

Review Article

COVID -19 Infection Prevention and Control: Review of Country Experiences

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Abstract

The novel coronavirus disease (COVID-19) caused by the new SARS-CoV-2 virus infection in December 2019 is one of the most severe public health emergencies facing the health systems around the globe. It reached the level of being a pandemic that caused a great disturbance and widely variable responses in nearly all countries. This review aims to highlight some of these country experiences to learn from others and to enhance better management strategy in our country. A PubMed search was performed to extract the country experiences from papers published till the 30th of April, 2020. As the onset of start, the course and severity of the pandemic differed from one country to the other, scientists from every country are doing their best to publish their experiences in the disaster management to help other countries avoid the mistakes in the management of such difficult situation. Problems facing different communities were summarized.

Keywords: Covid-19; outbreak; challenges; experiences

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OVERVIEW

The increased international travel and commerce leads to the rapidly evolving global infectious disease epidemiology. The incubation period of many infections needs longer time than travelling between different countries worldwide e.g. seasonal influenza (1-3 days), Rota Virus infection (1-3 days) also, a person infected with SARS-CoV-2 needs an incubation period of 2-14 days to express symptoms while he could travel from his country and come back within only 2 days.⁽¹⁾ From an infectious disease point of view, globalization has led to a borderless world that makes international cooperation and coordination necessary to control infections.

Nowadays, we are dealing with the COVID-19 pandemic resulting in a huge concern of a dangerous global public health threat.⁽²⁾ Wuhan, the capital city of Hubei province and a major transportation center of China, started presenting to local hospitals many cases of adults suffering from severe pneumonia of unknown etiology in December 2019. Most of the cases had history of visiting a wet market of seafood and live animals.⁽³⁾ The responsible

pathogenic agent for such clusters of patients was identified as 2019 novel coronavirus (2019-nCoV), where person to person transmission has been confirmed, in addition, an asymptomatic person was confirmed to be a source of infection transmission.⁽⁴⁾

On the 30th of January, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak to be a public health emergency of international concern posing a high risk to countries with vulnerable health systems.⁽⁵⁾ The SARS-CoV-2 spread rapidly from its origin in Wuhan to all around the world. Until the 5th of March, 2020 about 96,000 of COVID-19 cases and 3300 deaths have been reported.⁽³⁾ On March 11, 2020, the WHO has declared the COVID-19 outbreak as a global pandemic⁽⁶⁾, On April 14, 2020, the total globally reported confirmed cases was 1,844,863, despite the suspicion that the true numbers are much higher⁽⁷⁾, while on April 30, 2020 the global number of confirmed cases was estimated to be 3,090,445.⁽⁸⁾

In this report, we decided to collect the previously published scientific literature review papers related to measures taken in different countries to get their

experiences, to learn rapid response to similar situations and to ensure full preparedness of our health care system to combat such a pandemic.

APPROACH

One search engine namely PubMed was used. A Medline search was performed using the keywords COVID-19, outbreak, hospital associated, infection prevention and control, and challenges. Filters applied were English language, full text articles, only published articles till the 30th of April, 2020. The search resulted in 30 research articles; 13 articles were excluded because of their irrelevance. The remaining 17 articles have been reviewed and summarized, with exclusion of the repeated issues. Special focus was applied on the different problems that different healthcare systems suffered around the world and the solutions developed and applied by those systems in order to learn from the experience of other countries with such a pandemic.

CHALLENGES FACING HEALTH SYSTEMS

Sohrabi et al., reported that on 31st December 2019, 27 cases of pneumonia of unknown etiology were identified in Wuhan City, Hubei province in China.⁽⁵⁾ Wuhan city has a population exceeding 11 million. Most patients complained of dry cough, dyspnea, fever, and bilateral lung infiltration on imaging. All cases had history of visiting a sea food market in Wuhan where fish and other live animals as poultry, bats, and snakes were sold. Lu et al., determined that the causative organism was isolated through taking throat swabs conducted by the Chinese Center for Disease Control and Prevention (Chinese CDC) on the 7th of January, 2020, which was named SARS-CoV-2 and the disease was named as COVID-19 by the WHO.^(9, 10)

Moreover, Huh et al., stated that the continuous transmission of SARS-CoV-2 in Wuhan resulted in a huge number of patients either with or without COVID-19. So, adequate care should be provided for both patient categories. A great problem facing patients in Hubei province was their inability to reach medical care services. Such huge numbers of cases have led to decreased outcome of healthcare services due to shortage of the health system capacity to provide isolation and testing. So, it was necessary to develop an efficient plan for testing and referring patients in cooperation with the public health authorities of Wuhan's healthcare system.⁽¹¹⁾ On the 3rd of February, 2020 there were 6384 confirmed cases in Wuhan, in addition to severe shortage of medical resources as reported by Pan et al. 2020.⁽¹²⁾ Another critical problem facing the health system in Liaoning, Zhejiang, Shandong and other provinces in China as reported by Zhang et al., was the asymptomatic carriers who have been suspected and detected, where estimates suggested that they could represent about 60% of all COVID-19 infections.⁽¹³⁾ At the same time, Zou et al, proved that asymptomatic carriers

may be highly infective during the incubation period because the viral load detected in asymptomatic carriers was nearly the same as that in symptomatic patients.⁽¹⁴⁾ Consequently, scientists with the Ningbo CDC in East China's Zhejiang Province found that 6.3% of the close contacts of confirmed COVID-19 patients were ultimately infected with the virus, while 4.4% of the close contacts of asymptomatic carriers were ultimately infected as mentioned by Zhang J, et al, 2020.⁽¹³⁾ Zhang Z et al., reported that there were 2055 laboratory-confirmed health care professionals (HCP) from 476 hospitals across China on the 20th of February, 2020. Most of the HCP cases (88%) were reported from Hubei. Yet, no super spreader was identified among the HCP infections. The high number of infected HCP was very crucial confirming the severity of the epidemic, the scarcity of information related to the new virus during the early period of the outbreak and the required improvement in the medical system.⁽¹⁵⁾

The Centers for Diseases Prevention and Control (CDC) issued its Weekly Morbidity and Mortality Report (MMWR) on the 10th of April, 2020 which confirmed that community acquired infection of COVID-19 was associated with high morbidity and mortality rates among older patients in addition to its high spread in long-term skilled nursing facilities.⁽¹⁶⁾

Another, problem was highlighted by Ağalar and Engin (2020), who discussed a study that included 138 patients in China which demonstrated that 57 patients (41.3%) have been infected within the hospitals. Among these patients, 17 (12.3%) were admitted for medical reasons other than COVID-19, and 40 (29%) were HCP. Among the infected HCP, 31 (77.5%) were providing clinical services, 7 (17.5%) in emergency unit, and 2 (5%) were working in the Intensive Care Unit (ICU), respectively. In addition, the laboratory workers were exposed to the risk of COVID-19 infection during analysis of patients' samples.⁽¹⁷⁾

Moreover, two studies, one by Ağalar and Engin and the other by Meng et al., observed that some dental patients are suffering from cough, sneezing, or undergo dental procedures involving the usage of a high-speed handpiece and ultrasonic instruments that lead to aerosolization of the patients' secretions, saliva, or blood to the surroundings, exposing HCWs in the dental settings to the risk of acquiring infection. Also, Healthcare personnel in dental settings deal with apparatuses that might be contaminated with many pathogens during their use or during dental personnel's exposure to a contaminated clinic environment. Furthermore, infection could be transmitted to dental personnel due to puncture by sharp objects or through direct contact between mucous membranes and contaminated hands. In addition to the fact that dental procedures are usually associated with droplets and aerosols generation. Hence, the infection control measures in the daily work might not be sufficient to prevent COVID-19 spread especially from asymptomatic carriers.^(17, 18) Similarly, Lai et al., stated that close contact

of the ophthalmologists with their patients while performing direct ophthalmoscopy or slit lamp examination could lead to infection transmission to ophthalmologists. Furthermore, conjunctivitis may be misleading to ophthalmologists as sometimes it may be the first presenting sign of COVID-19 although the patient may be apparently asymptomatic.⁽¹⁹⁾

On the other hand, Lu *et al.*, drew the attention to the fact that nose and throat examinations pose a high risk to healthcare personnel in ENT settings. So, additional protective measures are required to protect ENT staff members.⁽²⁰⁾

In Wuhan, 14 healthcare workers (HCWs) were infected by one super spreader with an atypical presentation and resulted in the death of one physician. This led to shortage of HCWs, initiated a cycle of substandard infection control procedures which caused hospital acquired infection transmission and further increased disease transmission within the community.⁽²¹⁾ Screening of 24 orthopedic surgeons in Wuhan, in a study by Guo *et al.*, revealed 21 confirmed COVID-19 cases; out of these cases 3 were clinically diagnosed cases presented with fever and respiratory problems, chest CT scan with ground-glass opacity and consolidation, leucopenia and/or lymphopenia, and negative influenza virus tests in addition to a history of exposure to COVID-19.⁽²²⁾

EFFORTS TO CONTAIN THE DISEASE

Sohrabi *et al.*, reported that the Chinese health authorities in Wuhan applied strict adherence to standard infection control measures (e.g. frequent proper hand hygiene, use of personal protective equipment [PPE] etc.), that is highly recommended by the WHO and the Centers for Disease Control and Prevention (CDC).⁽⁵⁾ In Japan, a company launched an artificial intelligence powered App which provides updated information concerning COVID-19 outbreak and its preventive measures. A symptom checker, as recommended by various bodies like the WHO and the CDC, was added. It advised preventing spread of COVID-19 through prohibiting travel to high-risk places, contact with symptomatic individuals, and the consumption of meat from regions with confirmed COVID-19 cases.⁽⁵⁾

Additionally, Huh *et al.* (2020) stated that important rules were applied at the same time with standard infection control measures including early management to lower the transmission rates, decrease the outbreak risks, and enhance clinical outcome. Moreover, they highlighted the conclusion of certain countries like Singapore, Japan, and Korea which revealed that travelling history and/or contact with a confirmed case becomes inadequate as a case definition, and that acute respiratory illness systematic surveillance application was needed. That was also proposed by the CDC which announced that the USA will take into consideration including SARS-CoV-2 to its influenza-like illness surveillance system and that pathways were used to screen, test, and isolate patients suffering acute respiratory infections in different

hospitals.⁽¹¹⁾ The researchers also proposed several recommendations. First, laboratories should be prepared to surge capacity together with developing rapid testing at the point of care to mitigate the workload on the laboratory and enhance the diagnosis rate. Second, more beds and instruments (e.g., ventilators) should be provided for preparation of the surge capacity together with discharging patients who could be cared at home from long term care facilities. Finally, resources for management of COVID-19 cases should be checked and stocked while patients urged to visit hospitals should be carefully protected and mildly ill patients were advised to stay home, and to ask for medical advice if they suffer persistent or aggravated.⁽¹¹⁾

Pan *et al.* (2020) mentioned that the government in China used stadiums, exhibition halls and other places to prepare a number of “square cabin hospitals” for non-critical patients so they can secure resources at Huoshenshan hospital, Leishenshan hospital and other sites for critically ill patients.⁽¹²⁾ Also, Zhang *et al.* said that “China’s measures for managing asymptomatic carries included 14 days of centralized quarantine and observation and that people could be released from quarantine after two consecutive PCR tests (separated by 24 hours). Unless asymptomatic carrier develops clinical manifestations while in quarantine he is not included in confirmed cases in addition to the expansion of testing and follow-up of asymptomatic carriers including people in close contact with confirmed COVID-19 and asymptomatic cases.⁽¹³⁾ It was also reported that many proceedings have been taken to contain the COVID-19 outbreak in China as improving advice about the appropriate use of PPE, preparing logistics and medical supplies together with enhancing disinfection at the hotels where HCP stay besides the application of a contingency surveillance system to follow all exposed HCP essential for detection and management of infected HCP.⁽¹⁵⁾

Furthermore, a special medical expert group was established to make the needed efforts for diagnosis and treatment of suspected and confirmed cases among healthcare providers. Other efforts executed during such outbreak were presented by Meng *et al.* (2020). Among these efforts was the addition of COVID-19 to group B of infectious diseases in January 2020 by the Chinese National Health Commission, which also includes SARS and highly pathogenic avian flu. They also recommended all health care providers to follow the indicated protective measures used for group A infectious diseases (a disease group referred to highly infectious diseases, e.g. cholera and plague) while they permitted dental emergency cases only to be managed with strict adherence to the infection prevention and control measures and suspending daily clinical work practice until further notification. Furthermore, quality control centers concerning with dentistry profession raised recommendations for dental services during COVID-19 outbreak in order to ensure the quality of infection control. Moreover, all healthcare providers were asked to seek medical advice and stop

working in case of suffering from fever, coughing, sneezing, and/or other COVID-19 related symptoms has contacted closely with a confirmed family member. Dentists were advised to use saliva ejectors that reduce droplets and aerosols production and to avoid performing dental procedures that could induce coughing as per WHO recommendations.⁽¹⁸⁾

Ağalar and Engin concluded that it is important for HCP to be fully equipped with PPE and ready to receive patients and that COVID-19 suspected patients should be safely and rapidly isolated. At the same time, hospital entrances, patient rooms, and waiting areas should be provided with supplies needed for hand disinfection containing 60–95% alcohol and the needed waste containers. Further, triage personnel should be separated from possibly infectious patients to restrict close contact using physical barriers made of glass or plastic. Also, there must be 2 meters between the HCP and the patient inside the clinics and examination rooms to avoid close contact. Concerning laboratory workers, there must be proper training on the usage of biological agents and self-protection against its hazards together with the use of the appropriate PPE and avoidance of aerosol generating procedures. At the same time, risk assessment should be carried out periodically in all hospital laboratories and following the WHO laboratory biosafety highlights in relation to COVID-19.⁽¹⁷⁾

Lai et al. (2020) stated that the USA issued an alert to advise ophthalmologists to wear masks and eye protection when examining conjunctivitis patients with respiratory symptoms and history of international travel. This recommendation was recommended by the American Academy of Ophthalmology after performing risk assessment of the infection control precautions followed by ophthalmologists depending on a three-level hierarchy of control measures; administrative control, (environmental control and use of PPE).⁽¹⁹⁾

Regarding the healthcare workers in the ENT field, Lu et al, 2020 reported the implementation of additional protective measures while performing flexible laryngoscopy to reduce exposure to aerosols, replacing local anesthetic spray by gel anesthesia, the use of the smallest possible laryngoscopic diameter and ensuring the use of adequate surface anesthesia to reduce the sneezing reflex during nasal endoscopy. The recommendations also included isolating suspected COVID-19 patients after surgery into negative pressure rooms and screening them for COVID-19 then returning patients with negative results to ENT department, replacing open-type suctions by closed suction for tracheotomy patients and replacing aerosol inhalation procedures by in-tube infusion or spray humidification to humidify the trachea.⁽²⁰⁾ As a result of these regulations, there were 22 confirmed COVID-19 from a total of 4148 fever cases visited this hospital (since the 20th of February, 2020). On the other hand, Schwartz et al. (2020) recommended implementing a Traffic Control Bundling (TCB) to reduce infection rates among HCWs in

Taiwan. Starting with outdoor triage where positive COVID-19 patients are directed to the isolation ward in private isolation rooms while query patients (those who suffer atypical symptoms or whose tests are inconclusive) are placed in a quarantine ward (intermediate zone) for 14 days. Both isolation and quarantine directed patients were transferred through a designated route that avoids contact with the clean zone. Healthcare workers should strictly follow all infection control measures while moving between different patient areas, in addition to ensure daily cleaning and disinfection of the environmental surfaces in clean and intermediate patient zones while limiting cleaning and disinfection of the hot zone to be only in case of visible contamination with body fluids.⁽²¹⁾

Guo et al. (2020) in their study reported that during COVID-19 outbreak, N95 respirators have a protective effect for orthopedic surgeons compared to medical masks. So, they should be aware and vigilant towards wearing N95 respirators as a protective measure.⁽²²⁾

CONCLUSION AND RECOMMENDATIONS

The current COVID-19 pandemic highlighted the importance of rapid international response in the fields of disease diagnosis, virus isolation, financial support, and temporary hospital construction to deal with the increasing number of cases. Strict adherence to infection control measures is crucial to provide self-protection. Supporting basic health care is an important pillar in decreasing transmission risk. Also, provision of continuous online learning and education of all healthcare providers concerning infection control measures and methods of protecting themselves. It is necessary to integrate scientific research resources, increase research investment, enhance the cooperation between all scientists internationally, and apply scientific research results to enhance the ability to prevent spread of the pandemic.

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

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