Extension Service
West Virginia University

# Avian Influenza:

## What It Is and How to Protect Against Its Establishment

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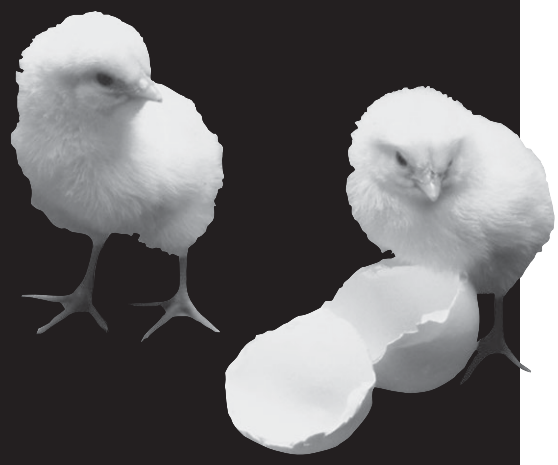

## What is avian influenza?

Avian influenza (AI) is a disease of poultry (both chickens and turkeys) caused by a type A virus belonging to the Orthomyxovirus group. The different types of avian influenza viruses are described and differentiated by the types of hemagglutinin (H) and neuraminidase (N) glycoproteins (surface antigens) on the outer surface of the virus. There are a total of 15 hemagglutinin and 9 neuraminidase types. An AI virus can start out by being of low pathogenicity (LPAI) but mutate without warning to become of high pathogenicity (HPAI) without a change in its H or N subtypes.

The virus tends to lodge in and reproduce in the digestive and reproductive tracts of the birds and is shed from both these sources during the early stages when the disease is acute. When the virus is highly pathogenic, it becomes systemic and invades practically all organs. Like most disease-producing organisms, the virus survives in moist and cool conditions, but it tends to die out in dry conditions and under high temperatures (Kreger, 1996).

## What are the sources of AI?

The AI virus is carried by all types of domestic and wild birds, particularly ducks and shorebirds. Some data show that some exotic birds like ratites also harbor the virus. The virus, however, does not affect these wild birds to the extent that it does commercial birds like chickens and turkeys. Wild birds and waterfowl carry a wide variety of the viruses, which may help to explain why they survive well in these reservoirs and are a constant source of infection. Wild birds and waterfowl contaminate lakes and ponds with their fecal matter, which contains high levels of viruses that survive for long periods in cool, moist environments. In Minnesota, evidence shows that outbreaks in turkeys tend to occur with the presence of migratory ducks.

Live bird markets are also a constant source of the virus (nonpathogenic H5N2 viruses were recovered from some of these markets after the 1983-84 Pennsylvania-Virginia-New Jersey outbreak). These markets tend to be a continuing source of introducing the virus into birds that are sold or purchased through them. Since many backyard flocks are also sold and bought through live bird markets, these flocks are also potential sources of the virus.

The virus is known to survive in manure and litter for long periods (more than three months). The virus is also excreted through nasal secretions and the conjunctiva and therefore is spread through aerosols. As a result, poultry houses and equipment (farm vehicles, egg flats, crates) can be a source after an outbreak if the houses and equipment are not thoroughly cleaned and disinfected. It can also be spread via clothing, footwear, and dust.

Moist and cool conditions encourage the virus's survival, but extremes of heat and dry conditions do not favor it. It is very important that people who have contact with commercial operations and any other affected avian species practice dedicated biosecurity measures (wear appropriate clothing and boot covers, shower in and out, disinfect equipment and vehicles) and generally stay away from uninfected birds.

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## Species affected by avian influenza

All birds are affected – domestic, commercial, caged, and migratory waterfowl. All of them are affected to some degree by the disease, but chickens and turkeys are most adversely affected. Turkeys in North America were first infected in 1963, and serious outbreaks in chickens in the United States occurred in 1929 and 1983-84.

Quail, geese and ducks are also affected but not to the extent that chickens and turkeys are. Of the migratory waterfowl, ducks seem to be the most important reservoir for avian influenza viruses. Ducks seem to pass the viruses to susceptible birds in the wild, so there is always a reservoir in the environment to infect other avian species.

## What are the manifestations of the disease?

The signs and symptoms vary, depending on the type of bird, the dose, and the route of entry, but the disease can start anywhere from a few hours to up to two weeks after exposure, especially in flocks. Symptoms, which can mimic those of other diseases, include sneezing and coughing, increased broodiness, reduced egg production, production of soft-shelled or misshapen eggs, reduced activity, reduced feed consumption, and sometimes an increased sudden mortality without any prior symptoms or causes. Other signs may include increased lacrimation, skin diseases, nervous disorders, and diarrhea. Sometimes there is a swelling of the head, eyelids, combs, wattles, and hocks accompanied by a purple discoloration of the wattles, comb, and legs.

An infection may result in no illness whatsoever, a mild disease, or a highly fatal disease (*Poul. Digest* 1998 Vol. 57, No.1:52). This may be due to the type of virus involved but also, of course, to the age, sex, and health of the birds themselves and whether they carry some other disease. An AI virus can be highly pathogenic for one avian species but not for another.

Like most diseases, some affected birds may show no clinical signs and simply become carriers and continue to shed the virus into the environment.

In the 1983-84 outbreak in Pennsylvania, Virginia, and New Jersey, the virus responsible was an H5N2 subtype, with manifestations being acute respiratory distress, reduced egg production, and mortality from 0-15%. About six months later, the virus (the subtypes did not change) became highly pathogenic, resulting in severe depression, tremors, 100% reduction in egg production, and an increase in mortality up to 89% (Easterday et al. 1997). An outbreak in Mexico with originally low-pathogenic H5N2 AI, started in fall 1993, became highly pathogenic, and was still active in 1995.

## How is AI controlled or contained?

Avian influenza can be contained by rapid depopulation of affected flocks and quarantine of such farms and the use of antibiotics to ward off secondary infections. Vaccinations may be used after the virus has been isolated and confirmed because there is no way of predicting which subtype will be responsible for an exposure. The problem with vaccines is that some vaccinated birds become infected and then become a source of the virus. Therefore, such flocks could help to spread the virus. As a result, use of vaccinations after the disease has actually occurred is not usual.

Rapid, stringent methods and a dedicated application of biosecurity measures can help prevent the widespread dissemination of AI once it gets started. The U.S. Department of Agriculture (USDA) recommends complete destruction of any birds or flocks with clinical, serologic, or virologic evidence of the virus to ensure that any bird or flock with any kind of exposure is eradicated, eliminating a potential source of infection.

Can AI ever be eradicated? The fact that a wide variety of the virus is carried by wild birds and waterfowl makes it difficult to eradicate completely because there is always the chance that infected droppings from such sources can be introduced into backyard and commercial flocks. This is a very good reason why biosecurity measures on all poultry commercial farms be strictly adhered to at all times. Under normal circumstances, it is always a good idea to separate avian species. Simply keeping commercial birds away from domestic and wild birds is a sensible idea.

When AI is discovered in an area, one of the best lines of defense is discouraging people who raise commercial poultry from congregating. This ensures that the virus is limited in how it can spread.

The fact that a low-pathogenic avian influenza virus is responsible for an outbreak is no cause for complacency because the virus can circulate for months and then become highly pathogenic. The emphasis, therefore, is on immediate and total containment and eradication.

## How can the virus be destroyed?

The viruses are not particularly resistant and can be controlled by high heat, dry conditions, and extremes of pH. After facilities are completely and effectively cleaned with detergents (they are protected by organic matter), they can be decontaminated by the use of formalin, sodium hypochlorite, or One-Stroke Environ.

The viruses have been known to survive for long periods in manure and litter so composting or stacking to generate heat will be effective in killing them.

## Does AI infect humans?

Until the outbreak of the Hong Kong avian influenza in 1997, commercial avian influenza viruses had not been known to be transmitted directly from birds to humans even though transmission of influenza virus had occurred between other species (HINI subtypes normally affecting

pigs have caused respiratory disease and reduced egg production in turkeys – Easterday et al. 1997). An influenza A virus related to the avian viruses was responsible for production of conjunctivitis in field and lab workers studying infected seals.

The Hong Kong AI was caused by an H5Nl type A virus in chickens that later infected humans and caused a third of the deaths (6 of 18) of those infected (*Int. Poul. Prodn.* Vol. 6, No. 2:46). This was the first such reported case of influenza being spread from birds to people.

An ongoing outbreak of HPAI has affected both chickens and ducks in several Asian countries since December 2003. These outbreaks – caused by the H5N1 strain – have jumped the species barrier, causing more than 100 human cases and more than 60 deaths in Cambodia, Thailand, Vietnam, and Indonesia. So far, more than 140 million domestic poultry have been destroyed, resulting in economic losses of about $10 billion.

A 2003 AI outbreak in Europe (Netherlands, Belgium, Germany) resulted in the death of one veterinarian from the Netherlands. Several poultry workers contracted conjunctivitis. The H7N7 strain was the responsible virus, which was also found in pigs. Although none of the pigs exhibited clinical signs, there was concern that they could serve as a reservoir for the virus. An AI outbreak in Canada in 2004 caused illness among poultry workers, including conjunctivitis and flu-like symptoms.

With the Asian AI outbreaks not being eradicated and the high rate of mortality, there is concern that these outbreaks could lead to an AI pandemic. Turkey, Romania, and Greece have confirmed finding H5N1 virus within their borders. The disease has also killed birds in the Tula region south of Moscow, Russia, and the northern grasslands of China. East African countries in the path of migratory birds are now taking steps to prevent the disease. Compounding the problem in Southeast Asia is the fact that people live in close proximity to their farm animals. Also, people there have, on occasion, killed and eaten sick birds. The World Health Organization (WHO) and other concerned agencies and countries have held meetings in Ho Chi Minh City, Paris, and Bangkok to try to solve the problem before it gets out of hand. Greece hosted a November 2005 meeting dedicated to coordinating disease response among the Balkan countries. European health ministers plan a summit meeting for December 2005.

## What is the best way to avoid AI in commercial poultry?

Strict adherence to known biosecurity measures, coupled with vigilance in detecting any changes in the well-being of a flock is the best way to avoid AI in commercial poultry. Keep an "all-in, all-out" philosophy of flock management.

Good farming practices – limited access by strangers, good-quality feed and water (poultry should not have access to water contaminated by wild birds), excellent litter conditions, adequate ventilation and heating, good manure/litter handling – all contribute to keeping all diseases at bay. Do not get in the habit of borrowing equipment and supplies from farm neighbors unless you are certain the materials are clean and have been disinfected. Farm vehicles and equipment should be cleaned and disinfected regularly, and farm personnel should have access to clean clothing and disinfection facilities. Boots and boot covers should be cleaned well before being disinfected in boot dips.

It is an excellent idea to avoid contact with wild birds, waterfowl, exotic birds, and birds or people who frequent live bird markets.

If and when AI does infect a commercial flock, the best thing to do is quickly isolate the farm, depopulate it, and clean, disinfect, and quarantine the farm until tests result in negative culture. This is very important even when the virus responsible is not virulent because in both the 1983 and 1993 outbreaks in Pennsylvania and Mexico, respectively, a nonvirulent virus mutated into a highly virulent one with drastic consequences.

The time needed for a nonpathogenic or low-pathogenic virus to become highly pathogenic also varies. In the 1983-84 outbreak in Pennsylvania, the virus took more than six months to become highly pathogenic. Even when an AI outbreak is found to be caused by a low-pathogenic subtype, it is important to take all measures to contain and eradicate it, if possible, before it gets the chance to mutate into a highly pathogenic subtype. Always report suspicious signs to company representatives or field technicians. Additional information about HPAI may be obtained from WVU Extension county offices and the W.Va. Department of Agriculture (WVDA). You may also call 301-734-8073.

## What is the effect of avian influenza on the poultry industry?

Apart from the AI outbreak of 1929, there have been other AI outbreaks in the United States to date: in Alabama (1975), Minnesota (1979), Pennsylvania (1983-84), Virginia and West Virginia (2002), Connecticut, and Rhode Island (2003), and Delaware, New Jersey, Pennsylvania, Maryland, and Texas (2004). The ultimate impact on the industry is enormous because of the easy manner in which it can be spread, resulting in the widespread infection of many farms.

Since affected farms have to be depopulated, cleaned, disinfected, and allowed to sit without birds until they test negative, farmers lose a lot of income. Consumers pay an increased price for meat and eggs (retail prices of eggs increased by more than 30% after the 1983-84 Pennsylvania outbreak) because of reduced numbers of birds and reduced

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egg production. Trade embargos from neighboring states and other countries result in a loss of jobs for individuals and revenue for farmers, companies, poultry-producing states, and the affected country. State and federal officials commit extra time, personnel, and money to help test flocks, depopulate farms, disinfect them, and institute quarantine procedures. All this costs money. The ultimate result is economic in terms of money spent to control and eradicate the disease, as well as actual loss of birds, eggs, and income for farmers, poultry companies, and allied industry. The 1983-84 Pennsylvania outbreak cost about $65 million and resulted in the destruction of about 17 million birds.

Even when economic losses can be quickly overcome, it is difficult to regain the trust and relationship with trading partners whose primary aim is to protect their flocks and industry. It takes a while because people want to be certain that infectious diseases such as this are completely eradicated before they continue with business as usual. For all these reasons, it is imperative that everything is done to avoid introducing this disease into a community and also to contain it once it does get into a community.

## What is the USDA doing about AI?

The U.S. Department of Agriculture's Agricultural Research Service (ARS) supports Animal and Plant Health Inspection Service (APHIS), Centers for Disease Control and Prevention (CDC), and the poultry industry with programs, research, and technical assistance. ARS scientists are working to classify AI viruses from around the world in terms of their disease-causing potential. They are also evaluating techniques to determine those that have the potential to mutate into deadlier forms. In addition, ARS is developing vaccines and helping drug companies to develop and obtain approval for other vaccines.

In May 2004, APHIS received $13.7 million from USDA to address AI concerns. Of this, about $10.8 million will be used in developing a national control and preventive program for LPAI.

USDA is working closely with WHO, the Food and Agricultural Organization, the World Bank, and the World Organization for Animal Health/l'Office International des Epizooties (OIE) to help affected countries eradicate the disease outbreaks, thereby reducing the likelihood of the disease entering the United States. Domestically, restrictions have been placed on importation of poultry and poultry products from affected countries, and APHIS has increased monitoring to detect smuggling of illegal poultry and poultry products.

In the event of an outbreak of HPAI (H5N1) in this country, APHIS will work with an interagency group of state and private veterinarians, federal personnel, and state and local officials to contain the outbreak. After an outbreak is eradicated, APHIS will work to have foreign governments reopen their markets to U.S. poultry and work with states to provide indemnity payments to poultry producers.

The most important action is to strictly adhere to biosecurity measures. Owners of flocks having access to open spaces may want to make sure their flocks are not close to areas frequented by wild birds. They should immediately report any changes in health status of flocks or suspicious increases in deaths of wild or migrating birds. Health personnel and others who deal with sick birds or flocks should wear appropriate protective apparel. For more information about the type of apparel to use, contact the WVDA, the USDA, or the CDC.

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