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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 H5N1 may enter North America later in 2006 through migratory flyways. Avian flu is highly contagious in domestic poultry. Strict biosecurity measures are practiced by commercial poultry farms and encouraged by governments. The economic effects of avian flu outbreaks can be significant, especially given international trade restrictions.

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. Strains are identified by two surface proteins designated by the letters H and N.[2] Some low pathogenicity strains (H5 and H7) 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.

[1] Tests for pathogenicity are conducted through genetic (DNA) sequencing, and by inoculating healthy chicks and monitoring their immune response and mortality. HPAI strains can result in mortality ranging from 30-100%. LPAI mortality typically does not exceed 10-20%.

[2] 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.

Low pathogenicity outbreaks are not unusual since LPAI is endemic in wild birds. The most recent domestic cases 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 highly pathogenic. 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 nor humans. 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, and increased smuggling interdiction efforts. The Department of Homeland Security helps with enforcement through Customs and Border Protection.

Since wild birds can carry the disease, the United States has increased surveillance where flyways overlap because officials suspect migrating birds in Asia could carry the virus to Alaska this spring, and down the Pacific and other flyways in the fall of 2006.

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.[4]

In the Rest of the World.[5] Since December 2003, at least 10 Asian countries have had confirmed outbreaks of H5N1 in poultry, including Vietnam, Thailand, Indonesia, Cambodia, China and Hong Kong, South Korea, Malaysia, Laos, and Japan. In 2005, H5N1 spread westward, being confirmed in six new countries: Russia, Ukraine, Kazakhstan, Turkey, Romania, and Croatia. In 2006, H5N1 spread further into Europe, and entered the Middle East and Africa, being confirmed in 33 new countries: 17 in domestic poultry (Afghanistan, Pakistan, India, Myanmar, Azerbaijan, Albania, France, Germany, Israel, Palestinian Autonomous Territories, Jordan, Egypt, Nigeria, Niger, Burkina Faso, Cameroon, and Côte d'Ivoire), and 16 in wild birds (Bulgaria, Greece, Slovenia, Bosnia-Herzegovina, Serbia-Montenegro, Hungary, Slovakia, Czech Republic, Austria, Italy, Switzerland, Poland, Denmark, United Kingdom, Georgia, and Iran). Iraq, Sudan, and Sweden have confirmed H5 outbreaks, but the subtype is not confirmed.

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

[4] House Agriculture Committee, "*Review Issues Related to the Prevention, Detection, and Eradication of Avian Influenza*," Serial No. 109-21, November 16, 2005 [http://agriculture.house.gov/hearings/109/10921.pdf]. Senate Agriculture Committee, "Avian Influenza: Role of U.S. agriculture to control and eradicate," November 17, 2005 [http://agriculture.senate.gov/Hearings/hearings.cfm?hearingId=1691].

[5] 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].

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.[6] 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. The role of migratory birds is of increasing concern, given the spread of the disease in 2006.

Avian flu is highly contagious in domestic poultry. The virus is spread by contact with infected feces, nasal, or eye excretions, and when people, clothing, vehicles, and supplies carry the virus between farms. Thus, strict biosecurity is practiced successfully by commercial poultry farms.[7] Confined poultry sheds prevent contact with wild birds.

In the United States, avian flu viruses have been common in live bird markets. Insufficient biosecurity allows birds and equipment to intermingle at the market and move back to farms. Sanitation of crates, periodic disinfection of the market, and restrictions on moving birds back to farms 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 concerns commercial growers who practice tighter biosecurity. In Asia, a large network of live bird markets and backyard farms have made eradication difficult.

Human Infection.[8] Certain strains of avian flu, including H5N1, can infect humans through close poultry-to-human transmission, usually through contact with fecal matter or other live bird excretions, especially in backyard settings or home slaughtering. However, the species barrier is currently significant. The human disease currently caused

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[6] "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*.

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

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

by H5N1 avian flu is unusually aggressive. Rapid deterioration and fatality occur from viral pneumonia and organ failure. Health professionals are concerned that the virus could mutate or combine with human flu viruses to allow efficient human transmission.

WHO has confirmed 207 human cases of H5N1from December 2003 to May 8, 2006, with 115 deaths (a 56% mortality rate). Nine countries have had human cases: Vietnam, Indonesia, Thailand, China, Egypt, Turkey, Cambodia, Azerbaijan, and Iraq.

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. The virus is killed at temperatures reached during conventional cooking practices (160 degrees F) thus making properly cooked poultry safe to eat. However, highly pathogenic viruses such as H5N1 can spread to nearly all parts of an infected bird, survive in raw poultry, and thus be spread through marketing and preparation of contaminated food.[9] Yet, in 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.*[10]

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.[6]

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.[11] 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

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[9] 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].

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

[11] 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].

for antibodies. If vaccination is not administered and monitored correctly, it can allow the virus to become endemic and continue to spread or mutate.

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," 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.[12] However, a new low pathogenicity indemnification program was developed in FY2005. USDA's standard indemnification rate for low pathogenicity programs is 50% of fair market value. 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 monitoring and surveillance of HPAI, and $16.7 million for management of LPAI.

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. The Agricultural Research Service received $7 million in the supplemental.

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

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). The $140 million, three-year FAO/WHO plan is being implemented but is not fully funded by donor countries.

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.

If consumer confidence remains high, demand for healthy poultry may rise. If consumer confidence declines, poultry prices may drop and demand for substitute meats may increase. The rapid spread of the virus in 2006 reduced consumer demand for poultry in Europe and Africa. FAO reports poultry consumption dropped 70% in Italy during February 2006, 20% in France, and 10% in northern Europe. Consumption has since partially recovered. In the United States, export prices dropped 13% from declining shipments to Eastern Europe and Central Asia in November and Decmeber of 2005.[13] 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]

When poultry production falls, demand for feed such as corn and soy meal may decrease. Poultry account for about one-third of total world feed use. Through most of 2005, the global impact on feed and poultry consumption was limited due to relatively quick recovery of production where outbreaks were contained, since poultry production cycles are quite short at about eight weeks.

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.

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[13] 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].

[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].