During January 28–February 6, 2020, and intravenous immunoglobulin therapy (20 g/d) during January 28–February 1. In addition, we administered glucocorticoid therapy with methylprednisolon (20–60 mg 2×/d by intravenous drip) during January 29–February 1. The patient’s fever abated on January 29. He tested negative for SARS-CoV-2 on February 4 and again on February 6. During the progression of his recovery, we observed gradual reduction of the white patches in the lung caused by SARS-CoV-2 infection (Appendix Figure 2). On January 28 and January 31, we observed multiple ground-glass–like high-density shadows on both lungs with blurred edges and interstitial changes. On February 3, high-density shadows were slightly absorbed in the upper lobe of the bilateral lungs. On February 6, some lesions in the lower lobe of both lungs were slightly absorbed, and we observed the same situation on February 8. The index patient was discharged to home on February 9.

In summary, our epidemiologic study demonstrates asymptomatic and human-to-human transmission of SARS-CoV-2 infection through close contacts in both familial and hospital settings. In addition, the laboratory test results, together with course of medical therapies described, can provide a practical reference for COVID-19 diagnosis and treatment.

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COVID-19 Outbreak Associated with Air Conditioning in Restaurant, Guangzhou, China, 2020

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During January 26–February 10, 2020, an outbreak of 2019 novel coronavirus disease in an air-conditioned restaurant in Guangzhou, China, involved 3 family clusters. The airflow direction was consistent with droplet transmission. To prevent the spread of the virus in restaurants, we recommend increasing the distance between tables and improving ventilation.

From January 26 through February 10, 2020, an outbreak of 2019 novel coronavirus disease (COVID-19) affected 10 persons from 3 families (families A–C)
who had eaten at the same air-conditioned restaurant in Guangzhou, China. One of the families had just traveled from Wuhan, Hubei Province, China. We performed a detailed investigation that linked these 10 cases together. Our study was approved by the Ethics Committee of the Guangzhou Center for Disease Control and Prevention.

On January 23, 2020, family A traveled from Wuhan and arrived in Guangzhou. On January 24, the index case-patient (patient A1) ate lunch with 3 other family members (A2–A4) at restaurant X. Two other families, B and C, sat at neighboring tables at the same restaurant. Later that day, patient A1 experienced onset of fever and cough and went to the hospital. By February 5, a total of 9 others (4 members of family A, 3 members of family B, and 2 members of family C) had become ill with COVID-19.

The only known source of exposure for the affected persons in families B and C was patient A1 at the restaurant. We determined that virus had been transmitted to ≥1 member of family B and ≥1 member of family C at the restaurant and that further infections in families B and C resulted from within-family transmission.

Restaurant X is an air-conditioned, 5-floor building without windows. The third floor dining area occupies 145 m²; each floor has its own air conditioner (Figure). The distance between each table is about 1 m. Families A and B were each seated for an overlapping period of 53 minutes and families A and C for an overlapping period of 73 minutes. The air outlet and the return air inlet for the central air conditioner were all nucleotide negative. This finding explained by droplet transmission alone. Larger respiratory droplets (>5 µm) remain in the air for only a short time and travel only short distances, generally <1 m (2,3). The distances between patient A1 and persons at other tables, especially those at table C, were all >1 m. However, strong airflow from the air conditioner could have propagated droplets from table C to table A, then to table B, and then back to table C (Figure).

Virus-laden small (<5 µm) aerosolized droplets can remain in the air and travel long distances, >1 m (4). Potential aerosol transmission of severe acute respiratory syndrome and Middle East respiratory syndrome viruses has been reported (5,6). However, none of the staff or other diners in restaurant X were infected. Moreover, the smear samples from the air conditioner were all nucleotide negative. This finding is less consistent with aerosol transmission. However, aerosols would tend to follow the airflow, and the lower concentrations of aerosols at greater distances might have been insufficient to cause infection in other parts of the restaurant.

Our study has limitations. We did not conduct an experimental study simulating the airborne transmission route. We also did not perform serologic studies of swab sample–negative asymptomatic family members and other diners to estimate risk for infection.

We conclude that in this outbreak, droplet transmission was prompted by air-conditioned ventilation. The key factor for infection was the direction of the airflow. Of note, patient B3 was afebrile and 1% of the patients in this outbreak were asymptomatic, providing a potential source of outbreaks among the public (7,8). To prevent spread of COVID-19 in restaurants, we recommend strengthening temperature-monitoring surveillance, increasing the distance between tables, and improving ventilation.

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Figure. Sketch showing arrangement of restaurant tables and air conditioning airflow at site of outbreak of 2019 novel coronavirus disease, Guangzhou, China, 2020. Red circles indicate seating of future case-patients; yellow-filled red circle indicates index case-patient.
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Severe Acute Respiratory Syndrome Coronavirus 2 RNA Detected in Blood Donations

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Because of high rates of 2019 novel coronavirus disease in Wuhan, China, Wuhan Blood Center began screening for severe acute respiratory syndrome coronavirus 2 RNA on January 25, 2020. We screened donations in real-time and retrospectively and found plasma samples positive for viral RNA from 4 asymptomatic donors.

Because of the rapid increase of cases of 2019 novel coronavirus disease (COVID-19; 1) and detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA in plasma (2,3), the safety of China’s blood supply became a major concern (4). Most blood centers and blood banks in China began taking measures to ensure blood safety (5); on January 25, 2020, we began screening all donations collected at the Wuhan Blood Center.

We performed real-time reverse transcription PCR (RT-PCR) for SARS-CoV-2 RNA by using MultiScreen Pro RT-PCR assay (SYM-BIO LifeScience, https://www.sym-bio.com.cn). We performed pool testing by mixing plasma from 6–8 samples or individual testing by using 1.6 mL of plasma. We eluted 100 µL of nucleic acid template and added 40 µL of it to the RT-PCR mix.

By March 4, we had screened 2,430 donations in real-time, including 1,656 platelet and 774 whole blood donations. We identified the first positive donor in our center in a positive pool with a weak amplification of the open reading frame 1ab gene. The donor gave 2 units of platelets on January 28, which were included in the pool. However, the donor’s prior donations collected on December 12 and 26 and January 13 were negative for viral RNA. Hubei Province Center for Disease Control and Prevention performed follow-up

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Appendix

Appendix Table. Summary of clinical features and laboratory results of the three family clusters infected with COVID-19 at presentation

| Variable                          | Family A            | Family B            | Family C            |
|-----------------------------------|---------------------|---------------------|---------------------|
| Relationship                      | Patient A1 (Index case) |
| Sister of patient A2              | Patient A2          |
| Sister of patient A1              | Patient A3          |
| Wife of patient A5, in-laws of patient A1 | Patient A4 |
| Niece of patient A1               | Patient A5          |
| Husband of patient A3, in-laws of patient A1 | Patient B1 |
| Wife of patient B3                | Patient B2          |
| Daughter of patient B1 and B3     | Patient B3          |
| Husband of patient B1             | Patient B1          |
| Daughter of patient C2            | Patient C1          |
| Mother of patient C1              | Patient C2          |
| Age (years)                       | 63                  |
| Sex                               | Female Retiree      |
| Occupation                        | 60                  |
| Sex                               | Female Retiree      |
| Occupation                        | 62                  |
| Sex                               | Female Retiree      |
| Occupation                        | 34                  |
| Sex                               | Female Staff        |
| Occupation                        | 63                  |
| Sex                               | Male Retiree        |
| Occupation                        | 44                  |
| Sex                               | Female Cook         |
| Occupation                        | 20                  |
| Sex                               | Female Student      |
| Occupation                        | 53                  |
| Sex                               | Male self-employed household |
| Occupation                        |                      |
| Sex                               | Female Civil servant |
| Occupation                        |                      |
| Chronic medical illness           | Hypertension, hyperlipidemia |
| Presenting symptoms and signs     | interval between hospital and symptom onset (days) |
| Presenting symptoms and signs     | 1                   |
| Time of onset                     | Jan. 24             |
| Fever                             | +                   |
| Cough                             | +                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 0                   |
| Time of onset                     | Jan. 27             |
| Fever                             | +                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 0                   |
| Time of onset                     | Jan. 29             |
| Fever                             | +                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 0                   |
| Time of onset                     | Jan. 29             |
| Fever                             | +                   |
| Cough                             | +                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | +                   |
| Presenting symptoms and signs     | 3                   |
| Time of onset                     | Feb. 2              |
| Fever                             | +                   |
| Cough                             | +                   |
| Running nose                      | +                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 3                   |
| Time of onset                     | Feb. 1              |
| Fever                             | +                   |
| Cough                             | +                   |
| Running nose                      | +                   |
| Polypnea                          | +                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | +                   |
| Presenting symptoms and signs     | 1                   |
| Time of onset                     | Feb. 3              |
| Fever                             | -                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 1                   |
| Time of onset                     | Feb. 5              |
| Fever                             | -                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     | 9                   |
| Time of onset                     | Jan. 31             |
| Fever                             | -                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Presenting symptoms and signs     |                    |
| Time of onset                     | Jan. 27             |
| Fever                             | -                   |
| Cough                             | -                   |
| Running nose                      | -                   |
| Polypnea                          | -                   |
| Head pain                         | -                   |
| Chest pain                        | -                   |
| Diarrhea                          | -                   |
| Variable                          | Family A | Family B | Family C |
|----------------------------------|----------|----------|----------|
| Body temperature (°C)            | 37.80    | 37.80    | 39.90    |
| Leukocyte count (×10⁹ cells per L) | 4.08     | 4.79     | 5.40     |
| Lymphocyte count (×10⁹ cells per L) | 0.93     | 1.05     | 1.49     |
| Lymphocyte%                      | 33.10    | 21.90    | 15.50    |
| Neutrophil count (×10⁹ cells per L) | 1.60     | 3.34     | 27.60    |
| Neutrophil %                     | 56.9     | 69.80    | 74.90    |

*Detail of the index case: the index case was the member of family A, who came from Wuhan to Guangzhou, by train from Jan. 22 to Jan. 23. She did not neither contact with wild animals, nor eat game meat. On Jan. 24, after lunch, the index case (patient A1) presented with fever and cough at 16:40, and then she presented to the hospital and admitted to the isolation ward with fever, cough and pneumonia feature on CT scans. After the positive result of throat swab by RT-PCR, she was diagnosed as COVID-19 on Jan. 26, all the other 9 family members were classified as close contacts and sent to the Guangzhou No.8 Hospital for isolation quarantine, of which four developed fever symptoms and were diagnosed as COVID-19 cases by RT-PCR from Jan. 27 to Feb. 3.

Patient A1 was the index case. The relationship between the patients was described as below: A2: sister of A1; A3: in-laws of A1, wife of A5; A4: niece of A1; A5: in-laws of A1, husband of A3. B1: wife of A3; B2: daughter of B1 and B3; B3: husband of B1, father of B2. C1: daughter of C2; C2: mother of C1.
Appendix Figure. Timeline for outbreak of COVID-19 among persons at restaurant, Guangzhou, China, 2020.