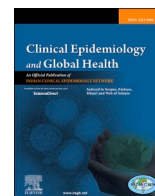




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## Original article

# COVID-19 in Punjab, India: Epidemiological patterns, laboratory surveillance and contact tracing of COVID-19 cases, March–May 2020

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## ABSTRACT

**Background:** In Punjab, first COVID-19 case was detected on March 5, 2020 followed by multiple clusters. Understanding the epidemiology of reported COVID-19 cases helps decision makers in planning future responses. We described the epidemiological patterns, laboratory surveillance and contact tracing of COVID-19 cases in Punjab.

**Methods:** We analysed state's COVID-19 data from March–May 2020 to describe time, place and person distribution. We analysed the laboratory surveillance and contact tracing reports to calculate frequency of testing, sample positivity rate (PR) and contacts traced per case.

**Findings:** A total of 2256 cases were reported from March–May 2020 (attack rate 75 cases/million and case fatality rate 2%). Attack rate was higher among males (81 cases/million males) and maximum affected age group was 60–69 years (164.5 cases/million). Five of 22 districts reported almost half cases in May's first week. Mortality rate was highest among individuals >60 years (six deaths/million) and males (two deaths/million males). Of 45 deaths, 41 reported comorbidities [(hypertension (42%), diabetes (40%)]. COVID-19 testing increased from 46 samples/day (PR: 2%) in March's first week to 4000 samples/day (PR: 2.5%) by May's end (2752 tests/million). Amritsar conducted 2035 tests/million (highest PR: 6.5%) while Barnala conducted 4158 tests/million (lowest PR: 1%). For 2256 cases, 19,432 contacts were traced (nine contacts/case) with 11% positivity rate.

**Interpretation:** COVID-19 in Punjab mostly affected males, >60 years of age and individuals with comorbid conditions. Many districts with less testing and contact tracing had higher positivity rate. We recommended to implement and ensure adequate testing and contact tracing in all the districts of Punjab.

## 1. Introduction

Coronavirus disease 2019 (COVID-19) also known as novel severe acute respiratory syndrome-Coronavirus-2 (SARS-CoV-2) is a highly infectious disease which emerged in Wuhan City, China in December 2019. On January 30, 2020, COVID-19 disease was declared as Public Health Emergency of International Concern (PHEIC) by World Health Organisation when disease spread rapidly to other countries within few weeks and as on the March 11, 2020 it was declared that the pandemic had spread to 114 countries.<sup>1,2</sup>

In India, the first case of COVID-19 was reported in Kerala on January 30, 2020 with travel history from Wuhan University, China.<sup>3</sup> On March 2, 2020, two more cases were reported, one from Delhi who had travelled from Italy and another in Hyderabad with travel history of United Arab Emirates. Later on March 4, an Italian citizen tested positive in Jaipur, Rajasthan leading to a cluster of 16 confirmed COVID-19 cases.<sup>4</sup> After that, the COVID-19 cases began to steadily rise indicating the beginning of an epidemic in India.<sup>5</sup>

In Punjab, the first case of COVID-19 was diagnosed on March 5, 2020; the Punjab government had initiated public health measures since

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January by screening all passengers at airports; identifying and preparing isolation centers and conducting mock drills; working to increase awareness of general public and strengthening the district Integrated Disease Surveillance Program (IDSP) units for rapid response.<sup>6</sup> Two weeks after the first case in Punjab was reported the first COVID-19 cluster was identified in Shaheed Bhagat Singh (SBS) nagar district followed by multiple clusters in different districts. Understanding the epidemiology of reported COVID-19 cases helps decision makers in planning future responses. Hence with this rationale, we proceeded to review the COVID-19 surveillance data from March 1st, 2020 to May 31st, 2020 to describe the epidemiological patterns, laboratory surveillance and contact tracing of COVID-19 cases in Punjab. -

## 2. Methods

We did a secondary data analysis of COVID-19 cases in Punjab, India. The COVID-19 details were recorded from all the 22 districts of Punjab by COVID-19 surveillance team at state headquarters in the standard formats on daily basis. Suspected COVID-19 cases were confirmed by ICMR standardised real time-reverse-transcriptase polymerase chain reaction (RT-PCR) test and these details were recorded in the laboratory surveillance records. Each COVID-19 confirmed case was interviewed and contact tracing was carried out by rapid response teams. Contacts were identified as high risk and low risk contacts as per guidelines by Government of India.<sup>7</sup> For high risk contacts (symptomatic and asymptomatic) and low risk contacts (symptomatic), the samples were tested once between 5th and 14th day of coming in contact with confirmed case. Details of the positive cases and their contacts were shared to state headquarters daily by the district IDSP teams on standard formats (COVID-19 positive line list and contact tracing line list). We reviewed the records of state surveillance unit in Punjab for COVID -19 cases and contact tracing and laboratory records for details on testing from March 1, 2020 to May 31, 2020.

Epidemiological patterns of COVID-19 were described by time, place and person. Time distribution was described by epidemic curve, five day moving average moving growth rate, trend of doubling rate. Place distribution was described by district wise area maps and person distribution by attack rate (age & sex specific, place of residence), mortality rate (age & sex specific) and comorbidities among COVID-19 deaths. Epidemic curve was prepared by the date of result of COVID-19 cases. Doubling rate was calculated by the formula  $(x \cdot \ln(2)) / (\ln(y/z))$ ; where x was the time that has passed since you started measuring doubling rate (7 days), y was number of cases on day x (7th day) and z was number of cases on day zero.<sup>8</sup> For calculating attack rates and mortality rate, the population denominators were projected for the current year.

Laboratory data was summarised into frequency of COVID-19 samples collected, trend in sample positivity rate and COVID19 tests/million population. Sample positivity rate was defined as the percentage of total number of COVID-19 positive cases to the total number of samples collected. Contract tracing was evaluated by number of contacts traced per case, number of contacts tested per case and sample positivity rate among contacts. COVID-19 sample positivity rate, COVID-19 tests/million population and contacts traced per case was estimated for all the 22 districts of Punjab. On the basis of contacts traced per case, the contact tracing was defined as good (>10 contacts/case), average (6–10 contacts/case) and poor (<6 contacts/case). The data collected was compiled, cleaned and analysed using Microsoft excel software and Epi info software version 7.2.

### 2.1. Ethical consideration

We received permission from the state government of Punjab and National Centre for Disease Control, New Delhi for review and analysis of COVID-19 data from the surveillance records and publication of final report.

## 3. Results

A total of 2256 COVID-19 cases were reported from all the 22 districts of Punjab during the period of March to May 2020. However, we identified that complete details were available only for 2152 COVID-19 cases which we analysed for demographic and clinical status. For the analysis of laboratory surveillance and contact tracing, complete information was available till May 31, 2020.

### 3.1. Epidemiology of COVID-19 in Punjab

We identified that the COVID-19 attack rate was 75 cases/million population and case fatality rate was 2% (45/2256) in Punjab till May 2020. Attack rate was highest among the males (81 cases/million males) and most affected age group was 60–69 years (164.5 cases/million population aged 60-69 years) followed by 50–59 years of age (139 cases/million population aged 50-59 years). Total recovered cases were 1987 (88.1%) and active cases were 224 (9.9%). The median age of cases was 40 years (range: 0.4–100). The clinical status showed that 93% (2003) cases were asymptomatic and only 6.9% (149) cases were showing symptoms. We also identified that higher attack rates were seen in the rural areas (71.9 cases/million) as compared to urban areas (62.6 cases/million) (Table 1).

In Punjab, the first COVID-19 case was detected on March 5, 2020 and first COVID-19 cluster was identified in district Shaheed Bhagat Singh (SBS) nagar. Nineteen of COVID-19 cases were detected from a single village and outbreak was successfully controlled within a week by containing 15 neighbouring villages (approx. 30,000 population), through extensive active surveillance, strict social distancing measures and contact tracing. After that, similar COVID-19 clusters were identified and successfully controlled in different districts namely Sahibzada Ajit Singh (SAS) Nagar, Pathankot, Patiala and Jalandhar (Fig. 1). Five of 22 districts reported half cases in the first week of May. The doubling time dropped from 17 days in April 26, 2020 to 3 days on May 3, 2020 (maximum cases: 330) due to influx of passengers from other states. However, with strategic testing and quarantine of inter-state travellers the doubling rate rose to 117 days within three weeks. But this rise was not sustained due to the ease of lockdown after May 15, 2020, and the doubling time reduced again to 53 days. (Fig. 2).

We identified that the mortality rates were higher among males (Two deaths/million males) and among 60 years of age and more (Six deaths/million population aged 60 years and more) followed by 45–59 years of age (Four deaths/million population aged 45-59 years) (Table 2). The median age among the COVID-19 deaths was 57 years (range: 0.5–91). Co-morbidities were present in 91% (41/45) of the expired cases and major comorbidities reported were hypertension (42.2%) and diabetes (40%) (Table 3).

**Table 1**  
Demographic profile of COVID-19 cases in Punjab, March–May 2020 (n = 2152).

		Frequency (%)	Attack Rate (per million)
Sex	Male	1351 (62.8)	81.4
	Female	801 (37.2)	53.9
Age group (Years)	0–9	99 (4.6)	19.4
	10–19	191 (8.8)	31.2
	20–29	370 (17.2)	62.3
	30–39	380 (17.7)	81.7
	40–49	320 (14.9)	83.6
	50–59	349 (16.2)	139.3
	60–69	320 (14.9)	164.5
	70–79	101 (4.7)	115.7
	≥80	22 (1.0)	46.1
Residential area	Rural	1414 (65.7)	71.9
	Urban	738 (34.3)	62.6

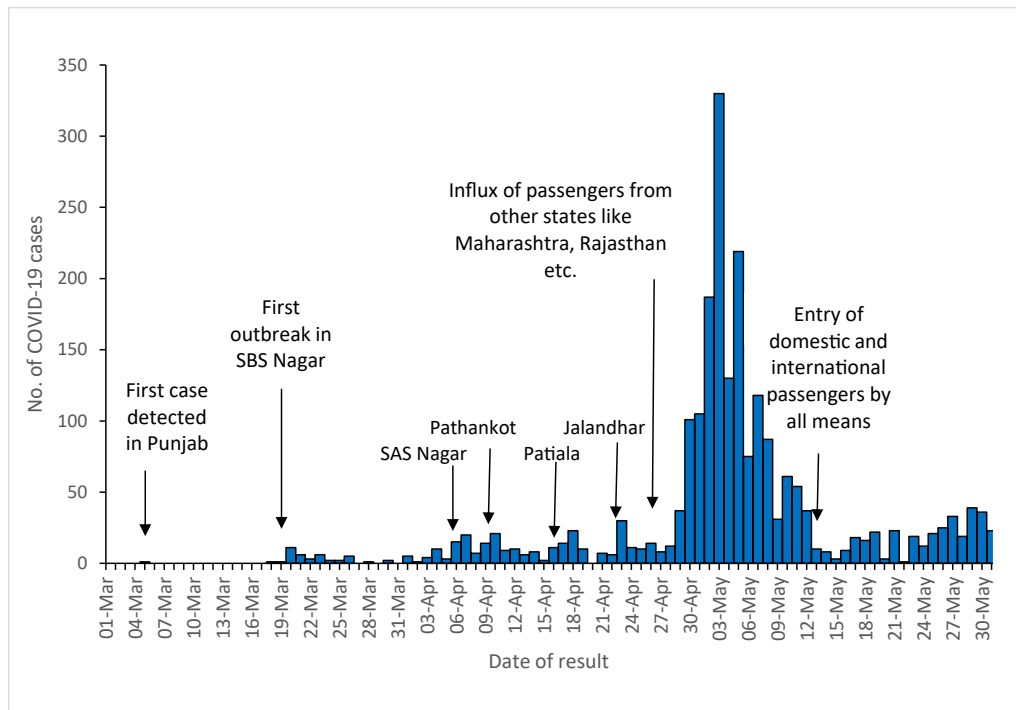


Fig. 1. Epidemic-curve of COVID 19 cases in Punjab, March–May 2020.

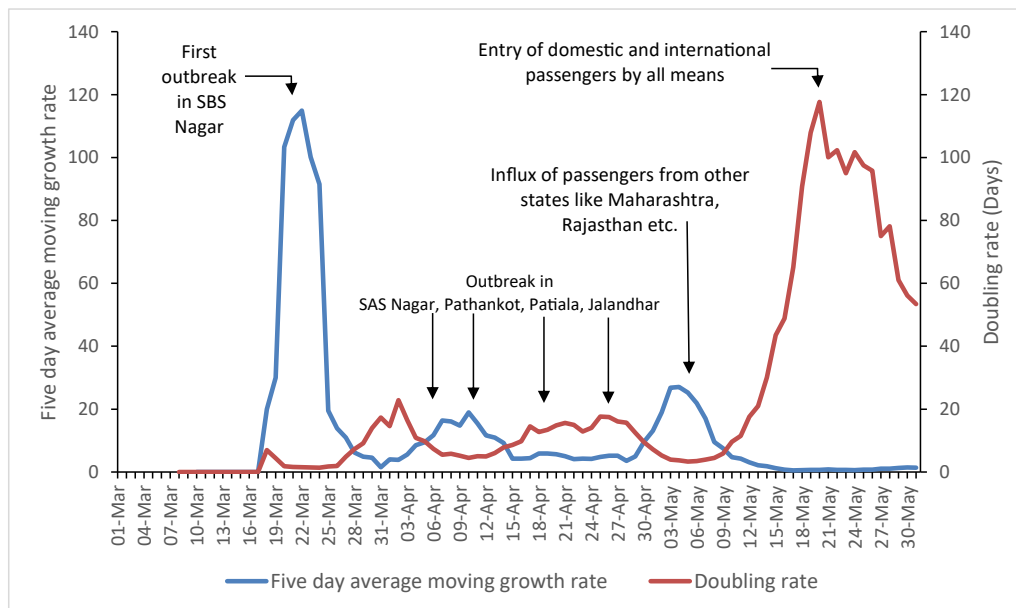


Fig. 2. Trend of doubling rate and five days average moving growth rate of COVID-19 in Punjab, March–May 2020.

Table 2

Demographic profile of COVID-19 deaths in Punjab, March–May 2020 (n = 45).

		Frequency (%)	Mortality Rate (per million)
Sex	Male	32 (71.1)	1.9
	Female	13 (28.9)	0.9
Age group (years)	<15	3 (6.7)	0.4
	15–29	2 (4.4)	0.2
	30–44	5 (11.1)	0.7
	45–59	16 (35.6)	3.7
	≥60	19 (42.2)	5.9

### 3.2. Testing patterns of COVID-19

In Punjab, frequency of testing had increased from about 46 samples per day (sample positivity rate 2%) in the first week of March to about 4000 samples per day (sample positivity rate 2.5%) by the end of May 2020. Total of 89,722 COVID-19 samples were collected and tested in Punjab from March–May 2020, which was 2752 tests/million population (Fig. 4). Out of 22 districts, six districts namely Amritsar, Gurdaspur, Hoshiarpur, Ferozepur, Ludhiana and Bathinda were testing less than the state’s average. Amritsar district conducted 2035 tests/million with highest positivity rate (6.5%) while Barnala conducted 4158 tests/million with lowest positivity rate (1%). Sample positivity rate was more

**Table 3**  
Clinical profile of COVID-19 deaths in Punjab, March–May 2020 (n = 45).

		Frequency (%)
Comorbidities	Yes	41 (91.1)
	No	4 (8.9)
Types of Comorbidities	Hyper tension	19 (42.2)
	Diabetes	18 (40)
	Cardiac disease	8 (17.8)
	Chronic Renal Disease	8 (17.8)
	Respiratory Disease	7 (15.6)
	Brain disease	4 (8.9)
	Others	14 (31.1)

than 3% in six districts: Amritsar, Gurdaspur, Hoshiarpur, Tarn Taran, Jalandhar, SBS nagar (Fig. 3).

### 3.3. Contact tracing of COVID-19

For 2256 COVID-19 cases, 19,432 contacts were traced and 99.2% (n = 19,285) contacts were found asymptomatic. High-risk contacts were 59.9% (11,644) and low-risk contacts were 40.1% (7788). Samples were collected in 72.8% (14,151) contacts and sample positivity rate among the contacts was 11% with a higher positivity among high risk contacts (13%). An average of nine contacts were traced per COVID-19 case and six contacts were tested per COVID-19 case. Contact tracing/case was highest in Kapurthala district (20 contacts/case) and lowest in Rupnagar (three contacts/case). Performance of contact tracing was poor in six districts namely Amritsar, Gurdaspur, Hoshiarpur, Rupnagar, Fazilka, Bathinda and good in nine districts namely Kapurthala, SBS Nagar, Pathankot, Jalandhar, Ludhiana, Patiala, Mansa, Muktsar and Faridkot (Fig. 5).

## 4. Discussion

We have described in this study the COVID-19 epidemiological situation in Punjab from March to May 2020. In terms of morbidity, most affected were males and individuals between 60 and 69 years of age. In terms of mortality also, males were most affected and persons more than 60 years of age had higher mortality rates. Hypertension and Diabetes were the most common comorbidities associated with COVID-19 deaths.

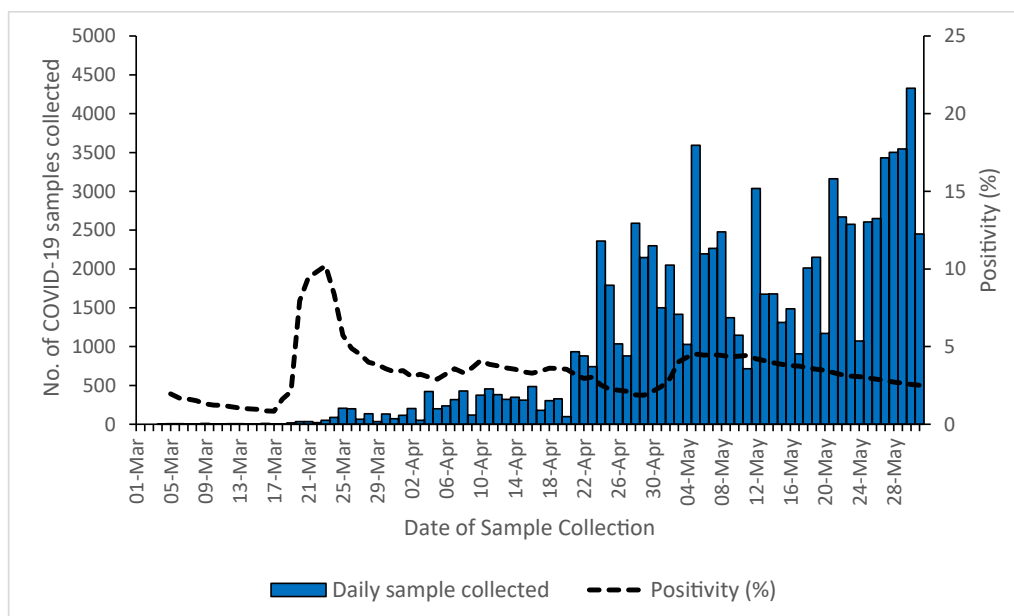
Laboratory surveillance has improved with the state led measures except for six districts which were testing less than state's average (2752 tests/million). For each COVID-19 affected, an average of nine contacts were traced in Punjab, however the performance of six districts was poor in terms of contact tracing. Districts where contact tracing was observed poor, were seen to have a high sample positivity rate.

The findings of our study related to age and gender distribution was similar to the ICMR COVID study, which also showed higher attack rates among males and in the age group 50–59 years followed by 60–69 years.<sup>9</sup> From this finding we interpret that elderly male population was more prone to get infected by COVID-19 as compared to females and other younger age-groups most probably due to higher proportion of comorbidities linked to an older age.

The case fatality rate at the country level was 2.8% and more than 70% deaths were due to comorbid conditions till the end of the May 2020; in Punjab the case fatality was relatively lower.<sup>10</sup> Our study adds to the current evidence of patients with comorbid conditions being at higher risk of mortality associated with COVID-19 due to weakened immune system.

The attack rate in Punjab was 75 cases/million in May 2020 which was less as compared to the neighbouring states/union territory like Chandigarh (252 cases/million), Jammu & Kashmir (156 cases/million) and Rajasthan (108 cases/million) and more than the states of Haryana (66 cases/million) and Himachal Pradesh (42 cases/million).<sup>10</sup> This could be due to the stringent testing and contact tracing. Himachal Pradesh (49 contacts tested/case) and Haryana (19 contacts tested/case) were testing more contacts as compared to Punjab and other neighbouring states.<sup>9</sup> Evidence also shows that in Solapur District of Maharashtra, it was the contact tracing that helped to brought down the positivity rate from 40% to 12.5% in two weeks.<sup>11</sup> In many districts of Punjab also, where contact tracing was poor, there is a high positivity rate. So, effective and sustained contact tracing is the key intervention to break the chain of transmission of COVID-19. The other possible reason could be the strategy to designate the micro containment zones apart from containment zones in order to prevent the spread of infection in small area by containing the population of less than 500.<sup>12</sup>

The attack rates observed in rural areas were higher as compared to urban areas; in the first week of May 1275 out of approximately 4000 pilgrims entered Punjab from the Nanded (Maharashtra) were tested positive and more than 80% of them resided in rural areas of Punjab.<sup>13</sup>



**Fig. 3.** Frequency of testing and percent positivity of COVID-19 in Punjab, March–May, 2020.

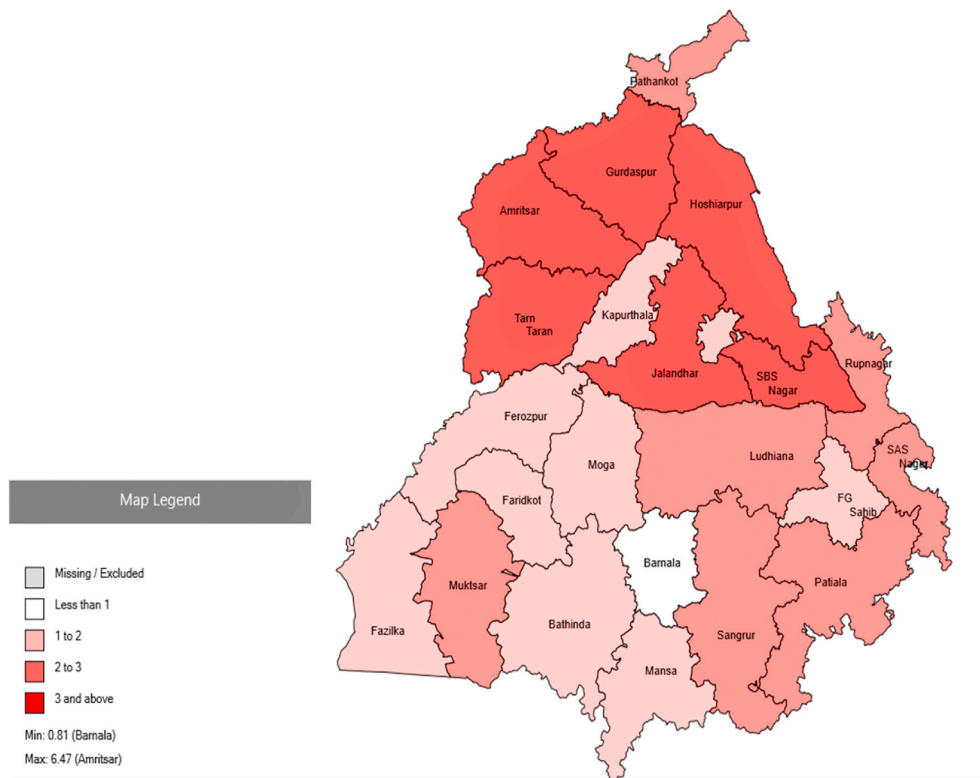


Fig. 4. COVID-19 sample positivity rate by districts in Punjab, March–May 2020.

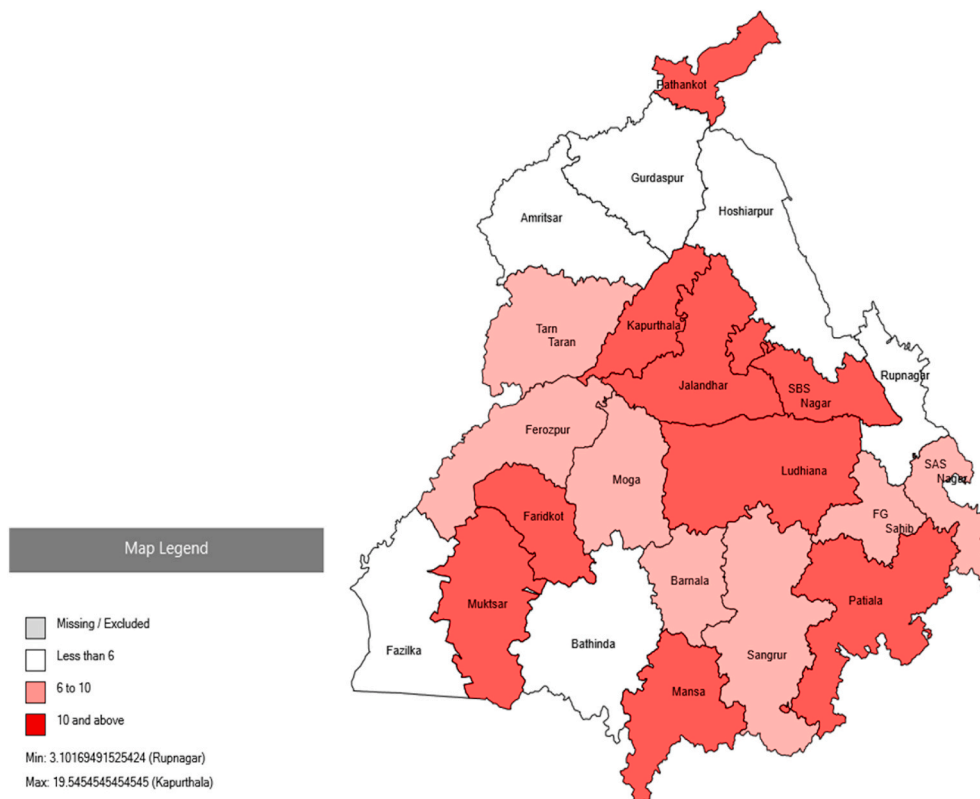


Fig. 5. Contacts traced per COVID-19 case by districts in Punjab, March–May 2020.

This could have led to the initial peak in the epidemic curve in the first week of May.

On May 7, 2020, the government of India launched the Vande Bharat

Mission to bring back Indians stranded overseas.<sup>14</sup> Punjab government eased the travel restrictions for passengers coming from abroad leading to an increase in cases. As documented in other countries, the epidemic



had turned to spread more after ease of the lockdown.<sup>15</sup> This probably led to the consistent fall in the doubling time after May 15, 2020, in Punjab.

The frequency of COVID-19 sample collection and testing had increased in Punjab over the period of three months (March–May). Till the end of May 2020, 20.5 tests per COVID-19 case (2693.7 tests/million) were conducted at national level while Punjab was conducting approximately 40 tests per COVID-19 case.<sup>10</sup> As per WHO, 10–30 tests per confirmed case was a good benchmark for adequate testing.<sup>16</sup> Therefore, the performance of Punjab was quite good in terms of COVID-19 testing.

Till March 2020, three laboratories were processing the COVID-19 samples in Punjab. Till May end, this laboratory network extended to six medical colleges (five government and one private) and six lab institutes (one government and five private) which were testing COVID-19 samples. However, six districts in Punjab was testing less samples as compared to state's average and half of these districts had positivity rate of more than three percent. This lack of uniformity in testing could also be responsible for the increase in cases.

The study had few limitations. Since this was a secondary data analysis, the clinical and socio-demographic data was not completely available for all the cases. Since COVID-19 cases of initial months of pandemic was analysed, there was lack of published literature to compare the findings of the current study and references from government as well as news websites were used.

## 5. Conclusion and recommendations

Punjab had better indicators of COVID-19 disease in terms of positivity rate, recovery rate and case fatality rate. Males, individuals more than 60 years of age and individuals with comorbid conditions were most vulnerable to COVID-19. Inter-state travel requires strong surveillance and aggressive quarantine measures of passengers to prevent further transmission. The laboratory surveillance of the COVID-19 has been strengthened over the period of time but there is need to implement and ensure that adequate testing and contact tracing is conducted uniformly in all the districts of the state.

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## Presentation at a meeting

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## Disclaimer

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the National

Centre for Disease Control.

## Declaration of competing interest

None declared.

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## References

- World Health Organisation. COVID-19 public health emergency of international concern (PHEIC) global research and innovation forum. Available from:; cited [https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-\(pheic\)-global-research-and-innovation-forum](https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-(pheic)-global-research-and-innovation-forum). Accessed April 20, 2021.
- World Health Organisation. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available from:; cited <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020>. Accessed April 20, 2021.
- Press information bureau, Ministry of Health and Family Welfare. Update on Novel Coronavirus: one positive case reported in Kerala. Available from:; cited [pib.gov.in/Pressreleaseshare.aspx?PRID=1601095](http://pib.gov.in/Pressreleaseshare.aspx?PRID=1601095); 2020. Accessed February 12, 2020.
- India today. 15 Italian tourists, 1 Indian driver test positive for coronavirus, says govt. Available from:; cited <https://www.indiatoday.in/india/story/coronavirus-15-italian-tourists-test-positive-confirmed-cases-rise-to-21-in-india-1652237-2020-03-04>. Accessed August 24, 2020.
- Kumar A, Roy R. Application of mathematical modeling in public health decision making pertaining to Control of COVID-19 pandemic in India. *Epidemiol Int.* 2020;5(2):23–26.
- Doctors to screen flyers at amritsar airport from monday amid coronavirus scare. Available from:; cited <https://www.ndtv.com/india-news/doctors-to-screen-flyers-at-amritsar-airport-from-monday-amid-coronavirus-scare-2169674>. Accessed July 5, 2020.
- National Centre for Disease Control. SOP (standard operating procedures) for investigation of a suspected COVID-19 case using case investigation form (CIF). Available from:; cited <https://ncdc.gov.in/WriteReadData/1892s/51329605621586240962.pdf>; 2020. Accessed September 17, 2020.
- GmbH D. Flatten the curve, but by how much? Chartable. Available from:; cited <https://blog.datawrapper.de/weekly-chart-coronavirus-doublingtimes/index.html>; 2020. Accessed June 29, 2020.
- Barani S, Bhargava B, Bhatnagar T, et al. Laboratory surveillance for SARS-CoV-2 in India: performance of testing & descriptive epidemiology of detected COVID-19, January 22 - April 30, 2020. *Indian J Med Res.* 2020;14.
- Press information bureau. PIB's daily bulletin on COVID-19. Available from:; cited [pib.gov.in/Pressreleaseshare.aspx?PRID=1628163](http://pib.gov.in/Pressreleaseshare.aspx?PRID=1628163). Accessed June 14, 2020.
- Indian express. Fortnight dip from 40% to 12.5%: in Solapur, effective contact tracing helps bring down Covid positivity rate. Available from:; cited <https://indianexpress.com/article/cities/pune/fortnight-dip-from-40-to-12-5-in-solapur-effective-contact-tracing-helps-bring-down-covid-positivity-rate-6705871/>. Accessed October 14, 2020.
- Pbhealth. Standard operating procedure micro containment zone 18-06-2020.pdf. Available from:; cited [http://pbhealth.gov.in/Compedium%20Final/\(17\)%20SOPs%20and%20norms/Standard%20Operating%20Procedure%20Micro%20Containment%20Zone%2018-06-2020.pdf](http://pbhealth.gov.in/Compedium%20Final/(17)%20SOPs%20and%20norms/Standard%20Operating%20Procedure%20Micro%20Containment%20Zone%2018-06-2020.pdf). Accessed July 3, 2020.
- herald Deccan. Punjab's COVID-19 tally crosses 1000-mark, 55% are Nanded pilgrims. Available from:; cited <https://www.deccanherald.com/national/punjab-covid-19-tally-crosses-1000-mark-55-are-nanded-pilgrims-833114.html>. Accessed October 2, 2020.
- Goswami S. Vande Bharat mission: one of the world's largest evacuation exercise to Be carried out by India starts. Available from:; cited <https://edtimes.in/vande-bharat-mission-largest-evacuation-mission-by-india-to-bring-back-citizens-stranded-abroad/>; 2020. Accessed October 2, 2020.
- Hindustan times. Many countries, including India, don't know when Covid-19 peak will come: top Chinese expert. Available from:; cited <https://www.hindustantimes.com/india-news/many-countries-including-india-don-t-know-when-covid-19-peak-will-come-top-chinese-expert/story-wPJAD9TfnypRNsv6Po5t1.html>. Accessed June 18, 2020.
- Our World in data. Coronavirus (COVID-19) testing - statistics and research. Available from:; cited <https://ourworldindata.org/coronavirus-testing>. Accessed October 14, 2020.