
RESEARCH ARTICLES

COVID-19 outbreak in Islamabad resulting from a travel-associated primary case: A case series

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Abstract

Background: On 18 March 2020, the second case of COVID-19 in the capital territory was reported by the local health department of Islamabad who presented with typical COVID-19 symptoms and had travel history. As per directions of Chief FEDSD, a team of field epidemiologists conducted outbreak investigations. The main objectives of this study were to investigate the clinical and epidemiological patterns of disease transmission and implementation of recommended SOPs.

Methods: Descriptive outbreak investigation followed by contact tracing was done in Kot Hathyal, Islamabad, from 21 March to 4 April 2020. Each case was enrolled as per the WHO predefined case definition and questionnaire, and data was maintained in line list. The daily health status of affected individuals was monitored physically as well as through phone calls. Data was maintained in Microsoft Excel. Secondary attack rate, median age, male to female ratio and 95% confidence interval was calculated in OpenEpi (version 3.01) for low and high risk contact groups.

Results: During investigation, 17 confirmed COVID-19 cases were enrolled as a result of contact with index case, male to female ratio was 5:1, and median age was 41 years (34 to 56 years). All cases exhibited symptoms compatible with COVID-19 except two. The median incubation period was 4 days. The secondary attack rate was 81.80%. No transmission from asymptomatic cases were noted.

Conclusion: The index case was a foreign national who had arrived in Pakistan mid-November 2019 to attend a religious gathering at Lahore from 12 to 15 March 2020. The intra and inter city travel caused the introduction of 17 new cases in Islamabad. Due to the lack of fully-fledged isolation centers in Islamabad, a home-based isolation strategy was introduced for the first time in the country. As the affected area was densely populated, the whole area was cordoned off for two weeks. This was also the country's first lockdown.

Key words: COVID-19, outbreak, contact tracing, transmission, Islamabad, Pakistan

Introduction

Coronavirus disease (COVID-19) is a highly contagious disease caused by a newly emerged virus first reported in China during December 2019. This virus transmits primarily through droplets produced through coughs or sneezes, or contact by hand shakes or contaminated surfaces (1). The World Health Organization (WHO) declared the COVID-19 outbreak as a public health emergency of international concern (PHIEC) on 30 January 2020 (2) and as a pandemic on 11 March 2020 (3). The International Health Regulations (IHR) Emergency Committee stated that it "believes that it is still possible to interrupt virus spread, provided that countries put in place strong measures to detect disease early, isolate and treat cases and trace contacts" (4). The coronavirus has affected 213 countries and territories around the world and 2 international conveyances (5).

On 26 February, Pakistan reported its first travel associated confirmed case of COVID-19 from Karachi. On the same day, another travel associated case was reported in Islamabad (6, 7). Up to 30 November 2020, 398,024 cases and 8,034 deaths had been reported in Pakistan (8). After the declaration of the COVID-19 pandemic, the Government of Pakistan implemented mitigation strategies including active surveillance, early case detection, contract tracing, clinical management, isolation, quarantine, face mask usage, social distancing and public health awareness campaigns for the containment of the disease (9).

A suspected case of COVID-19 was reported by the local health department in Islamabad on 19 March 2020, who presented with fever, abdominal pain, body aches and loose motions since 16 March. The case was later confirmed as COVID-19 positive by National Institute of Health, Islamabad, through RT-PCR. The primary case

in this COVID-19 outbreak was a foreign person who had attended a religious gathering held in Raiwind, Pakistan. As part of the regular practice, a group of 15 consociations from that particular gathering were deputed to Barakahu, a semi urban area of Islamabad where they stayed in a mosque for 24 days. Management and investigation of the outbreak was immediately conducted on 21 March 2020 to identify further active cases through contact tracing, quarantining all the close contacts and providing recommendations, as well as implementation of public health measures recommended for successful containment of the disease.

Methodology

Study design and participants

The case definition was adopted from the WHO's standard case definition, and a COVID-19 confirmed case was defined as a person with COVID-19 infection confirmed through RT-PCR. A contact was defined as a person who experienced any one of these exposures during the 2 days before and 14 days after the onset of symptoms of a probable or confirmed case: face to face contact with a probable or confirmed case within one meter and for more than 15 minutes, direct physical contact with a probable or confirmed case, or direct care of a patient with probable or confirmed COVID-19 case without using proper personal protective equipment.

Adopting descriptive study design, the investigation was conducted in Barakahu, Islamabad, by joint teams of national institute of health (NIH), district health department Islamabad and local administration. This study, being the outbreak investigation of a pandemic disease, was exempted from institutional review board approval.

Epidemiological investigation and management

Confirmed COVID-19 cases were interviewed using a predefined questionnaire to obtain data regarding the pre-set parameters, including demographic characteristics, signs and symptoms, risk factors and transmission patterns. Close contacts were enlisted and followed up for 14 days after their last interaction with the confirmed case. Observing strict biosafety measures, samples of close contacts were collected, packaged and sent to NIH lab for confirmation. All close contacts were kept in quarantine for 14 days at their residence and were actively followed up. Daily health status of all cases as well as contacts were monitored and people who developed symptoms were shifted to isolation wards for further management.

Case interviews

Patients with confirmed COVID-19 infection and their household members were interviewed to determine date of symptom onset, and any possible link between cases and contacts during the incubation period using the WHO predefined questionnaire.

Contact tracing

After getting the information of possible contacts from cases, all contacts were interviewed and categorized as high risk (close contact) and low risk contacts depending on their coessentiality of interaction with case. A high risk contact was defined as any person who lived or shared space with a confirmed case until his/her isolation, those who took care of the confirmed case whether household or non-household, or close interaction of any person for more than 15 minutes without any PPE prior to isolation of case. Distant unprotected contacts were categorized as low risk contacts. Due to limited stock of diagnostic kits, only high risk contacts were screened on whether they were symptomatic or non-symptomatic.

Laboratory testing

Observing strict biosafety measures, oropharyngeal and nasopharyngeal swabs were collected from all the suspected persons, preserved and sent in Viral Transport Medium (VTM) to the virology lab at NIH, as per recommended procedures. RNA was extracted using the QiAamp Bio Robot Kit. Real-time RT-PCR was done with the Quanti Tect Virus+Rox Vital Kit on the Bio-Rad CFX96 Touch Real-Time PCR detection System. Primer and probes were used as described in Corman and colleagues. The reference laboratory worked exactly as described in Corman and colleagues (10).

Secondary attack rate among contacts

Data were maintained in Microsoft Excel. Secondary attack rate and 95% confidence interval was calculated in OpenEpi (version 3.01) for low and high risk contact groups. Secondary attack rates were calculated for four groups: (1) household cluster, in which one household member had COVID-19 and the rest of the household members were quarantined together in one room; (2) anyone sharing a living space with a confirmed COVID-19 case; (3) non-household high risk contacts; (4) known low risk contacts.

Results

The primary case or index case (patient 0) was a Kyrgyzstani national, who had arrived in Pakistan mid-November 2019 to attend an annual religious event that takes place at Raiwind, Lahore. The day after their arrival, the primary case had visited multiple cities, stayed in Lahore from 12 to 27 November 2019, Faisalabad 27 November to 30 December 2019; Gujranwala 1 to 8 January 2020; Bunair 9 to 23 January; Hyderabad 24 January to 15 February; Kohat 16 February to 9 March; and Raiwind 9 to 15 March. The primary case along with 12 other consociations arrived in Islamabad on 15 March at a bus terminal, reached Barakahu via a passenger bus and stayed in a mosque. The primary case developed fever, vomiting and loose motions on 16 March. Later, with the help of local residents, he was brought to the Pakistan Institute of Medical Sciences (PIMS) hospital on 18 March. Keeping in view his extensive travel and stay history in a heavily

crowded area and interactions with foreigners at Raiwind, he was suspected as a COVID-19 patient. Therefore, his throat swab sample was taken at PIMS hospital and subsequently sent to NIH lab for confirmation. Through RT-PCR method, the sample was detected positive for SARS-CoV-2 on 20 March and the report was shared with relevant departments for immediate case management and containment of the suspected outbreak.

All close contacts were enrolled and their samples tested by RT-PCR between 21 to 28 March. As the index case and other consociations had close interactions with communities around the mosque during their stay, possible community contacts were identified through door to door visits, traced and quarantined for 14 days. Contacts were actively followed up on daily basis. All close contacts were instructed to minimize interactions with respective household members.

By 31 March, 2020, a total of 17 succeeding cases of COVID-19 had been diagnosed, out of which 14 (82%) were males and 3 (16%) were females. All these cases were enlisted as high-risk contacts of the primary case or succeeding cases before being diagnosed. The median age of these 17 cases was 41 years with an IQR of 34 to 56 years.

A total of 9 out of 12 close contacts of the index case were COVID-19 positive up to 23 March 2020. Patient 1 developed a sore throat, cough and fever on 19 March. Patient 2 developed a sore throat, body ache and fever on 19 March. Patient 3 only had a fever which started on 20 March. Patient 4 developed a cough and fever on 20 March. Patient 5, patient 6, patient 7, patient 8 and patient 9 had no symptoms.

Patient 10 was a local resident of Barakhahu and had direct contact with the index case (the one who brought the index case to the hospital on 18 March). Patient 10 developed a sore throat and fever on 24 March and tested positive for COVID-19 on 27 March, almost in the middle of the incubation period.

The household of patient 10 consisted of 10 members. Two members (Patient 11 and 12) tested positive, whereas the other members remained RT-PCR negative. Patient 11 developed a sore throat, fever and cough on 24 March, whereas Patient 12 only developed a cough on 26 March. Both patients were tested COVID-19 positive on 29 March.

During his infectious period, patient 11 visited his sister's home on 24 March and stayed there for 4 days. He remained in close contact with all 7 households and transmitted the virus to a further 3 persons. Patient 12 developed a fever on 28 March and tested positive on 30 March. Patient 13 had no symptoms but tested positive at the time of screening on 31 March. Patient 14 developed body ache, vomiting and fever on 31 March and tested COVID-19 positive on 1 April.

Patient 15 visited patient 10 during the time of his illness on 25 March. She developed body ache and fever on 27 March and tested positive on 1 April 2020.

All cases, excluding patient 5 and 13, were symptomatic, and most of the cases developed benign

symptoms (Table 1). No transmission from asymptomatic cases was registered to their respective contacts throughout the observation period (first week of April 2020). Presymptomatic transmission was the only potential phase for the spread from patient 10 to patient 11 and 12, and from patient 15 to patient 17. Patient 10 and 11 had similar dates of symptoms onset, which is only possible if patient 10 shed the virus 4 days before onset of symptoms, and patient 11 had a 4 to 6 days of incubation period. Four transmission events possibly occurred on the day or after the onset of symptoms i.e., from patient 10 to patient 16, from patient 11 to patient 13, 14 and 15 (Table 1). Transmission during the prodromal phase of the disease took place from patient 0 to patient 1, 4, 5, 6 and 9. The incubation period ranged from 2 to 7 days. Although, considering the most likely duration of the incubation period or in case of a range of durations, the average duration and the median incubation period was 4 days, with an interquartile range (IQR) of 3.5 to 5 days.

After the index case was confirmed for SARS CoV-2 infection and subsequent detection occurred, further cases of COVID-19, of both high and low risk contacts, were identified. Up to the first week of April, 2020, 91 high risk contacts were identified, out of which 38 were household contacts who were together until isolation of the case(s), 11 were non-household contacts of index case who were isolated in a mosque, and 42 were other close unprotected non-household contacts (Table 2). Of those isolated in the mosque, nine members turned into cases, deriving a secondary attack rate (SAR) of 81.8% with a 95% CI of (37.41 – 155.3) %. Among the community household contacts who lived with the cases until they were isolated, 14 more cases were detected, producing a secondary attack rate (SAR) of 36.8% with 95% CI (20.14 – 61.81) %. As these 38 household contacts had 152 contact days (median 4 days), the secondary attack rate (SAR) can also be revealed as approximately one infection per 11 household contact days. Between other close unprotected high risk non-household contacts, 2 further cases were detected, resulting in a secondary attack rate (SAR) of 4.8% with 95% CI (0.58 – 17.2) %. One case appeared among the distant unprotected low risk contacts, leading to a secondary attack rate (SAR) of 6.3%, having 95% CI (0.16 – 34.82) % (Table 2).

Table 1. Characteristics of laboratory-confirmed cases in the Bharakahu, Islamabad capital territory (ICT) COVID-19 outbreak, March to April 2020

Patients	Date of Symptoms Onset	Most Likely Predecessor (Primary case or other patient)	Most Likely Date of Infection	Incubation Period (Days)	Transmission Forwards to Successor Case				Self-Reported Symptoms
					Asymptomatic	Presymptomatic	On Date of Symptoms Onset	In the Prodromal Phase	
Patient 1	19-Mar	Primary Case	Mar 15-16	3 to 4 (assumed 3.5)	No	No	No	No	Fever, sore throat, cough, bodyache and loss of smell
Patient 2	19-Mar	Primary Case	Mar 16-17	2 to 3 (assumed 2.5)	No	No	No	No	Fever, sore throat, cough and bodyache
Patient 3	20-Mar	Primary Case	Mar 16-17	3 to 4 (assumed 3.5)	No	No	No	No	Fever and bodyache
Patient 4	20-Mar	Primary Case	Mar 15-16	4 to 5 (assumed 4.5)	No	No	No	No	Cough, fever and loss of smell
Patient 5	NA	Primary Case	Mar 14-19	unknown	NA	NA	NA	NA	Asymptomatic
Patient 6	20-Mar	Primary Case	Mar 14-18	2 to 6 (assumed 4)	No	No	No	No	Loss of appetite and Bodyache
Patient 7	22-Mar	Primary Case	Mar 15-17	5 to 7 (assumed 6)	No	No	No	No	Fever, Sore throat, bodyache and rhinorrhea
Patient 8	21-Mar	Primary Case	Mar 16-18	3 to 5 (assumed 4)	No	No	No	No	Loss of smell
Patient 9	23-Mar	Primary Case	Mar 15-16	7 to 8 (assumed 7.5)	No	No	No	No	Sore throat, bodyache and loss of smell
Patient 10	24-Mar	Primary Case	18-Mar	6	No	Patient 11 Patient 12	Patient 16(possible)	No	Sore throat and fever
Patient 11	24-Mar	Patient 10	Mar 18-20	4 to 6 (assumed 5)	No	No	Patient 13 Patient 14 Patient 15	No	Fever, cough, sore throat and loss of smell
Patient 12	26-Mar	Patient 10	Mar 18-19	7 to 8 (assumed 7.5)	NA	NA	NA	NA	Cough
Patient 13	NA	Patient 11	Mar 24-25	unknown	NA	NA	NA	NA	Asymptomatic

Patient 14	31-Mar	Patient 11	Mar 26-27	4 to 5 (assumed 4.5)	NA	NA	NA	NA	Fever, Vomiting, bodyache and shortness of breath
Patient 15	28-Mar	Patient 11	Mar 25-26	3 to 4 (assumed 3.5)	No	Patient 17	No	No	Fever and bodyache
Patient 16	27-Mar	Patient 10	25-Mar	2	NA	NA	NA	NA	Bodyache and cough
Patient 17	30-Mar	Patient 15	Mar 25-26	4 to 5 (assumed 4.5)	NA	NA	NA	NA	Bodyache and fever

*NA= not applicable, Asymptomatic means transmission by a patient who never developed any symptoms over the period of infection; pre-symptomatic means transmission by a patient who developed symptoms only after spreading virus to another person; at day of symptoms onset means spread by a patient on the date of symptoms onset; in the prodromal phase means spread by a patient in the phase where only non-specific symptoms (i.e. except fever and cough) were present.

Table 2. Secondary attack rates (SAR) among high risk and low risk contacts in the Bharakahu, Islamabad capital territory (ICT) COVID-19 outbreak, March to April 2020

Type of Contact		No. of Contacts	No. of Cases Generated from these Contacts	Secondary Attack Rate (SAR)	95% Confidence Interval (CI)
<i>Household Contacts:</i>					
High Risk	Together until isolation of the case	38	14	36.80%	20.14 - 61.81
	<i>Non-Household Contacts:</i>				
	Shared isolation in a room	11	9	81.80%	37.41 - 155.3
	Other close unprotected contacts	42	2	4.80%	0.58 - 17.2
Low Risk	Distant unprotected contacts	16	1	6.30%	0.16 - 34.82

Discussion

Pakistan is now fighting COVID-19 with all its might, but the spread of the disease in all provinces of the country has made it extremely difficult to control. The median incubation period that was calculated for the coronavirus that emerged in Barakahu, Islamabad, was 4.0 days, which is similar to the findings of Merle et al. (Germany) (11) and Guan et al. (China) (11,12). The incubation period for COVID-19 is on average 5-6 days, however can be up to 14 days (13). In a small number of case reports and studies, pre-symptomatic transmission has been documented through contact tracing and enhanced investigation of clusters of confirmed cases (14, 15). Data from published epidemiology and virological studies provide evidence that COVID-19 is primarily transmitted from symptomatic people to those who are in close contact through respiratory droplets, by direct contact with infected persons or by contact with contaminated objects and surfaces (16, 17). COVID-19 virus shedding is the highest in the upper respiratory tract (nose and throat) in the early course of disease (18, 19), which is in first 3 days from the onset of symptoms (20, 19). Preliminary data suggests that people may be more contagious during the time of symptom onset as compared to later on in the disease (9). To date, there has been no documented asymptomatic transmission. Asymptomatic cases have been reported through intensive efforts on contact tracing in some countries (13). In this study, it was found that fever, body ache, sore throat, cough, loss of smell and shortness of breath were the dominant symptoms, and that vomiting, loss of appetite and rhinorrhea were uncommon.

In this study, secondary attack rates based on closely monitored high risk contacts were calculated. The secondary attack rate thereby decreases with the intensity of contact. The secondary attack rate among members of cohered households was 81.80%, but decreased to 36.80% among household contacts who were only together until isolation of the case. These cohered households showed the high risk of close contacts i.e., isolated together in a room where they were already staying. The secondary attack rate among the distant unprotected contacts and other close unprotected contacts was 6.30% and 4.80% respectively, which seemed low, indicating little spread in this cluster. However, more effective spread of the virus might have been prevented by the proactive quarantine of high-risk contacts later identified as cases.

Public gatherings manifestly increase disease transmission and therefore social distancing was recommended as the primary preventive strategy. Transmission originating from people with more distinct respiratory symptoms might have resulted in a higher number of secondary cases (20). The first religious congregation (RC) gathering was in Malaysia from 27 February to 3 March 2020. A total of 1,545 COVID-19 cases in Malaysia were linked to gathering of religious congregations in Kuala Lumpur (21). This is apparently proceeded as a source of infection in Pakistan, because the infected Malaysian attended RC on 12 March held in

Lahore, Pakistan. Around 150,000 consociations, mostly from Pakistan but some from other Muslim countries, attended this gathering and it transformed into a transmission hub in Pakistan (22).

In India, a 70-year-old person, after returning from Italy and Germany, refused to be self-quarantined. He went on to attend several religious gatherings and even visited a festival in another city that attracts 300,000 people every day. He acted as source of infection, and many of his close contacts tested positive later (23).

Conclusion

In conclusion, 17 more people became positive out of 90 contacts from a single travel associated COVID-19 confirmed case. Most of the cases presented with classic COVID-19 symptoms with mild severity, and it was also found that infectiousness before symptom onset, on the day of symptom onset and during mild prodromal symptoms, was significant. Additionally, the incubation period was very short. Due to lack of fully fledged isolation centers in Islamabad, home based isolation strategy was used for the first time in the country. As the affected area was densely populated, the whole area was cordoned off for two weeks. Hence, it was the country's very first lockdown.

Recommendations

Countries should prepare and implement Standard Operation Procedure (SOP) with regards to RC during times of such pandemics. Also, a country should establish isolation centers as soon as possible in preparedness phase to cope with any unwanted situations for timely management of cases. Furthermore, lockdown should be imposed, especially in densely populated areas where risk of disease transmission is high.

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