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Coronavirus disease 2019 (COVID-19) is a respiratory infection caused by the virus SARS-CoV-2. Coronaviruses (CoVs), enveloped positive-sense RNA viruses, are further subdivided into four different genera, historically based on serological analysis and now on genetic studies: alpha-, beta-, gamma-, and delta-CoV. The first two mainly infect mammals, while the second two mainly infect birds. There are currently seven known CoVs that can infect humans: HCoV-229E, HCoV-NL63, HCoV-OC43, HCoV-HKU1, SARS-CoV, MERS-CoV, and SARS-Cov-2. The last three are beta-CoVs, which are relatively high in infectivity and disease severity and pose a great threat to public health security in all countries. Current studies have shown that SARS-Cov-2 has already mutated into two lineages called “L-type” and “S-type.” The phylogenetic tree indicates that the S-type is older than the L-type and more closely resembles bat coronaviruses. However, the L-type accounts for a larger proportion in the samples currently collected, suggesting that the recently evolved L-type spreads or replicates faster in human populations [1].

The clinical manifestations of COVID-19 patients are mainly respiratory symptoms, fever, chills, fatigue, diarrhea, conjunctival congestion, etc. Breathing difficulties and/or hypoxemia can occur in severe cases 1 week later, and critical patients rapidly progress to acute respiratory distress syndrome, sepsis, shock, metabolic acidosis, coagulation dysfunction, and multiple organ failure. Chest radiologic characteristics include multiple small patchy shadows and interstitial changes in the early stage, and then, multiple ground-glass opacity and patchy infiltrates in both lungs. Lung consolidation may appear in more severe cases, where pleural effusion is rare

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[2]. The main infection source of COVID-19 is patients and occasionally seen in the asymptomatic. SARS-Cov-2 mainly spreads through respiratory droplet and contact, or possibly, through aerosol when one is exposed to aerosols of high concentrations and for a long time in a relatively closed environment [2]. As a new infectious disease, people are generally susceptible to COVID-19 due to the lack of immunity, and we are still in the pandemic period. According to current epidemiological investigations and related research results, the latent period of COVID-19 is usually 1–14 days, and mostly 3–7 days. The basic regeneration index (R_0) is from 2 to 4.7. Its infectivity is strong on the onset, and also have infectivity at the end of the latent period [3]. Most of the deaths are patients aged 60 and above and suffer from underlying diseases, such as hypertension, cardiovascular disease, and diabetes [4].

The World Health Organization (WHO) announced COVID-19 a global pandemic on March 11, 2020. As of September 12, 2020, COVID-19 has spread to 216 countries and regions, with more than 28.2 million confirmed cases and over 900,000 deaths. Compared with SARS-CoV and MERS-CoV, although SARS-Cov-2 features milder clinical manifestations and lower case-fatality rate, it spreads much faster [5], hence the constant rise in the number of COVID-19 infections and deaths. COVID-19 has become the most widespread and severe global pandemic since the H1N1 influenza pandemic in 1918. It has not only brought a huge burden to medical and health systems worldwide, but also caused a huge impact on global economic development.

13.1 Overview of COVID-19 Pandemic in “Belt and Road” Countries

COVID-19 represents a global health crisis, and the pandemic is still spreading rapidly. Asia is the region first hit by the pandemic. In December 2019, when multiple cases of unexplained pneumonia were discovered in Wuhan, Hubei Province, China, the country immediately activated its joint prevention and control mechanism, adopted grid management policies, and implemented comprehensive prevention and control measures to block the spread of the epidemic in China. On March 2, 2020, the European Center for Disease Control and Prevention raised the risk level of COVID-19 to “high.” WHO stated that Europe had become the “epicenter” of the COVID-19 pandemic. The total confirmed and dead cases reported by Europe exceeded the total of other countries and regions outside of China, and the number of cases reported daily was higher than that when the epidemic peaked in China. Although the spread of SARS-Cov-2 in Europe has slowed down after some time, the global pandemic is still on the rise and the situation is severe (see Fig. 13.1 [6]). The Americas, represented by the United States, followed Europe and became a new epicenter. As of September 12, 2020, the number of confirmed cases in the Americas and Brazil had exceeded 14.44 million, or 51.52% of the global total (14447680/28040853), becoming the continent with the largest number of confirmed cases and deaths. Among the “Belt and Road” countries, India has seen the largest number of confirmed cases of COVID-19 and is most affected by the epidemic, with over 4.56 million confirmed cases and nearly 90,000 new cases in a

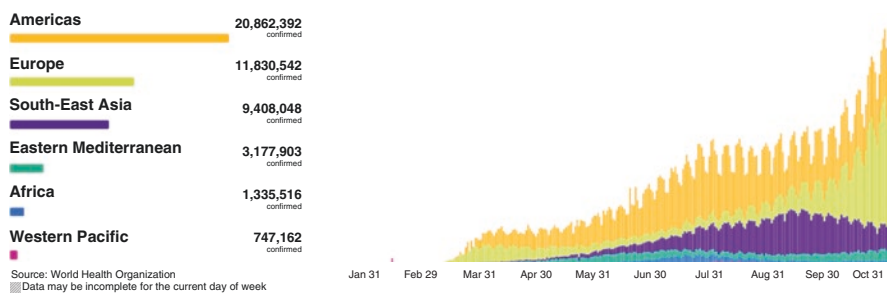


Fig. 13.1 Number of confirmed COVID-19 cases from January 1, 2020 to October 1, 2020 (by region). (Confirmed cases (10,000); Date; America; Southeast Asia)

single day. Its overall confirmed cases have exceeded Brazil and ranks second in the world. Other “Belt and Road” countries severely affected by the epidemic are Russia, Bangladesh, Saudi Arabia, Pakistan, Kazakhstan, and Iran. In the next 1–2 years, COVID-19 will maintain a high prevalence globally and a trend declining somewhere but possibly rising somewhere else. Facing economic globalization and integration, all countries and regions in the world must be prepared and ready to jointly prevent and control the spread of COVID-19.

13.2 COVID-19 Risk and Principles of Prevention and Control

13.2.1 Pandemic Risk

1. The transmission features of SARS-CoV-2 make some of its sources of infection relatively “hidden” and difficult for timely detection. Moreover, there is a risk of clusters of cases and even community transmission caused by local residual sources of infection and imported infections from abroad. SARS-CoV-2 is highly contagious, peaking 2 days before the onset to 1 week after the onset. Patients may feel in the early stage that the symptoms are mild and do not need to go to see a doctor. Besides, the untypical symptoms of the infected person and the difficulty in timely discovery of the source of infection make it possible in reality that transmission starts before the case is discovered and managed in isolation.
2. The sensitivity of the surveillance system of healthcare institutions needs to be improved. If all types of medical institutions, especially key “sentinel” departments of primary medical institutions such as fever clinics, respiratory medicine department, and emergency departments, fail to execute in an effective manner the first-diagnosis responsibility system, or the time taken for the investigation of suspected patients from sample collection to laboratory diagnosis is too long, the patients may not be properly administered, which may in turn cause familial cluster, nosocomial infection, or even spread to the community.
3. Medical institutions at all levels are faced with different degrees of nosocomial infection risks. The spread in medical institutions can be easy due to the rela-

tively closed environment, the heavy flow of people, and the large number of susceptible populations. In addition, without basic nosocomial protection and screening measures for suspected infections, SARS-CoV-2 infected patients with other diseases and treated or hospitalized in non-infectious departments may bring great risks of nosocomial infection.

4. The relaxation of measures and public awareness of protection can increase the chance of interpersonal contact, hence rising risks of infection. In view of the low epidemic level at present, the public may relax their vigilance, neglect the use of personal preventive measures, or gather together more with others, which all will increase the chance of infection and transmission.
5. As disease control and prevention agencies at all levels are understaffed, without adequate professionals for emergencies over a long term, the pandemic response is low in speed and efficiency. Community prevention and control also face similar problems.
6. COVID-19 as a pandemic is still in its early stages, and will remain severe for at least 2 years. Without specific medicine, the immune barrier of people is established in two ways: natural infection or vaccination. Given the uncertainty of the latter, even if vaccines can be developed soon, there are still potential safety, effectiveness, and productivity issues, while an immune barrier formed through natural infection will require a huge price and quite long [7].

13.2.2 Principles of Prevention and Control

13.2.2.1 General Requirements and Principles

In the early stage of the pandemic, community mobilization, adopt grid-based, carpet-style management, and observe the “4 Earlies,” that is, early detection, early reporting, and early isolation/quarantine for early diagnosis and treatment were given to fully played [8]. In the normalized prevention and control stage, the overall prevention and control strategy of “preventing importation of cases, avoiding a resurgence of local cases,” and timely detection, rapid disposal, targeted control, and effective treatment were implemented [9].

13.2.2.2 Specific Requirements and Principles

13.2.2.2.1 Put Prevention in the First Place

1. Wear masks properly. Wear a mask when you are in close contact with others within a distance of less than 1 m in crowded closed places.
2. Reduce gatherings. Keep a social distance of more than 1 m. Reduce unnecessary gatherings and the number of people in gatherings. Try not to go to places and especially closed places where people gather.
3. Increase ventilation and disinfection. Frequently open windows for ventilation in the room to maintain air circulation. Hygienic measures such as daily cleaning and disinfection must be implemented in public places, stations, docks, and public transportation.

4. Improve health etiquette. Develop hygiene habits and lifestyles such as keeping “one-meter socializing distance,” washing hands frequently, wearing masks, and using serving chopsticks. Cover the nose and mouth with tissues or the elbow when coughing or sneezing.

13.2.2.2.2 Implement the “4 Earlies” Measures

1. Early detection. Measure body temperature in public places, strengthen pre-screening, triage and fever clinic investigations for “early detection” of confirmed cases, suspected cases, asymptomatic infections, and then “early report” as required. No late, left-out or concealed reports are allowed.
2. Quick disposal. Complete the epidemiological investigation within 24 h, tap the advantages of big data, etc., so as to identify possible sources of infection as soon as possible, discover and track close contacts. Implement “early isolation” measures to timely isolate and treat confirmed and suspected cases, and for asymptomatic infections and close contacts, implement centralized medical observation for 14 days. Carry out thorough disinfection of possible contaminated places.
3. Targeted control. Scientifically delineate the prevention and control area to the smallest unit (building, ward, residential area, natural village, etc.), and decisively adopt measures such as restricting gatherings of people, blockade, and cut off the route of transmission to minimize the risk of infection. Promptly announce relevant information of the prevention and control area.
4. Effective treatment. Designate hospitals for admission and treatment, implement “early treatment” measures. Admit and treat mild cases in a timely and effective manner, reduce their conversion to severe ones. Adhere to the “4 Concentrations,” provide multidisciplinary treatment to severe cases. Maximize the cure rate and reduce the mortality rate. After the patient is cured and discharged from the hospital, implement 14-day medical observation in home quarantine or a concentrated manner.

13.2.2.2.3 Highlight Key Links

1. Prevention and control at key places. In accordance with relevant technical guidelines, and under the premise of implementing prevention and control measures, fully open shopping malls, supermarkets, hotels, restaurants, and other living places. Adopt appointments and flow restriction measures when opening parks, tourist attractions, sports venues, indoor venues such as libraries, museums, art galleries, and closed entertainment and leisure venues, such as theaters and amusement halls. All kinds of necessary meetings, exhibitions, etc., can be held.
2. Prevention and control of key institutions. Prevent risks in nursing institutions for the aged, welfare homes, prisons, mental healthcare institutions, and implement prevention and control measures such as entry and exit management, personnel protection, health monitoring, and disinfection.
3. Prevention and control of key population groups. Instruct key groups such as the elderly, children, pregnant women, the disabled, and patients with severe chronic

diseases in personal protection, and offer psychological counseling, care, and assistance.

4. Medical institution prevention and control. Strengthen the prevention and control of nosocomial infections, promote time-phased appointments for diagnosis and treatment, strictly implement community management requirements for medical institutions, promptly investigate risks and take measures. Strictly manage visits and escorts to avoid cross-infection. Be strict with prescreening, triage, and fever clinic work processes, implement protective measures for healthcare workers, and strengthen health management and monitoring of them.
5. School prevention and control. Implement a “daily report” and “zero report” mechanism for the health of faculty, staff, and students. Provide health tips, carry out health management, classroom ventilation, disinfection, etc., and measure body temperatures of kindergartners and students in the morning and at noon. Track and register cause of illness of those absent from school (duty).
6. Community prevention and control. Strengthen the grid management of grassroots communities and tap the role of community volunteers. Offer health education and manage environmental sanitation, rented houses, dormitories, and non-native population. Communities where the outbreak has occurred should strengthen the investigation, isolation, and terminal disinfection of close contacts, and take such measures as restricting gatherings of people and closed management when necessary.

13.2.2.2.4 Strengthen Support

1. Expand the scope of detection. Make scientific assessments based on detection capabilities and as needed in prevention and control. Detect key populations such as close contacts, overseas immigrants, fever clinic patients, newly hospitalized patients and accompanying persons, medical institution staff, port quarantine and border inspection personnel, etc., that should be detected. For other people, detect “whoever want to.”
2. Employ big data. Rely on information service platforms for timely sharing of nucleic acid and serum antibody test results and data on key personnel to the electronic database. Promote the safe and orderly flow of personnel. Promote and apply the version for people entering China, and carry out closed-loop management of them.
3. Strengthen scientific research and international cooperation. Promote research on vaccines, pharmaceutical science and technology, virus mutation, and immune strategies. Speed up the development of detection reagents and equipment, improve sensitivity, specificity, and simplicity. Further enhance detection capabilities and shorten detection time. Strengthen information sharing, technical exchanges, and prevention and control cooperation with international organizations like WHO and relevant countries.

13.2.2.2.5 Strengthen Organization and Leadership

1. Allocate responsibilities to institutions and units. Implement territorial responsibilities, strengthen organization and leadership, increase funding, strengthen the

dynamic reserve of medical supplies, and improve capacities in prevention, control, and emergency response.

2. Dynamic adjustment of the level of risk and emergency response. All localities shall dynamically adjust the level of risk and emergency response according to classification standards and local transmission situation. Adapt measures to local conditions and circumstances, and constantly improve the prevention and control emergency plan and various supporting work plans. Once there is an outbreak, emergency response measures shall be taken in time, followed by targeted prevention and control [9].

13.3 Case Study

China's Response to the First Wave of COVID-19 Epidemic

1. Overview

Four pandemics have appeared in the world since the twentieth century, and the most serious one was the Spanish pandemic in 1918, causing approximately 20–50 million deaths worldwide [10]. The COVID-19 epidemic is a major public health emergency. The virus has spread faster and wider than any other since the founding of the People's Republic in 1949, and has proven to be the most difficult to contain. It is both a crisis and a major test for China. Under the leadership of the Communist Party of China, the whole nation has followed the general principle of “remaining confident, coming together in solidarity, adopting a science-based approach, and taking targeted measures,” and waged an all-out people's war on the virus. Through painstaking efforts and tremendous sacrifice, and having paid a heavy price, China has succeeded in turning the situation around. In little more than a single month, the rising spread of the virus was contained; in around 2 months, the daily increase in domestic coronavirus cases had fallen to single digits; and in approximately 3 months, a decisive victory was secured in the battle to defend Hubei Province and its capital city of Wuhan. With these strategic achievements, China has protected its people's lives, safety and health, and made a significant contribution to safeguarding regional and global public health.

2. Prevention and Control Stages and Strategic Measures [11]

The prevention and control of COVID-19 in China can be roughly divided into five stages:

Stage 1, swift response to the Public Health Emergency (December 27, 2019 to January 19, 2020). When cases of pneumonia of unknown cause were monitored in Wuhan City, Hubei Province, China reported the epidemic the first time, and promptly took scientific and epidemiological investigations to stop the spread of the disease. It spared no time in reporting the epidemic to WHO, the United States, and other countries, and announced the sequence of the virus to the world. As localized community transmission and clusters of

cases occurred in Wuhan, and Wuhan-associated confirmed cases began to appear in other areas, China embarked on thorough epidemic prevention and control.

Stage 2, initial progress in containing the virus (January 20 to February 20). The number of new confirmed cases nationwide increased rapidly, and the prevention and control situation got extremely severe. China took a key move to stop the spread of the virus by resolutely closing passage from Wuhan and Hubei, commencing the war to defend Wuhan and Hubei. The Central Committee of the Communist Party set up a leading group for response to the epidemic and deployed a central steering group to Hubei and other severely affected areas. The State Council successively established a joint prevention and control mechanism and a working mechanism for resuming work and production. The whole country gathered its resources and strength and rushed to assist Hubei and Wuhan. Localities initiated emergency response to major public health emergencies. The most comprehensive, rigorous, and thorough national epidemic prevention and control was officially launched, and the spread of the epidemic was initially contained.

Stage 3, newly confirmed domestic cases on the Chinese mainland drop to single digits (February 21 to March 17). At this stage, the rapid spread of the virus had been contained in Wuhan and the rest of Hubei Province, the situation in other parts on the mainland had stabilized, and the daily figure for new cases had remained in single digits since mid-March. As the situation evolved, the Central Committee made a major decision to coordinate epidemic prevention and control, economic and social development, and orderly resume work and production.

Stage 4, Wuhan and Hubei—an initial victory in a critical battle (March 18 to April 28). The spread of the national epidemic with Wuhan as the main battlefield was basically blocked, and the control measures for the passage from Wuhan and Hubei were lifted. Wuhan cleared the number of COVID-19 patients in the hospital, and the defense war of Wuhan and Hubei achieved decisive results, and major strategic results of the country in epidemic prevention and control. The epidemic spread sporadically at home, but rapidly overseas. Imported cases from abroad caused the spread of related cases. On this situation, the Central Committee determined the prevention and control strategy of “preventing importation of cases, avoiding a resurgence of local cases,” consolidated and furthered the effectiveness of domestic epidemic prevention and control, timely dealt with clusters of epidemics, promoted the resumption of work and production by categories, and cared for overseas Chinese citizens in need.

Stage 5, ongoing prevention and control (April 29 to present). Sporadic cases have been reported on the mainland, resulting in case clusters in some locations. Imported cases from abroad are basically under control, and the epidemic situation continues to be active. The national epidemic prevention and control has become normalized. Further efforts are made to promote the resumption of work, production, and schooling.

3. Experiences

Since the beginning of COVID-19 outbreak, China has adopted two response strategies—containment and suppression, both of which have adopted considerable non-pharmaceutical interventions [3]. It has fully tapped the capacities of community mobilization, implement grid-based, carpet-style management, all-people prevention and control, stable and targeted prevention and control, and comprehensive measures for “early detection, early reporting, early investigation, early isolation, early diagnosis, and early treatment” to prevent the import, spread, and export of the epidemic, and control its spread.

Five pieces of main experiences:

One, take firm and effective measures to control the source of infection and reduce the infection rate. Revise six versions of COVID-19 prevention and control plans. Adopt strict isolation and control measures for four categories of people—confirmed cases, suspected cases, fever patients, and close contacts—so as to admit, test, treat, and isolate whoever in need. The practice has proved that detecting and isolating cases, tracing and isolating close contacts for medical observation have been the most effective measures of containment strategy, when comparing with travel restrictions and contact reduction, and can prevent more people from infection. These measures can work even better when combined with other non-pharmaceutical interventions, such as reducing the movement of people (traffic control and travel restrictions, etc.), keep social distancing (stopping large-scale activities, delaying the opening of schools and the resumption of work in factories), and encouraging personal prevention [12].

Two, speed up testing. Devolve the authority to detect infectious diseases from CDC testing to all Level 2 and above hospitals, increase laboratories, cultivate personnel, and at the same time, use third parties to strengthen the testing work. Form a closed-loop system to “complete network report in 2 h, detection information feedback in 12 h, and epidemiological survey in 24 h.” At the beginning of the epidemic, the average interval between the diagnosis of a patient was 15.4 days, and in mid-term, 3 days, hence the sharp decline in the probability of disease transmission. The epidemiological survey and closed-loop system have enabled us to grasp the initiative in the control of the epidemic.

Three, manage to ensure the supply of medical services and increase the admission rate. Designate over 2000 medical institutions and intensive care hospitals nationwide, and more than 10,000 fever clinics. Increase hospital beds in Wuhan and establish an emergency treatment network with a tiered layout of designated hospitals, mobile hospitals, and isolation points. Build Huoshenshan and Leishenshan hospitals, and transform general hospitals such as Tongji Hospital, Union Hospital, and Hubei Provincial People’s Hospital. Mobile hospitals have played a very important role in admitting mild cases, so that patients found out in community screening could be

admitted to the hospital. With three main features (rapid in construction, large in scale, low in cost) and five basic functions (isolation, classification, basic medical care, frequent monitoring and quick referral, and basic life and social participation) [13], they admitted whoever in need in the epidemic [11]. The disaster prevention hospital they represent is an important part of the national response to the COVID-19 pandemic, and such a role may continue in future epidemics and public health emergencies [13].

Four, add isolation points. Transform more than 630 hotels, schools, training centers, and medical institutions into isolation rooms for close contacts and suspected patients, take effective isolation measures, and implement prevention and control measures.

Five, go all out to treat patients, increase the cure rate, and reduce the mortality rate. China has carried out large-scale medical rescue work, with 346 national medical teams, 42,000 medical workers, and 19,000 critical care medical workers rushing to Hubei and Wuhan for assistance. The national team takes over all severe cases, restructure systems and takes over ICUs, with doctors from the Department of Intensive Medicine, Respiratory Medicine, Circulatory Medicine and Infection Department serving as the main force. The treatment of severe cases in a concentrated manner has been constantly improved, and traditional Chinese and western medicine are combined in mobile hospitals to treat mild cases and prevent them from becoming severe ones.

Implement “Five Combinations.” First, combine basic medicine and clinical medicine. Second, combine the front and the rear. In case of problems with the medical work in the front, a video connection is made from the rear, and multi-disciplinary support is provided to mobilize key disciplines across the country to support Wuhan. Third, combine doctors and nurses. Fourth, combine medical treatment and management, which is also a major feature in the epidemic, when more than 42,000 medical staff with strong expertise, professionalism and administrative command ability, worked in the epidemic area in an orderly manner. Fifth, vertical administrative leadership system. Establish medical department, nursing department, and hospital control department. None of the 42,000 medical staff were infected. And the mobile hospital has realized zero deaths, zero infections, and zero recurrences. Traditional Chinese medicine has played a significant role, and the medical workers dared the disease and shown the spirit of self-sacrifice.

Thanks to the above prevention and treatment measures, China has significantly reduced the incidence and mortality of COVID-19, and successfully contained the continuous spread of COVID-19 virus in the community. Given the extremely low infection rate in China, currently, the vast majority of people are still vulnerable to COVID-19 infection. Therefore, it is necessary to carry forward public health measures to prevent infections. Meantime, China

is developing vaccines and specific therapeutic drugs, and adopting prevention and control measures that have the least impact on social production and life. These experiences have consolidated the country's confidence in defeating the epidemic and are conducive to containing the next wave of the COVID-19 epidemic [14].

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