

Deep thought of COVID-19 based on Diamond Princess's quarantine and home quarantine

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COVID-19 caused by SARS-Cov-2 infection breakout in Wuhan, China¹. It spread to all provinces and municipalities from December 2019 to February 2020. Patients have been confirmed by SARS-Cov-2 infection in more than 20 countries of the world. As of March 2, 2020, 79968 people have been infected by the epidemic in China, and 2873 people have died, with a mortality rate of 3.59%. Japan and South Korea have found a rapid increase in the number of cases².

As one of the most luxurious cruises in the world, the Diamond Princess embarked on a romantic journey from Yokohama, Japan, on January 20, 2020. It held more than 3700 people from more than 50 countries and regions. On January 25th, an eighty years old male passenger disembarked in Hongkong. He presented with fever and respiratory symptoms. Then, he was confirmed by SARS-Cov-2 infection on February 1st. When the cruise ship returned to Yokohama port, far away from the wharf, more than 3700 passengers and crew members were required to stay on board for 14 days of quarantine. As of February 21, 2020, a total of 2404 passengers and crew members were examined in the half month, of which 621 were diagnosed with COVID-19³. As time went on, the number of confirmed cases on board continued to increase on a large scale, with the trend of infection of the whole ship (Figure 1A). Finally, passengers left the cruise ship one after another on Febru-

ary 19⁴. The growth pattern of patients in Wuhan is similar to that in cruise ships (Figure 1B). We think isolation on board the ship led to more infections, indicating the huge limitations of disinfection and isolation. The movement of the virus in or around the hull shows a strong ability of air transmission. David Fisman, Professor of Epidemiology at the University of Toronto, Canada, said by e-mail: "Diamond Princess's quarantine is like trapping a group of people in a large container with a virus". For the same reason, Harvard epidemiologist Michael Mina tweeted that the isolation was inhumane. Instead, it may cause a 10-fold increase in the transmission of virus in a certain area. The Diamond Princess is actually an infection model of a residential building, or even a community. Once there is a case in the building or in the community, it will be spread to the neighbors through the air way with its own home as the center.

COVID-19 has increased rapidly by the end of January. In response to this public health emergency, China's government has adjusted the epidemic prevention and control into a first level response and has taken a series of unprecedented measures to curb the spread of the epidemic, including Wuhan's "closed city", such as closed road traffic, and the prohibition of personnel flow and exchanges, home isolation, etc.⁵. Isolation at home is considered to be the most direct and effective way to prevent and

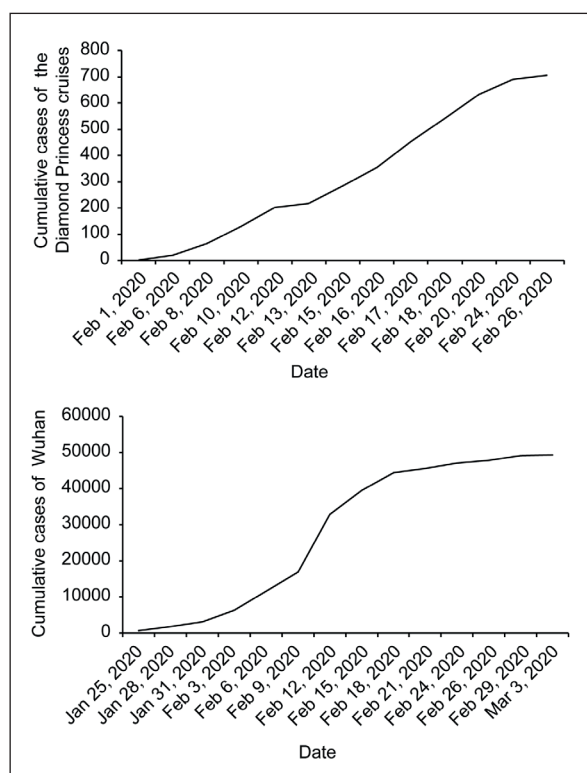


Figure 1. Cumulative cases of the COVID-19 outbreak in Diamond Princess cruises (A) and Wuhan of China (B). Data from the Chinese Center for Control and Prevention.

control the epidemic. China's COVID-19 increased from 630 cases in January 23rd to 79968 in March 2th, which was 126 times more than that in February 25th. According to COVID-19 incubation period, it can usually persist 3-7 days and no more than 14 days. The majority of patients were infected after the government implemented home quarantine. Among them, many cases occur by cross infection among family groups. According to reports, some patients or virus carriers in the incubation period have transmitted the virus to more than ten people⁶. More than 70% of the infected people are over 40 years old. The oldest is a 91-year-old male. The age distribution of the infected people is similar to that of the Diamond Princess. The COVID-19 transmission pathway is mainly from the near distance respiratory droplet transmission, direct contact and indirect contact from the way of virus transmission.

The droplets can enter the sensitive mucosal surface through a certain distance (generally 1-2 m). Daily face-to-face talking, coughing, and sneezing can cause droplets to spread.

COVID-19 is also caused by air borne diseases such as influenza and measles. National Health Commission of the People's Republic of China released the "aerosol transmission possibility"⁷. That is to say, the area is closed and isolated. Once the patient appears, other people may be infected by inhalation of aerosol containing virus. Aerosols may come from the feces of patients with viruses in the sewer. The mortality rate of COVID-19 in Wuhan area was 4.55% (data as of March 2, 2020, 49426 in Wuhan, 2251 deaths), significantly higher than the national average (3.59%), which may be related to the lack of beds in early hospitals and forced isolation at home. In addition, after a long time of isolation at home, psychological disorder will occur such as insomnia, anxiety, fear, irritability, sadness and so on⁸.

With the support of medical staff from all over the country to Hubei Province (as of February 20, 278 medical teams and 32395 medical staff have been sent from all over the country to help Hubei Province), the newly built Huoshenshan hospital, Leishenshan hospital, a large number of shelter hospitals and new planned fixed-point treatment hospitals have been put into use. A large number of patients and suspected cases have been admitted to the hospital and received systematic treatment. At present, COVID-19 patients in Hubei and other parts of the country have seen a significant decrease in occurrence since mid February. There have been no confirmed and suspected cases for several consecutive days in several provinces. Diamond Princess, due to the emergence of a rare case, took the whole ship isolation. The cruise has a total of 1337 cabins, including 748 cabins, which is equivalent to a residential building with more than ten floors. Passengers on board are required to stay in their own rooms, wear masks, walk on the deck for only a few minutes every day, and keep a distance of about 2 meters from other passengers. Meals will be delivered to the passengers' rooms. It's the same as being isolated at home. In such an environment, there is no new source of foreign infection in the sea "experimental building" which is completely isolated from the world, and the virus is transmitted in the ship. The long-term outcome will show the infinite expansion of infection and exponential growth trend. No one can be avoided. Isolation measures for the prevention and control of the virus are a failure. Therefore, we think home isolation is not a very reliable method. It may be a better option to collect the patients into the hospital and take unified treatment.

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Conflict of Interests

The authors declare that they have no conflict of interests.

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