



Risk assessment on the epidemics of human infection with a novel avian influenza A (H7N9) virus in Jiangsu Province, China

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Abstract

A novel avian influenza A (H7N9) virus was discovered in February 2013 in China and has resulted in more than 100 confirmed human infections including 26 fatal cases as of May 2, 2013. The situation raises many urgent questions and global public health concerns. In this study, epidemiologic characteristics of infected human cases in Jiangsu province were analyzed and risk assessment was undertaken based on the information available. Briefly, it is highly unlikely that a pandemic of human infection with avian influenza A (H7N9) virus will happen in Jiangsu Province in the near future. In the end, some measures are recommended to prevent the situation from becoming worse.

Keywords: avian influenza, H7N9, risk assessment

BACKGROUND

In February 2013, a novel avian influenza A (H7N9) virus emerged in eastern of China and quickly spread to other areas^[1-3]. Up to May 2, 128 human infections have been confirmed, with 26 deaths. Transmission may occur through direct or close contact or through exposure to environments that are contaminated with infected poultry. Even though no human-to-human transmission has been reported, it raises serious concerns for public health^[4].

ETIOLOGICAL CHARACTERISTICS OF HUMAN INFECTION WITH AVIAN INFLUENZA A VIRUS

Influenza A viruses, belonging to the family *Orthomyxoviridae* and possessing 8 negative-sense RNA segments encoding 11 known proteins, are divided into subtypes, based on the nature of their surface glycoproteins, hemagglutinin (HA) and neuraminidase (NA). Currently, 16 HA and 9 NA subtypes have been identified in wild water birds, the natural host for all

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influenza A viruses and the reservoir from which viruses emerge to infect domestic poultry and occasionally mammals. Only some of these subtypes have been identified in humans, specifically the H1N1, H2N2, and H3N2 viruses, corresponding to the three major pandemics of the last century. Influenza A viruses are known to also infect a variety of other mammals, including pigs, horses, mink, felids, and so on.

Influenza A viruses infecting poultry can be divided into two distinct groups on the basis of their ability to cause disease in chickens. The very virulent viruses cause highly pathogenic avian influenza [HPAI], in which mortality may be as high as 100%. These viruses have been restricted to subtypes H5 and H7 (e.g. H5N1 and H7N7), although not all viruses of these subtypes cause HPAI. All other viruses cause a much milder, primarily respiratory disease designated low pathogenicity avian influenza [LPAI]. Due to its rapid spread and high mortality, HPAI is classified as a List A disease by the World Organization for Animal Health (OIE) and Type A disease by the Chinese Ministry of Agriculture, respectively. In recent years, several avian influenza outbreaks caused by the H7 subtypes in poultry were reported in such countries as the USA, North Korea, South Korea, Bulgaria, Japan, Denmark, Germany, and the Netherlands^[5-7]. In March and April 1997, there were outbreaks of H5N1 avian influenza in Hong Kong^[8,9].

Due to host restriction, avian influenza A viruses are generally difficult to cross the species barrier and are not efficiently transmitted among humans. According to the current literature available, most of human infections with avian influenza A viruses are caused by H7 and H5. H7 is the most common pathogen of human infection, and human infections with avian H7 subtype virus (e.g., H7N2, H7N3, and H7N7) have been reported occasionally in North America and Europe in recent years. The first reported case of direct transmission of a sub-type H7 virus from an avian to a human host occurred in 1996, when conjunctivitis developed in a woman who kept pet ducks 1 day after she experienced a possible eye abrasion while cleaning her duck house^[10,11]. An outbreak of subtype H7 infections in humans occurred in the spring of 2003, when an HPAI (H7N7) virus was detected in commercial poultry farms in the Netherlands and necessitated the culling of > 30 million birds^[12,13]. Eighty-six persons involved in the culling operation and 3 of their family members who had not been in contact with infected poultry had virologically confirmed subtype H7 illness, which suggests that limited human-to-human transmission of the avian virus also had occurred. Subsequently, human infection with H7N2 and

H7N3 subtypes appeared in North America^[14]. Most recently, multiple H7 viruses have resulted in human infections in the United Kingdom. In 2006, an LPAI virus (H7N3) was isolated from a poultry worker with conjunctivitis^[15]. In 2007, another four persons were confirmed with H7 virus human infection^[16].

H7N9 virus discovered in February 2013 in China is a novel avian influenza A virus, which has not been detected in humans or animals previously and is prevalent and causing an emerging fatal infectious disease in several provinces in China now. This human H7N9 virus is the product of reassortment of viruses that are of avian origin only, with the HA genes and NA genes from H7 and N9 subtypes, respectively, and 6 internal genes from the H9N2 subtype^[17].

EPIDEMIOLOGICAL ANALYSIS OF HUMAN INFECTIONS WITH AVIAN INFLUENZA A (H7N9) VIRUS IN JIANGSU, CHINA

To date, a total of 128 laboratory-confirmed cases of human infection with avian influenza A(H7N9) virus including 26 deaths have been reported to the WHO, which are distributed in 39 cities of 10 provinces, such as Zhejiang, Shanghai, and Jiangsu. In these reported cases, males were nearly two times more than females, and most of them were above 50 years of age.

In Jiangsu province, the onset of illness of the first confirmed case was on March 19, 2013. Sporadic cases occurred in succession and 27 confirmed cases including 4 deaths had been accumulatively reported till May 2, 2013, just slightly lower than those reported for Zhejiang province (46 cases, including 6 deaths) and Shanghai City (33 cases, including 13 deaths).

Geographical distribution

The cases were concentrated in the southern regions of Jiangsu province, 11 in the city of Nanjing, 6 in Suzhou and 4 in Wuxi. In addition, Changzhou, Zhenjiang, Yangzhou, Xuzhou, Suqian and Yancheng had 1 case, respectively.

Population distribution

The average age of the infected cases in Jiangsu was 54.0 years, and the youngest and the oldest were 21 and 85 years old, respectively. There were 19 males and 8 females, and the male to female ratio was 2.38:1.

Follow-up of contacts

The 27 cases reported had so far several hundreds of close contacts in total. Only five of these contacts

developed fever, cough or sore throat, but were at last excluded from H7N9 infection by laboratory tests.

RISK ASSESSMENT

According to the latest research results, the prevalence of human infection with the avian influenza A (H7N9) virus has the following characteristics:

- Base on the information available, so far it is still inferred that the source of human infection with avian influenza A (H7N9) was originated from poultry. It means that the most important source of human infection would be exposure to environment contaminated by infected poultry or directly touching the infected poultry. In addition, trading of freshly slaughtered poultry in the wet markets in cities may be a confirmed risk factor to human infection.
- Analysis of population distribution and medical history of the human cases indicated that human infection with H7N9 subtype virus mainly occurred in older people, or people with chronic diseases or who were immunocompromised. There is no report on children infected with this novel virus in Jiangsu province. Clinical studies suggested that most of the infected human cases presented acute onset and progressive deterioration. The combination therapy with broad-spectrum antibiotics was not effective. Moreover, the risk of death for those infected was very high.
- So far, there is no evidence of sustained human-to-human transmission. However, two confirmed cases have been associated with possible family cluster.
- At present, there is no evidence that the international animal trade or population flow would provoke a pandemic risk. However, due to the limited knowledge about the source of infection and the animal reservoirs, specific control and prevention measures cannot be taken. Therefore, it is foreseeable that the affected area would be further expanded in the recent future.

In summary, it is impossible that a pandemic or outbreak of human infection with avian influenza A (H7N9) virus will happen in Jiangsu province in the near future.

RISK MANAGEMENT RECOMMENDATIONS

The cases of human infection with avian influenza A (H7N9) virus should be timely detected, diagnosed and given proper treatment through the following prevention and control measures:

- Strengthen the routine surveillance of influenza

like illness (ILI) and severe acute respiratory infection (SARI), and screening cases of human infection with avian influenza A(H7N9) virus (especially clusters of such cases) throughout the province.

- Take full advantage of the “China Infectious Disease Automated Alert and Response System (CIDARS)” which will immediately send a warning message as soon as a confirmed case or a surveillance case of human infection with avian influenza A (H7N9) virus was reported through the Internet to the database of the infectious disease direct reporting system. Once receiving such a message, the district CDC staff must carry out on-site verification within 2 hours.
- Workers of all the medical institutions should enhance their sense of responsibility in the diagnosis and treatment of suspected cases of human infection with avian influenza A (H7N9) virus.

Develop an integrated control and prevention system based on the coordination between different ministries, departments and agencies:

- The most important task is to treat patients and track close contacts to carry out medical observation conscientiously.
- Hospitals with admitted patients should pay attention to self-protection of health workers and disinfection of the environment and isolation of cases or suspected cases so as to prevent the occurrence of nosocomial infections.
- The management of live and slaughtered poultry trade in wet markets should be enhanced and sick or dead birds or animals should be disposed properly.

Carry out a wide range of health education activities about human infection with avian influenza A (H7N9) virus via the media, such as the Internet, newspapers, and television, which may make the public understand this emerging disease correctly, reduce unnecessary worries about it, and most important of all, improve self-awareness of infection prevention.

Clinical researches and epidemical studies are urgently needed to understand this novel virus and the emerging disease caused by it:

- Identify the source of human infections and the animal reservoirs of this novel virus.
- Ascertain the mode of infection and the risk of human to human transmission.
- Actively study the specific preventive vaccine and efficient drugs or therapies for this novel disease.

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