In Wuhan, Hubei Province, China, on December 8, 2019, physicians at one hospital reported a cluster of patients having pneumonia of unknown cause (1–3). These cases garnered considerable attention from the Chinese government and World Health Organization (WHO).

In early-stage pneumonia, severe symptoms of acute respiratory infection had appeared. Some patients had rapidly developed severe complications, such as acute respiratory distress syndrome and acute respiratory failure (4). On January 7, 2020, the Chinese Center for Disease Control and Prevention found a new type of coronavirus from a throat swab sample of a patient, which was named “severe acute respiratory syndrome coronavirus 2” or “SARS-CoV-2” by the WHO. As of February 6, 2020, 31,161 patients have been confirmed with the SARS-CoV-2 infection in China, and 25 countries have patients with this infection. The WHO identified this infection as a global event and named the disease caused by the SARS-CoV-2 infection “coronavirus disease” or “COVID-19” on February 11, 2020.

We investigated COVID-19 prevalence in 4 key cities outside Wuhan. We conducted a retrospective analysis to predict COVID-19 development in the future. As of February 6, 2020, 31,161 patients have been reported to have COVID-19 in China, with 22,112 patients in the Hubei Province (70.96%). In addition, the provinces of Guangdong (1,018 patients), Zhejiang (1,006), Henan (914), Hunan (772), Jiangxi (661), and Anhui (631) accounted for 16.05% of cases. The remaining 27 provinces accounted for 12.99% of cases.

For these 6 provinces (Guangdong, Zhejiang, Henan, Hunan, Jiangxi, and Anhui), we visited the official websites of municipal health committees. Data published by some municipal health committees were incomplete, with respect to age, sex, or others, so the city was excluded. Finally, we selected the cities of Hangzhou, Wenzhou, Shenzhen, and Hefei as samples (5–8). We focused on epidemiologic data: age, sex, short- (visited Wuhan occasionally) and long-term (worked or lived in Wuhan) contact with Wuhan residents before disease onset, contact with patients diagnosed with COVID-19 before the disease onset, unknown source of infection, and time of onset of symptoms.

Table 1 shows that, as of February 6, 2020, information of 1,026 patients has been extracted from the websites of the 4 city health committees. Of them, 950 patients were included in the study, accounting for 92.6% of recorded patients. As for the residence, 156 patients were extracted from Hangzhou; 421 patients were extracted from Wenzhou, and 334 patients were extracted from Shenzhen. These 950 patients included 477 (50.21%) men and 473 (49.79%) women. The age (mean ± standard deviation) was 45.64 ± 15.59 years. Before contracting COVID-19, 138 (14.53%) patients had severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection from an unknown source. Most COVID-19 patients in the 4 cities were from Wuhan originally and had spread the infection locally. Therefore, the initial stage of SARS-CoV-2 transmission in cities outside of Wuhan were mainly input. Cutting off the input and controlling the community communication could reduce local incidence.
Further, 138 patients had SARS-CoV-2 infection from an unknown source (14.53%).

Figure 1 shows that the first patient with COVID-19 was diagnosed on January 3 in Shenzhen, January 10 in Hefei, January 11 in Hangzhou, and January 4 in Wenzhou. The number of patients increased rapidly from January 15 to 24.

Figure 2 shows that the cases in each city were mainly acquired through short- or long-term contact with people from Wuhan and that the number of patients increased rapidly from January 15 to 24. The number of patients who came in contact with Wuhan residents or were diagnosed with COVID-19 before disease onset increased rapidly from January 19 to 26. The number of patients for whom the source of infection was unknown increased rapidly from January 19 to 27.

The age range of 950 patients was 1–91 years, implying that SARS-CoV-2 can infect humans at any age.
age. The age range of 862 patients was 19–69 years, accounting for 90.7% of the total (Table 1), and the reason was that they were highly mobile. The low number of patients under 18 (4.3%) and over 70 (4.9%) years of age (Table 1) was due to their low mobility, and the main source of their infection was family transmission.

The Spring Festival starts on January 12 in China. The Chinese government took measures (e.g., extending this holiday) to inhibit the peak flow of people at the time. According to the Ministry of Transport, on February 3, 2020, the number of passengers during the Spring Festival was 30.3% lower than that at the same time in 2019. Hence, the risk of a massive increase in SARS-CoV-2 infection due to transmission during the Spring Festival was reduced.

The first patients from the 4 cities we examined had worked, lived, or traveled in Wuhan. Therefore, the source of patients was “imported” mainly from Wuhan and then spread locally. China was preparing for the Spring Festival, so many people who worked or lived in Wuhan traveled to celebrate it. Therefore, the first patients were mainly Wuhan residents. The number of people who entered China determined the speed of SARS-CoV-2 transmission and number of patients. Wuhan closed its entry and exit ports on January 23, 2020. It had been 14 days since February 6. With the extension of time, the transmission capacity of people imported from Wuhan reduced greatly, but secondary infection had occurred in local areas. Evidence shows that staff and salespersons of a shopping mall in Wenzhou were infected, and through them the customers in the shopping mall were infected.

The main mode of SARS-CoV-2 transmission is close contact among people. Since January 25, 2020, the number of patients in the 4 cities has decreased gradually (Fig. 1) due to intervention measures taken by the Chinese government. These included closing shopping malls, public places and city access; isolating COVID-19 patients and people suspected with COVID-19; reducing the flow of people; wearing masks; stopping pharmacies selling cold cures; and stopping patients from seeing general physicians for symptoms of common cold. These interventions stopped patients from seeing general physicians and then spread locally. China was preparing for the Spring Festival, so many people who worked or lived in Wuhan traveled to celebrate it. Therefore, the first patients were mainly Wuhan residents. The number of people who entered China determined the speed of SARS-CoV-2 transmission and number of patients. Wuhan closed its entry and exit ports on January 23, 2020. It had been 14 days since February 6. With the extension of time, the transmission capacity of people imported from Wuhan reduced greatly, but secondary infection had occurred in local areas. Evidence shows that staff and salespersons of a shopping mall in Wenzhou were infected, and through them the customers in the shopping mall were infected.

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The intermediate hosts of SARS-CoV and Middle East respiratory syndrome-related coronavirus are the masked palm civet and dromedary camels, respectively (11,12). It is believed that the host of SARS-CoV-2 is a bat, but not the direct ancestor. SARS-CoV-2 is transmitted to humans through an intermediate host, the identity of which is unknown (13). This unknown intermediate host may be the source of reinfection. Whether asymptomatic patients will become long-term carriers of SARS-CoV-2 and lead to the next outbreak warrants investigation.

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Conflict of interest None to declare.

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