



Prevalence of SARS-CoV-2 cases among pediatric population during 3 waves: A retrospective comparative analysis from a tertiary care hospital in Northern India

Deepinder Singh¹, Ashima Katyal², Prerna Aggarwal³

ABSTRACT

Objective

SARS-CoV-2 has been reported in all age groups. However, the proportion of confirmed cases in children has been relatively small in the 1st and 2nd wave. Concerns had been raised that whether 3rd wave will severely affect pediatric population or not and a study has been conducted to see the prevalence of SARS-CoV-2 among pediatric population during 3 waves in India.

Methodology

A retrospective study was done on the nasopharyngeal swab and oropharyngeal swabs from children suspected with SARS-CoV-2, received in the Department of Microbiology, KCGMC, Karnal from various districts of Haryana, India during three waves of SARS-CoV-2. Present study was done in different age groups like 0-5 years, 6-10 years and 11-17 years. 1st wave from March to September 2020 and 2nd wave was from February to May 2021 and there was 3rd wave from January to June 2022.

Results

A total of 27389, 182178 and 33866 samples of children < 17 years of age were received during 1st, 2nd and 3rd waves respectively making total samples received in all three waves to 243433. Positivity rate among children was 3.05 %, 5.31%, and 1.8 % during 1st, 2nd and 3rd waves respectively. The 2nd wave showed maximal cases in pediatric population as compared with the first and second wave (7.8%). Further, it was found that in all three waves the positivity rate was higher in females as compared to males. Overall children less than 5 years were having more positivity rate than 6-10 year and 11-17 years age groups

Conclusion

As concerns had been raised that the 3rd wave would have more impact on children but the figures show otherwise. In fact, 2nd wave had more positive cases as compared to 1st and 3rd wave. Overall children less than 5 years were having more positivity rate than 6-10 year and 11-17 years age groups. Girls had a higher positivity rate as compared to boys in all age groups.

Keywords: SARS-CoV-2, Children, third wave, girls

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INTRODUCTION

In December 2019, cluster of cases of pneumonia of unknown cause emerged in Wuhan City, China, resulted in the identification of a novel coronavirus on 12 January 2020, denoted as severe acute respiratory syndrome coronavirus 2 (SARS CoV-2), and the associated disease as coronavirus disease 2019 (COVID-19) [1]. The virus spread rapidly around the world and was declared a pandemic by the World Health Organization (WHO) on 11 March 2020 [2] and many countries adopted public health measures to curb its spread. Coronaviruses are large, lipid-enveloped, single-stranded RNA viruses found in avian and mammalian species. Human coronaviruses commonly cause mild upper respiratory tract infections, accounting for approximately 30% of common colds, although instances of severe disease are described in the elderly, children, and immunocompromised hosts [3]. SARS-CoV-2 have been reported in all age groups. However, the proportion of confirmed cases in children has been relatively small in 1st and 2nd wave [4]. Concerns had been raised that 3rd wave will severely affect children but did it really happen? So we have conducted a study to see prevalence of SARS-CoV-2 infection in the pediatric population among 3 waves.

Methodology

A retrospective study was done on the nasopharyngeal swab and oropharyngeal swabs

from children suspected with SARS-CoV-2, received in the Department of Microbiology, KCGMC, Karnal from various districts of Haryana, India during three waves of SARS-CoV-2. Present study was done in different age groups like 0-5 years, 6-10 years and 11-17 years. 1st wave was considered from March to September 2020 and 2nd wave was from February to May 2021 and there was 3rd wave from January to June 2022. Samples were processed for RNA extraction and extraction was done by automated extraction machine. Insta NX Mag-g6 and mastermix was prepared using Trivitron pcr kits. Template addition was done and followed by RTPCR by biorad cfx96.[5,6]. All the biomedical waste generated during this study in the laboratory will be discarded as per Biomedical Waste and Handling Rules, 2016 guidelines and Biomedical Waste Management (Amendment) Rules 2018 and 2019[7]. The statistical analysis was carried out using IBM SPSS (Statistical Package for Social Sciences) statistical version 24. The analysis has included the categorical data, quantitative data, chi –square test.

Results

A total of 27389, 182178 and 33866 samples of children < 17 years of age were received during 1st, 2nd and 3rd waves respectively making total samples received in all three waves to 243433. Out of these 3423 were found to be covid positive leading overall positivity rate to 1.40%.

Table 1: Total no. of samples of children <17 years of age received and overall positivity rate during three Covid waves

Total no. of samples received during 1 st wave	Total no. of samples received during 2 nd wave	Total no. of samples received during 3 rd wave	Total no. of samples received during three Covid waves	Total number of Covid positive samples	Percentage positivity (%)
27389	182178	33866	243433	3423	1.40

Chi-square test was performed for association between two categorical variables using the formula given below - $\chi^2 = \sum(O_i - E_i)^2/E_i$ where O_i is the observed value and E_i is the expected value.

P value was determined using IBM SPSS (Statistical Package for Social Sciences) statistical version 24 and p value ≤ 0.001 was considered as significant.[Table 2]

**Table 2: Age and gender wise distribution of Covid samples & positivity rate among 3 waves**

	Age Groups (years)	Males (%)	Positivity among Males (%)	Females (%)	Positivity among Females (%)	Total	Chi-Square	p-value
1 st wave	<5	2304(55)	2.8	1889(45)	3.3	4193	69.664	.0001**
	6-10	2925(58)	3.2	2161(42)	3.6	5056		
	11-17	9280(51)	2.9	8820(49)	2.5	18100		
	TOTAL	14509(53)		12870(47)				
2 nd wave	<5	2156(54)	7.18	1809(46)	8.3	3965	3.720	.156
	6-10	4624(53)	3.4	4149(47)	4.4	8773		
	11-17	17710(54)	3.6	15300(46)	5.0	33010		
	TOTAL	24490(54)		21258(46)				
3 rd wave	<5	2304(55)	2.4	1889(45)	2.6	4193	71.301	.0001**
	6-10	2935(58)	2.2	2161(42)	1.4	5096		
	11-17	9280(51)	1.3	8820(49)	1.1	18100		
	TOTAL	14519(53)		12870(47)				

In the first wave 14,509 (53%) males and 12,870 (47%) females were tested for Covid. Highest positivity was seen in age group 6-10 years both for males (3.2%) and females (3.6%) followed by < 5 years age group i.e. for 3.3% for males and 2.8% for females and lowest positivity was recorded among 11-17 years age group which was 2.9% for males and 2.5% for females. Overall positivity rate was more among females as compared to males in the first wave. Chi-Square was applied and value came out to be 69.664 and results are significant (p= 0.001). Maximum patients were tested during the 2nd wave i.e. 24,490 males and 21258 females.

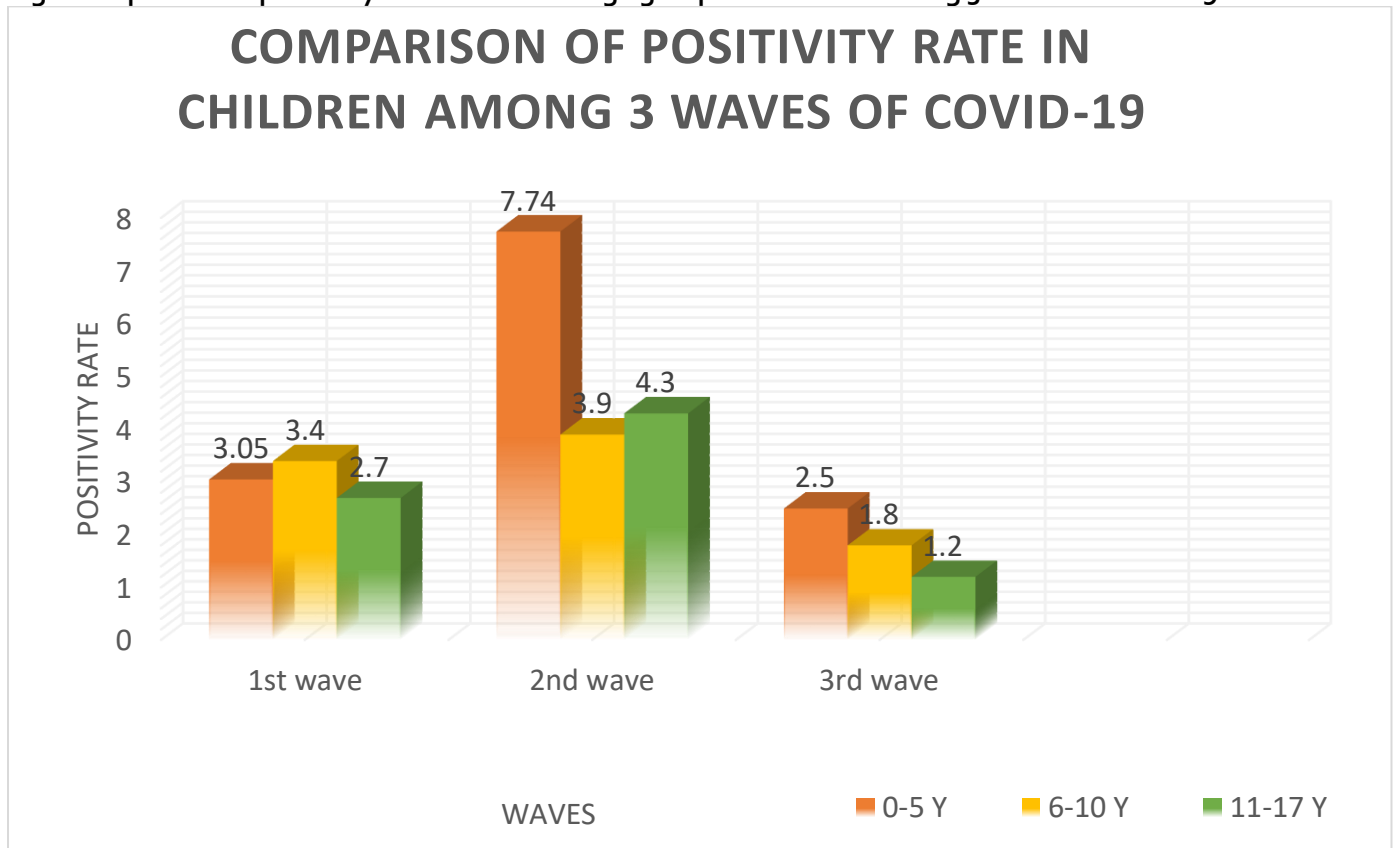
During 2nd wave Highest positivity was seen in < 5 years age group years both for males (7.18 %) and females (8.3%) followed by 11-17 years age group i.e. for 3.6% for males and 5.8% for females and lowest positivity was recorded among age group 6-10 years which was 3.4 % for males and 4.4 % for females. Chi-Square value for 2nd was 3.720 and results are non-significant (p= 0.156). Positivity rate was more among females as compared to males in the 2nd wave. During 3rd wave, 2304 males and 1889 females were tested. Chi-Square value for 2nd wave was 3.720 and results are significant (p= 0.001). Positivity rate was more among females as compared to males



in 3rd wave. During 3rd wave Highest positivity was seen in < 5 years age group years both for males (2.4 %) and females (2.6%) followed by 6-10 years age group i.e. for 2.2 % for males and 1.4 % for females and lowest positivity was recorded among age group 11-17 years which was 1.3 % for males and 1.1 % for females. Positivity rate among children was 3.05 %, 5.31%, and 1.8 % during 1st, 2nd and 3rd waves

respectively. In 2nd wave highest positivity was seen in < 5 year children (7.8%). Further, it was found that in each wave, more positive cases were seen among females as compared to males. Overall children less than 5 years were having more positivity rate than 6-10 year and 11-17 years age groups. Comparison of positivity rate in different age groups of children among 3 waves of covid -19 is shown in fig 1.

Fig 1 comparison of positivity rate in different age groups of children among 3 waves of covid -19S



DISCUSSION

The present study describes the positivity rate and demographic characteristics among the three waves of COVID-19 pandemic at a tertiary care center in northern India. As compared to the first and third waves, the cases during the second wave of the pandemic presented with more positiverate [8]. Krishnamurthy S et al.[9] also conducted a study which was in concordance with the present study i.e children were more infected in 2nd wave as compared to 1st wave. This may be due to the reason that virus in 2nd wave was more transmissible than other

variants of covid -19. In 2nd and 3rd wave highest positivity was seen in < 5 year children while in 1st wave it was seen in 6-10 years age group. So, overall children less than 5 years were having more positivity rate than 6-10 year and 11-17 year age groups which was not in concordance with study conducted by Ghosh R et al[10] which depicted that maximum involvement was of >10 years age group in 3rd wave. Among all 3 waves, samples received were more for males as compared to females in all age groups which is in concordance with study



conducted by Kunno J et al.[11]Further, it was found that in all three waves positivity rate was higher in females as compared to males. All of the above data shows that as expected 3rd wave was less prevalent among children rather 2nd wave was more prevalent in children. This may be due to developed innate immunity among the children after 2nd wave. A more efficient innate immune response resulted in a different adaptive immune response to SARS-CoV-2 in children, as compared to adults. It is now well established that children can mount a robust neutralizing antibody response to SARS-CoV-2 [12,13]. Initial reports from small pediatric cohort studies showed lower serum neutralizing activity, as compared to adults and a reduced breath of the antibody response to the spike protein.

Few limitations of this study also deserve attention. As there is no data on clinical features of patients and number of deaths during all three waves which would have been better indicator to analyze the impact of 3rd wave among pediatric population . Further, it is a study conducted at a tertiary care isolation center. Therefore, it may not estimate the

exact prevalence of symptoms for the population.

CONCLUSION

Accurate forecasting for the prevalence of COVID-19 can contribute to plan the health infrastructure and services under dynamic demand and to guide emergency preparedness effectively in responding to this disease outbreak. As concerns had been raised that the 3rd wave would have had more impact on children but the figures show otherwise. Given the results with respect to prevalence of COVID-19 among children from 0-17 years of age, we conclude that 2nd wave had more positivity rate among children as compared to 1st and 3rd wave. It was initially stated that 3rd wave would be more prevalent among children as compared to 2nd wave due to vaccination in adults and no vaccination among children. Among all children, children less than 5 years of age were having more positivity rate than 6-10 years and 11-17 years age groups. In nutshell, prevalence among pediatric population is independent of vaccination status instead it depends on ability of virus to spread.



REFERENCES

1. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *N Engl J Med.* 2020:1–9.
2. World Health Organization. Coronavirus disease 2019 (COVID-19) situation report–51. World Health Organization, 11 March 2020.
3. Ison MG, Lee N. Noninfluenza respiratory viruses. In: Cohen J, Powderly W, Opal S, eds. *Infectious diseases.* 4th ed. Vol. 22017. London: Elsevier, 2017:1472–82.
4. Kavitha C, Gowrisankar A, Banerjee S. The second and third waves in India: when will the pandemic be culminated? *Eur Phys J Plus.* 2021; 136:596.
5. Ayakody H, Rowland D, Pereira C. *et al.* Development of a high sensitivity RT-PCR assay for detection of SARS-CoV-2 in individual and pooled nasopharyngeal samples. *Sci Rep* 12, 5369 (2022). <https://doi.org/10.1038/s41598-022-09254-1>
6. Munir R, Scott LE, Noble LD, Steegen K, Hans L, Stevens WS, 2023. Performance Evaluation of Four Qualitative RT-PCR Assays for the Detection of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). *Microbiol Spectr* 11:e03716-22. <https://doi.org/10.1128/spectrum.03716-22>
7. Parida A, Capoor MR, Bhowmik KT. Knowledge, attitude, and practices of Bio-medical Waste Management rules, 2016; Bio-medical Waste Management (amendment) rules, 2018; and Solid Waste Rules, 2016, among health-care workers in a tertiary care setup. *Journal of laboratory physicians.* 2019 Oct;11(04):292-6.
8. Singh S, Sharma A, Gupta A, Joshi M, Aggarwal A, Soni N, et al. Demographic comparison of the first, second and third waves of COVID-19 in a tertiary care hospital at Jaipur, India. *Lung India* 2022;39:525-31. [10.4103/lungindia.lungindia_265_22](https://doi.org/10.4103/lungindia.lungindia_265_22)
9. Krishnamurthy S, Kar SS, Dhodapkar R, Parameswaran N. Comparison of COVID-19 Infection in Children During the First and Second Wave. *Indian Journal of Pediatrics* (October 2022) 89(10): 1016–1018
10. Ghosh R, Bhagyawant KK, Udavant P, Surywanshi R, Chaudhary H. Covid-19 in children in third wave: clinical presentation, complications and effect of influenza vaccination. *Pediatric on call journal.* 2023;20(3):71-77
11. Kunno J, Supawattanabodee B, Sumanasrethakul C, Wiriyasivaj B, Kuratong S, Kaewchande C. Comparison of Different Waves during the COVID-19 Pandemic: Retrospective Descriptive Study in Thailand. *Advances in Preventive Medicine.* 2021
12. Blanchard-Rohner G, Didierlaurent A, Tilmanne A, Smeesters P, Marchant A. Pediatric COVID-19: Immunopathogenesis, Transmission and Prevention. *Vaccines* (Basel). 2021 Sep 8;9(9):1002. doi: 10.3390/vaccines9091002. PMID: 34579240; PMCID: PMC8473426.
13. Yonker, L.M.; Neilan, A.M.; Bartsch, Y.; Patel, A.B.; Regan, J.; Arya, P.; Gootkind, E.; Park, G.; Hardcastle, M.; John, A.S.; et al. Pediatric Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2): Clinical Presentation, Infectivity, and Immune Responses. *J. Pediatrics* 2020, 227, 45–52.e5.