



Trends of chicken pox in children: an ode to the robust network of surveillance system with laboratory support

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ABSTRACT

BACKGROUND

Chicken pox (varicella) is the primary infection caused by Varicella Zoster Virus (VZV) and it predominantly affects children, with highest incidence in the 1-9 years old age group. VZV transmission mainly occurs from direct contact, inhalation of aerosols from vesicular fluid of skin lesions of varicella or zoster, and possibly through infected respiratory secretions and its aerosols. Varicella outbreaks are frequently reported from various regions of India. In India about 74 outbreaks of chicken pox was reported in 2022. The objective of this research to describe the distribution and characteristics of Chicken pox outbreaks in Karnataka region during 2022 & 2023 in 7 districts, an observational study.

METHODS

Total of 213 suspected cases from February 2022 to February 2023 were included in the study. Samples from various districts of Karnataka were received in reference laboratory BMCRI under IDSP. Laboratory confirmation was performed in the State level viral research and diagnostic laboratory, BMCRI on representative samples sent from each district for VZV. IgM antibodies against VZV were detected by ELISA (NovaLisa).

RESULTS

A total of 213 suspected cases were observed from February 2022 to February 2023. Towards the end of the year in 2022, 58 cases were reported in Kolar. 8 representative samples were sent and all were positive for VZV IgM ELISA. A total of 47 cases were reported from Tumkur throughout the year. 47 samples were sent in total of which 43 tested positive for VZV. 48 cases were reported in Mandya, 10 representative samples were positive. 12 cases in Koppal. 29 cases from Hassan and all 7 representative samples were positive for IgM. 8 cases were reported from Davanagere and confirmed positive for IgM VZV through ELISA.

CONCLUSION

Karnataka has an ideal setting for the spread of VZV. The ambient temperature in the winter, early spring & closely placed population aids in the spread of infection. The number of chickenpox cases were higher amongst the children compared to the adults. This may be due to the fact that adult population already developed natural acquired immunity against chickenpox. Timely identification by surveillance and referral of samples by the district public health laboratories helped in early detection and treatment of the cases. The Chicken pox Vaccination has not been incorporated into the National immunization schedule as of now. A programme of varicella vaccination can potentially change the epidemiology of varicella and limit its burden childhood as well as its social and financial cost.

Keywords: Varicella zoster virus, Outbreak, Chicken pox

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INTRODUCTION

The highly contagious Varicella Zoster virus, which is a member of the Herpesviridae family, is the cause of chickenpox, a disease that mainly affects young children [1]. Despite the decline in disease incidence in developed countries following the introduction of the varicella vaccine, outbreaks continue to persist in developing nations [2]. Varicella is one of the leading causes of vaccine preventable deaths in children. The commercial varicella vaccine may protect against 85% of cases of chicken pox and 95% of cases of severe secondary sequelae. [2]

Direct contact, inhaling aerosols from vesicular fluid and possibly infected respiratory secretions are the main ways that aid the transmission of VZV. Incubation period lasts between 10 and 21 days and outbreaks have been documented often in different parts of India [3]. A clinically evident infection results in lifetime immunity. Throughout the year, the illness is mostly acute and self-limited, but it can also occasionally result in complications like pneumonia, encephalitis, and subsequent bacterial infections. One of the disease's long-term effects is the reactivation of a latent varicella infection, which leads to the development of herpes zoster. [4] The present study aims to describe the distribution and characteristics of Chicken pox outbreaks in 7 districts of Karnataka during 2022 & 2023. Case definition of chicken pox was defined as an acute onset of a generalized maculopapular-vesicular rash with concomitant presence of papules, blisters, pustules or crusts appearing on trunk and face and spreading to extremities, without other apparent causes [5]. In India about 74 outbreaks of chicken pox was reported in 2022 [6]. An outbreak was defined as ≥ 5 varicella cases that are related in place and are epidemiologically linked.

2. METHODOLOGY

Viral research and diagnostic laboratory (VRDL), Department of microbiology, BMCRI in co-ordination with the IDSP reference laboratory, BMCRI is involved in activities related to routine viral

diagnostics and viral outbreak investigations. On request and in partnership with the State Health Authorities (District surveillance units), extensive laboratory support towards viral outbreak management is provided. Between February 2022 and February 2023, large numbers of chickenpox cases were reported from Kolar, Koppal, Hassan, Mandya, Gadag, Tumkur and Davanagere districts of Karnataka. Subsequently, the respective DSUs deployed rapid response teams for the investigation for identifying the characteristics of the outbreak and associated risk factors along with possible control measures. Follow up was carried out up to 42 days (double the incubation period of VZV), calculated from the date of occurrence of the last reported case of that region.

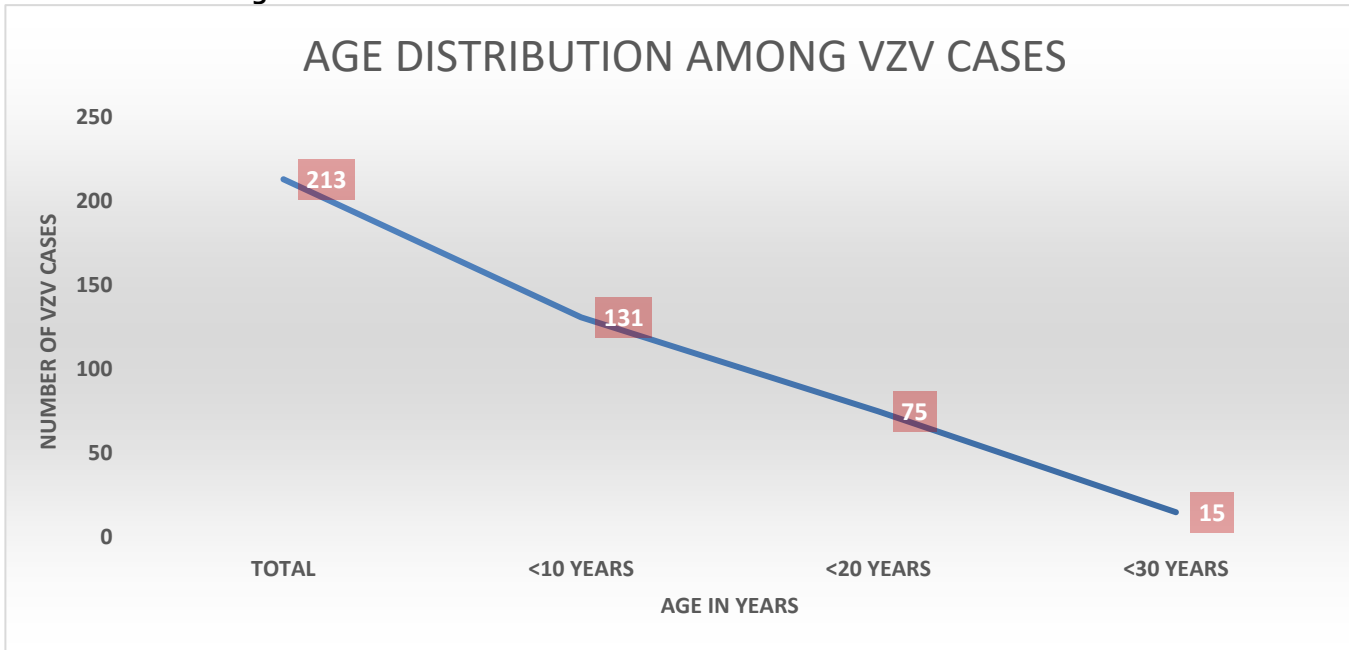
Demographic details and Clinical history were collected from the investigation report and line list sent by the respective district surveillance unit. All representative Serum samples collected from the respective DSUs sent to the VRDL in cold chain, were stored in aliquots until tested at -20 C. Laboratory confirmation was performed on all samples using IgM ELISA for VZV. The VZV specific IgM antibodies were detected using commercially available kits (NovaLisa) as per the manufacturer's instructions. Statistical analysis was done using SPSS software v24.0. The data was shown in the form of frequency and percentage. The study was done with data and samples received as part of laboratory confirmation in an outbreak investigation through IDSP. Ethical clearance not taken.

3. RESULTS

3.1 Demography

A total of 213 suspected cases were observed from February 2022 to February 2023. Among the cases 114 (53.5%) were male and 99 (46.4%) were female. 137 (79.1%) of them were less than 10 year of age, 29 (16.7%) between 11 and 20 and 7 (4%) adults above the age of 21. (FIGURE 1)

FIGURE 1: Overall age distribution of the cases of Varicella zoster



3.2 Clinical features

The most common clinical manifestation observed was fever with rashes (89%). The rash was generalized in all of the cases, and the first site was the trunk in the majority (78%) of the patients. The typical presentation was a maculopapular rash followed by vesicles with most of the patients presenting with 50–100 lesions. The history of contact with a case of chickenpox was available in all the patients while none of them gave a history of vaccination against VZV.

3.3 Outbreak characteristics in Kolar

The cases of fever with rash were more towards the end of 2022. The earliest case was reported on 16th Nov 2022 in a 10-year-old boy. He was put on home isolation

and recovered without any complication. An outbreak was reported on 5th December 2022 when 11 cases of fever with rashes were reported from the village of Venkatapura in early December and in children less than 12 years of age. Serum samples were collected and sent for ELISA to the Viral Research and development lab, BMCRI where they tested positive for VZV IgM. In the subsequent weeks the total number of cases of Fever with rashes added up to 53. A total of 8 samples were sent for ELISA and all were positive. Overall, 39/53 (73.5%) cases were children less than 10 years of age. 28/53 (52.8%) were male while 25/53 (47.1%) were female cases. (Table I)

Table I: Age distribution of cases in all 5 districts with total number of cases reported

AGE DISTRIBUTION OF CASES AMONG 5 DISTRICTS		
DISTRICT	AGE RANGE	DISTRIBUTION
KOLAR (n= 53)	<10 YEARS	39 (73.5%)
	<20 YEARS	10 (18.8%)
	<30 YEARS	4 (7.5%)
MANDYA (n= 48)	5-15 YEARS	48 (100%)
HASSAN (n= 29)	<10 YEARS	27 (93.1%)
	<20 YEARS	2 (6.8%)
KOPPAL (n= 12)	<10 YEARS	7 (58.3%)
	<20 YEARS	3 (25%)
	30+	2 (16.6%)

DAVANGERE (n= 8)	10-19 YRS	8 (100%)
TUMKUR (n= 47)	<10 YEARS	19 (40.4%)
	11-15 YEARS	23 (48.9%)
	16-30 YEARS	5 (10.6%)
GADAG (n=16)	<10 YEARS	7 (43.7%)
	11-15 YEARS	5 (31.2%)
	30+	4 (25%)

3.4 Outbreak characteristics in Mandya

A total of 48 cases were reported from Mandya. Majority of cases, 40/48 (83.3%) were concentrated towards the end of December to 2nd week of January. Earliest case reported on 12th December in a school going boy with vesicle like lesions and fever. 10 samples were sent for laboratory confirmation and All were positive. 27/48 (56.2%) were male and 21/48 (43.7%) were female.

3.5 Outbreak characteristics in Hassan, Koppal and Davanagere

From Hassan, 29 cases were reported. All cases clustered in the month of February, 2023. First case was reported on 3rd February 2023 in a school at Mosale Hossalli. 7 representative samples were sent and all were positive. All the cases were of children under 11 years.

14/29 (48.27%) were male while 15/29 (51.7%) were female. In Koppal cases were reported in Early January with total of 12 cases. 8/12 (66.6%) were female and 4/12 (33.3%) were male. Female preponderance was seen. 6 representative samples were positive. 7 (58.3%) were children under 11 years of age while 3(25%) were young adults and 2 (16.6%) adult cases. In Davanagere 8 cases of fever with rashes in school going children between the ages of 10 and 19 years were reported in January 2023, 4/8 male and 4/8 female cases. All the serum samples were sent to the VRDL, BMCRI where all tested positive for VZV ELISA IgM. In all districts active cases were subjected to home isolation. Health education and spot supportive treatment were given. All the cases recovered without any major complications. Summarized in (TABLE II)

Table II: Date of outbreak and number of samples sent with positivity rate

LOCATION	NUMBER OF CASES (n=213)	OF SAMPLES SENT FOR LAB CONFIRMATION	POSITIVE	NEGATIVE
KOLAR	53 (24.8%)	8	8 (100%)	-
MANDYA	48 (22.5%)	10	10 (100%)	-
KOPPAL	12 (5.6%)	6	6 (100%)	-
HASSAN	29 (13.6%)	7	7 (100%)	-
DAVANAGERE	8 (3.7%)	8	8 (100%)	-
TUMKUR	47 (22%)	43	36 (83.7%)	7
GADAG	16(7.5%)	14	12(85.7%)	2

3.6 Outbreak characteristics in Tumkur, Gadag

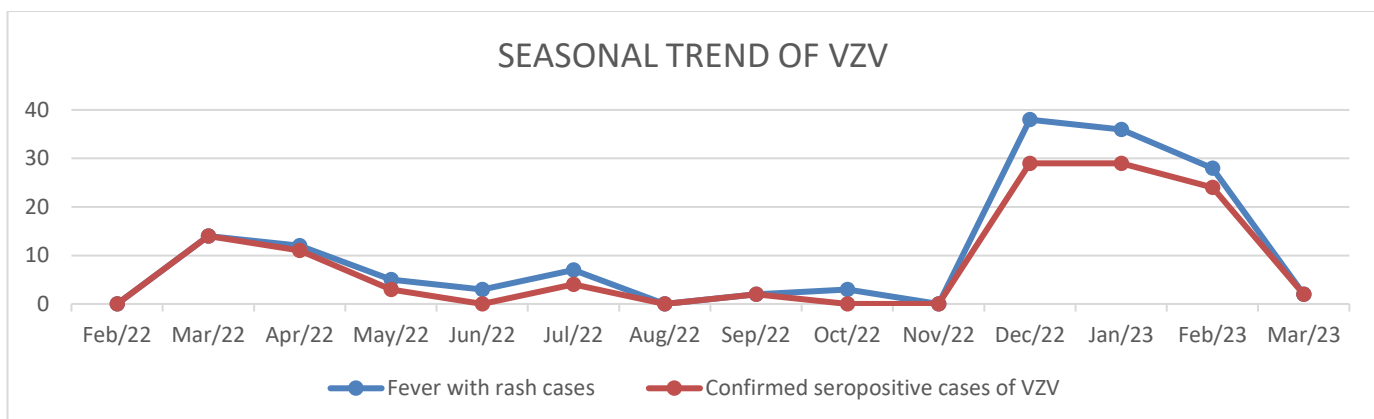
In Tumkur district a total of 20 cases of VZV were reported in between the months of March and April 2022. Earliest case was reported on 5th March 2022 in a 16-year-old boy. Then in December 2022 a total of 23 cases were reported. The earliest case reported was on 1st December 2022. Remaining 04 cases were reported between the months of July to September. The district of Tumkur saw an influx of cases twice during the year of 2022. 19/47 (40.4%) cases reported were among children under 10 years, 23 (48.9%) among 11–15-year-olds and 5 (10.6%) cases in adults. 36/43 (83.7%) of the representative samples sent by the DSUs tested positive for VZV IgM. 29/47 (61.7%) of the cases were Male while 18 (38.2%) were female. Sporadic cases of fever with rash were reported during the months between July and August 2022 in Gadag adding up to 16 cases. 14 serum samples were received for testing of VZV and 12 were positive for VZV IgM. 8/16 (50%) were male and 8/16 (50%) were female. There were no deaths observed during the active surveillance.

4. DISCUSSION

In Karnataka, ambient temperatures prevail and the population resides in close proximity. Comprehensive information on vaccination status is lacking in certain regions. Generally, children in these areas lack a documented history of varicella zoster vaccination. The Indian Academy of Pediatrics recommends vaccination for specific groups, including adolescents without a history of childhood varicella, household contacts of immunocompromised children, those attending day care centers, and susceptible adolescents and adults engaged in institutional settings (e.g., school teachers, day care center workers, military personnel, and healthcare professionals).^[12] Studies indicate that

administering varicella vaccination as post-exposure prophylaxis within five days of exposure significantly reduces the likelihood of clinical varicella infection in contacts. Emphasizing the importance of regular training programs for health workers stationed in peripheral centers is crucial to early detection of highly contagious communicable diseases, thereby preventing outbreaks. Seroprevalence studies in India have indicated that a significant proportion of the population from children to adults remains susceptible to VZV infection. In the present study, the predominantly affected group were children of less than 10 years of age in all 7 districts. Singh M P et al^[7], in Chandigarh also observed that the predominant age group affected in the outbreaks were children less than 15 years of age. Majority of the districts showed an equal incidence of cases among males and females except Hassan and Koppal which showed a slight female preponderance. In the district of Kolar 39 cases (73.5%) were less than 10 years of age all reported towards the end of 2022. In the district of Mandya 40/48 (83.3%) cases were reported between December 2022 and 2nd week of January. In Hassan all cases clustered in the month of February, 2023. Similar pattern seen in the districts of Koppal and Davanagere gives more insight about the seasonal pattern of VZV outbreaks. Districts like Tumkur had cases of fever with rashes throughout the year with 2 major peaks; in the months between March to April and December. The reason for this could lie with certain geographical and ecological factors that aid in the easier transmission of infections in this region. Kadri Et Al^[8], in Kashmir observed a seasonal pattern of outbreaks in late winters & warm months similar to our study. The current study also showed seasonal variation among VZV cases. (Figure 2)

FIGURE 2: Seasonal variation of VZV- More cases reported in the winter months





Vaidya et al ^[9], in a study done at an industrial zone in Dadra and Nagar Haveli emphasized that proper surveillance is important for timely detection, to declare an outbreak and to make strategies to combat it. The data in the present study was obtained due to the efficient surveillance system which highlights the robust network with strengthened laboratory support that complemented timely detection of cases and appropriate outbreak management. According to IDSP data available ^[5], there was a sharp decline in the number of Chicken pox outbreaks reported in the year 2021 compared to 2020. This may be attributed to the increased surveillance & contact tracing of fever cases in 2020 leading to identifying the chicken pox outbreaks by default. The increased usage of masks & schools being closed probably led to the sharp decline of cases in 2021. The outbreaks reported in 2022-2023, has been similar to pre covid times which may be attributed to the timely detection and reporting of outbreaks, the reopening of schools and the relaxation of mask usage protocols.

5. CONCLUSION

The swift response of rapid response teams and local medical officers in identifying and tracing cases within schools has played a pivotal role in controlling the spread. The network of surveillance systems, complemented by laboratory confirmation, has had a substantial impact on timely reporting and preventing further outbreaks. These efforts are instrumental in influencing policy changes, despite the fact that chickenpox vaccination is not currently included in the national immunization schedule. Implementing a vaccination program has the potential to alter the epidemiology of varicella, alleviating its impact on childhood and mitigating the associated social and financial burdens.

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