



Seroprevalence of Respiratory Syncytial Virus among Rural Population: Insights into Infection Rates and Immune Status: Pilot Study

Dilip D. Hinge*¹, Satish R. Patil¹, Vinit N. Deshmukh¹, Kailas D. Datkhile¹.

¹Krishna Institute of Medical Science, Krishna Vishwa Vidyapeeth, Karad, Satara, Maharashtra

Corresponding Author Email: ddhinge@gmail.com

Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 11 Aug 2023	<p><i>Respiratory Syncytial Virus (RSV) is a significant cause of respiratory tract infections, particularly affecting infants, young children, and immunocompromised individuals, with a substantial global burden of morbidity and mortality. This study aimed to assess the seroprevalence of RSV among a rural population in Karad Taluka, India, an area where RSV data is scarce due to its predominantly urban focus. Ethical approval was obtained, and written informed consent was collected from participants' parents or legal guardians. Blood samples were collected from individuals aged 16 months to 5 years residing in rural areas, and IgM RSV-specific antibodies were detected to identify recent infections using SERION enzyme-linked immunosorbent assay (ELISA). Additionally, demographic information and clinical history were collected through a structured questionnaire. The data were entered into an electronic database, and seroprevalence was calculated based on the proportion of individuals with positive serological results. The study revealed that by the age of 3 years, 81.0% of children exhibited IgM seropositivity to RSV, with a cumulative seroprevalence of 72% in the entire study population. The seroprevalence varied with age, demonstrating an ongoing RSV activity within the community, as evidenced by the high IgM positivity. However, as children grew older, a decline in IgM positivity was observed, possibly due to protective antibodies developed from previous exposures or a longer time elapsed between RSV exposure and sample collection in older children. These findings underscore the vulnerability of young infants to RSV and the need for early protection in India. It highlights the importance of considering timing and age-appropriate administration of RSV vaccines in vaccination strategies, as well as the potential limitations of maternal immunization in protecting preterm infants. Understanding RSV seroprevalence in rural areas is crucial for guiding public health interventions and resource allocation to mitigate the impact of this virus on vulnerable populations, particularly young children who are at the highest risk.</i></p>
CC License CC-BY-NC-SA 4.0	<p>Keywords: Respiratory Syncytial Virus (hRSV), Seroprevalence, Rural population.</p>

1. Introduction

Respiratory syncytial virus (RSV) is a leading cause of respiratory tract infections, particularly among infants, young children, and immunocompromised individuals. It is associated with a significant burden of morbidity and mortality worldwide. (1) The rates of RSV detection in various studies conducted in younger children (0-5 years) vary from 2.1% to 62.4% in India which is higher as compared to children from other age groups (2). In 2020, higher RSV-associated disease burden was reported among children (<5 years) in low-income and lower-middle-income countries (3). According to the fact sheet, WHO recommends several interventions for RSV disease prevention and control,

including hand hygiene, respiratory etiquette, and environmental cleaning. The only licensed intervention currently available to prevent severe RSV disease in specific high-risk infants and children is passive immunotherapy with palivizumab. (4,5)

There is a paucity of data on RSV seroprevalence and infection rates among rural populations because it is extensively studied in an urban area. Understanding the seroprevalence and immune status of RSV in rural areas is crucial for guiding public health interventions and resource allocation to mitigate the impact of this virus on vulnerable populations.

Rural areas often have distinct demographic and environmental characteristics that can influence the transmission of RSV and even they are face unique challenges, including limited access to healthcare facilities, lower socio-economic status, and inadequate awareness about infectious diseases. These factors may contribute to differences in RSV seroprevalence and infection rates compared to urban areas.

The infection rates and immune status of individuals from rural, we can gain insights into the burden of RSV in rural areas.

2. Methods

Study Design: This cross-sectional study aimed to assess the seroprevalence of Respiratory Syncytial Virus (RSV) among a rural population in Karad taluka. **Ethical Considerations:** Ethical approval was obtained from institutional ethical committee (KIMS, KVV, Karad). The confidentiality of participants' personal information and the demographic data were ensured throughout the study.

Study Setting and Participants: The study was conducted at Krishna Institute of Medical Science, Karad Maharashtra, India. Patients were recruited among the child who visited to hospital as per inclusion criteria. The inclusion criteria included individuals of age groups 16 months above to 5 years residing in the rural area and willing to participate in the study. Written informed consent was obtained from parents/legal guardians of child.

Sample Collection and Laboratory Testing: Blood samples were collected from the study participants using standard aseptic techniques. Approximately 2 ml blood was obtained from each participant. The samples were transported to the laboratory under appropriate storage conditions.

Serological testing was performed to detect IgM RSV-specific antibodies in the collected blood samples to identify recent infection. SERION enzyme-linked immunosorbent assay (ELISA) classic version V 113.16 kit made by institute virion; Germany was used for determination of IgM antibody. The manufacturer's instructions were followed at each step during performing the assay.

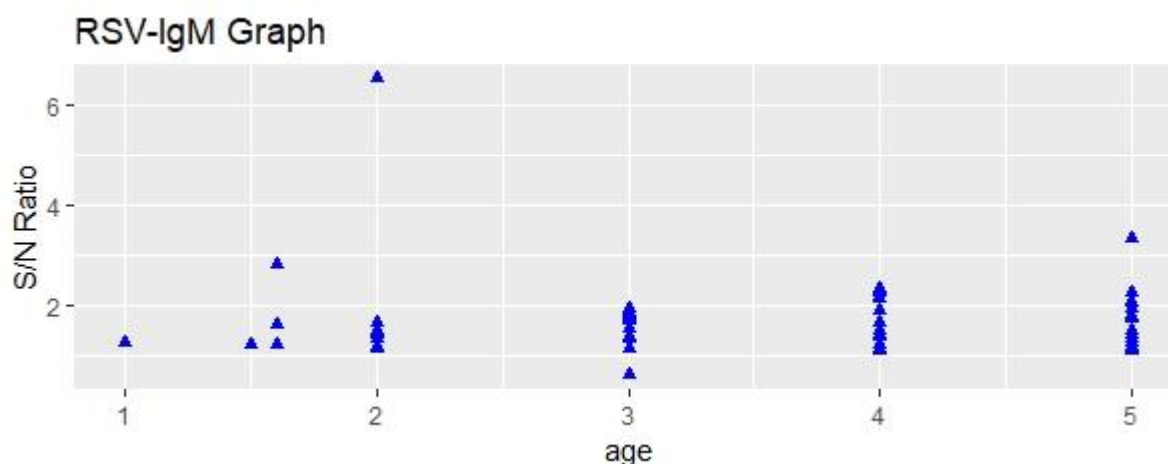
Data Collection and Analysis: In addition to blood sample collection, a structured questionnaire was administered to collect relevant demographic information (age, sex, locality, etc.) and clinical history (previous respiratory infections, hospitalizations, etc.) of the participants. The questionnaire was developed in the local language clearly explain them for better understanding.

The collected data, including serological results and questionnaire responses, were entered into a secure electronic database. The seroprevalence of RSV antibodies was determined by calculating the proportion of individuals with positive serological results.

Limitations: Potential limitations of the study included the sample size, which might not fully represent the entire rural population.

3. Results and Discussion

Figure 1: A



S/N ratio- S/N ratios represent the absorbance of the sample divided by the mean absorbance of negative controls

Table 1:

Age(years)	IgM anti RSV Positivity, (% Positivity)
>1	2/5, (40%)
2	4/11, (36%)
3	13/16, (81%)
4	09/13, (69%)
5	11/16, (68%)
Total	44/61 (72%)

At the age of 3 years, 81.0% (13 of 16) children exhibited seropositivity to IgM, and a subsequent augmentation was observed at the age of 3 years. The cumulative seropositivity of IgM Anti-RSV antibody was determined to be 72% (44 of 61, 62.06-82.19 95% confidence interval). The ELISA S/N ratios of the individual samples, which represent the absorbance of the sample divided by the mean absorbance of negative controls in ELISA, demonstrated a clear and gradual increase in a significant proportion of samples across the age groups ranging from 15 months to 5 years. This trend suggests an ongoing RSV activity within the population, as supported by the high IgM positivity.

The seroprevalence studies conducted in rural population have provided valuable insights into the extent of RSV exposure in the population. These studies have revealed that a significant proportion of children have anti-RSV antibodies, indicating a susceptibility to RSV infections. By the age of 6 months, nearly the entire infant population in India is devoid of anti-RSV antibodies. (1) Another study recorded the highest RSV-associated hospitalizations in infants aged 0 to 5 months, further highlighting the vulnerability of young infants to RSV. (6) As the children grew older, a decrease in IgM positivity was observed. This decrease could be attributed to a reduced number of infections, likely due to the presence of protective antibodies developed from previous exposures or a longer time elapsed between RSV exposure and sample collection in older children. (1) The seroprevalence data also indicate a decline in antibody levels during the first few months of life. Maternal antibodies play a crucial role in protecting infants against RSV, but their presence diminishes over time, leaving infants more susceptible to infections (1).

The findings emphasize the importance of early protection against RSV in India. Vaccination strategies need to consider the timing and age-appropriate administration of RSV vaccines to provide effective immunity to infants. Additionally, the study suggests that maternal immunization may not provide sufficient protection to preterm infants, indicating the need for alternative preventive measures. The seroprevalence studies on RSV in rural highlight the need for focused efforts to control RSV infections, particularly in young infants who are at the highest risk. Understanding the

seroprevalence rates helps in formulating effective prevention and vaccination strategies to reduce the burden of RSV-associated diseases in the Indian population.

References

1. Arankalle, V. A., Kulkarni, R., Malshe, N., Palkar, S., Lalwani, S., & Mishra, A. C. (2019). Seroepidemiology of respiratory syncytial virus in western India with special reference to appropriate age for infant vaccination. *Journal of Medical Virology*, *91*(8), 1566-1570. doi:10.1002/jmv.25489
2. Ghia, C., & Rambhad, G. (2021). Disease Burden Due to Respiratory Syncytial Virus in the Indian Pediatric Population: A Literature Review. *Clinical Medicine Insights. Pediatrics*, *15*, 11795565211029250. doi:10.1177/11795565211029250
3. Li, Y., Wang, X., et al; Respiratory Virus Global Epidemiology Network; Nair, H; RESCEU investigators. (2022). Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in children younger than 5 years in 2019: a systematic analysis. *The Lancet*, *399*(10340), 2047-2064. doi:10.1016/S0140-6736(22)00478-0
4. Domachowske, J. B., Anderson, E. J., & Goldstein, M. (2021). The Future of Respiratory Syncytial Virus Disease Prevention and Treatment. *Infectious Diseases and Therapy*, *10*(Suppl 1), 47-60. doi:10.1007/s40121-020-00383-6
5. World Health Organization. (n.d.). Fact Sheet - Respiratory Syncytial Virus (RSV) disease. [Website]. Retrieved from [https://www.who.int/news-room/fact-sheets/detail/respiratory-syncytial-virus-\(rsv\)-infection](https://www.who.int/news-room/fact-sheets/detail/respiratory-syncytial-virus-(rsv)-infection)
6. Na'amnih, W., Kassem, E., Tannous, S., Kagan, V., Jbali, A., Hanukayev, E., ... Muhsen, K. (2022). Incidence and risk factors of hospitalizations for respiratory syncytial virus among children aged less than 2 years. *Epidemiology and Infection*, *150*, e45. doi:10.1017/S0950268822000152