The H7N9 Influenza Virus in China — Changes since SARS

Yu Wang, M.D., Ph.D.

Zoonotic infectious diseases are a challenge. Ten years after the emergence in China of the severe acute respiratory syndrome (SARS), another novel virus — an avian influenza A (H7N9) virus — has emerged here, causing substantial disease. These human infections are the first reported cases caused by an H7N9 subtype virus, whose surface hemagglutinin and neuraminidase genes may have derived from H7N3 and H7N9 viruses, respectively, and whose six internal genes may have derived from an H9N2 virus.1 But China is now alert to potential influenza pandemics and other emerging infectious diseases.

The increasing consumer demand for animal products has resulted in greatly increased animal husbandry and human–animal interactions. The rate of human infections caused by animal pathogens has therefore unavoidably increased, and new infectious diseases have emerged. H5N1 influenza virus, which has caused a total of 45 cases of illness and 30 deaths in humans in China since 2003, was avian in origin.2 The 2009 pandemic influenza (A/H1N1pdm) virus may have been swine in origin.3 Now we have identified the novel avian influenza A (H7N9) virus, which within 2 months has caused a cumulative number of human cases in China that is almost three times as high as the number caused by H5N1.

Since the advent of SARS, the Chinese government’s awareness of and capacity to respond to health emergencies have substantially improved. The outbreak of the novel H7N9 avian influenza infection has provided us with a chance to evaluate that capacity.

First, rapid disclosure of information has been a priority. The newly established National Health and Family Planning Commission reported to the World Health Organization (WHO) and the public about the epidemic on March 31, 2013, shortly after the Chinese Center for Disease Prevention and Control (CCDC) completed full gene sequencing (on March 29) and the cases were diagnosed (on March 30, after discussion with clinicians and epidemiologists). Since then, information about new confirmed cases has been released on a daily basis.

Second, the overall capacity of the national disease prevention and control system has been greatly improved. The detection and confirmation of the pathogen underlying an emerging disease used to be a complicated and time-consuming process, with special technical requirements. In this case, within 1 month, the novel virus had been identified and diagnostic reagents had been developed and provided for clinical testing.

Third, during the SARS outbreak, the Chinese government’s inadequate disclosure of information was due in part to a lack of capacity to collect disease information. A Web-based infectious-disease reporting system has been built during the past decade, and it played a vital role in the response to H7N9. This reporting system, which covers 90% of the township hospitals in China, was put in place at the beginning of 2004. The CCDC receives notification of each clinically diagnosed new case of 39 notifiable diseases from 68,000 computer terminals every day — which may make China’s the largest direct infectious-disease reporting system in the world. The government uses the information that the system collects on epidemics, ensuring transparency and the development of proper strategies for addressing those epidemics.

Some observers are concerned that China may not be capable of conducting laboratory diagnosis at hospitals at a grassroots level. In Jiangsu Province, where the economy is more developed than in many other parts of the country, 121 hospitals have been qualified for and are capable of performing nucleic acid testing in suspected cases. It is not practical, however, to enable all township hospitals to undertake such testing.


DOI: 10.1056/NEJMep1307009
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Fourth, international information exchange and collaboration have been proactively established. The WHO’s International Health Regulations (2005) and Pandemic Influenza Preparedness Framework (2011) dictate that clear information and pathogen materials must be shared during the response to an emerging infectious disease. Under this framework, H7N9 sequences were released immediately, and WHO network laboratories and several other research institutes were provided with the H7N9 virus on April 11, 2013. Such timely international communication promoted a global response to this emerging infectious disease.

An important concern regarding this novel virus is whether viral evolution and mutation will lead to sustained human-to-human transmission and possibly even a pandemic. To monitor viral evolution, epidemiologic and virologic data for each patient were collected and analyzed in real time. Because infection with this virus appears to be asymptomatic in the avian population, greater geographic distribution of poultry can readily expand the human–animal interface and increase the risk of disseminated human infection.

Given the concern that clinical treatment may be less effective in patients with H7N9 infection who have reached the later stage of pneumonia, the National Health and Family Planning Commission issued revised treatment guidance in the latest version of its Clinical Guide (Chinese Guidelines for Diagnosis and Treatment of Human Infection with H7N9 Avian Influenza). The approach that has been developed for areas where H7N9 infection is detected in humans entails testing any febrile patient with a decreasing white-cell count, using either a rapid antigen test or reverse-transcriptase polymerase chain reaction for H7. To try to prevent the development of severe pneumonia, patients with positive results on either test have been treated as early as possible with antiviral drugs such as oseltamivir. Because of challenges with influenza in the past, China has stockpiled oseltamivir doses that can be used in treating patients with H7N9 infection. The number of reported cases of novel H7N9 influenza infections peaked in late April and has since declined.

In addition to the greatly improved basic and comprehensive laboratory capacity and the new rapid and sensitive surveillance system, evidence-based intervention strategies have been essential to addressing this emerging disease — for example, complete closure of live poultry markets in cities (a strategy that is currently implemented in Shanghai, Nanjing, and Hangzhou) may have contributed to reducing the number of cases. As of June 1, 2013, no new H7N9 cases have been reported since May 5 in these regions.

The pandemic potential of novel avian-origin viruses should not be underestimated. When, where, and how the novel H7N9 virus emerged remains unknown. Since it is associated with high morbidity and mortality in humans, heightened protective measures should be taken. Vaccine and antiviral drugs need to be developed as soon as possible, and most important, the virus should be closely monitored for any human-to-human transmission and pandemic potential.4

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

From the Chinese Center for Disease Control and Prevention, Beijing, China.

DOI: 10.1056/NEJMp1305311
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In Support of SUPPORT — A View from the NIH
Kathy L. Hudson, Ph.D., Alan E. Guttmacher, M.D., and Francis S. Collins, M.D., Ph.D.

Each year in the United States, nearly 500,000 infants — 1 in every 8 — are born prematurely, before 37 weeks of gestation. Despite substantial advances in their care, premature infants face a daunting array of challenges; they are at high risk for death in infancy and face severe and lifelong health problems if they survive.1 The National Institutes of Health (NIH) has a legal and moral responsibility to do research in partnership with scientists and families to optimize the care of these highly vulnerable infants. In recent weeks, a major public debate has arisen regarding a