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Avian Influenza: Agricultural Issues

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Summary

Since the fall of 2003, a strain of highly pathogenic avian influenza (H5N1) has spread throughout Asia, infecting mostly poultry but also a limited number of humans. In recent months, the virus has spread into parts of Europe. Controlling avian flu in poultry is seen as the best way to prevent a human pandemic from developing, by reducing the number of animal hosts in which the virus may evolve.

Avian flu can be highly contagious in domestic poultry. Strict biosecurity measures are practiced among commercial poultry farms and are encouraged by governments. The economic effects of any avian influenza outbreak can be significant, especially given international trade restrictions.

This report mainly covers flu in poultry, and will be updated. For more on human issues, see CRS Report RL33145, *Pandemic Influenza: Domestic Preparedness Efforts*, by Sarah A. Lister.

Status of Avian Influenza Outbreaks

In the United States. The highly pathogenic H5N1 strain of current global concern has not reached the United States, neither in poultry nor humans. The most recent cases in domestic poultry, with three unrelated and less pathogenic strains, were in 2004.

To reduce the possibility that H5N1 enters U.S. borders, the U.S. Department of Agriculture (USDA) has blocked imports of poultry and poultry products from affected countries. The Department of Homeland Security helps with enforcement through Customs and Border Protection. Surveillance of migratory birds is increasing.[1]

In the Rest of the World. Since December 2003, several Asian countries have had confirmed outbreaks of H5N1 in poultry, including Vietnam, Thailand, Indonesia,

[1] For domestic issues related to avian flu in poultry, see the U.S. Department of Agriculture (USDA) at [http://www.aphis.usda.gov/lpa/issues/avian_influenza]. For background on human issues, see the Centers for Disease Control (CDC) at [http://www.cdc.gov/flu/avian].

Cambodia, China and Hong Kong, South Korea, Malaysia, Laos, and Japan. Since the summer of 2005, H5N1 spread westward and has been confirmed in at least five new countries: Russia, Kazakhstan, Turkey, Romania, and Croatia. Wild birds are one of the main carriers, but their role is not completely understood. The risk and likelihood of the virus spreading into Africa and the Middle East is increasing. Other countries on migratory bird routes are increasing surveillance efforts.

The situation in Asia is historically unprecedented and extremely challenging. The U.N. Food and Agriculture Organization (FAO) estimates that over 130 million birds have died or been culled in Asia. Some countries were reluctant to acknowledge the disease for fear of economic consequences. In other countries, lack of compensation for farmers whose flocks are destroyed has been a disincentive to report outbreaks early. In some parts of Asia, about 80% of the poultry are produced in small backyard farms.[2]

International Control Efforts. As H5N1 spreads, it may become endemic in countries with low levels of veterinary services or animal husbandry practices that harbor the virus. Chances increase that the virus will evolve through mutation or reassortment into a strain that could be transmitted easily between humans. Thus, FAO and the World Health Organization (WHO) developed a strategy calling for the swift and coordinated control of avian flu in poultry as the best way to prevent or delay a human pandemic from developing, by reducing the number of animal hosts in which the virus may evolve.[3]

Two Forms with Many Strains

Avian influenza (AI) viruses exist throughout the world in many different strains. Avian flu is an Influenza A virus that infects birds, and certain strains have been known to infect both animals and humans. Avian flu is characterized by two forms in birds:[4]

- a low pathogenicity (LPAI) form that causes mild illness, and
- a highly pathogenic (HPAI) form that is extremely contagious, causes severe illness, and frequently has high rates of mortality.

Both forms are possible in several strains. Strains are identified by two surface proteins designated by the letters H and N.[5] Some low pathogenicity strains (H5 and H7)

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[2] For international issues, see the World Health Organization (WHO) [http://www.who.int/csr/disease/avian_influenza/en], U.N. Food and Agriculture Organization (FAO) [http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/special_avian.html], and the World Organization for Animal Health (OIE) [http://www.oie.int/eng/avian_influenza].

[3] "A Global Strategy for the Progressive Control of Highly Pathogenic Avian Influenza (HPAI)," FAO and OIE, in cooperation with WHO, November 2005 [http://www.fao.org/ag/againfo/subjects/documents/ai/HPAIGlobalStrategy31Oct05.pdf].

[4] Tests for pathogenicity are conducted in two ways: through genetic (DNA) sequencing, and by inoculating healthy chickens and monitoring their immune response and mortality over a 10-day period. HPAI strains can result in greater or lesser rates of mortality, perhaps ranging from 30-100%. LPAI strains typically do not exceed 10-20 percent mortality.

[5] The surface proteins are called hemagglutinin and neuraminidase, abbreviated H and N. Sixteen H subtypes and nine N subtypes have been identified, and they can occur in any combination.

are capable of mutating into highly pathogenic strains, and thus are treated aggressively. For example, in Italy in 1999, an H7 LPAI virus mutated into HPAI within nine months.

Because LPAI is endemic in wild birds, low pathogenicity outbreaks are not unusual. The 2004 domestic outbreaks included low pathogenicity strains of H7N2 in Delaware, Maryland, and New Jersey, and H2N2 in Pennsylvania. A strain classified as highly pathogenic H5N2 was found in Texas, although it did not manifest as highly pathogenic. Other recent outbreaks in U.S. poultry include low pathogenicity H7N2 in Connecticut and Rhode Island in 2003, and in Virginia, West Virginia, and North Carolina in 2002. Only three highly pathogenic domestic outbreaks have occurred (1924, 1983, and 2004).

Transmission

Wild birds are the primary natural reservoir for Influenza A viruses and are often the vector that introduces new outbreaks into domestic flocks. Wild birds often are resistant to the virus and do not show clinical symptoms. The role of migratory birds is of increasing concern, although, in the past, scientists have not been sure that infected birds were able to migrate long distances.

Avian flu can be highly contagious in domestic poultry. The virus is spread by contact with infected feces, nasal, or eye excretions. Once present in domestic flocks, human activity becomes a risk for further transmission as people, clothing, vehicles, and supplies move between farms. Thus, strict biosecurity measures are practiced among commercial poultry farms and are encouraged by USDA and international organizations.[6]

In the United States, avian flu viruses have been common in live bird markets concentrated in ethnic or urban areas. Biosecurity practices can often be lacking or insufficient if birds and equipment intermingle in the market or move back to farms. Thus sanitation of crates, periodic disinfection of the market, and restrictions on moving birds back into general farm populations are needed. USDA has focused on these markets as one of the first places to control the disease. Live bird markets are a small portion of the U.S. poultry industry (about 0.25%), but the frequency of outbreaks is of concern to the majority of commercial growers practicing tighter biosecurity protocols. In Asia, a larger network of live bird markets and the much larger number of small backyard farms have posed significant problems for eradicating the disease.

Human Infection. Certain strains of avian flu can infect humans through poultry-to-human transmission, usually through contact with fecal matter or other live bird excretions. The World Health Organization (WHO) and the World Organization for Animal Health (OIE) conclude that avian flu is not a food-borne disease since the virus is killed by the temperature reached in normal cooking. The Centers for Disease Control and Prevention (CDC) recommends standard food safety practices.

The human disease caused by H5N1 differs from typical human flu. H5N1 can replicate in a wide range of cells, more so than the usual flu virus. This can result in a severe disseminated disease affecting multiple organs, which has caused high rates of

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[6] For biosecurity recommendations, see the USDA "Biosecurity for the Birds" website at [http://www.aphis.usda.gov/vs/birdbiosecurity/hpai.html].

mortality. The human vaccine currently available for mass inoculation in the fall of 2005 does not protect against H5N1; vaccine trials and development are underway. Public health professionals are concerned that the virus could mutate or combine with human flu viruses to allow efficient human-to-human transmission.

The number of human cases of H5N1 confirmed by WHO during the current outbreak (December 2003-November 17, 2005) totals 130, resulting in 67 deaths (a 51% mortality rate). Five countries have had human cases. Vietnam (92 cases, 42 deaths) and Thailand (21 cases, 13 deaths) have the most, with Indonesia, Cambodia, and China having fewer. Some scientists believe that if the virus evolves to allow human-to-human transmission, the mortality rate may decline, but whether this happens remains unknown.

The first human cases of H5N1 were in Hong Kong in 1997 (18 cases, 6 deaths). Two other strains are documented to cause human illness: H7N7 in the Netherlands in 2003 (83 cases, 1 death), and H9N2 in Hong Kong in 1999 and 2003 (3 cases).

In the United States, the 2002 low pathogenic outbreak in poultry in Virginia resulted in limited evidence of one human case. A man involved in the poultry depopulation effort was found to have antibodies for H7N2 avian flu. In the fall of 2003, a man from Westchester County, New York, contracted and recovered from H7N2 avian flu.

Control

Controlling avian flu in poultry through prevention and eradication is done domestically by individual farmers in cooperation with state and federal governments, and with industry associations. The USDA Animal and Plant Health Inspection Service (APHIS) is the lead federal agency.

Internationally, FAO has a joint response plan with WHO for the current outbreak (see footnote 3). The $140 million, three-year plan is being implemented but is not fully funded by donor countries. The United States has pledged about $25 million.

Preventing Infection. Biosecurity practices are the most important means of preventing outbreaks in poultry. This includes preventing access of wild birds to domestic flocks and limiting access to farm buildings by outside conveyances. For example, delivery trucks and personnel are cleaned and disinfected before entering a farm's biosecure area. In Asia and other parts of the world, the large number of small farms or backyard flocks without biosecurity practices has posed greater problems for control. Such animal husbandry practices are slow to change.

Eradicating Outbreaks. Because the virus is highly contagious and easily spread in poultry, the most common method of control after there is an outbreak is culling (also called "stamping out," depopulating) the infected flocks, and certain flocks in close proximity to the infected flock. Federal statute allows such destruction of animals (9 CFR 53.4). Quarantines of surrounding areas are imposed (usually by state authorities) until the disease is eradicated. Following depopulation, buildings and equipment are rigorously disinfected before new birds are allowed, a process that takes at least several weeks. The virus is killed by common disinfectants or heat (about 160 degrees F).

Vaccines. While vaccination of poultry is possible and has been used on a small scale with some success, it generally is not considered a sufficient control method. Vaccination poses problems for international trade as many countries will not import poultry products from other countries that use vaccination, since animals will test positive for antibodies. If vaccination is not administered and monitored correctly, it can allow the virus to become endemic and continue to spread or mutate.[7]

In November 2005, USDA has a stockpile of 40 million doses of vaccine (for two types of H5 and two types of H7 viruses). The Administration's recent funding request for avian flu (discussed below) includes a proposal to double USDA's stockpile.

Federal Response to Domestic Outbreaks. Domestic outbreaks usually are managed through joint federal, state, and industry cooperation. States usually lead the response in terms of depopulation and quarantines. APHIS provides personnel and equipment to advise and supplement state resources. In highly pathogenic outbreaks, APHIS may take a larger role. The USDA National Veterinary Services Lab (NVSL) conducts confirmatory tests on the pathogenicity and type of virus. USDA also works to limit export restrictions (such as to states or counties) and reopen export markets.

Indemnities to Farmers. Compensation programs are desired to encourage farmers to report outbreaks and cooperate with control programs when culling is needed. States generally manage indemnification programs for low pathogenicity outbreaks. Some industry associations, such as those on the Delmarva peninsula (Delaware, Maryland, and Virginia), have compensation funds. In the past, USDA has not had a compensation program for LPAI.[8] However, a new federal program is being developed following increased appropriations in FY2005 for a low pathogenicity program. USDA's standard indemnification for low pathogenicity programs is 50% of fair market value. For highly pathogenic outbreaks, statute allows USDA to offer 100% indemnification (9 CFR 53.2).

Federal Appropriations to Control Avian Flu in Poultry

Federal appropriations for avian flu have grown significantly. In FY2004, Congress provided APHIS with $994,000 for avian flu for monitoring and control. During the 2004 outbreak, USDA used emergency authority to release $13.7 million of Commodity Credit Corporation (CCC) funds to accelerate its avian flu plans. In FY2005, Congress appropriated APHIS $23.8 million for avian flu, with about half for an indemnity reserve. For FY2006, the new APHIS appropriation for avian flu is $13.8 million. The conference agreement for agriculture appropriations (H.R. 2744, H.Rept. 109-255) notes that $28.3 million is available, including carryover, with about $12 million for indemnities.

For international aid, the Emergency Supplemental Appropriations Act of 2005 (P.L. 109-13) provided $25 million to the U.S. Agency for International Development (USAID)

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[7] See two journal articles by scientists at the World Organization for Animal Health (OIE): Ilaria Capua and Stephano Marangon, "Vaccination for avian influenza in Asia," *Vaccine*, 22 (2004), 4137-7138 [http://www.oie.int/eng/avian_influenza/vaccination%20in%20Asia.pdf], and Ilaria Capua & Stephano Marangon, "The use of vaccination as an option for the control of avian influenza," May 2003, [http://www.oie.int/eng/avian_influenza/A_71%20SG_12_CS3E.pdf].

[8] A limited indemnification program was created for an LPAI outbreak in 2002 (9 CFR 53.11).

and CDC to combat the spread of avian flu. Conferees encourage cooperation with FAO and WHO on a joint international plan (the FAO/WHO plan mentioned in footnote 3).

On November 1, 2005, President Bush submitted a request for $7.1 billion in emergency funding to address avian flu in both humans and poultry. Of this amount, $91 million (1.3%) would go to USDA. This includes $73 million for APHIS for domestic activities, $7 million for the Agricultural Research Service, and $11 million for international activities (in the form of technical assistance on surveillance, biosecurity, culling, vaccination, and control).

Congressional Hearings. The House and Senate agriculture committees held hearings on avian influenza on November 16 and 17, 2005, respectively. Witnesses from the Administration, academia, and industry reviewed efforts to prevent and control avian flu outbreaks.[9]

Economic Impacts

The economic effects of any avian influenza outbreak can be significant. Direct costs include expenses to cull birds and quarantine farms, and lost production on affected farms. However, larger economic effects arise from international trade bans which can cause price changes that affect farms outside the quarantine area. If consumer confidence remains high, demand for healthy poultry may rise; but if consumer confidence lags, poultry prices may drop. Markets for substitute meats may also be affected, as can markets for feed such as corn (both domestic and exported).

The United States is the world's largest producer and exporter of poultry meat and the second-largest egg producer. USDA estimates that about 8.5 billion broilers were produced in 2003, and farm sales of poultry were worth $23.3 billion (out of $105 billion for all livestock, and $200 billion including crops). Broiler production was $15.2 billion, followed by eggs at $5.3 billion, and turkeys at $2.7 billion. Five states account for 60% of U.S. production: Georgia (15%), Arkansas (14%), Alabama (13%), Mississippi (9%), and North Carolina (9%). The U.S. exports about 16% of its poultry production.

No economic estimates of an H5N1 outbreak in the United States are provided because of the highly uncertain nature of any possible, hypothetical outbreak. The 1983-84 outbreak of highly pathogenic avian flu in the United States caused the destruction of 17 million birds and cost $65 million. In the small 2004 domestic outbreak, about 400,000 chickens were depopulated in the United States. While this was less than 0.02% of U.S. broiler production, the effect on local regions and farms was much greater.

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[9] The statement of the APHIS Administrator, the witness at the House hearing, is available at [http://agriculture.house.gov/hearings/109/h51116w1.pdf]. Statements from Senate witnesses are available at [http://agriculture.senate.gov/Hearings/hearings.cfm?hearingId=1691].