

## The Hospital Response to COVID-19 in China

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### Abstract

The origin of the COVID-19 pandemic was in Wuhan, China. The sudden rise in cases was met with strict isolation and treatment measures. The uniqueness of the Chinese health care system and hospital response may have been instrumental in the early plateauing of cases and deaths.

**Keywords:** COVID-19, China, hospital, Fangcang

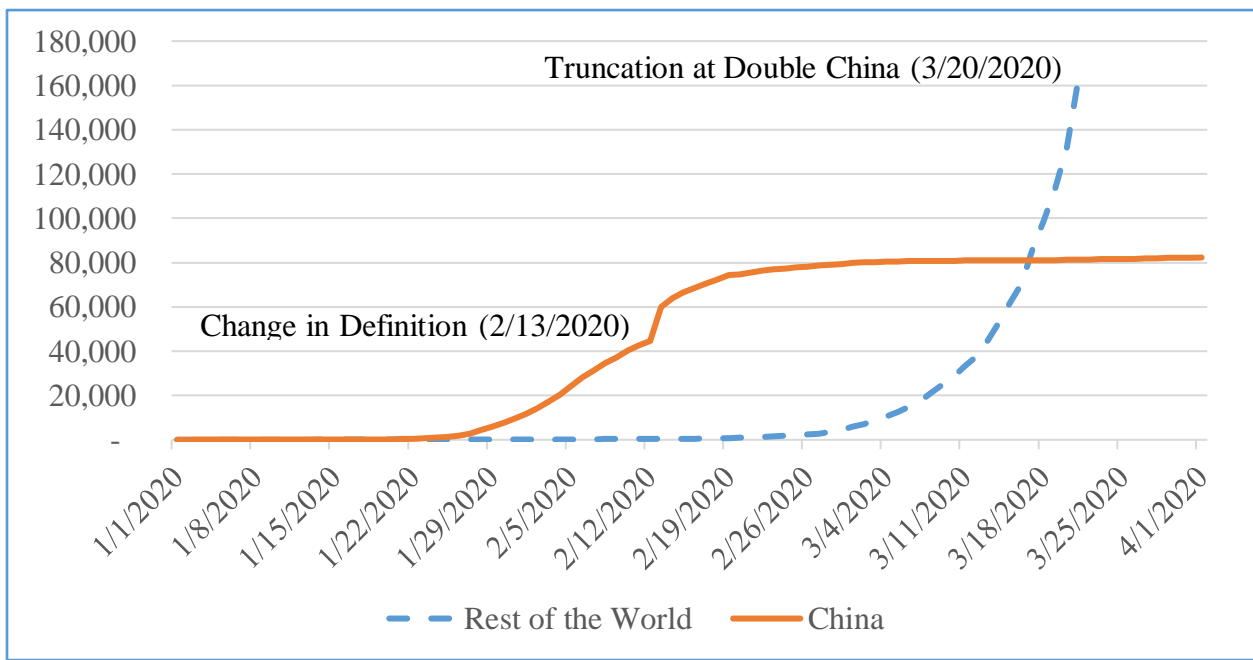
### Introduction

The first patients who were diagnosed with the novel severe acute respiratory coronavirus 2 (SARS-CoV-2, or COVID-19) were individuals who had a common link of exposure – being at a seafood wholesale market in Wuhan, China in December 2019 (Zhu, et al., 2020). By February 11, 2020, China reported 72,314 cases of COVID-19 (Wu & McGoogan, 2020). Out of the first confirmed cases, there were more than 1,000 deaths for a case fatality rate of 2.3%. The majority of cases were considered mild (81%) or severe (14%). Five percent of cases were considered critical, with signs of respiratory failure, septic shock, and/or multiple organ dysfunction or failure. For critical cases, the case fatality rate was 49%. Additionally, the case fatality rate was higher for those with preexisting comorbidities, such as diabetes, cardiovascular disease, chronic respiratory disease, hypertension, and cancer. During the first months of 2020, COVID-19 was the second leading cause of death from infectious diseases in China, behind only HIV/AIDS (Thomala, 2020a).

The COVID-19 outbreak occurred just prior to Chinese Lunar New Year, the most important cultural holiday in China. During this time, many people travel on crowded airplanes, trains, and buses, to return home to be with their families. Because this upcoming holiday posed a significant risk for disease transmission and spread, the Chinese government canceled all Lunar New Year

celebrations and large gatherings. In Hubei province, traffic was restricted and closely monitored. Across all provinces, almost all modes of transportation were also restricted, and the government implemented social distancing measures. Grocery stores took temperatures of all customers before entering in almost all the cities of China. With all of these efforts at isolation, the number of cases plateaued during February. By April 8, 2020, China reported 83,157 cases and 3,342 deaths, for a case fatality rate of 4.0% (World Health Organization, 2020).

The spread of COVID-19 to the rest of the world has been dramatic – and has been labeled a pandemic by the World Health Organization on March 11, 2020. Without the same efforts at isolation, the number of cases in the rest of the world matched China in mid-March. As shown in Figure 1, by March 20, 2020, the number of cases in the rest of the world had doubled the number of cases in China (Ritchie, 2020). The World Health Organization Scientific and Technical Advisory Group for Infectious Hazards changed the case definition from requiring pneumonia to including presentation with milder symptoms (Heyman & Shindo, 2020).



**Figure 1.** COVID-19 Cases in China and the Rest of the World, 1/1/2020 to 4/1/2020. Source data: Ritchie (2020).

How was China able to respond so quickly to the spread of COVID-19 and treat these cases? To answer this question, the next sections of this paper provide background on the Chinese health care system and hospital activities.

## The Chinese Health Care System

In 2003, it was estimated that 79% of China's rural population and 45% of China's urban population were not covered by health insurance (Meng, et al., 2019). Concern over the lack of insurance led to the implementation of the New Rural Cooperative Medical Scheme to increase coverage for individuals in rural areas. In 2007, the Urban Residents Basic Medical Insurance was implemented to increase coverage for urban unemployed citizens, including children, students, elderly people without previous employment, and unemployed people (Sun, Gregersen & Yuan, 2017). In 2009, further health reform was implemented by the Chinese government, with the goal of expanding health insurance, strengthening the capacity of primary care, changing the financing model for public hospitals and primary care facilities, improving essential medicine policies, and delivering essential public health packages. By 2019, the rate of health insurance coverage had increased to 95% (Yip, et al., 2019).

Challenges still existed following these reforms. Urban areas had far more medical resources when compared to rural areas. The number of medical personnel, their education levels, and quality of hospital care varied from city to city, especially between rural and urban areas (Meng, et al., 2019, Xu, et al., 2019). Reimbursement of healthcare expenses for those who were insured also varied from city to city. Additionally, in order to compensate for the loss in pharmaceutical sale revenues, some patients were required to undergo unnecessary diagnostic tests, which may have led to over-diagnoses. Finally, some imported medications for certain diseases, especially cancer, were still not covered by insurance (Xu, et al., 2019).

Despite these challenges, the healthcare system in China remained flexible. The system could be adjusted for unexpected events, such as COVID-19. After the outbreak of COVID-19, the Chinese government mandated that hospitals should treat patients first, and settle bills later (Ye, 2020). By January 2020, the government confirmed that tests and treatment for COVID-19 would be completely covered through a combination of medical insurance and government financial support.

Also in 2003, the Severe Acute Respiration Syndrome (SARS) crisis was associated with transformation of the Disease Control and Prevention System (DCPS) in mainland China (Li et al., 2016). Expanding DCPS infrastructure was a national health policy priority. Government funding increased substantially for the 31 provincial and 2,858 county-level centers over the next decade. Of course, there remained room for improvement in funding and efficiency of the operations of the DCPS.

The COVID-19 outbreak still poses substantial challenges for the Chinese healthcare system. In 2018, China had about 997,434 healthcare institutes, including 33,009 hospitals (0.23 per 1,000 persons; 4.1 beds per 1,000 persons), 943,639 primary healthcare institutes, and 18,033 specialized public health institutions (National Bureau of Statistics in China, 2018). To operate this system, China had about 3.6 million licensed physicians (2.6 per 1,000 persons) and 4.0 million registered nurses (2.9 per 1,000 persons). In comparison, in 2018 the United States had 6,146 hospitals (0.18 per 1000 persons; 2.8 beds per 1,000 persons), 1.0 million physicians (3.1 per 1000 persons), and 3.1 million registered nurses, nurse practitioners, and physician assistants (9.5 per 1000 persons)

(Kamal, et al., 2020). Thus, compared to the United States, China had more available hospitals and beds, but fewer physicians and nurses per capita.

## New Hospitals

At the onset of the outbreak, the first three designated hospitals had 6,754 available beds (Thomala, 2020b). Since hospitals began adding beds whenever they could, the fourth and fifth designated hospitals added 2,183 beds. Still, in Hubei province, where COVID-19 emerged, thousands of patients required hospital admission, and hospitals were running short on beds, supplies, and workers. Outpatient clinics were also being closed due to the outbreak, and it soon became evident that temporary hospitals were needed. Thus, two new temporary hospitals were built in Wuhan: Huoshenshan and Leishenshan Hospitals, which were both based off of a temporary hospital that was built during the 2003 SARS outbreak. During that outbreak, experts recommended converting nursing homes and long-term medical facilities into temporary hospitals that would only serve SARS patients, since these sites were already equipped with beds and other essential medical facilities. As a result, Xiaotangshan sanatorium, which was originally used for patients with long-term illness, was converted and repurposed into Beijing Xiaotangshan Hospital over a period of 7 days. Overall, Beijing Xiaotangshan Hospital accepted 680 SARS patients, with 672 successfully recovering. Remarkably, none of the 1,382 medical staff at the hospital were infected. Following the SARS outbreak, the hospital was abandoned and deconstructed. However, due to COVID-19, the hospital is currently being reconstructed and restored to treat COVID-19 patients.

Huoshenshan and Leishenshan Hospitals were built with the same idea of solely containing infected patients, and were built using a similar design to Xiaotangshan. These hospitals are termed “Fangcang” hospitals (Chen, et al., 2020). Huoshenshan was built first, with the decision to build it being made on January 23, 2020. The goal was to build 1,000 beds, as well as a laboratory, radiology department, and other essential departments. A 5G base station was simultaneously built nearby for remote consultations. Building Huoshenshan in such a short time required over 7,000 construction workers and hundreds of heavy-duty machines, and by February 2, 2020, Huoshenshan officially began to receive patients. The decision to build Leishenshan Hospital was made two days following the decision to build Huoshenshan Hospital. Leishenshan was equipped with 1,600 beds, and began to receive patients on February 8, 2020.

At the same time, makeshift hospitals were being built in many provinces of China. Similar to field hospitals used in war, these makeshift hospitals were built with the goal of accommodating patients with milder symptoms. Existing buildings, such as stadiums and exhibition centers, were converted into makeshift hospitals, since they were usually already equipped with air conditioning and WiFi. Construction took about 2 days, on average. As of February 15, 2020, nine makeshift hospitals were constructed, with 6,960 beds total. Of these, 5,606 were occupied. By March 10, 2020, over 12,000 patients had received treatment in one of these makeshift hospitals.

Huoshenshan and Leishenshan were built with only a five year expected functional time. It is expected that once the outbreak is over, other hospitals could sufficiently serve infected patients, and these hospitals would close. Some makeshift hospitals have been put “at rest,” but not officially closed, in case of a second outbreak. However, it is expected that makeshift hospitals

will eventually return to their original purposes. These hospitals may now be closed (Steinbuch, 2020).

In New York, New Orleans, and elsewhere in the United States, existing buildings (facilities and convention centers) are being converted into specialized facilities for the care of COVID-19 patients (Bean, 2020; Klar, 2020). For example, in New York City, the Jacob Javits Convention Center has been refitted into a hospital for care of COVID-19 patients after discharge from tertiary care hospitals, before they are ready to return to their homes. In New Orleans, the Ernst N. Morial Convention Center has been turned into a hospital for care of COVID-19 patients after discharge from the tertiary care hospitals, before they are ready to return to their homes.

## Conclusions

The Chinese government's responses to COVID-19 resulted in an early plateau of cases and deaths. Responses included the rapid construction of Fangcang hospitals in Wuhan, designed to isolate and treat COVID-19 patients solely. All across China, makeshift hospitals were also built in existing buildings, with the goal of treating patients with mild symptoms. As COVID-19 has spread globally, other cities have also begun converting facilities into makeshift hospitals, but no other countries have decided to build Fangcang hospitals designed solely for COVID-19 treatment. As the number of COVID-19 deaths in the United States has surpassed those of China, cities in the United States may need to consider the possibility of constructing or converting hospitals to solely treat COVID-19.

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