Epidemiological characterization of COVID-19 – Pune, 2020-2021

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The present study describes the epidemiological characteristics of 3,08,259 suspected cases of COVID-19 from the Pune district, India. The samples were referred for COVID-19 testing between January 24, 2020 and April 30, 2021. Demographic and clinical data were extracted from the ICMR-portal as a single dataset and analyzed. Of the 3,08,259 samples tested, 2,63,833 (85.6%) were asymptomatic. Symptomatic cases ratio in the first and the second COVID-19 wave was 1:2. Among symptomatic cases, cough was the most common complaint, followed by fever. Among the COVID-19 positives, one-fifth were asymptomatic, highlighting the necessity for close contact tracing even among apparently healthy contacts. The second wave of COVID-19 had double the per cent of symptomatic individuals as compared to the first wave.

Key words Asymptomatic - COVID-19 - epidemiology- suspected cases

A cluster of pneumonia cases of unknown origin in Wuhan, China, caused concern among health officials in late December 2019[1]. The World Health Organization (WHO) chose the official name of COVID-19 for the disease, as well as the term severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) for the virus[2]. On March 11, 2020, the WHO announced COVID-19 as a pandemic[3]. In view of the global increase in the number of cases, the Indian Council of Medical Research-National Institute of Virology (ICMR-NIV), Pune, developed a two-step strategy for the diagnosis of COVID-19 using the real-time reverse transcriptase polymerase chain reaction (qRT-PCR)[4,5]. To track the progression and evolution of COVID-19 pandemic, different risk groups such as asymptomatic direct and high risk contacts of the confirmed cases, all symptomatic and hospitalized patients with influenza-like-illness/severe acute respiratory illness (SARI), migrant and oversees returnee were included for the COVID-19 testing by the ICMR[6]. The advisory on COVID-19 testing categorised the routine surveillance in containment area, non-containment area, in hospital setting and testing on demand[6]. In the initial phase of the pandemic, ICMR-NIV received samples from the oversees returnees[7] and samples from the suspected COVID-19 cases across the country[6].

The present study is a descriptive analysis of the nasal and oropharyngeal swabs referred for COVID-19 testing between January 24, 2020 and April 30, 2021 at the ICMR-NIV, Pune. We also analyzed COVID-19

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asymptomatic and symptomatic cases ratio, positivity based on the gender and compared these characteristics and positivity between the first and the second COVID-19 waves. Nasal and oropharyngeal swabs of suspected COVID-19 cases fulfilling the criteria specified for COVID-19 testing by the ICMR[6] were referred to ICMR-NIV for testing by the Maharashtra Public Health department. From January 2021 onwards, ICMR-NIV restricted COVID-19 RT-PCR testing to 500 samples in a day, as more focus was diverted towards COVID-19 whole genomic sequencing and assessing the SARS-CoV-2 mutations. Public Health department staff captured the clinical and demographic data from the suspected patients on the RT-PCR mobile app (developed by the National Informatics Centre, Ministry of Electronics and Information Technology, Government of India). COVID-19 collection centres along with throat/nasal swab specimens also sent Specimen Referral Form Identification Number (SRF ID) to the laboratory for SARS-CoV-2 testing. In the laboratory, through the SRF ID, the patient data were fetched on the ICMR portal, and subsequently, individual COVID-19 test results were uploaded. The molecular testing of the nasal and oropharyngeal swabs from the suspected COVID-19 patients was performed as per the protocols described elsewhere[4,5]. Primer and probes, SuperScript™ III one-step qRT-PCR kit and automated MagMAX kit for nucleic acid extraction were purchased from Thermo Fisher Scientific US. Demographic and clinical data from the case records of the suspected COVID-19 patients available on the ICMR-portal (between January 24, 2020 and April 30, 2021) were extracted from the system as a single dataset and all personal identifying information was removed. Prior permission from the institutional human ethics committee was sought. No sampling was done to achieve a predetermined study size, and all cases were included.

Age distribution graphs were constructed using patient age at baseline for confirmed cases. Sex ratio (male : female ratio) was also calculated. The per cent COVID-19 positivity was temporally plotted against the epi-weeks. While calculating the COVID-19 positivity, numerator was taken as COVID-19 positive cases and total samples tested in denominator. The categorical variables were summarized as per cent while continuous variables either as mean or median. The categorical variables were compared between the groups using the two-sided Fisher's exact test. The

Table. Characteristics of suspected COVID-19 nasal and oropharyngeal swab samples tested at ICMR-NIV, Pune - January 24, 2020 and April 30, 2021

Characteristics	Number (%)	
Overall tested, n	3,08,259	
Median age, yr (IQR)	33 (23-47)	
Age group (yr)	Female (n=132389)	Male (n=175870)
0-4	5262 (4.0)	6091 (3.5)
5-14	10,870 (8.2)	12,879 (7.3)
15-44	82,624 (62.4)	1,12,706 (64.1)
45-59	23,440 (17.7)	31,089 (17.7)
>60	10,193 (7.7)	13,105 (7.5)
Asymptomatic	2,63,833 (85.6)	
Symptomatic	44,426 (14.4)	
Fever	14,568 (32.7)	
Cough	24,806 (55.8)	
Diarrhoea	910 (2.0)	
Crepitation	21 (0.0)	
Headache	9 (0.0)	
Abdominal pain	589 (1.3)	
Breathlessness	9063 (20.4)	
Nausea	733 (1.6)	
Vomiting	1232 (2.8)	
Sore throat	9703 (21.8)	
Body ache	5486 (12.3)	
Nasal discharge	1646 (3.7)	
Haemoptysis	407 (0.9)	
Chest pain	869 (2.0)	
Sputum	1137 (2.6)	
Healthcare workers	1281 (0.41)	
Hospitalized	62,707 (20.3)	

data were analyzed using Epi Info™ version 7.2.2.16 (CDC, Atlanta, Georgia, USA).

By April 30, 2021, a total 3,08,259 nasal and oropharyngeal swabs were referred to the ICMR-NIV, Pune (Table). The male : female ratio was 1.33:1. The median age of the suspected cases was 33 yr (inter-quartile range [IQR] 23-47) (male-33 yr [IQR] 24-45); female 33 yr (IQR 23-47). Most of the referred cases were asymptomatic 2,63,833 (85.5%). Of the total suspected cases, 62,707 (20.3%) were admitted in the hospitals (Table). Of the total cases, 14.5 per cent were symptomatic and of these cough was
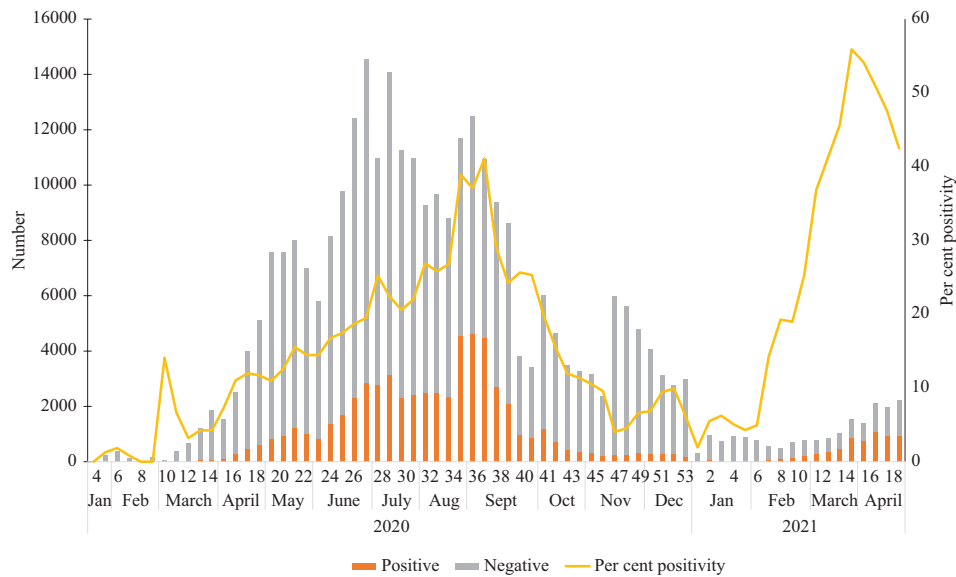
Figure. Distribution of COVID-19 samples and per cent positivity - January 24, 2020 and April 30, 2021.

the most common complaint among 24,806 (55.84%), followed by fever in 14,568 (32.8%). The results were consistent with the new coronavirus pneumonia diagnosis and treatment program (3rd, in Chinese) published by the National Health Commission of China[8]. Most symptoms were distributed evenly among the different age groups except breathlessness which increased with increasing age. Other studies also reported elderly patients complaining of severe dyspnoea[9] and elderly patients with COVID-19 more likely to progress to severe disease[10].

Of the total suspected cases, 65,312 (21.1%) were identified as laboratory-confirmed COVID-19-positive cases. The median age of positive cases was 35 yr (IQR: 21-47 yr). Among these positive cases, 37,910 (58.04%) were male, and there was a significant difference in positivity between male and female (P<0.001) patients. Similar findings have been reported by other studies[11-13]. The positivity increased as the age increased, there were 28.3 per cent elderly infected with COVID-19 as compared to 15.1 per cent cases under five years. Of the 1281 sample tested among the healthcare workers, 105 (8.1%) were found positive. Symptomatic to asymptomatic ratio among the healthcare workers was 1:1.6. Among the total positive health-care workers, 51 of 528 (9.6%) were male, whereas 54 of 753 (7.1%) were female.

Of the total COVID-19-positive cases, 13,066 of 44,426 (29.4%) were positive among symptomatic

while 52,246 of 2,63,833 (19.8%) were positive among the asymptomatic cases. This difference in COVID-19 positivity among the symptomatic versus asymptomatic cases was significant (P<0.001). These results highlight the importance of close contact tracing of apparently healthy contacts and longitudinal surveillance through virus nucleic acid tests. Of the 13,066 COVID-19 positive symptomatic cases, 5300 (40.5%) were hospitalized as compared to asymptomatic cases [7425 of 52,246 (14.25%)], and this difference was found to be significant (P<0.001). Further, gender wise significant (P<0.001) difference was observed among COVID-19 positive symptomatic cases wherein 4937 of 13,066 (37.7%) were female while males were 8129 (62.3%).

Temporal distribution in the Pune district showed a trend of rapid increase of cases in the early stage of the epidemic and then a gradual and steady decrease (Figure). The total number of cases increased remarkably between June (wk 26) and early September (wk 35), peaked around early September (wk 36), and then declined. The second COVID-19 wave was noted in the second week of February 2021 (wk 6) and thereon the positivity increased rapidly. While comparing the second COVID-19 wave with the first wave (wk 15-47 of 2020), the symptomatic to asymptomatic ratio was 1:6 in the first and 1:2.8 in the second wave. The COVID-19 per cent positivity was also nearly double for the

second wave as compared to the first wave (21.1% in the first wave vs. 43.6% in the second wave). The sudden surge of cases in the second COVID-19 wave may be attributed to the emergence of highly infectious double mutant SARS-CoV-2 (B.1.617 lineage)[14]. The per cent positivity among the symptomatic cases also increased from 27.1 per cent in the first wave to 59.1 per cent in the second wave.

The large number of cases included in this analysis was a major strength of this study. Our study had certain limitations also. First, we were unable to assess detailed clinical characteristics of COVID-19 cases. Second, due to evolving COVID-19 testing criteria, uniform case definition throughout the period could not be maintained and dataset, especially from the initial stage of the pandemic might contain multiple sample per person. Third, we restricted COVID-19 RT-PCR testing of samples from January 2021 onwards, which limited our samples in the second COVID-19 wave. Fourth, there were no data for a few important variables of interest – related to exposure, co-morbid conditions, case severity and outcome – which limited our ability to draw conclusions from the data.

To conclude, almost one fifth of the asymptomatic cases were COVID-19 positive, highlighting the close contact tracing among apparently healthy contacts. There were more symptomatic individuals during the second wave of COVID-19 as compared to the first wave. Cough and fever were the predominant symptoms among the symptomatic cases.

Conflicts of Interest: None.

References

1. World Health Organization. *Pneumonia of unknown cause – China*. Available from: *https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/*, accessed on December 15, 2020.

2. World Health Organization. *Naming the coronavirus disease (COVID-19) and the virus that causes it*. Available from: *https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-corona virus-disease-(covid-2019)-and-the-virus-that-causes-it*, accessed on December 15, 2020.

3. World Health Organization. *Novel-Coronavirus-2019/Events-as-they-happen; 2020*. Available from: *https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen*, accessed on December 15, 2020.

4. Alimohamadi Y, Taghdir M, Sepandi M. The estimate of the basic reproduction number for novel coronavirus disease (COVID-19): A systematic review and metaanalysis. *J Prev Med Public Health* 2020; *53 :* 151-7.

5. World Health Organization. *Detection of 2019 Novel Coronavirus (2019-nCoV) in Suspected Human Cases by RT-PCR*. Available from: *https://www.who.int/docs/default-source/coronaviruse/peiris-protocol-16-1-20.pdf?sfvrsn=af1aac73_4*, accessed on January 23, 2021.

6. Information on Testing. Molecular Based Test (RT PCR/TruNat/CBNAAT). Available from: *https://www.icmr.gov.in/ctestsrat.html*, accessed on December 15, 2020.

7. Potdar V, Choudhary ML, Bhardwaj S, Ghuge R, Sugunan AP, Gurav Y, *et al*. Respiratory virus detection among the overseas returnees during the early phase of COVID-19 pandemic in India. *Indian J Med Res* 2020; *151* : 486-9.

8. National Health Commission of the People's Republic of China. *Notice on Issuing the Pneumonia Diagnosis and Treatment Plan for Novel Coronavirus Infection (Trial Version 3)*. Available from: *http://www.nhc.gov.cn/xcs/zhengcwj/202001/f492c9153ea9437bb587ce2ffcbee1fa.shtml*, accessed on December 15, 2020.

9. Perrotta F, Corbi G, Mazzeo G, Boccia M, Aronne L, D'Agnano V, *et al*. COVID-19 and the elderly: Insights into pathogenesis and clinical decision-making. *Aging Clin Exp Res* 2020; *32* :1599-608.

10. Liu K, Chen Y, Lin R, Han K. Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. *J Infect* 2020; *80* : e14-8.

11. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, *et al*. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020; *382* : 1708-20.

12. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) China, 2020. *China CDC Wkly* 2020; *2* : 113-22.

13. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Jiang Z, *et al*. Epidemiology of COVID-19 among children in China. *Pediatrics* 2020; *145* : e20200702.

14. Cherian S, Potdar V, Jadhav S, Yadav P, Gupta N, Das M, *et al*. Convergent evolution of SARS-CoV-2 spike mutations, L452R, E484Q and P681R, in the second wave of COVID-19 in Maharashtra, India. *bioRxiv* 2021. doi: 10.1101/2021.04.22.440932.

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