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Avian Influenza: Agricultural Issues

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Summary

A strain of highly pathogenic avian influenza (H5N1) has spread throughout Asia since 2003, infecting mostly poultry but also a limited number of humans. The virus reached Europe in 2005, and the Middle East and Africa in 2006. Officials believe this strain may enter North America later in 2006 through migratory flyways. Avian flu is highly contagious in domestic poultry, prompting strict biosecurity measures. International trade restrictions can cause significant economic effects.

A different strain of H5N1 was found in wild swans in Michigan in August 2006. This low pathogenicity strain does not pose the same threat as highly pathogenic H5N1.

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. This report mainly covers avian flu in poultry, and will be updated.

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:[1]

- 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, designated by the letters H and N.[2] Some low pathogenicity strains (H5 and H7) can become highly pathogenic, and thus are treated aggressively. In Italy in 1999, an H7 LPAI virus mutated into HPAI within nine months.

[1] Pathogenicity is determined by genetic sequencing, and by inoculating healthy chicks and monitoring them. HPAI mortality ranges from 30-100%; LPAI mortality is usually less than 20%.

[2] Surface proteins, called hemagglutinin and neuraminidase, are abbreviated H and N. Sixteen H subtypes and nine N subtypes have been identified. They can occur in any combination.

Low pathogenicity outbreaks are not unusual since LPAI is endemic in wild birds. The most recent cases in U.S. poultry were in 2004 with LPAI strains of H7N2 in Delaware, Maryland, and New Jersey, and H2N2 in Pennsylvania. An H5N2 strain classified as HPAI was found in Texas, although it did not manifest as such. Other cases include low pathogenicity H7N2 in the Northeast in 2003, and in the mid-Atlantic in 2002. Only three HPAI outbreaks have occurred domestically (1924, 1983, and 2004).

Status of Avian Influenza Outbreaks

In the United States.[3] The highly pathogenic H5N1 strain of current global concern has not reached the United States, neither in poultry, wild fowl, nor humans. To reduce this possibility, the U.S. Department of Agriculture (USDA) has blocked imports of poultry and poultry products from affected countries, and increased smuggling interdiction efforts. The Department of Homeland Security helps with enforcement.

Since wild birds can carry the disease, USDA and the Department of the Interior have increased wild bird surveillance where flyways overlap because officials suspect migrating birds in Asia could carry the virus to Alaska, and down North American flyways in the fall of 2006. However, USDA's Office of Inspector General identified gaps in the surveillance plan.[4] Steps have been taken subsequently to improve surveillance.

In August 2006, USDA confirmed that two wild mute swans in Michigan tested positive for a low pathogenicity strain of H5N1. The swans showed no signs of sickness and were tested as part of the expanded surveillance program. This LPAI strain does not threaten poultry or humans like highly pathogenic H5N1, and is not in commercial flocks.

Congressional Hearings. The House and Senate agriculture committees held hearings on avian influenza on November 16 and 17, 2005, respectively. Administration, industry, and academic witnesses reviewed prevention and control efforts. The Senate committee held another hearing to review avian flu preparedness on May 11, 2006.[5]

In the Rest of the World.[6] Since December 2003, at least 10 Asian countries have had confirmed outbreaks of highly pathogenic H5N1 in poultry. In 2005, the virus spread westward towards eastern Europe, being confirmed in six new countries. In 2006, it spread to dozens of new countries in Europe, the Middle East, and Africa.

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[3] See the U.S. Department of Agriculture (USDA) at [http://www.usda.gov/birdflu],and the Centers for Disease Control and Prevention (CDC) at [http://www.cdc.gov/flu/avian].

[4] USDA-OIG, *Animal and Plant Health Inspection Service Oversight of Avian Influenza* (Audit Report 33099-11-Hy), June 2006 [http://www.usda.gov/oig/webdocs/33099-11-HY.pdf].

[5] House Agriculture Committee, "*Review Issues Related to the Prevention, Detection, and Eradication of Avian Influenza*," Serial No. 109-21, November 16, 2005. Senate Agriculture Committee, *Avian Influenza: Role of U.S. Agriculture to Control and Eradicate*, November 17, 2005; and *USDA Avian Influenza Plan Review*, May 11, 2006.

[6] For international issues, see the World Health Organization (WHO) [http://www.who.int/en], U.N. Food and Agriculture Organization (FAO) [http://www.fao.org], and the World Organization for Animal Health (OIE) [http://www.oie.int].

The H5N1 outbreak is historically unprecedented and extremely challenging. The U.N. Food and Agriculture Organization (FAO) estimates that over 200 million birds have died or been culled. 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.

International Control Efforts.[7] 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.

Transmission

Wild birds are the primary natural reservoir for Influenza A viruses and often are resistant to the virus. Domestic flocks can be infected by contact with wild birds. Avian flu is highly contagious in domestic poultry. The virus is spread by contact with infected feces, nasal, or eye excretions. People, clothing, vehicles, and supplies can carry the virus between farms. Thus, strict biosecurity measures are adopted by nearly all U.S. commercial poultry farms.[8] Confined poultry sheds prevent contact with wild birds.

Avian flu viruses have been common in live bird markets. These markets sell less than 1% of U.S. poultry, but outbreaks concern commercial growers who practice tighter biosecurity. USDA has focused on these markets because insufficient biosecurity allowed birds and equipment to intermingle at the market and return to farms. In Asia, a large network of live bird markets and backyard farms have made eradication difficult.

Human Infection.[9] Certain avian flu strains, including H5N1, can infect humans through close poultry-to-human transmission, usually through with fecal matter or other live bird excretions in backyard settings or home slaughtering. However, the species barrier is significant. The human disease caused by H5N1 causes rapid deterioration and fatality from viral pneumonia and organ failure. Officials worry that the virus could mutate or combine with human flu viruses to allow efficient human transmission.

Food Safety. No epidemiological evidence exists indicating that people have been infected with any avian flu virus, including H5N1, from properly cooked poultry or eggs.

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[7] "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], and "Avian Influenza Control and Eradication: FAO's Proposal for a Global Programme," FAO, Jan. 2006 [http://www.fao.org/ag/againfo/subjects/documents/ai/Global_Programme_Jan06.pdf]. See also CRS Report RL33219, *U.S. and International Responses to the Global Spread of Avian Flu: Issues for Congress.*

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

[9] For more on human issues, see CRS Report RL33145, *Pandemic Influenza: Domestic Preparedness Efforts*, by Sarah A. Lister.

The virus is killed at conventional cooking temperatures (160 degrees F), making properly cooked poultry safe. However, highly pathogenic viruses such as H5N1 can spread to nearly all parts of an infected bird, survive in raw poultry, and be spread if contaminated poultry is marketed and prepared.[10] Yet, with commercial poultry production under strict veterinary control, such as in the United States, infected poultry are very unlikely to enter the food chain. Infected flocks are destroyed and not slaughtered for food. Thus, the Centers for Disease Control and Prevention (CDC) and the USDA recommend standard food safety practices such as those for preventing infection from *Salmonella* and *E.coli.*[11]

Control

Avian flu is controlled domestically through prevention and eradication by individual farmers cooperating with industry associations and state and federal governments. 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.

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. For example, delivery trucks and personnel are cleaned and disinfected before entering a farm's biosecure area. In other parts of the world, small farms or backyard flocks without biosecurity practices have posed greater problems for control. Such animal husbandry practices are slow to change.

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.[12]

In the United States, vaccination is most likely to be used for breeding poultry, egg layers, and other higher value birds. Vaccination in a ring surrounding an eradication zone is another possible vaccination strategy.

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[10] WHO, "Avian Influenza (AI): Food Safety Prevention Measures", accessed May 3, 2006 at [http://www.euro.who.int/eprise/main/WHO/Progs/FOS/Microbiological/20041019_1], and "Highly Pathogenic H5N1 Avian Influenza Outbreaks: Food Safety Implications," Nov. 4, 2005, [http://www.who.int/foodsafety/fs_management/No_07_AI_Nov05_en.pdf].

[11] USDA Fact Sheet, "Avian Influenza," March 2006, [http://www.usda.gov/wps/portal/usdahome?contentidonly=true&contentid=2005/11/0511.xml].

[12] Savill et al., "Silent spread of H5N1 in vaccinated poultry," *Nature*, 442: 17 (August 2006), p. 757, at [http://www.nature.com/nature/journal/v442/n7104/pdf/442757a.pdf]. Capua and Marangon, "Vaccination for avian influenza in Asia," *Vaccine*, 22 (2004), 4137-7138, at [http://www.oie.int/eng/avian_influenza/vaccination%20in%20Asia.pdf], and Capua and 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].

In November 2005, USDA had a stockpile of 40 million doses of vaccine (for two types of H5 and two types of H7 viruses). USDA plans to double this stockpile with supplemental funds appropriated for avian flu in December 2005 (discussed below).

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," or depopulating) the infected flocks, and certain flocks in close proximity to the infected flock. 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).

Domestic outbreaks usually are managed through joint federal, state, and industry cooperation. States usually lead the response in terms of depopulation and quarantines of surrounding areas which are imposed until the disease is eradicated. APHIS provides personnel and equipment to advise and supplement state resources. In highly pathogenic outbreaks, APHIS may take a larger role. Federal statute allows the destruction of affected animals (9 CFR 53.4). 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.[13] However, a new low pathogenicity indemnification program was begun in FY2005 and final regulations are expected in 2006. USDA's standard indemnification rate for low pathogenicity programs is 50% of fair market value, which may supplement state or industry compensation. For highly pathogenic outbreaks, regulation allows USDA to offer 100% indemnification (9 CFR 53.2).

Federal Appropriations to Control Avian Flu in Poultry

For FY2007, USDA requests $82 million for avian flu: $77 million for APHIS and $5.4 million for agricultural research. Of the amount for APHIS, $56.7 million would be for a new HPAI monitoring and surveillance program, and $16.7 million for LPAI. The Senate-reported appropriations bill (H.R. 5384) concurs with the HPAI request, but provides $3 million less for LPAI. The House-passed bill concurs with the LPAI request, but provides $9.5 million less than requested for HPAI.

For FY2006, the regular appropriation to APHIS for its LPAI program is $13.8 million (but with carryover, $28.3 million is available, with about $12 million for indemnities; P.L. 109-97, H.Rept. 109-255). In addition, Congress appropriated USDA $91.4 million in emergency supplemental funds as part of $3.8 billion for pandemic influenza (Division B, Title II, of P.L. 109-148). From the supplemental, APHIS received $71.5 million for domestic surveillance, diagnosis, and vaccine stockpiles; and international technical assistance for surveillance, biosecurity, and control.

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

In FY2005, Congress appropriated APHIS $23.8 million for avian flu, with about half for the indemnity reserve. In FY2004, APHIS received a $1 million appropriation, and USDA transferred $13.7 million in emergency funds during the 2004 outbreak.

In other international, agricultural aid, the Emergency Supplemental Appropriations Act of 2005 (P.L. 109-13) provided $25 million to the U.S. Agency for International Development (USAID) and CDC to combat avian flu. Conferees encourage cooperation with FAO and WHO on a joint international plan (footnote 6).

Economic Impacts

Avian flu can affect the agricultural economy significantly. Usually, direct costs include culling birds and quarantining farms. Larger economic effects arise from international trade bans which affect farms outside the quarantine area. However, in the current H5N1 outbreak, global consumer confidence is increasingly at stake despite official statements that normal cooking would kill any virus if it was present.

With strong consumer confidence, demand for healthy poultry may rise. But weak consumer confidence could depress poultry prices and raise demand for substitute meats. In a recent domestic survey, 46% of chicken eaters said they would stop eating chicken and 25% said they would eat less chicken if avian flu entered the United States.[14] In 2006, consumer demand for poultry dropped in Europe and Africa. Lower shipments to Eastern Europe and Central Asia depressed U.S. poultry prices in 2005.[15]

Demand for feed such as corn and soy meal is tied to poultry production. Poultry account for about one-third of total world feed use. So far, the global impact on feed consumption has been limited due to relatively quick recovery of production where outbreaks were contained, since the production cycle is quite short (about eight weeks).

The United States is the world's largest producer and exporter of poultry meat and the second-largest egg producer. About 8.5 billion broilers are produced, worth over $23.3 billion on the farm (22% of farm livestock sales, and 12% of total farm sales including crops). Broiler production accounts for about $15 billion, eggs $5 billion, and turkeys nearly $3 billion. Five states account for 60% of U.S. production: Georgia (15%), Arkansas (14%), Alabama (13%), Mississippi (9%), and North Carolina (9%). About 16% of U.S. poultry production is exported.

No economic estimates of an H5N1 outbreak in the United States are provided because the extent of such an outbreak is highly uncertain.

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[14] Harvard School of Public Health, "Project on the Public and Biological Security," January 17-25, 2006, [http://www.hsph.harvard.edu/press/releases/press02232006.html].

[15] FAO, "Escalating bird flu crisis jeopardizes global poultry trade prospects," Feb. 28, 2006 [http://www.fao.org/newsroom/en/news/2006/1000240/index.html], and USDA Economic Research Service, "Livestock, Dairy, and Poultry Outlook," February 15, 2006 (monthly), [http://www.ers.usda.gov/publications/ldp].