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Commentary

Transmission of SARS-CoV-2 in the Karaoke Room: An Outbreak of COVID-19 in Guangzhou, China, 2020

Yuzhou Gu†, Jianyun Lu†, Wenzhe Su, Yanhui Liu, Chaojun Xie, Jun Yuan*

Guangzhou Center for Disease Control and Prevention, Guanghzou, Guangdong Province, China

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1. INTRODUCTION

Pandemic of 2019 novel Coronavirus Diseases (COVID-19) caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has already become a common public health problem around the world. According to the general consensuses, the main transmission modes of SARS-CoV-2 are respiratory droplet and close contact [1,2], which reveals the risk for group gathering without social distance and personal protection [3].

Karaoke is now a popular entertainment among retired Chinese people. They usually create WeChat (social application like WhatsApp) groups to connect those with common hobby and to organize offline karaoke parties. On February 2020, a cluster of COVID-19 affected five patients in Guangzhou, China was found to be associated with a karaoke party hosted by a WeChat group. Due to the absence of effective antiviral and vaccine, to clarify the characteristic of such special epidemic is essential for avoiding the future community transmission. Therefore, in the current study, we described and analyzed the epidemiological characteristics of this outbreak. The work was approved by the Ethics Committee of Guangzhou Center for Disease Control and Prevention (GZCDC-ECHR-2020P0015).

2. CASE PRESENTATION

The two index patients (patient A and B) were the initiators of the upon WeChat group. On January 22, they organized a karaoke party at a karaoke bar and 14 of the group members attended. They gathered in two separated karaoke rooms, seven participators were at room A with patient A, patient B and the other seven were at room B. On January 24, patient A began to cough and expectorate, and patient C who sat beside patient A in room A experienced onset of cough and expectoration 4 days after the karaoke party. Up to 14 days after January 22, no more participators reported any COVID-19-like symptoms. But with the laboratory tests (RT-PCR and antibody test), we further confirmed three asymptomatic patients in room B, patient B and D, E who sat next to B. We listed the clinical features and laboratory results of the patients in Table 1, and the timeline of this cluster was shown in Figure 1.

This outbreak occurred at the early stage of epidemic of Guangzhou. That time, most infection were related to Hubei Province (the initial area of the COVID-19 epidemic in China). In this case, both the five patients are native population. They have not travelled to Hubei for more than a year and they denied having any contact with certain COVID-19 patients or persons came from Hubei. However, on January 14 and 15 (1 week before the karaoke party), patients A and B had shopped together at the clothing wholesale markets which were popular with businessmen from Wuhan City (capital and epicenter of Hubei) before the city locked down on January 23. Based on the existed epidemic that occurred inside some clothing wholesale markets in Guangzhou, it is possible that patients A and B were infected by unknown cases from Wuhan at the days they shopped at the markets [4]. But for the rest three patients, the only exposure opportunity was gathering with patients A and B at the karaoke rooms. Thus we determined that patients C–E were both infected in the karaoke rooms.

With the same structure, the two karaoke rooms are both air-conditioned rooms without windows and occupy 10 m^2. Inside each room, a long sofa that can accommodate 8 to 10 persons is located toward the main screen; persons need to share two microphones for singing and one touch screen for song choosing (Figure 1).

*Corresponding author. Email: yuanjuncom@163.com
†These first authors contributed equally to this article.
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Table 1 | Personal and clinical characteristics, laboratory and chest CT results of the five patients

Variables	Patient A	Patient B*	Patient C	Patient D	Patient E
Age	67	65	55	57	63
Sex	Female	Male	Female	Female	Female
Occupation	Retiree	Retiree	Retiree	Retiree	Retiree
Chronic medical illness	Hypertension	Asthma	Chronic pharyngtis	None	None
Time of symptom onset	Jan. 24	Asymptomatic	Jan. 26	Asymptomatic	Asymptomatic
Fever	-	-	+	-	-
Cough	+	-	+	-	-
Expectoration	+	-	+	-	-
Haemoptysis	+	-	-	-	-
Dyspnoea	-	-	-	-	-
Headache	+	-	-	-	-
Diarrhea	-	-	-	-	-
White blood cell count ($\times 10^9$ cells/L)	3.90	-	6.80	3.66	5.57
Lymphocyte count ($\times 10^9$ cells/L)	0.88	-	0.97	2.13	2.19
Lymphocyte %	22.60	-	14.30	58.20	39.30
Neutrophil count ($\times 10^9$ cells/L)	2.79	-	5.60	1.07	2.42
Neutrophil %	71.40	-	82.40	29.30	43.40
Chest CT scan	Bilateral ground-glass opacities	-	Subsegmental areas of consolidation	Bilateral ground-glass opacities	Bilateral ground-glass opacities

*Serological tests only showed IgG positive for patient B thus he was not required to hospitalize and have the laboratory and CT tests.

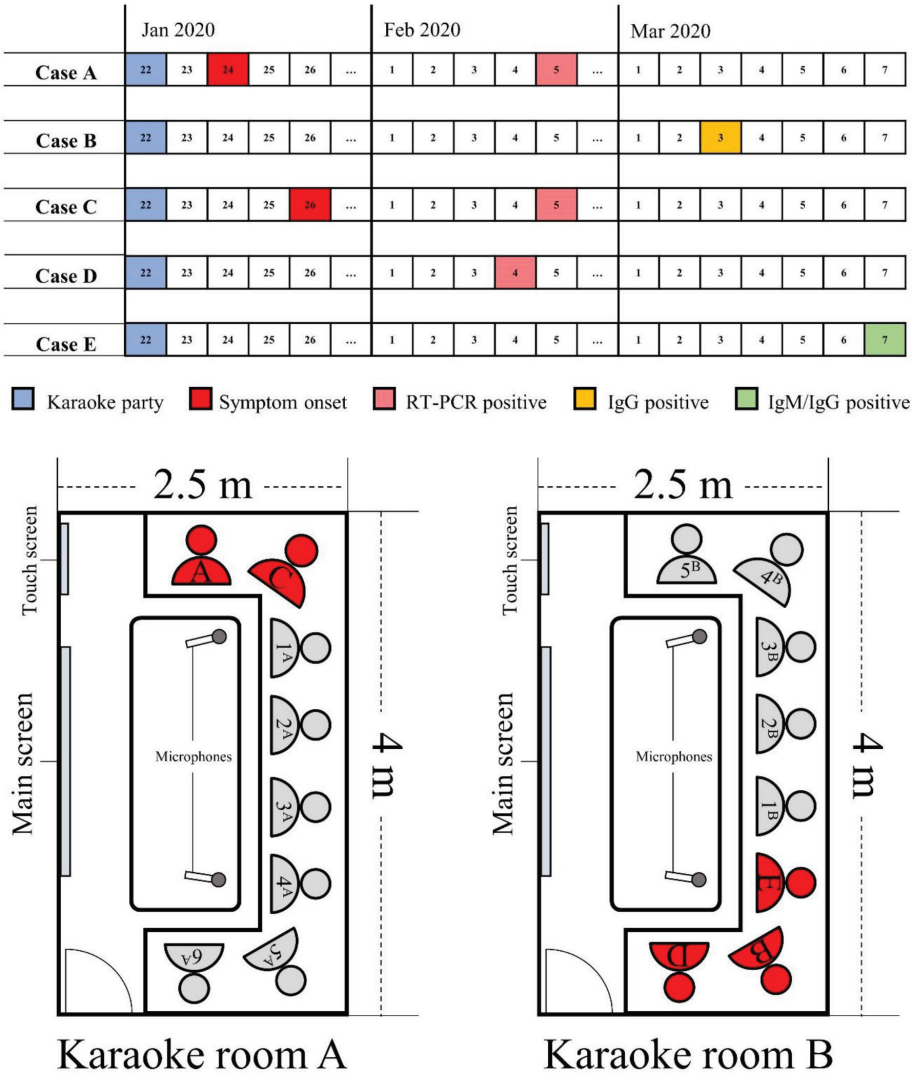

Figure 1 | Timeline of the cluster, structure of the karaoke rooms and the seating arrangement of the karaoke party.

3. DISCUSSION AND CONCLUSION

On January 22, the 16 participators gathered in these small rooms for about 5 h, without natural ventilation. None of them wore any face masks and the distance between each other was <0.5 m. People exhaled and even shouted out heavily when they were singing, hence a large amount of respiratory droplets would be sprayed out during this activity. Research has found the respiratory droplets usually travel <1 m, thus droplets generated by index patients were mostly likely to settle on the environmental surfaces and the mucosa of participators near them [5]. Obviously, patient C and participator 1^{A} in room A, patient D, patient E and participator 1^{B} in room B had the greatest opportunity to get infected through respiratory tract (Figure 1). Moreover, because the singer's mouth could be very close to the microphone, it is possible for the SARS-CoV-2 to be sprayed onto the microphones while the index patients were singing. Previous study has shown the SARS-CoV-2 could remain infectious for up to 4 days on the inner side of face masks, which indicated the infective virus was available on the microphones [6]. Especially in the poor-ventilated karaoke rooms, SARS-CoV-2 cannot be diluted by the clean air [7], persons who sang followed the index patients could be infected by close contact with the microphones. According to the seating arrangements, patients A and C probably shared one of the microphones in room A, and the situation for patients B, D and E may be similar (Figure 1). This contact further increased the risk for patients C–E undoubtedly. Therefore, we deduced that the cause of this outbreak was droplet transmission through singing in close distance and sharing the microphones with the index patients in the poor-ventilated karaoke rooms for long period. The most likely scenario is that, for the room A, patient C was directly infected by patient A. And for the room B, patients D and E were both infected by patient B.

This deduction still has some limitations. The smear samples from the microphones of the two karaoke rooms were all negative for SARS-CoV-2 by RT-PCR. However, we found that the karaoke bar has the regulation to put the one-off covers on the microphones before every karaoke party and to eliminate it after the customers leave. Probably the virus from the patients only remained on the surface of these one-off covers but failed to penetrate to the main bodies of the microphones. Moreover, we did not conduct an experimental study simulating these transmission route.

In March 2020, two outbreaks of COVID-19 among karaoke parties were reported in Hong Kong [8] and Korea [9], which involved seven and six patients, respectively. These two cases both alerted the risk for people to gather in such confined environment and contact with each other at a close distance, but they did not explore the exact transmission route inside the karaoke rooms. In the current study, we not only summarized the characteristics of the cluster related to karaoke participation in Guangzhou, China, and further revealed the most possible transmission mode based on the epidemiologic information.

When case A was identified, Guangdong was the most serious provinces in China other than Hubei. That time, COVID-19 pandemic was fast expanding and near a 1000 cases had been reported in Guangdong. Our result suggested that during this pandemic period of COVID-19 or other severe respiratory infectious diseases like SARS and MERS, the government should temporarily close this kind of entertainment venues. However, even though the pandemic is now under control in several countries like China, the risk for infection with SARS-CoV-2 in these poorly ventilated environments still cannot be ignored. The owners of the karaoke bars should improve the indoor ventilation of the karaoke rooms, set the requirement for the customers to wear face masks, and provide everyone in the karaoke rooms a dedicated microphone. Anyway, for the ordinary citizens, the best way to avoid the risk of getting infected in the karaoke room at this special period is to reduce this kind of gathering, or at lease to choose a bar with well-ventilated, and to pay more attention to personal protection via masks wearing, social distancing and hands washing [8].

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHORS' CONTRIBUTION

YG acquired, interpreted the epidemiological data and draft the manuscript. JL and JY designed the study, and revised the manuscript. WS acquired and interpreted the laboratorial data. YL analyzed the data and revised the manuscript. CX interpreted the data and revised the manuscript. All authors have read and approved the manuscript.

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ABBREVIATIONS

COVID-19, 2019 novel coronavirus diseases; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The work was approved by the Ethics Committee of Guangzhou Center for Disease Control and Prevention (GZCDC-ECHR-2020P0015).

REFERENCES

[1] Guan Wj, Ni Zy, Hu Y, Liang Wh, Ou Cq, He Jx, et al. Clinical characteristics of 2019 novel coronavirus infection in China. MedRxiv 2020.

[2] To KKW, Tsang OTY, Yip CCY, Chan KH, Wu TC, Chan JMC, et al. Consistent detection of 2019 novel coronavirus in saliva. Clin Infect Dis 2020;71;841–3.

[3] Centers for Disease Control and Prevention. Coronavirus Disease 2019 (COVID-19). How to protect yourself and others [Internet]. The United States: Centers for Disease Control and Prevention. Available from: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html [cited 2020].

[4] Guangzhou Municipal Heal Commission. COVID-19 epidemic in Guangzhou, April 14, 2020 [Internet]. Guangzhou: Guangzhou Municipal Heal Commission. Available from: https://mp.weixin.qq.com/s/dG_zirWNvDl7DYogLRZFSA [cited April 15, 2020].

[5] Kutter JS, Spronken MI, Fraaij PL, Fouchier RAM, Herfst S. Transmission routes of respiratory viruses among humans. Curr Opin Virol 2018;28;142–51.

[6] Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen HL, Chan MCW, et al. Stability of SARS-CoV-2 in different environmental conditions. Lancet 2020;1;E10.

[7] Pica N, Bouvier NM. Environmental factors affecting the transmission of respiratory viruses. Curr Opin Virol 2012;2;90–5.

[8] Cheng VCC, Wong SC, Chuang VWM, So SYC, Chen JHK, Sridhar S, et al. The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. J Infect 2020;81;107–14.

[9] Kang YJ. Lessons learned from cases of COVID-19 infection in South Korea. Disaster Med Public Health Prep 2020;1–8.