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Perspective

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# COVID-19 emergencies around the globe: China's experience in controlling COVID-19 and lessons learned

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## Abstract

**Motivation:** Nations around the world have been significantly impacted during the COVID-19 pandemic. China's strategies for controlling COVID-19 offer valuable lessons for the global community. By learning from China's experience and lessons, other countries could also find appropriate methods to control the pandemic.
**Problem statement:** What measures has China taken to control the pandemic? What lessons has China learned through this pandemic?
**Approach/methods:** The literature on China's lessons and experience in controlling the COVID-19 pandemic was searched and reviewed. Related newspapers and magazines were also searched.
**Results:** China's experience can be summed up as establishing temporary hospitals, strict isolation, experts with a knowledge of COVID-19, and measures that increase social distancing.
**Conclusions:** By learning from the experience of China, other countries in the world could eventually find the methods to control the COVID-19 pandemic. An emergency response system should be established in each country. Doctors and nurses are not alone in fighting COVID-19, and the entire world is helping them. With cooperation, current difficulties could be overcome.

**Key words:** COVID-19, global health, pandemic, quarantine

## Introduction

The 2019 coronavirus disease (COVID-19) pandemic has resulted in over 4.3 million confirmed cases and over 290 000 deaths globally. During this global emergency, even though some signalling errors and failures existed at the beginning, China took massive measures, including locking down Wuhan, in order to prevent COVID-19 spreading to other parts of China and the world. Recognizing its initial response errors, China showed leadership in tackling the COVID-19 epidemic within its borders by implementing stringent measures. Through a combination of widespread testing and contact tracing, legally enforced physical (social) distancing measures, and use of modern technologies such as automated robot cleaners and facial recognition for contact mapping, China has successfully slowed the spread to a halt: on 19 March 2020—for the first time since the outbreak began in 2019—China reported no locally transmitted cases of COVID-19 [1]. China's strategies for controlling COVID-19 offer valuable lessons for the global community. By learning from China's experience and lessons, other countries could also find appropriate methods to control the pandemic.

## Methods

### Literature selection

Published literature, newspapers and magazine articles on China's experience and lessons in controlling the COVID-19 epidemic were reviewed. The searched databases included PubMed, Web of Science, MEDLINE, and China National Knowledge Infrastructure (CNKI). Key words used included 'COVID-19' 'Global health' 'Pandemic' and 'Quarantine'. Information was also collected from the government websites of countries in America, Africa, Asia and Europe. Quality assessment was performed to confirm the relevance of the literature to COVID-19 management. Our intention was to extract information on health policy orientation from the literature. We consulted national publications and we also included international publications in our analysis. We present the information in the Results section by describing policies and measures taken during the outbreak, including adequate health-care workers, quarantine, enough hospital beds, strict disinfection measures, powerful organization and collaboration, locking down the heavily infected areas, primary health care, experience of Taiwan Province, information about COVID-19 in health-care professionals, and the socio-economic implications of the COVID-19 pandemic.

### Quality assessment

Authors Authors HAO JIN and LIGONG LU carried out the quality assessment of the included studies after review, with any remaining uncertainties resolved by authors JUNWEI LIU and MIN CUI. The quality assessment was carried out as a part of the analysis procedure of the included studies. We conducted the study quality assessment based on some specific aspects related to China's experience in controlling COVID-19 and lessons learned.

## Results

After searching, reviewing and quality assessment, literature on China's experience in COVID-19 management was included in our analysis. The measures taken by the government of China and medical workers were extracted. We present the different strategies followed by China that have been published.

### Adequate health-care workers

On 23 January 2020, Wuhan was locked down, and on 24 January 2020, medical workers across the nation were drafted to aid Wuhan, including experts on critical care, respiratory diseases, infectious diseases, and epidemic prevention. During the locking down of Wuhan, a total of 42 600 medical workers were drafted into Wuhan. The drafted medical workers were from different regions and provinces of China and all of them volunteered to aid Wuhan. They registered their names in the medical institutions where they worked, and local governments organized buses or trains to transport them to the infected area. Cities across China put medical supply factories back to work. Especially, production of protective gear was stepped up. Gloves and protective suits were donated from other parts of China. In addition, enough nuclear acid test kits were supplied to Wuhan to speed up the process of confirming cases. In this way, Wuhan was able to quarantine all the people who might spread COVID-19, and keep the majority of the people in lockdown safe.

### Quarantine

Altogether 132 quarantine centres with a total of 12 571 beds were opened across Wuhan. Some of the quarantine centres were transformed from convention centres and stadiums. Those in quarantine included people who had had close contact with confirmed COVID-19 cases, patients with fever and people with clinical syndromes that had not yet been confirmed. The government of Wuhan converted public buildings such as stadiums and convention centres into temporary hospitals, which could offer more beds for the isolation areas. Patients were transferred from the quarantine centres to temporary hospitals, where testing could be done promptly. Temporary hospitals could only take in patients with mild symptoms, and patients admitted could basically take care of themselves.

### Enough hospital beds

Work began on new hospitals to supply beds specially designed to treat COVID-19 patients. Approvals were pushed through faster and construction was speeded up as much as possible. The first emergency hospital started to take in severely ill COVID-19 patients less than two weeks after construction work began. One new hospital was not enough. A second emergency hospital and quarantine centres for non-severe patients were also constructed. A total of more than 3000 beds were supplied by the two newly established hospitals. Wuhan's general hospitals adapted their regular wards into quarantine rooms for treating severely ill COVID-19 patients. Enough hospital beds were ensured in this way so that all confirmed patients could be sent to hospital.

### Strict disinfection measures

Unprotected exposure to patients was avoided because it would lead to the infection of medical staff as the virus was highly contagious. No personal belongings could be taken into the quarantine areas, and whatever went inside had to stay inside. Anything that had to be taken out was put into disinfectant for a whole day. Doctors and nurses had to wear two layers of protective suits, hand gloves, shoe covers, face masks and goggles before entering the special ward. Severely ill patients needed special care, because without enough oxygen, the patient starts to lose consciousness and would move a lot without control. It made treatment such as using a ventilator or giving injections much more difficult. Patients' alarm bells would not stop ringing, and nurses had to rush to attend to them. The protective gear could not be taken off until the end of the shift. As medical workers could also be scared, a psychological support service was provided for them [1, 2].

### Powerful organization and collaboration

Meetings were quickly chaired by the government of China to stress safety and health as the top priority and containing the epidemic as the most important task. On 7 January 2020, the national government of China held a meeting to stress the importance of the COVID-19 epidemic management. Additionally, Hubei Province started a public health emergency response. Subsequently, provinces including Zhejiang, Guangdong and Hunan also started public health emergency responses. Governments of all levels stressed the safety and health issues, and residential committees supervised the implementation of prevention measures. Hospitals required all medical staff to obey the regulations introduced during this epidemic to

prevent hospital infection. Efforts were made to prevent COVID-19 spreading to nations with weaker health systems by locking down the infected areas and sharing genetic sequences of the virus.

## Locking down the heavily infected areas

As a heavily infected area, Wuhan went into lockdown from 10 a.m. on 23 January 2020. Public transportation across the area, including city buses, subways, ferries and long-distance buses, was suspended. This was an effective measure to stop a deadly virus from spreading further through the nation. Since some migrant workers were among those who were forced to stay, rescue shelters were provided so that they had somewhere to take cover. The number of confirmed COVID-19 patients in Wuhan was announced daily by the government. Huge markets were shut down by local authorities to stop the movement of the virus. The government alerted people across the nation to stay away from the infected area, Wuhan. To keep COVID-19 away from the healthy population, Wuhan strengthened its lockdown measures. Government community workers knocked on each door throughout Wuhan and checked every resident's health status by temperature screening in order to uncover COVID-19 cases. Everyone was ordered to stay home until further notice. Residents who needed to go to hospital could phone the community centre. Only residents with medical emergencies or those with jobs related to fighting the epidemic were allowed to leave. Groceries were purchased online, left at the entrance and picked up later in order to avoid contact.

Staying at home avoids unnecessary contact and demobilizing the lockdown area is the key to cutting off paths for COVID-19 to spread. Medical workers and residents worked together to safeguard the areas. These approaches to pausing the rapid spread of COVID-19 changed the course of what was a rapidly escalating epidemic [1, 2].

## Primary health care

During the recent outbreak, primary health care played an important role in screening and monitoring for COVID-19, and maintaining routine care of other health conditions. Primary health-care institutions were strengthened with effective integration of clinical care and the public health service, and played an essential role of interface between hospitals, communicable diseases centres (CDC), and the community, during outbreaks of COVID-19. Primary health-care providers were designated by the National Health Commission of China to do screening, triage and home quarantine monitoring. A survey carried out in mid-February 2020 on 3562 primary health-care institutions in 31 provinces of China found that 90% of township health centres had made these efforts during the outbreak. Thanks to the functioning coordination between hospitals and CDCs, primary health-care providers were able to screen patients early on and give them proper training to self-isolate as well as to engage in community mobilization and public education. The primary health-care providers could also triage patients to specialized hospitals or cabin hospitals to reduce over-crowding and to allow hospitals to focus their resources on more serious cases [2].

## Experience of Taiwan Province in controlling COVID-19

Except for continental China, lessons could also be learned from Taiwan Province. During the outbreak, Taiwan applied associated policy decisions to sustain the health-care system. As soon as mainland China reported the unidentified outbreak to the World Health Organization on 31 December 2019, Taiwan Province assembled a taskforce and began health checks on board flights from Wuhan. Taiwan Province's rapid implementation of disease prevention measures helped to detect and isolate the province's first COVID-19 case on 20 January 2020. Laboratories in Taiwan Province developed 4-hour test kits and isolated two strains of the coronavirus before February. Taiwan Province effectively delayed and contained community transmission by leveraging experience from the 2003 severe acute respiratory syndrome (SARS) outbreak, prevalent public awareness, a robust public health network, support from health-care industries, cross-departmental collaborations, and advanced information technology capacity. Researchers analysed the Provincial Health Insurance database and the critical policy decisions made by Taiwan Province's government during the first 50 days of the COVID-19 outbreak. Strategic prioritization of other public health functions and resources and broader government operations was also applied. Taiwan Province adopted an integrated approach that incorporated public health, human services and health-care systems thereby increasing resilience and better preparing nations for future events. Intergovernmental and interjurisdictional coordination and adequate funding were also applied to ensure emergency preparedness and response capacity [3].

## Results of the actions

After the continuous efforts made by medical workers and governments, all patients in Wuhan's temporary hospitals were discharged by 10 March 2020. By 18 March 2020, all patients with COVID-19 infections and suspicious infections had been discharged from hospitals. The lockdown of Wuhan was formally cancelled on 8 April 2020 [8]. Some East Asian countries including Japan and South Korea also adopted strict measures similar to China, and all successfully controlled the epidemic of COVID-19. In some countries where strict isolation measures have not been taken and residents have not developed the habit of wearing facial masks and keeping good hygiene, the epidemic is still continuing currently.

## Information about COVID-19 in health-care professionals

Health-care workers had to be prepared to go to clinics and hospitals, putting themselves at high risk from COVID-19. Figures from China's National Health Commission show that more than 3300 health-care workers had been infected as of early March and, according to local media, by the end of February at least 22 had died. Reports from medical staff describe physical and mental exhaustion, the torment of difficult triage decisions, and the pain of losing patients and colleagues, all in addition to the infection risk [4].

## The socio-economic implications of the COVID-19 pandemic

Chinese suppliers are key in the world (300 of the world's top 500 companies have facilities in the high-tech manufacturing hub of Hubei, where the outbreak began). The COVID-19 outbreak has had many socio-economic effects on individual aspects of the world economy. The COVID-19 pandemic has sparked fears of an impending economic crisis and recession. Social distancing, self-isolation and travel restrictions have led to a reduced workforce across all economic sectors and caused many jobs to be lost. Schools have closed down, and the need for commodities and manufactured products has decreased. In contrast, the need for medical supplies has significantly increased. The food sector is also facing increased demand due to panic buying and stockpiling of food products [5].

## Discussion

Some lessons of China in controlling COVID-19 have been summarized.

### Lessons learned

China's experience can be summed up in six points. (i) *Establishing temporary hospitals*. On the issue of how to increase medical care for patients with mild symptoms, China's experience showed that establishing temporary hospitals is vitally important. Temporary hospitals enabled patients with mild symptoms to be isolated, so that they would not infect their family members. It is very important to keep COVID-19 infections away from the healthy population, and the situation would be out of control if a large number of medical workers got infected. (ii) *Strict isolation*. Isolation is a significant step, since the incidence of COVID-19 can climb very fast. Locking down the infected areas is a very effective measure and strong action that the government should take in the early phase of an epidemic. Other countries' governments were supposed to do something similar to China's lockdown in Wuhan. Big cities in other countries may have difficulty in locking down, but China provided important information for them. In fact, effective quarantine is the only way because currently we do not have typical medication for COVID-19. Isolation is the oldest but perhaps the most effective way to prevent COVID-19 from spreading further. (iii) *Experts with a knowledge of COVID-19*. Experts with a knowledge of COVID-19 are vitally important. In fact, experts were drafted to other countries from China. These experts had all been to Wuhan and had a rich experience of COVID-19. (iv) *Increasing social distancing*. Measures that increase social distancing such as cancelling sporting events may help to reduce transmission. In addition, courtesies such as kisses and hugs should be held back until after this pandemic. These measures, of course, should be based on local context and risk assessment, and should be time limited. (v) *Communication is significant*. Timely communication and transparency plays a critically important role in controlling the pandemic. Officials should overcome fears of economic and political repercussions. Nations all over the world have struggled to communicate the epidemiology of this new infection. (vi) *An evaluation of the problems of the lockdown*. The lockdown imposed by governments to contain the spread of COVID-19 is associated with various psychosocial problems The complications within the family and time management issues that can occur during a lockdown were explored. The stigma and anxiety associated with the coronavirus disease have also been addressed. It is noted that the problems faced by vulnerable communities including individuals with substance use disorder tend to be ignored. These are crucial areas that psychologists and mental health professionals should consider before discussing intervention [6].

### Other alternatives

There are alternative measures that could be taken in order to control the number of newly infected COVID-19 patients. Recently, some new COVID-19 infections were confirmed in Beijing, China. Instead of strict isolation and locking down, China established some technological strategies to control the situation. The applied techniques included electronic contact tracing, and rapid virus nucleic acid tests. In reality, by using a mobile phone App, people who had been to the infected areas could be easily traced. Test results could be obtained in 15 minutes by the novel nucleic acid test method. In addition, electronic patient records were integrated and shared between primary health-care institutions and hospitals. Therefore, partnerships between hospitals and primary health-care institutions were encouraged and close associations formed in many cities [7]. In this way, suspicious infected patients were quickly identified, with the city's normal operation maintained meanwhile.

### Challenges China is facing

Since China has a population of 1.4 billion, it faces great challenges in preventing a reappearance of the COVID-19 outbreak. Some points for attention have been determined: (i) Establish an emergency response system in each city. (ii) Ensure good communication between governments and citizens. (iii) Maintain a large funding input. (iv) Keep strict management of the food markets. Taking these factors into account, China would be able to control the probable reappearance of COVID-19 in the future.

### Recommendations for the future

The pandemic is still not over. If an epidemic of some other unknown communicable disease happens in the future, how should we improve our strategies? It is an issue for the whole world. First, if there is an epidemic of some other unknown communicable disease in the future, we should be aware of it as soon as the infection appears. Second, it is vitally important to stop the infection from spreading at an early stage. This is why early detection and early isolation are emphasized. Third, we should do more research on the overreaction of our immunological system to COVID-19. When patients become seriously ill, the survival rate will be extremely low. This is because some pathological characteristics of COVID-19 patients are different from the usual acute respiratory disorder syndrome (ARDS): in typical ARDS, the pulmonary alveoli are largely involved, but in COVID-19 patients, both pulmonary alveoli and small bronchus are involved, producing much mucilage. That is why it is difficult to withdraw the ventilator and also why it is difficult to give ventilation to severely ill COVID-19 patients. We also noted that in China, epidemiological data and studies performed show different rates of morbidity between chronic COVID-19 patients and acute COVID-19 patients. In order to protect chronic COVID-19 patients, measures should be taken to extend the therapeutic plans. A new research path is necessary to foster the integration of the treatment methods for chronic COVID-19 patients [9].

### A research plan of the effectiveness of non-pharmacological and pharmacological (including traditional) measures

Some non-pharmacological therapies such as social distancing, personal protective equipment and ventilator support can only partially contribute to the treatment of COVID-19. Several vaccine projects are still in preclinical, phase I and phase II clinical trials and most of the potential drugs for treatment of COVID-19 are being investigated for safety and efficacy against SARS-CoV-2. Remdesivir is considered to be the most promising antiviral agent. The other excellent anti-influenza RdRp inhibitor favipiravir is also being clinically evaluated for its efficacy in COVID-19 patients. The regimen of LPV/RTV plus ribavirin was shown to be effective against SARS-CoV in vitro. Another promising alternative is hydroxychloroquine plus azithromycin, which showed excellent clinical efficacy on Chinese COVID-19 patients and anti-SARS-CoV-2 potency in vitro. Chinese herbal drugs were also considered as an alternative approach for prevention of COVID-19 in high-risk populations, including Astragali Radix, Glycyrrhizae Radix et Rhizoma, Saposhnikoviae Radix, Atractylodis Macrocephalae Rhizoma, Lonicerae Japonicae

Flos and Fructus forsythia. However, clinical evidence for these treatments in the prevention of this emerging viral infection is lacking. Further research should be focused on the effectiveness of these non-pharmacological and pharmacological (including traditional) measures [10].

## Conclusions

From China's experience, it can be concluded that establishing temporary hospitals, strict isolation, bringing in experts with a knowledge of COVID-19, and introducing measures that increase social distancing are key to handling the COVID-19 pandemic. By learning from China's experience, other countries in the world would eventually find the methods to control the COVID-19 pandemic. Additionally, an emergency response system should be established in each country. Doctors and nurses cannot relax, but they are not fighting COVID-19 alone, and the entire world is helping them. It is believed that every country will learn lessons from this outbreak. As long as nations cooperate, the current difficulties can be overcome.

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## Conflict of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article. There is no conflict of interest.

## Contributors

Lu LG proposed the study. Liu JW and Cui M performed the research and Jin H wrote the first draft. All of the authors contributed to the design and interpretation of the study and to further drafts. Lu LG, Liu JW and Cui M are the guarantors.

## Ethical approval

Not applicable.

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