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The necessity of detailed epidemiological investigation in the early stage of an outbreak: lessons from a six-case cluster of COVID-19 in Guangzhou, China

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The epidemic of 2019 novel coronavirus disease (COVID-19) spread from Hubei Province to all 31 provinces in China during January and February 2020. However, epidemiological evidence has confirmed that human-to-human transmission among close contacts had occurred since the early stage of the outbreak in December 2019.^{1,2}

Guangzhou is the capital city of Guangdong Province, located in southern China. By March 2020, 440 cases of COVID-19 had been reported.³ In February, we investigated a case (Case A, a 67-year-old woman, symptom onset on 24 January) who had no contact history with Hubei or any confirmed cases. However, she had joined a karaoke party hosted by a WeChat (similar to WhatsApp) group (Group A) on 20 January. Karaoke is popular among elderly people in China and WeChat provides a convenient platform for those who enjoy the hobby to meet others and to arrange to attend karaoke gatherings. Since most karaoke rooms have poor ventilation, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is easily transmitted at such events.

During the investigation, case A identified that one of her online friends who also attended the party had posted several photos in the group chat of an isolation ward around that time. We later confirmed that this online friend was another case (Case B, a 55-year-old woman, symptom onset on 26 January) without any history of exposure to Hubei and people infected with COVID-19.

Case E (a 56-year-old woman) was asymptomatic and confirmed by Reverse-transcription Polymerase Chain Reaction (RT-PCR) on 4 February as the close contact

of her husband (Case C, a 59-year-old man, symptom onset on 27 January) and son (Case D, a 15-year-old man, symptom onset on 1 February), but the source of infection of this household remained unclear. After relating case A to B, we further discovered another karaoke party held by a WeChat group (Group B) on 22 January. The participants of these parties included not only cases A and B but also case E.

None of the other 34 participants of the two parties mentioned above was a previously confirmed COVID-19 case and none had developed any symptoms. They all denied having contact with Hubei or any COVID-19 patients.

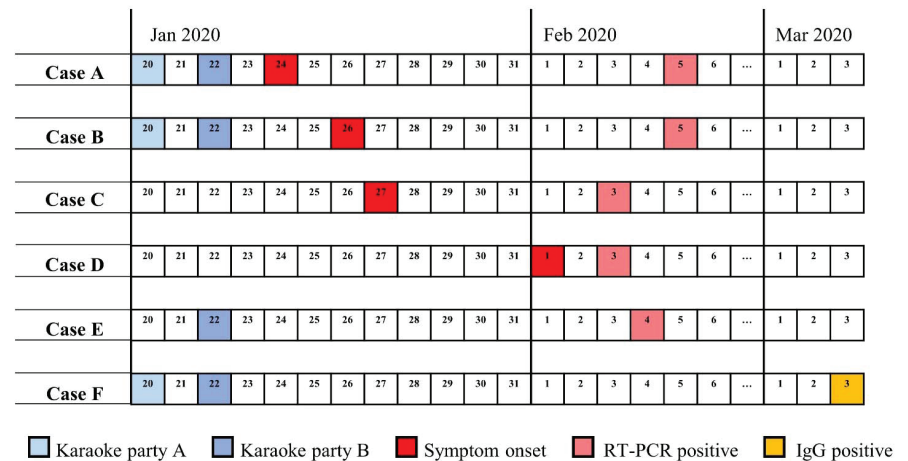
However, we identified that other than cases A and B there was only one person (Case F, a 65-year-old man) who had attended both parties and been in contact with all three cases (A, B, E). According to our further

investigation, Case F was the initiator of WeChat Group B and he enjoyed organizing karaoke parties for the group members, which had previously included Cases A and B. Case E was case F's friend, who was not previously a member of group A or B; 22 January was her first time to join their activity. Thus, we took samples for Case F. RT-PCR results for the throat and anal swabs were both negative, but the antibody test showed an IgG positive result for the serum sample (Figure 1). Such results indicated that case F was once an asymptomatic case of COVID-19 and was now already in the recovery phase. They also suggested that serological results could be another valuable piece of evidence for clarifying epidemiological relationships in the future.⁴

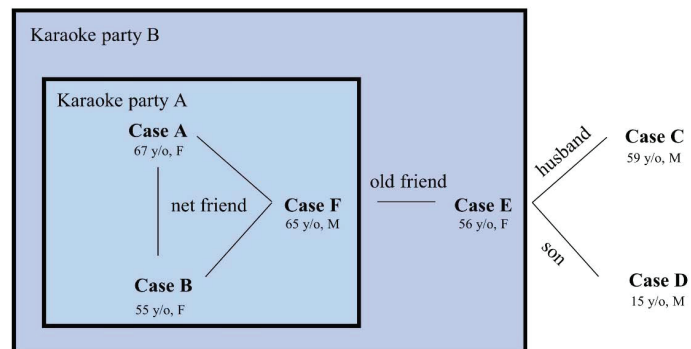
However, the core problem – that of identifying the infectious source of the six-case cluster – had not yet been solved. In

Figure 1: Timeline of the COVID-19 cluster and the relationships among the cases.

a. Timeline of the cluster



b. Relationships among the cases



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Guangzhou, the first case of COVID-19 had been reported on 21 January. By increasing temperature monitoring in the community and case surveillance in the fever clinic, 237 cases had been confirmed before Case A was identified.⁵ At this early stage of the epidemic, nearly 90% of infections had come from Hubei or were related to Hubei.² We did not find the epidemiological link between the above cases (including their close contacts) and Hubei or any previously confirmed cases. One of the reasons may be that we did not pay enough attention to investigating the cases that were clearly related to Hubei, hence their traces of activity were not detailed enough. We had probably missed some key information that could associate this cluster epidemic to the previous cases, and as time passed, recall bias would significantly reduce the accuracy of new information. We tried to reinvestigate the full lists of participants of the karaoke parties that Cases A, B, E and F had joined before 20 January, but this group of online friends aged over 50 years all failed to successfully recall the details.

In addition, asymptomatic patients can unknowingly transmit the virus. It is possible that cases A, B, E or F had been infected by an unconfirmed asymptomatic patient and then transmitted the virus to the others through the karaoke party. Case E further transmitted to her family (Cases C and D).

At the time we investigated this outbreak, RT-PCR was the most common method of case screening and the confirmatory criteria were positive for both N gene and ORF1ab gene. Technologies of serological and genetic tests for SARS-CoV-2 were unavailable before March 2020. As the next step, we will continue searching for the rest of the participants who had been at the same parties with these cases and will try to clarify the transmission relationships as far as possible, with the help of serological and genetic results.

However, this lesson has shown the necessity of detailed epidemiological investigation in the early stage of an outbreak, especially for an emerging infectious disease. During this period, while clear exposure and contact history could be easily recognised for most cases, we still needed to draw the epidemiological networks as completely as possible. The information would be valuable for enhancing the traceability of the secondary cases and the following community transmission in the later stage of the epidemic.

Currently, the epidemic of COVID-19 has spread throughout the world. Negligence of epidemiological investigation in many countries might be one of the reasons for this severe situation. We hope that our lesson could be a reminder for the world to take early action when facing emerging infectious diseases in the future.

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