

A superspreading event involving a cluster of 14 coronavirus disease 2019 (COVID-19) infections from a family gathering in Hong Kong

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Abstract

Objectives

An outbreak of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first reported in Wuhan, China in December 2019, with subsequent spread around the world. Hong Kong, a Special Administrative Region of China, recorded its first confirmed case on 23 January 2020. In this report, we describe a family cluster of 12 confirmed cases with 2 additional confirmed cases from secondary transmission.

Method

We reported the epidemiological, clinical and laboratory findings of the family cluster and the public health measures instituted.

Results

All 12 confirmed COVID-19 cases were among the 19 attendees of a 3-hour Chinese New Year family dinner consisting of hotpot and barbecue. Environmental sampling of the gathering venue was negative. 2 additional confirmed cases who were the co-workers of 2 confirmed cases were later identified, indicating secondary transmission. Contact tracing, quarantine and environmental disinfection were instituted to contain further spread.

Discussion

Our findings are highly suggestive of a superspreading event during the family gathering. The source is likely one of the cases during the asymptomatic phase. It attested to the high infectivity of SARS-CoV-2 through human-to-human transmission from social activities and argued for the necessity of social distancing in curtailing the disease spread.

Background

An outbreak of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)¹, was first reported in Wuhan, China in December 2019. With its spread to other countries and areas, COVID-19 was declared a public health emergency of international concern (PHEIC) by the World Health Organization on 30 January 2020.

Current research suggested SARS-CoV-2 to be of zoonotic origin with the capacity of human-to-human transmission². It was highly infectious^{3,4} and could be transmitted via droplets and contact with contaminated surfaces. Airborne transmission might take place during aerosol-generating procedures⁵. Some experts proposed that certain social activities involving aerosol generation, such as hotpot and sauna, were associated with increased risk of transmission⁶. Transmission from asymptomatic contacts was also reported⁷.

Hong Kong, a metropolitan city located at China's southern coast and with intimate economic and social tie with mainland China, reported its first confirmed COVID-19 cases on 23 January 2020. As of end February 2020, Hong Kong had recorded a total of 95

confirmed cases of COVID-19. 26 cases were locally or possibly locally acquired infection without identifiable sources. In this report, we described a family cluster of 12 confirmed cases with 2 additional confirmed cases from secondary transmission.

Method

Case identification

Cases of COVID-19 were identified from notification by medical practitioners in Hong Kong to the Centre for Health Protection (CHP), Department of Health or from contact tracing of confirmed cases.

Epidemiological investigation

For each notification, CHP initiated case investigation, including source identification, contact tracing and additional case findings. Incubation period of COVID-19 was defined as 1 to 14 days prior to symptom onset.

We describe the course of our epidemiological investigation leading to the identification of this family cluster and present the clinical, epidemiological and laboratory findings of the cases.

Environmental investigation

During the investigation, it was noted that all confirmed cases attended a family gathering prior to symptom onset. A site visit was conducted to the venue of the gathering with environmental swabs collected for examination.

Laboratory investigation

All locally-confirmed cases of COVID-19 described in this report were laboratory-confirmed by positive detection of SARS-CoV-2 RNA in patient's clinical specimens using real-time reverse transcription polymerase chain reaction. The same approach was used for environmental swabs.

Infection control measures

We describe the various infection control measures instituted.

Results

The index case and his family

On 9 February 2020, CHP received notification of a confirmed case of COVID-19 involving a 24-year-old male (Patient 1) who had developed fever and productive cough since 30 January 2020. He was admitted to a public hospital on 8 February 2020 and his nasopharyngeal aspirate was tested positive for SARS-CoV-2. He did not travel outside Hong Kong during the incubation period. He worked as a sales representative and denied any contact with confirmed COVID-19 cases.

Contact tracing revealed that his parents and maternal grandmother who resided with him also developed fever and cough on 28 and 31 January 2020 respectively. They were admitted for isolation and were also tested positive for SARS-CoV-2 (Patients 2 to 4).

In view of the proximity of their symptom onset dates, a common source exposure was suspected. Further enquiry revealed that they attended a Chinese New Year gathering with 15 other relatives on 26 January 2020 (Figure 1). At the time of the investigation, 8 of them were found to be symptomatic from 30 January to 8 February 2020 and were thus

arranged for hospital admission. 7 were tested positive for SARS-CoV-2 (Patients 5 to 11). 2 of the attendees (a father and his son) were visitors from Guangdong Province, China and had already returned home at the time of our investigation. We were later informed by the Health Commission of Guangdong Province that the son developed cough and runny nose on 2 February 2020 and was tested positive for SARS-CoV-2 on 10 February (Patient 12). The father had reported cough for a few days since 20 January 2020 but had subsided during the gathering. His respiratory specimen collected on 9 February was negative for SARS-CoV-2. His serology remained negative for SARS-CoV-2 antibodies.

Family gathering

The 19 attendees lived in separate residences and the family gathering was the only occasion attended by all 12 confirmed cases during the incubation period. It was held in a commercial party room and lasted for about 3 hours during the evening. The attendees had an indoor hotpot dinner and a barbeque held at an outdoor area outside the room. No game meat or wild poultry was consumed. They also played Mahjong and snooker. None of the attendees were symptomatic during the gathering. Staff of the party room did not enter the room during the gathering and there were no other patrons that evening. None of the staff and patrons who used the room in the following days reported symptoms.

Environmental investigations

Site visit was conducted to the party room on 9 February 2020. Environmental swabs were taken at 18 high-touch areas, including doorknobs, door handles, table surfaces and edges and switches. All were tested negative for SARS-CoV-2.

Additional case finding and infection control measures

Extensive contact tracing was conducted for each individual patient confirmed in Hong Kong. All symptomatic contacts were isolated in public hospital for treatment and SARS-CoV-2 testing. Asymptomatic contacts were quarantined in quarantine facilities or put under medical surveillance depending on the nature and duration of contact with the patient. A total of 46 close contacts and 166 other contacts were identified. Among them, 2 contacts who were co-workers of Patients 3 and 5 respectively developed symptoms on 1 and 3 February and were tested positive for SARS-CoV-2 (Patients 13 and 14).

Overall, the entire cluster of 14 confirmed cases consisted of 7 males and 7 females aged 22 to 91 (median: 51). All of them had good past health and had no travel history outside Hong Kong during the incubation period (except Patient 12 visiting from China). They all presented with upper respiratory symptoms and/or fever (Figure 2).

Environmental cleansing and disinfection were arranged for the party room, cases' residences and workplaces. As of end-February, all cases remained stable and 8 (Patients 1, 3, 4, 5, 9, 10, 12 and 13) were discharged. No further cases related to this cluster were identified.

Discussion

This was the largest COVID-19 family cluster recorded in Hong Kong at the time of reporting. Our epidemiological investigation suggested that primary transmission took place during the family gathering with secondary transmission leading to infection of 2 more cases. The most likely source was one of the cases during the asymptomatic infectious phase.

Our investigation supported and supplemented the current understandings of COVID-19 infection. In this cluster, the incubation periods ranged from 2 to 13 days, which were compatible with the current knowledge⁸. Nevertheless, those with a longer incubation period might represent secondary interfamilial transmission. Our findings also supported human-to-human transmission of SARS-CoV-2. As the family gathering was the only occasion attended by the 12 patients during the incubation periods, it demonstrated the high infectivity of SARS-CoV-2 (as 11 out of 17 susceptible attendees, excluding the potential source, were infected) and its ability to cause a super-spreading event.

Transmission of SARS-CoV-2 could be enhanced through close and prolonged social contacts such as in the family gathering described above. Contact with contaminated surface might play a less significant role in this cluster as demonstrated by the negative environmental sampling results and the absence of secondary transmission in the party room staff and subsequent patrons.

Although the family gathering involved hotpot dinner, there was not enough information to support the expert hypothesis that it could enhance SARS-CoV-2 transmission through aerosol generation.

Our investigation had several strengths. Our immediate investigation allowed identification of the possible sources and establishment of the transmission chain. Extensive contact tracing allowed swift identification of more confirmed cases and ensured contacts were quarantined and put under medical surveillance. The timely institution of these infection control measures allowed complete case ascertainment in this cluster and shed light on the transmission dynamic of COVID-19.

In Hong Kong, family gathering involving relatives from other extended families and friends were very common during major festivities (e.g. Chinese New Year) as it was considered an important local tradition. These occasions offered good opportunities for spreading of a highly infectious agent such as SARS-CoV-2.

Social distancing had been advocated as one of the community mitigation measures during influenza pandemics. It entailed increase in physical distances and reduction of gathering in dense social settings⁹. With the continuing global spread of COVID-19, apart from advocating personal hygiene and protection, social distancing might be necessary to curtail further disease spread in the community, especially during the containment phase of the epidemic.

Reference

1. Gorbalenya AE, Baker SC, Baric RS, et al. Severe acute respiratory syndrome-related coronavirus: the species and its viruses—a statement of the Coronavirus Study Group. bioRxiv. 2020; (published online Feb 11. DOI: 2020.02.07.937862 (preprint).)
2. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020 Feb 15;395(10223):514-523. doi: 10.1016/S0140-6736(20)30154-9. Epub 2020 Jan 24.
3. Tuite AR, Fisman DN. Reporting, Epidemic Growth, and Reproduction Numbers for the 2019 Novel Coronavirus (2019-nCoV) Epidemic. Annals of Internal Medicine. 2020 Feb 5. doi: 10.7326/M20-0358.

4. Wu JT, Leung K, Leung GM. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. *Lancet*. 2020 Jan 31. pii: S0140-6736(20)30260-9. doi: 10.1016/S0140-6736(20)30260-9.
5. World Health Organization. Q&A on infection prevention and control for health care workers caring for patients with suspected or confirmed 2019-nCoV. 16 February 2020. Available from: <https://www.who.int/news-room/q-a-detail/q-a-on-infection-prevention-and-control-for-health-care-workers-caring-for-patients-with-suspected-or-confirmed-2019-ncov>
6. Pao J. Hotpot diners 'caught Wuhan virus via droplets, not aerosols'. *Asia Times*. 2020 February 10. Available from: <https://asiatimes.com/2020/02/hotpot-diners-caught-wuhan-virus-via-droplets-not-aerosols>
7. Rothe C, Schunk M, Sothmann P. Transmission of 2019-nCoV Infection from an Asymptomatic Contact in Germany. *The New England Journal of Medicine*. 2020 Jan 30. doi: 10.1056/NEJMc2001468.
8. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20–28 January 2020. *Euro Surveill*. 2020 Feb;25(5). doi: 10.2807/1560-7917.ES.2020.25.5.2000062.
9. Ahmed F, Zviedrite N, Uzicanin A. Effectiveness of workplace social distancing measures in reducing influenza transmission: a systematic review. *BMC Public Health*. 2018 Apr 18;18(1):518. doi: 10.1186/s12889-018-5446-1.

Figure 1. The family tree of the cluster.

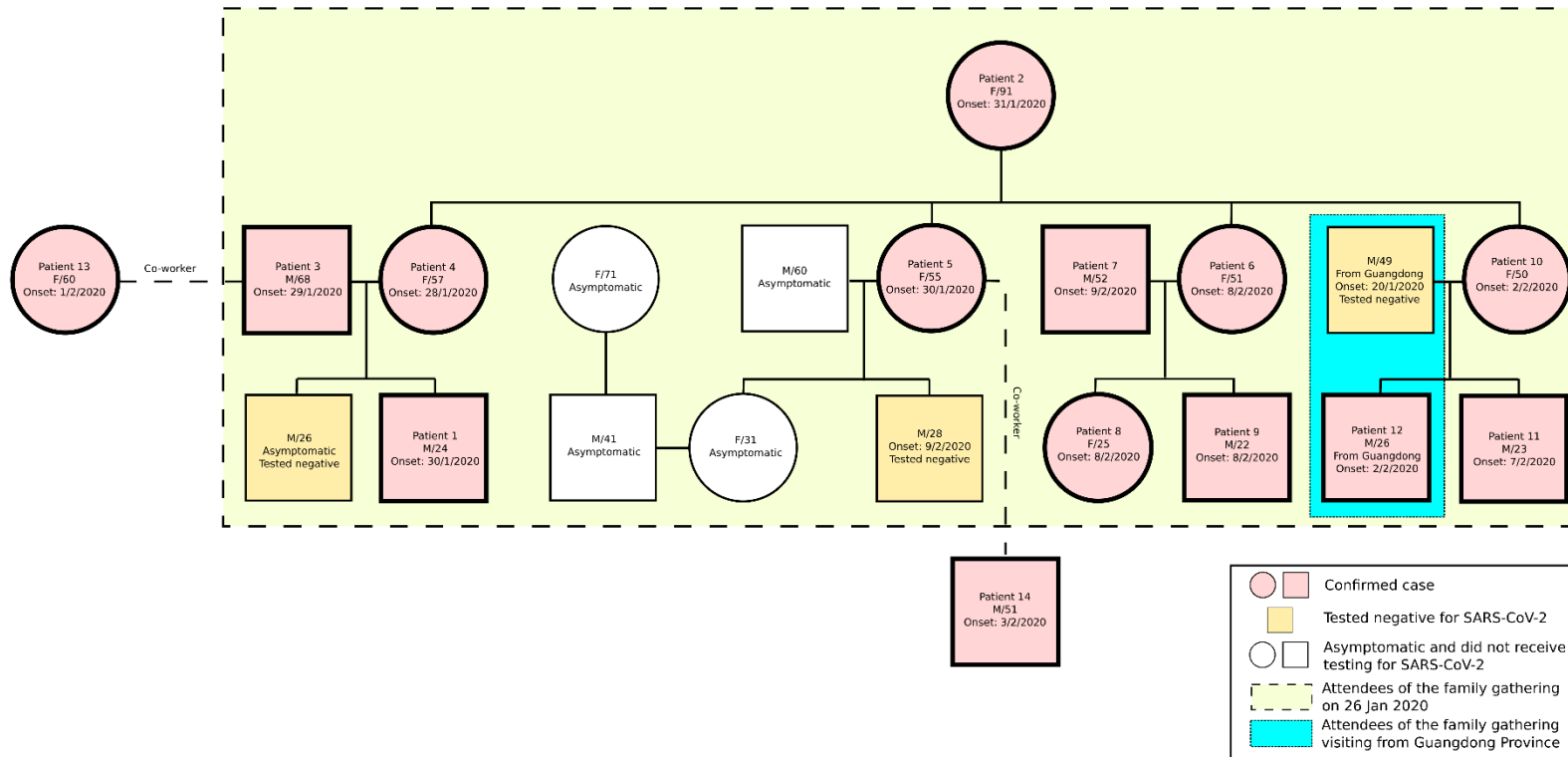


Figure 2. Chart illustrating key events of Patients 1 to 14. (NPA: nasopharyngeal aspirate)

