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Inside China and COVID-19: Questions and answers

Since the outbreak of the novel 2019 coronavirus (SARS-CoV-2) and the burgeoning pneumonia (COVID-19) incidence in Wuhan, China, I have personally examined many patients and been actively involved in the prevention and treatment process. As an infectious disease physician and witness to this human tragedy, this has led me to ask myself many questions. The most important might be: if we could relive this experience, what would we do differently? Could we reduce the case fatality rate (CFR) in the Wuhan area to roughly resemble that of other areas or the Spanish flu?

In the early stages of the outbreak, with rapid SARS-CoV-2 spread, many questions remained unanswered, including the source of the pathogen, mode of transmission, infectiousness and clinical characteristics. There were initial suggestions that the overall case fatality rate might not be that different to seasonal influenza, with analogies drawn to the 60,000 annual influenza deaths in the US. As the scale of the outbreak became apparent and additional data became available, a higher CFR became apparent, with a figure of 2.1% according to the data released on February 6, 2020) [1], but this figure will be subject to revision as additional data emerges. Based upon my experience the CFR might be varied from region to region, due to the availability of SARS-CoV-2, medical care and practice, and the accuracy of number of infected patients. A particular issue, making direct comparisons with influenza mortality difficult in today's world, is the ready availability of anti-influenza antivirals and vaccines, and the absence of any proven efficacious antiviral and vaccine for the treatment of COVID-19. [2,3],

After the outbreak of SARS in 2003, China has established a comprehensive infectious disease prevention, control, and biosafety system to effectively respond to infectious disease outbreaks. The National Health Commission of China issued the “Administrative Measures for the Pre-examination and Triage of Infectious Diseases in Medical Institutions” and “Notice on the Establishment of Infectious Disease Department in Secondary and above General Hospitals” on February 18, 2005 and September 13, 2014, respectively [4,5]. Aiming to rapidly respond to public health emergencies and improve the handling capacity, the State Council issued “Emergency Regulations of Public Health Emergency” and “National Public Health Emergency Contingency Plans” in May 2003 and January 2006, respectively. China has established a direct network reporting system for infectious diseases, which enables real-time reporting from primary medical institutions or Center for Disease Control (CDC) branches at county/district-level to the China CDC through the Internet. Subsequently, in order to strengthen the monitoring and reporting of pneumonia of unknown cause, “National program for monitoring pneumonia of unknown cause (Draft)" was released in July 2004 and “National program for surveillance, investigation and management of pneumonia of unknown cause” was released in August 2007 [6]. In order to achieve the early diagnosis of infectious diseases, especially newly emerging infectious diseases, China has stocked over 300 detection technologies for pathogens and has the capability of detecting these pathogens within 3 days with the support of major special projects such as the National Eleventh Five-Year Plan, the Twelfth Five-Year Plan, and the Thirteenth Five-Year Plan. This set of systems played a key role in response to the outbreak of H5N1, hand, foot and mouth disease (HFMD), new Bunyavirus, H1N1, and H7N9 in recent years, especially for the discovery and identification of new Bunyavirus and H7N9 avian influenza virus.

Although Chinese researchers identified a novel coronavirus SARS-CoV-2 associated with the Wuhan pneumonia in less than ten days after the outbreak, efforts to prevent the epidemic of SARS-CoV-2 were not successful. Based on the current epidemiological data and clinical characteristics, the author believes that there are several contributing factors, as described below.

1. The origin of the epidemic remains unknown. The retrospective epidemiology study of 423 cases performed by China CDC showed there may be multiple sources of infection in addition to the Huanan Seafood Market in Wuhan from the very beginning of epidemic [7]. The significance of epidemiology of family clustering cases was also underestimated [8].
2. The number of early cases is too small to fully understand the clinical features and severity of the disease. The earliest report of 41 confirmed cases with an alarming mortality rate, raised the question of whether this novel coronavirus could be treated as a common coronavirus [9]. Although coronavirus is an important cause of acute exacerbation of chronic bronchitis and of pneumonia, its incidence is lower than that of influenza and respiratory syncytial virus, and rhinovirus, at least in temperate climates [10]. Of the six coronaviruses that have previously been identified as capable of causing human disease, SARS and MERS coronaviruses have been of the greatest concern, as human coronaviruses generally account for merely 5%–10% of all acute upper respiratory tract infections in adults, albeit reaching 25%–35% during outbreaks [10–14]. Human coronaviruses can cause severe pneumonia in the immunocompromised such as HIV-positive individuals, or in other vulnerable populations: in an outbreak of HCoV-OC43 infection in elderly people living in a Canadian long-term care facility the case fatality rate was 8%, the mortality is nevertheless far inferior to that of SARS and MERS, and may therefore be overlooked by the medical community [15].
3. Clinical symptoms observed with this novel coronavirus infection can be relatively atypical, e.g. some patients had diarrhea, and progress of the disease is relatively slow. Patients who develop severe disease usually experience deterioration such as dyspnea and hypoxemia in the first week after disease onset. Thus, many patients visited the doctor for the first time, or were hospitalized, a week

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after onset of their disease. The virus thus enjoyed an opportunity to spread for a relatively long period before patients were isolated or hospitalized.

4. Mild cases and asymptomatic infections have dramatically increased the difficulty of preventing and controlling this disease. Asymptomatic individuals and those with mild infections rarely seek medical care, allowing virus replication in the upper respiratory tract that can be transmitted to others [16]. These 'virus carriers' may be scattered across communities, families, in non-fever clinics and non-infectious disease departments in hospitals, resulting in familial clusters of pneumonia or nosocomial spread of the virus.
5. The modes of transmission are diversified. The National Health Commission of the People's Republic of China issued "Guideline on diagnosis and treatment options for 2019 novel coronavirus-infected pneumonia (Fifth Draft)" on February 5, 2020 which stated "respiratory droplets and contact transmission are the main modes of transmission" [17]. Other routes, such as aerosol transmission and digestive tract transmission, as suggested by the detection of viral nucleic acid in feces, remain to be confirmed. The diversity and uncertainty of transmission routes further increases the difficulty of disease preventing and control.
6. The implementation of standard precautions measures in the prevention and control of nosocomial infections was insufficient. Infection control precautions should be applied by all healthcare practitioners providing care for patients in community and primary care settings, and practitioners should be provided with guidance on correct implementation. Standard prevention should be based on the principle of treating all patients as potentially infectious and taking appropriate preventive control measures. However, constantly overloaded medical staff and hospitals in China have maintained normal operations during the initial phase of the 2019-nCoV outbreak: a Chinese general practitioner cares on average for 5,000 residents, compared to the international norm of 2,000. Under such workload, medical staff do not have enough time to fully communicate with patients or to perform hand hygiene. Standard prevention is the "touchstone" for the control of nosocomial infections, especially for infectious diseases of the respiratory tract. In addition, there are not enough single-patient rooms in emergency departments, fever clinics, and respiratory departments in Chinese general hospitals to ensure quarantine of patients with suspected respiratory infections. The epidemics of both SARS in 2003 and MERS in 2015 were related to lack-of-control of nosocomial infections [18,19].

The difficulty in early detection of COVID-19 infection was further confounded by the lack of specific clinical features of the disease: some patients presented with only mild or no respiratory symptoms; others were without fever or pneumonia symptoms. Thus, it is very difficult to promptly identify and isolate infection sources in a conventional emergency room/primary care process.

As the general population could be susceptible to an emerging infectious disease such as COVID-19, appropriate measures should be taken to safeguard the wellbeing of the public when such infections emerge, especially in the absence of a vaccine, which may well take a long time to be developed. The key is to break the chain of infection, assisted hopefully with an understanding of the mode of transmission, but if not, at least with adoption of standard precautions. Although early detection of the source of infection can be difficult, it is still necessary to identify patients and asymptomatic infections to the fullest extent possible. All suspected patients should be quarantined in single occupancy rooms for treatment, to avoid the spread of virus within the family and the hospital. Meanwhile, suitable precautions and adherence to the principles of prevention and control of infectious diseases should be implemented to cut transmission. Appropriate measures, including isolation and the use of personal protective equipment should be considered, based on the mode of transmission of the disease: both blood-borne and non-blood-borne infections need to be considered and prevented during diagnosis and treatment. Moreover, a two-way protection (i.e. patient to the medical staff and medical staff to patient) is necessary. Hand hygiene is the most important standard precaution and one of the most effective ways to prevent the spread of health care-related pathogens.

From the perspective of prevention in families and communities, awareness and continued education of the general public on the basics of disease prevention are necessary, such as how to wear masks, wash hands thoroughly, and cough etiquette; the intention is that they protect themselves and prevent transmission to others.

From the perspective of nosocomial infection control, all medical staff must enquire about the epidemiological history of patients, particularly patients with fever and/or clinical characteristics of pneumonia. Suspected patients should be quarantined immediately in a single occupancy room. For both the emergency department and general ward, there should be at least a quarantine area available to isolate patients with respiratory infections. Moreover, during routine diagnosis and treatment, standard preventive measures including strict hand hygiene and the use of appropriate proper personal protective equipment, tailored to the risk of the procedure, should be strictly implemented. Goggles or face shields should be worn for airway management, sputum suction, oral cavity and ophthalmic procedures.

Only with all of these efforts coordinated can transmission of virus be cut within the family, the risk of nosocomial infections minimized, and the epidemic finally controlled.

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Declaration of competing interest

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