 2, maximum cases were noted in the age group of below 15 years. Outbreaks of Chickenpox are common in Worldwide[2,7,9]. Recently, the outbreaks of Chickenpox have been reported from various States of India like Jharkhand[16,18]; Assam[19]; Tamilnadu[8]; Himachal Pardesh[13]; Kashmir[14]; Chandigarh[6]; Odisha[20]. The district of Dadra and Nagar Haveli also has a history of outbreaks due to the circulation of Clade-1 VZV[15,21]. Most authors agree that the transmission of chickenpox follow a seasonal pattern, Varicella virus reduces their transmissibility in high temperatures, the causes of the seasonal transmission may be environmental or social in nature[10]. In the district of Dadra Nagar Haveli, the outbreaks of Chickenpox was normally been encountered in the month of December to February of the year of 2016-17, when the outbreak was common it happens in the same period only[21]. But in the present investigations, the time of Outbreaks were note between January and July month. This indicates that the seasonality of the outbreak of Chickenpox is changing. The migratory population, close proximity of living, overcrowding environments and increased social interactions elevated the rate of transmission of the disease[1]. The present clusters of Chickenpox were also started from immigration of a viremic migrate and the others attributed factors of these clusters are as explained above. Normally the outbreaks of Chickenpox have been reported in ages ranging from pre-school children to adults[16]. In this study a difference has been seen in the age of the infected. In the first cluster, most of the infected persons belong to the age group above 15 years, whereas, in the second cluster, most of cases

were in the age group of below 15 years. The outbreaks of Chickenpox were confirmed on the basis of clinical presentations with the help of serological tools, molecular tools and a combination of serological and molecular tools in the laboratory (Singh, *et al* 2015; Vaidya, *et al* 2018; Kerketta, *et al* 2019; Kujur, *et al* 2022)[6,15,16,20]. In this outbreaks events the cluster were identified by their clinical presentations and confirmed by the serological reports obtained from NIV Pune.

Conclusion

Chickenpox is a Vaccine-preventable disease; it is mostly affected the age group from pre-school and less among adults. Due to self-limiting in nature, the disease is mostly neglected. Every year, outbreaks of Chickenpox are reported from different locations in India. In the absence of Chickenpox vaccination in routine immunization schedules of the country, effective surveillance mechanisms and cluster management are the only ways to restrict the risk for exposure. The result of the study also emphasis that there are equal chances of transmission among adults as well as children. The capacity building of the stakeholders like caretakers, teachers and hostel warden may also be helpful to the early detection of warning signals.

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Conflict of Interest : The authors declare no personal or financial conflict of interest.

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References

1 Misra V, Gawali D, Jain AK, Khetan R, Jain SB — Acute Rise in the Incidence of Chickenpox due to Temperature Variation in a Specific Locality of Gwalior City. *Indian J Community Med* 2021; **46(2):** 323-4. doi: 10.4103/ijcm.IJCM_156_20. Epub 2021 May 29. PMID: 34321753; PMCID: PMC8281847.

2 Loparev V, Marto E, Rubtcova E — Toward Universal Varicella-Zoster Virus (VZV) Genotyping: Diversity of VZV Strains from France and Spain. *Journal of Clinical Microbiology* 2007; **45(2):** 559-63.

3 Centers for Disease Control and Prevention. Chickenpox (varicella). (2021).

4 Varela FH, Pinto LA, Scotta MC — Global impact of varicella vaccination programs. *Hum Vaccin Immunother* 2019; **15(3):** 645-57. https://doi.org/10.1080/21645515.2018.1546525 PMID: 30427766

5 Heininger U, Seward JF — "Varicella," *Lancet* 2006; **368(9544):** 1365-76.

6 Singh MP, Chandran C, Sarwa A, Kumar A, Gupta M, Raj A, Ratho RK — Outbreak of chickenpox in a Union Territory of North India. *Indian Journal of Medical Microbiology* 2015; **33(4):** 524-7.

7 Zhang X, Yu Y, Zhang J — The epidemiology of varicella cases among children in Beijing's Fengtai District from 2008 to 2012. *Vaccine* 2014; **32(29):** 3569-72.

8 Meyers J, Logaraj M, Ramraj B, Narasimhan P, MacIntyre CR — Epidemic Varicella Zoster Virus among University Students, India. *Emerg Infect Dis* 2018; **24(2):** 366-9. doi: 10.3201/eid2402.170659. PMID: 29350152; PMCID: PMC5782884.

9 Garnett GP, Cox MJ, Bundy DAP — The age in infection with varicella zoster virus in St Lucia, West Indies. *Epidemiology and Infection* 1993; **110:** 361-72.

10 Noha Saleha and Bassem Al Moghazyb. Seasonal variation and trend of chicken pox in the southern region of Saudi Arabia (2007–2012). *J Egypt Public Health Assoc* 2014; **89:** 143-7.

11 Balraj V, John TJ — An epidemic of Varicella in rural southern India. *J Trop Med Hyg* 1994; **97:** 113-6.

12 Sinha DP — Chickenpox-a disease predominantly affecting adults in rural West Bengal, India. *Int J Epidemiol* 1976; **5:** 367-74.

13 Gupta SN, Gupta N and Gupta S — Concurrent multiple outbreaks of varicella, rubeola, German measles in unvaccinated children of co-educational mount Carmel senior secondary school, Thakurdwara Palampur of northern Himachal, India. *Journal of Family Medicine & Primary Care* 2015; 117-23.

14 Kadri SM, Rehman S. Rehana K — Rising Trends of Chicken Pox Outbreaks among School Children in Kashmir, India-Suggestions for Health Policy. *EC Bacteriology and Virology Research* 2.5. 2017: 179-90.

15 Vaidya SR, Tilavat SM, Kumbhar NS, Kamble MB — Chickenpox outbreak in a tribal and industrial zone from the Union Territory of Dadra and Nagar Haveli, India. *Epidemiology and Infection* 2018; **146:** 476-80. https://doi.org/10.1017/S0950268818000201

16 Kujur A, Kiran K, Kujur M — An Epidemiological Study of Outbreak Investigation of Chickenpox in Remote Hamlets of a Tribal State in India. *Cureus* 2022; **14(6):** e26454. DOI 10.7759/cureus.26454

17 Vashishtha VM, Choudhury P, Kalra A, Bose A, Thacker N, Yewale VN, *et al* — Indian Academy of Pediatrics (IAP) Recommended Immunization Schedule for Children Aged 0 through 18 years – India, 2014 and Updates on Immunization. *Indian Pediatr* 2014; **51:** 785-803.

18 Pall S, Kumar D — Outbreak investigation of viral exanthem in Jharkhand, India: an eye opener for surveillance managers and vaccine policy makers. *Int J Community Med Public Health* 2018; **5:** 4756-60.10.18203/2394-6040.ijcmph20184564

19 Malakar M, Choudhury M, Thinsin S, Bose RS — Investigation of an outbreak of varicella in a village of Goalpara district, India. *Int J Basic Clin Pharmacol* 2017; **6:** 93-6. 10.18203/2319-2003.ijbcp20164759

20 Kerketta AS, Dwibedi B, Subudhi P — Chickenpox Outbreak in a Tribal District Rayagada, Odisha, India: Warrants Need for Vaccination. *Poster Abstracts* 2019; OFID, **6 (Suppl 2):** S605.

21 Vadya SR, Tilavat SM — Varicella Outbreak in Children from Silvassa, Dadra and Nagar Haveli, India. *Indian Pediatrics* 2021; **58:** 483-4.