

Comparative Analysis of *Avian Influenza* (Bird Flu) on birds and its Effects on Humans

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ABSTRACT

This study explains the comparative analysis of Avian Influenza or Bird flu or H5N1 on birds and its effects on humans. Bird flu (also termed avian influenza or avian influenza A or H5N1) is an illness that affects wild and domesticated birds that usually causes either little or no symptoms unless the bird population is susceptible, in which it may cause death in many birds within about 48 hours. Influenza Avian, also known as bird flu or H5N1, is a subtype of the influenza A virus which can cause illness in humans and many other animal species. A bird-adapted strain of H5N1, called HPAI A(H5N1) for highly pathogenic avian influenza virus of type A of subtype H5N1, is the highly pathogenic causative agent of H5N1 flu,

commonly known as avian influenza ("bird flu"). According to the World Health Organization, more than 850 people were infected with Avian Influenza or Bird Flu between 2003 and 2016; more than 50 percent of those individuals died. Clinical signs of H5N1 in birds range from mild Decrease in egg production, Nasal discharge, Coughing and sneezing and sometimes the first noticeable sign is sudden death. Avian influenza is spread through direct contact with nasal discharges and feces of an infected bird. Any bird showing symptoms of avian influenza should be quarantined immediately and separated from the rest of the birds (or humans).

Keywords: Comparative, analysis, Avian Infuenza, bird flu, H5N1, humans.

INTRODUCTION

Bird flu (also termed avian influenza or avian influenza A or H5N1) is an illness that affects wild and domesticated birds that usually causes either little or no symptoms unless the bird population is susceptible, in which it may cause death in many birds within about 48 hours. Bird flu virus has been isolated from more than 100 species of wild birds and is endemic in many aquatic wild bird species (for example, sea gulls and terns). Avian influenza is a slightly misleading term, as influenza is among the natural infections found in birds [1]. The term avian influenza used in this context refers to zoonotic human infection with an influenza strain that primarily affects birds. Bird flu, also called avian influenza, a viral respiratory disease mainly of poultry and certain other bird species, including migratory water birds, some imported pet birds, and ostriches, that can be transmitted directly to humans.

The first known cases in humans were reported in 1997, when an outbreak of avian influenza A virus subtype H5N1 in poultry in Hong Kong led to severe illness in 18 people, one-third of whom died [2].

Bird flu influenza A viruses primarily affect birds and are not easily able to infect people. However, in the late 1990s, a new strain of bird flu arose that was remarkable for its ability to cause severe disease and death in domesticated birds, such as ducks, chickens, or turkeys. As a result, this strain was called "highly pathogenic" (meaning very severe) avian influenza (HPAI, a term seen in older publications). The first human case of illness from highly pathogenic avian influenza was identified in 1997.

Influenza Avian, also known as bird flu or H5N1, is a subtype of the influenza A virus which can cause illness in humans and many other animal species [3]. A bird-adapted strain of H5N1, called HPAI

A(H5N1) for highly pathogenic avian influenza virus of type A of subtype H5N1, is the highly pathogenic causative agent of H5N1 flu, commonly known as avian influenza ("bird flu"). Human infection with avian influenza is rare (the incidence has been that over 700 human infections have occurred with Asian H5N1 virus, according to the World Health Organization [WHO], in mainly 15 countries in Asia, Africa, Europe, the Pacific Islands, and in the near East) but frequently fatal. According to statistics published by the WHO in 2015 and the U.S. Centers for Disease Control and Prevention (CDC) in 2016, mortality (death) rates from infection with Asian H5N1 have been approximately 60%.

It is enzootic (maintained in the population) in many bird populations, especially in Southeast Asia. One strain of HPAI A(H5N1) is spreading globally after first appearing in Asia. It is epizootic (an epidemic in nonhumans) and panzootic (affecting animals of many species, especially over a wide area), killing tens of millions of birds and spurring the culling of hundreds of millions of others to stem its spread. Many references to "bird flu" and H5N1 in the popular media refer to this strain [4].

Government officials in China announced they detected a new strain of bird flu in March 2013. It was named H7N9 (also termed H7N9 Chinese bird flu). As of November 2016, the WHO reported a total of 800 laboratory-confirmed human cases of H7N9 virus since March 2013. Mortality rates have varied from about 20%-34%. Fortunately, the virus subtypes that have caused bird flu in humans are not easily transmitted to humans. However, health experts are concerned about possible future changes in these viruses that may allow them to become more contagious.

Birds have been affected with avian influenza in Asia, Europe, the Near East, and Africa, and the outbreak has killed millions of poultry. Bird flu from the highly pathogenic strain was found in the United States in December 2014 and eventually detected in 21 states (15 states with domestic poultry infections and in six states with detection of the virus only

in wild birds). No human infections were reported in these U.S. bird flu outbreaks. Human cases of bird flu have largely been confined to Southeast Asia and Africa. However, mutations (changes in the genetic material of the virus) often occur in the virus, and it is possible that some mutations could create a more contagious virus that could cause a worldwide pandemic of bird flu among humans [6]. Fortunately, the mutations that have occurred to date in nature have not made the virus more contagious. Unfortunately, recent research work has been able to introduce genetic material into bird flu viruses that makes these laboratory strains highly transmissible to humans. This information will be discussed in another section.

The virus spreads from bird to bird as infected birds shed flu virus in their saliva, nasal secretions, and droppings. Healthy birds get infected when they come into contact with contaminated secretions or feces from infected birds. Contact with contaminated surfaces such as cages might also allow the virus to transfer from bird to bird. Contact with humans occurs in the same way, mainly by flocks of poultry cultivated by farmers that are exposed to wild birds infected with bird flu. Other people are exposed to the bird flu when, for example, infected birds are processed for sale before they are cooked or if they come in contact with contaminated wild bird droppings or dead birds.

According to the World Health Organization (WHO) and the United Nations Food and Agriculture Organization, H5N1 pathogenicity is gradually continuing to rise in endemic areas, but the avian influenza disease situation in farmed birds is being held in check by vaccination, and there is "no evidence of sustained human-to-human transmission" of the virus.[3] Eleven outbreaks of H5N1 were reported worldwide in June 2008, in five countries (China, Egypt, Indonesia, Pakistan and Vietnam) compared to 65 outbreaks in June 2006, and 55 in June 2007. The global HPAI situation significantly improved in the first half of 2008, but the

FAO reports that imperfect disease surveillance systems mean that occurrence of the virus remains underestimated and underreported [7]. In July 2013, the WHO announced a total of 630 confirmed human cases which resulted in the deaths of 375 people since 2003

Between 2003 and late 2005, outbreaks of subtype H5N1, the most deadly variety of bird flu, occurred among poultry in Cambodia, China, Indonesia, Japan, Kazakhstan, Laos, Malaysia, Romania, Russia, South Korea, Thailand, Turkey, and Vietnam. Hundreds of millions of birds in those countries died from the disease or were killed in attempts to control the epidemics. Similar culling events have taken place since then, including culls in countries in Africa, Asia, and the Middle East [8].

Signs and symptoms of Avian Influenza

In Humans: According to the World Health Organization, more than 850 people were infected with *Avian Influenza* or Bird Flu between 2003 and 2016; more than 50 percent of those individuals died. The majority of human *Avian Influenza* infections and deaths occurred in Egypt, Indonesia, and Vietnam. Small outbreaks of bird flu caused by other subtypes of the virus have also occurred. A person with *Avian Influenza* will develop serious symptoms. The incubation period is from 2 to 8 days, and it can take up to 17 days. This is compared with 2 to 3 days for human seasonal flu. Initial symptoms include a high fever, over 38 degrees centigrade, lower respiratory tract symptoms, and, less commonly, upper respiratory tract symptoms. The following signs and symptoms may occur:

- A cough, usually dry
- Hoarse voice
- A high fever, over 38 degrees centigrade
- A blocked or runny nose
- Aching bones, joints, and muscles
- Bleeding from the nose
- Chest pain
- Cold sweats and chills
- Fatigue
- Headache

- Loss of appetite
- Sleeping difficulties
- Upset stomach, sometimes involving diarrhea
- Bleeding from the gums
- Bloody sputum

Some patients develop pneumonia and breathing difficulties. This occurs around 5 days after the first symptoms appear. The patient's condition can deteriorate rapidly, resulting in pneumonia, multiple organ failure, and death. In general, humans who catch a humanized influenza A virus (a human flu virus of type A) usually have symptoms that include fever, cough, sore throat, muscle aches, conjunctivitis, and, in severe cases, breathing problems and pneumonia that may be fatal [9]. The severity of the infection depends in large part on the state of the infected persons' immune systems and whether they had been exposed to the strain before (in which case they would be partially immune). No one knows if these or other symptoms will be the symptoms of a humanized H5N1 flu.

The avian influenza hemagglutinin binds alpha 2-3 sialic acid receptors, while human influenza hemagglutinins bind alpha 2-6 sialic acid receptors [10]. This means when the H5N1 strain infects humans, it will replicate in the lower respiratory tract, and consequently will cause viral pneumonia [11]. There is as yet no human form of H5N1, so all humans who have caught it so far have caught avian H5N1.

The reported mortality rate of highly pathogenic H5N1 avian influenza in a human is high; WHO data indicate 60% of cases classified as H5N1 resulted in death. However, there is some evidence the actual mortality rate of avian flu could be much lower, as there may be many people with milder symptoms who do not seek treatment and are not counted [12] [13]

In one case, a boy with H5N1 experienced diarrhea followed rapidly by a coma without developing respiratory or flu-like symptoms [14]. There have been studies of the levels of cytokines in humans infected by the H5N1 flu virus. Of

particular concern is elevated levels of tumor necrosis factor-alpha, a protein associated with tissue destruction at sites of infection and increased production of other cytokines. Flu virus-induced increases in the level of cytokines is also associated with flu symptoms, including fever, chills, vomiting and headache. Tissue damage associated with pathogenic flu virus infection can ultimately result in death [15]. The inflammatory cascade triggered by H5N1 has been called a 'cytokine storm' by some, because of what seems to be a positive feedback process of damage to the body resulting from immune system stimulation. H5N1 induces higher levels of cytokines than the more common flu virus types [16].

In birds: Clinical signs of H5N1 in birds range from mild

- Decrease in egg production
- Nasal discharge
- Coughing and sneezing
- To severe, including loss of coordination, energy, and appetite
- Soft-shelled or misshapen eggs
- Purple discoloration of the wattles, head, eyelids, combs, and hocks
- Diarrhea

Sometimes the first noticeable sign is sudden death.

Causes of Avian Influenza (Bird flu)

Avian influenza is spread through direct contact with nasal discharges and feces of an infected bird. Any bird can be infected with this virus, including wild birds, domestic or pet birds, and poultry. Humans can become infected and ill after coming into contact with infected birds. The following have been linked to human illness:

- Touching or defeathering infected birds
- Touching or breathing in feces and other secretions of infected birds
- Preparing infected poultry for cooking
- Slaughtering or butchering infected poultry
- Handling birds for sale
- Attending markets selling live birds

- Eating cooked poultry or eggs does not cause infection.

However, people should cook poultry until the internal temperature is at least 165 degrees Fahrenheit or 74 degrees centigrade, and eggs until both the white and yolk are firm. Bird droppings can contain the virus, and they can contaminate feed, equipment, vehicles, shoes, clothing, soil, dust and water.

Treatment of Avian Influenza

Any bird showing symptoms of avian influenza should be quarantined immediately and separated from the rest of the birds (or humans). The veterinarian will diagnose the bird flu through tests for viral infection. The treatment, however, is dependent on the specific virus infecting the bird. According to the WHO, antiviral medications can suppress viral replication and improve outcomes for patients. Antivirals can prevent some cases from becoming fatal. Oseltamivir (Tamiflu) should be administered within 48 hours after symptoms appear, for best effect. However, as mortality rates are high, doctors may prescribe oseltamivir after this time.

This drug has become a focus for some governments and organizations trying to prepare for a possible H5N1 pandemic [17]. On April 20, 2006, Roche AG announced that a stockpile of three million treatment courses of Tamiflu are waiting at the disposal of the World Health Organization to be used in case of a flu pandemic; separately Roche donated two million courses to the WHO for use in developing nations that may be affected by such a pandemic but lack the ability to purchase large quantities of the drug.

However, [18] has said:

"Even now, we remain unsure about Tamiflu's real effectiveness. As for a vaccine, work cannot start on it until the emergence of a new virus, and we predict it would take six to nine months to develop it. For the moment, we cannot by any means count on a potential vaccine to prevent the spread of a contagious

influenza virus, whose various precedents in the past 90 years have been highly pathogenic"

The dose and length of treatment will depend on how severe the case is. Patients with gastrointestinal problems may not be able to absorb the drug as effectively as others. Studies suggest that some cases may be resistant to this treatment. Patients who are diagnosed with or suspected of having avian flu or should remain at home, or remain isolated in the hospital.

Apart from taking Tamiflu, healthcare professionals advise patients to:

- Rest
- Drink plenty of fluid
- Receive proper nutrition
- Receive medications for pain and fever, prescribed by a health care professional.

Complications, such as bacterial pneumonia, are common in patients with H5N1. These patients will need antibiotics, and some may need extra oxygen.

Prevention of Avian Influenza

There are several avian influenza vaccines for several of the avian H5N1 varieties, but the continual mutation of H5N1 renders them of limited use to date: while vaccines can sometimes provide cross-protection against related flu strains, the best protection would be from a vaccine specifically produced for any future pandemic flu virus strain

Careful handling of or precautions around live or dead birds can help to prevent the spread of disease. It is not possible to prevent bird flu from spreading, but the authorities can help communities prepare for possible infections by monitoring bird migration patterns. Vaccination exists for human seasonal flu, but not for bird flu.

Dr. Daniel Lucey, co-director of the Biohazardous Threats and Emerging Diseases graduate program at Georgetown University has made this point,

"There is no H5N1 pandemic so there can be no pandemic vaccine".[43] However, "pre-pandemic vaccines" have

been created; are being refined and tested; and do have some promise both in furthering research and preparedness for the next pandemic. Vaccine manufacturing companies are being encouraged to increase capacity so that if a pandemic vaccine is needed, facilities will be available for rapid production of large amounts of a vaccine specific to a new pandemic strain. [19] [20] [21]

According to the World Health Organization (WHO), a vaccine for H5N1 exists, but it is not yet ready for widespread use. Individuals can minimize the spread of different types of flu, bird flu and other infections by taking some precautions.

Hand hygiene: Wash hands regularly with warm water and soap before and after using the bathroom, before and after handling food, and after coughing.

Coughing: Cough in to an elbow or a tissue and carefully disposed of the tissue. If you cough into the hand and then touch some item, another person can pick up the virus from that item.

Isolation: Those who are sick should stay away from public places and avoid contact with people, where possible.

Vaccinations: Stay up-to-date especially with the seasonal flu and pneumococcal vaccines.

The WHO note that the seasonal flu jab does not appear to protect against H5N1.

Precautions around birds: When preparing foods, do not use the same utensils for cooked and raw meats. Before and after handling raw poultry, wash your hands with soap and water. Do not go near a dead or sick bird. Call the relevant local authority to report any sightings of dead animals. Those who work with domestic birds should follow local and national guidelines [22] [23]. Anyone traveling to an area where avian influenza may be present should avoid live animal markets and poultry farms, and stay away from bird feces.

CONCLUSION

A human cannot easily become infected with bird flu, and it is even less likely that it will pass from one person to another. However, if a person has seasonal human flu and then becomes co-infected with bird flu, the H5N1 virus could conceivably exchange genetic information with the human flu virus. In this way, H5N1 could gain the ability to spread between people. An easily human-transmissible avian flu virus strain could have serious consequences. Controlling outbreaks of both human and bird flu may help reduce

the likelihood of them coming into contact with each other and creating a new strain.

For any flu-like illness suspected to be due to bird flu virus, call a doctor as soon as possible to see if it is necessary to take an antiviral medication (oseltamivir Tamiflu). The medication may shorten the course of the illness or lessen the symptoms. Be sure to mention if you have had any contact with sick or dead poultry or recent travel to an area of the world currently affected by bird flu.

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