

COVID-19 Epidemiology Study from a tertiary care center in North India

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ABSTRACT:

Background & Objectives: Present pandemic caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) presenting mostly as infectious respiratory disease, has caused significant mortality and mobility during its course. The clinical characteristics and outcome of the infected people has been variedly reported in the literature. Epidemiological studies will provide public health authorities and government with an estimate of the burden and statistics which will help in future, to improve the response to pandemics. **Methods:** Nasopharyngeal and oropharyngeal samples, of suspected patients for COVID-19 were tested by RT-PCR. Retrospective data for the period of 2 years (March 2020 to February 2022) was evaluated considering the gender difference, clinical presentation and relation of the Ct-value with various parameters. **Results:** Total of 1,93,864 samples were processed and 7.5% positivity rate was reported. Among the total samples received 1,04,378/1,93,864 (54.8%) were males. Positivity rate was least in 1-9 years of age and maximum in > 80 years age. Clinically no symptom was specific for the disease, presentation of the patients range from mild symptoms to high grade fever, cough, sore throat, loss of smell and taste and also gastro-intestinal symptoms. 1,75,407/1,93,864 (90.5%) were asymptomatic patients. Comparing the Ct value, considering the gender and symptom status, no significant difference was observed. **Interpretation and Conclusions:** Our study is an addition to the ongoing epidemiological data already available. More such studies will help in understanding the epidemiology at a national level.

Keywords: COVID-19, Epidemiology, Ct value, SARS-CoV-2, RTPCR

INTRODUCTION:

India with a population of approximately 1.37 billion (1) has experienced three waves of the present COVID-19 pandemic till now, caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). As per the present Indian scenario the pandemic in India has taken 3 major waves with three different SARS CoV-2 variants. First wave peaked in September 2020 with alpha variant, the second owed to the delta variant which peaked in April 2021 and the third which was more of a

flash, came in January 2022 with Omicron as the predominant variant (2). Globally the first case was identified and reported in Wuhan city, Hubei province of China in December 2019 (3). Owing to its rapid spread and mortality it was declared as Public Health Emergency of International Concern on 30 January 2020, and subsequently pandemic on 11 March 2020 by World health organization (3). India reported its first confirmed case of COVID -19 on 27th January 2020. It was reported from Kerala, district Thrissur, in a 20 year

old female student who returned to Kerala from Wuhan, China, on 23rd January 2020 (4). Subsequently two more students in Kerala with the history of travel from Wuhan, also reported to be positive. After a period of one month the infection was reported from several other states of India. Chandigarh reported its first case of COVID-19 on 18th March 2020,(5) sample tested positive at Post-Graduate Institute of Medical Education and Research (PGIMER), Department of Virology. The patient was 23 year old female with the history of travel from England. She was admitted to the isolation ward at the Government Medical College and Hospital in Sector 32, and was discharged after negative report on 4th April 2020.

SARS-CoV2 is a member of the *Sarbecovirus* subgenus of *Coronaviridae* family. It is a large family of enveloped, positive- stranded RNA viruses, divided into 4 genera: Alpha coronavirus, Beta coronavirus, Gamma coronavirus, and Delta coronavirus (6). SARS-CoV2 is the third virus under genus Beta coronavirus, infecting humans in last 2 decades after SARS in 2002 and MERS in 2012. The size varies from 65-125 nm in diameter (7), and is easily transmissible from person to person by droplet or aerosols. By April 2022, globally 41.5 cr positive cases has been reported and India, second after United States has reported 4.27 cr cases of SARS CoV2(8).The study includes the various parameters including age, gender and symptoms correlating with the result of the RT-PCR and the cycle threshold (Ct value) of the patients.

MATERIAL AND METHODS:

Viral Research Diagnostic Laboratory (VRDL) at Government Medical College and Hospital, Chandigarh (GMCH-32) has been testing COVID-19 suspected cases by RT-PCR, from various hospital of Chandigarh (sector 22, sector 45 and Mani Majra) in addition to the samples from screening OPD, wards and surveillance by Department of Community Medicine of GMCH-32. This is a retrospective study of all the patients who were tested for COVID-19 by RT-PCR at GMCH-32. The study period was from the March 2020 till February 2022, including all the three waves of COVID-19 pandemic. Samples processed were from the upper respiratory tract, both nasopharyngeal and oropharyngeal swabs. The samples were received from various centers, collected in Viral Transport Medium, transported in triple packing maintaining the cold chain. The decontamination of the samples was done in Biosafety cabinet class II with Personal Protective Equipment. All the samples were tested for SARS-CoV2 by RT-PCR on Biorad CFX96 Real Time PCR Machine using RTPCR kits and extraction kits approved by ICMR Delhi. Different kits was used, targeting two to three target genes among the S gene, E gene, N gene, ORF 1ab gene

or RdRp gene. RNaseP was used as an internal control in some kits while internal control was provided in most of the kits. Positive and the negative controls were included in each run. The interpretation of the result based on Ct value and the sigmoid shape of the curve was done according to the kit literature. For most of the kits, the Ct value for valid negative control was either >35 or not detectable and Ct value ≤ 35 was considered valid for positive control. The Ct-value of ≤ 35 with a sigmoid curve, in the target genes along with the internal control (IC) was reported positive for COVID-19. In cases where IC was not raised, the sample was reported as invalid, and repeat sample was again collected and processed. Differences between groups were assessed using OpenEpi.com for calculating the “p” value. P-value less than 0.05 was considered as statistically significant. The data was entered on the Indian council of Medical research (ICMR) portal on daily basis.

RESULTS:

The RT-PCR testing for SARS-CoV-2 at our centre started in March 2020, with limited testing capacity. Till 28th February 2022 a total of 1, 93,864 samples had been processed, out of which 14,602 were positive and 1,344 samples was repeated as the internal control was not amplified. Initially the positivity rate increased from March 2020 till September 2020, then a decline in the cases was reported until February 2021, after which again a rise was reported with peak in April 2021 followed by another peak in January 2022. (Graph I)

Maximum positive samples were reported in January 2022 (4524) and minimum in November 2021 (22). Overall positivity rate was 7.5% in two years, ranging from 0.16% in Nov 2021 to 30.9% in September 2021. Positivity in males among the tested male population was 7.7% (8041/104378) while for females it was 7.3% (6561/89485), with no significant difference.

Asymptomatics and symptomatic patients have been compared for various parameters including total samples received, total positive cases and average Ct- values (Table-I).

The samples received for testing were largely from asymptomatic patients, 90.5 %, (175407). These asymptomatics were either the contacts of positive patients, surveillance samples, pre-operative testing samples or individuals getting tested for travelling purpose. The total number of samples tested positive belonged to asymptomatics (10155, 69.5%) but the Positivity rate was higher in symptomatic (24.1%, 4447/18456) and only 5.8% (10,155/175407) positivity was seen in asymptomatics, showing significant difference (p-value <0.0001). The average Ct-value was approximately same in both the groups.

Positive cases were evaluated according to the age and Ct-values of orf/ E gene and N/S gene (Graph-

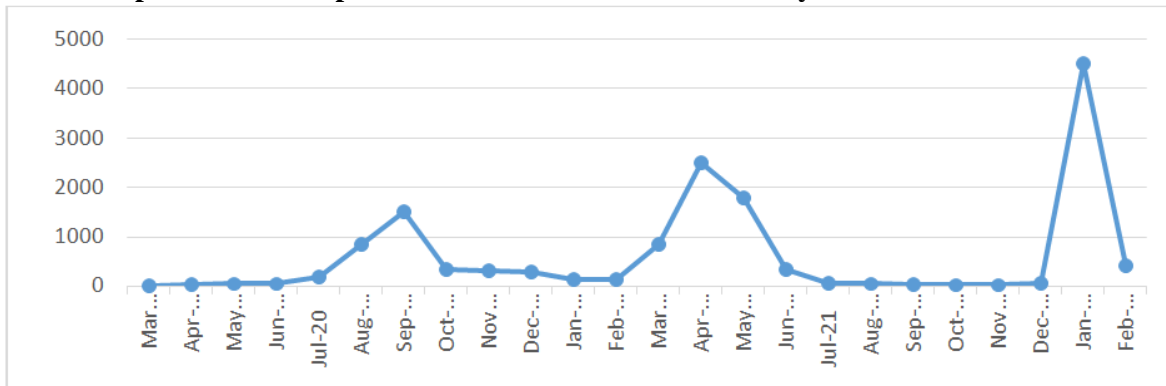
II). Positivity percentage observed was least in 1-9 years of age, and an increasing trend was noticed with the increasing age, and maximum in >80 years of age. Ct-value was relatively similar in all the age groups with slightly higher bend in age group of less than 20 years of age, reflecting less viral load.

The Ct-values were compared among symptomatics, asymptomatics, males and females. They were divided as high, intermediate and low with Ct- values of less than or equal to 25, between 26 to 30 and Ct values more than 31, respectively to assess the viral load (Graph-III). The number of positives with higher viral load (Ct-value ≤ 25) in symptomatics were significantly higher as compared to asymptomatics (57.9% vs. 48.4%, p-value < 0.001). Low to moderate viral load was more in asymptomatics. Viral load was not found to be related to the gender.

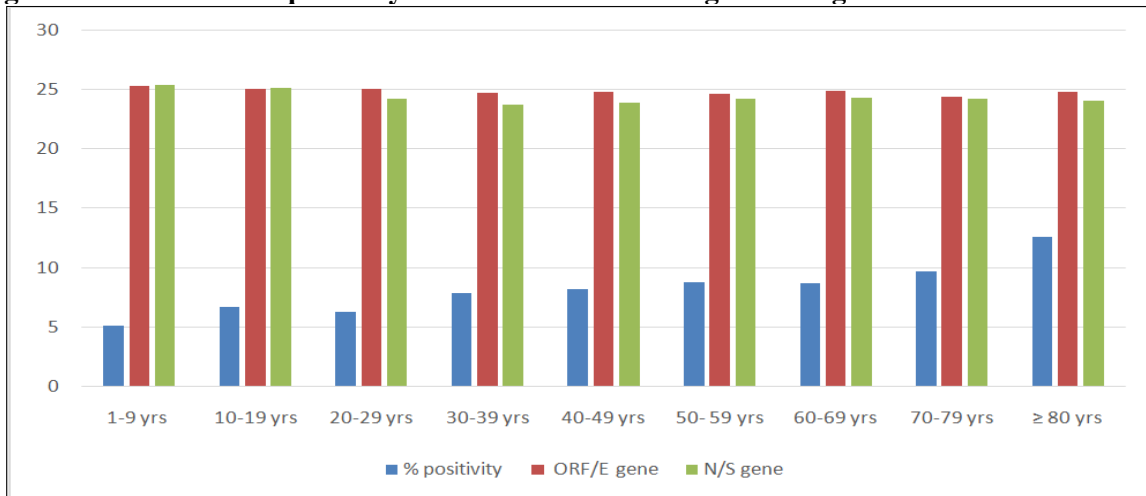
Patient's presentations varied from asymptomatic to wide range of symptoms like fever, cough, sore throat, dyspnea, loss of smell and taste, shortness of breath, diarrhea, etc. Table-II represents the percentage and positivity rates of various clinical presentations and their RT-PCR results for COVID-19.

Though fever and cough were the most common presentations at the time of sample collection as well as in positives, but more than 2/3 of the patients with fever and cough were negative. The patients coming with complain of dysfunction of taste and smell only 41.5% positive while the percentage positivity was 80% among patients who presented with this particular symptom. Therefore no symptom was significantly related to the COVID -19 positivity.

Graph-I: Number of positive cases reported since March 2020 till February 2022



Graph-II: Age wise distribution of positivity and Ct-values of Orf/E gene or N gene



Graph-III: Ct- values compared in symptomatics, asymptomatics, males and females

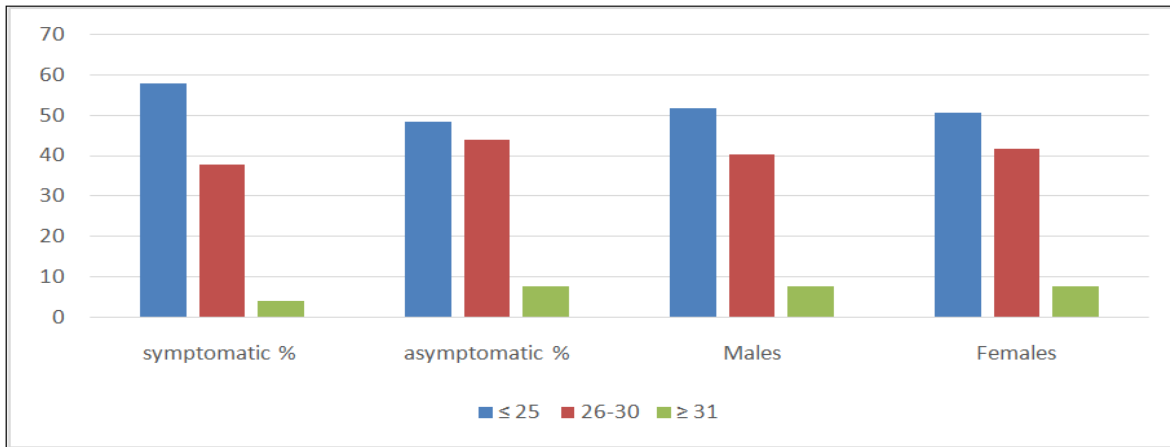


Table-I: Comparing various parameters in symptomatics and asymptomatics

	Total samples	Asymptomatics		Symptomatics	
Samples received	193864	175407 (90.5%)		18456 (9.5%)	
Male samples	104378	93507 (89.5%)	53.3% among total asymptomatics	10871 (10.4%)	58.9% among total symptomatics
Female samples	89485	81900 (91.5%)	46.6% among total asymptomatics	7585 (8.4%)	41.1% among total symptomatics
Total positive cases	14602	10155 (69.5%)	5.8% among total asymptomatics	4447 (30.4%)	24.1% among total symptomatics
Male positive cases	8041	5416 (67.3%)	5.8% among total male asymptomatics	2625 (32.6%)	24.2% among total male symptomatics
Female positive cases	6561	4739 (72.2%)	5.8% among total female asymptomatics	1822 (27.7%)	24.0% among total female symptomatics
Average Ct-value					
Orf/E gene	24.9	25.2		24.2	
N/S gene	23.9	23.8		24.1	

Table-II: Percentage and positivity rates of various clinical presentations

Symptoms	Symptoms in symptomatics (18,456)		Symptoms in positive symptomatics (4447)		% for a particular symptom in positive symptomatics in relation to total symptomatics with that symptom	Negativity among particular symptom (%)
Fever	10,612	57.5%	3304	74.3%	33.2% (3304/10,612)	66.8% (7308/10,612)
Cough	6,792	36.8%	1361	30.6%	20% (1361/6792)	80% (5431/6,792)
Shortness of breath	4,706	25.5%	724	16.3%	15.4% (724/4706)	84.6% (3982/4,706)
Sore throat	2695	14.6 %	893	20.1%	33.1% (893/2695)	66.9% (1802/2,695)
Loss of	2307	12.5%	1845	41.5%	80.0% (1845/2307)	20.0% (462/2,307)

taste and smell						
GI symptoms	3433	18.6%	1279	28.7	37.2% (1279/3433)	62.7% (2154/3,433)

DISCUSSION:

Epidemiology of SARS-CoV-2 was assessed from a tertiary care centre in Chandigarh for a period of two years with a total of 1,93,864 samples tested and 14,602 reported positive by RT-PCR testing. The pandemic had significant global impact in terms of physical, psychological as well as financial burden on most of the people, as they either themselves suffered with the disease or lost their dear ones. Foreseeing the global community spread the first wave in India was preceded by several collective and individual preventive measures, still in August 2020, India reported highest number of cases per day, approximately 64 thousand cases (9). India had been reporting second highest number of cases after United States (8) during the pandemic. The second wave was worst, Indian media (10) quoted it to be as the “India's worst tragedy since partition”, leaving behind the terms like COVID orphans and COVID widows. This destruction owed to the super spreading events like Tablighi Jamaat, Kumbh mela and election rallies across the country shaking its economy significantly (11,12). The third wave was predominantly with a variant that was highly transmissible but the mortality and severity was very less (13). The positivity rate reported at our centre was 7.5% which is comparable to the rate reported in Chandigarh i.e. 8.38% (14). The average rate reported from the country is 5.5% (15) owing to the variable positivity rates from different states, highest rate was from Kerala -13%, followed by Maharashtra - 8.8%, Karnataka and Tamil Nadu with 6% each while Sikkim reported the lowest rate of only 1.1%(16).

The age group of the patients ranged from one year to 92 years, positivity rate increased with the age and it was maximum (11%) in elderly more than 80 years of age. The median age of patients was 42 years in our study, Cheng et.al. (17) reported it to be 58.5 years while 45.1years was reported from a meta-analytical analysis from 60 centers(17). Male preponderance has been reported in the literature (17, 18, 19, 20) including our study, positivity rate was also more in males though the gender difference was not significant. The patients tested for COVID-19 had a wide range of spectrum ranging from asymptomatics to mild fever, cough, influenza like symptoms, involvement of lower respiratory tract, leading to critical illness and even GI symptoms. Initially during the pandemic asymptomatics were considered to have minimal risk of transmitting the infection but subsequently it was reported both by WHO and CDC that they also spread the disease significantly (21,22). Among the total cases reported positive at our

centre 69.5% were asymptomatic at the time of testing, signifying the importance of early testing and identification of positives. A study from China (23) has also reported approximately 81% of asymptomatics or with mild symptoms. Thevarajan I et.al. (17) and Kumar N et al. (19) have also reported 88% and 56% of asymptomatics respectively. According to Danial P et.al. (24) asymptomatics accounts for upto 50% of COVID positives who can transmit infection upto 14 days. These silent spreaders are associated with subclinical lung abnormalities.

Clinical presentation had wide range, the commonest presentation reported in the literature (17, 20) was fever, in upto 55% to 99% of cases, and we reported fever in 74.5% of symptomatics. Dry cough was reported in 30.6% of cases, though other authors reported in upto 65 to 70% cases (17). GI symptoms which included nausea, vomiting, diarrhea, loss of appetite and abdominal pain had also been reported in 28.7% of cases in our study, other authors have reported them in around 5% to 20% of patients (17). Olfactory and taste dysfunction was evidently recognized presentation in COVID-19 and we reported olfactory and taste dysfunction in 41.5% of positives. The figure is comparable to that reported in the literature (25,26, 27). Other rare presentations included sore throat, shortness of breath and nasal discharge.

The significance of Ct-value had been a query in relation to the number of parameters including the disease severity, recovery from infection, degree of transmissibility, blood parameters or association with symptoms. We evaluated the Ct value in both asymptomatics and symptomatics considering the positivity difference in gender and age concluding that Ct-value has no co-relation with symptomatology, gender or age of the patients. Number of authors have published their findings focusing these queries. Wenyu et.al. (20) analyzed the blood count indexes and biochemical indexes in relation to the Ct values and reported, the negative correlation with lymphocyte count and positive with neutrophils and CRP levels. He also mentioned that though the viral load increases from mild to severe cases, but it was not the only reason for the disease deterioration. Bayat et.al. (28) evaluated the infectivity potential among close contacts with Ct value of more than 30 and less than 30 with a significant difference.

In our study we have included most of the epidemiological parameters still the limitation is, it being a single center retrospective study. The data calculated is

on the basis of laboratory findings only, with the history provided at the time of sample collection. The patients were not dynamically monitored throughout the course of their disease due to the practical limitations. Though our data relates to the limited literature available, still more multi-centric data is required for more strong correlations.

During the pandemic the planet had witnessed more than 50 lakh deaths (3) due to COVID-19, on the other hand extraordinary efforts by the policy makers and individuals had also saved countless lives globally. It is foresighted by the experts that the COVID-19 will become a recurrent disease like other respiratory viruses with emerging variants and varied severity, owing to its waning immunity whether post infection or post vaccination. The future impact is expected to be less due to the combination of various factors like previous exposure of majority of the world population, vaccination target of 60-70 % globally, (23) formed policies and public awareness for COVID norms. Still the challenges like vaccine supply in low income countries, vaccine delivery issues and virus mutation will be a hurdle in fighting COVID. Therefore the pandemic may end but we will have to learn to live with SARS-CoV-2.

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Conflicts of Interest: None

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