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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 will be updated as events warrant.

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. (This report primarily addresses avian flu in poultry, although some human dimensions are discussed.) The most recent cases in domestic poultry were in 2004, with three unrelated and less pathogenic strains.

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, as many as nine Asian countries have had confirmed outbreaks or instances of H5N1 in poultry, including Vietnam, Thailand, Indonesia, Cambodia, China and Hong Kong, South Korea, Malaysia, Laos, and Japan. More recently, in the summer and fall of 2005, H5N1 spread westward and has been confirmed in at least five new countries: Russia, Kazakhstan, Turkey, Romania, and

[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].

Croatia. Wild birds seem to be one of the main carriers, but their role in spreading the virus 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.

As the virus spreads, and becomes endemic in countries with low levels of veterinary services or animal husbandry practices that harbor the virus, the chances increase that the virus will evolve through mutation or reassortment into a strain that could be transmitted easily between humans. Thus, many experts call for the swift and coordinated control of avian flu in poultry as the best way to prevent a human pandemic from developing, by reducing the number of animal hosts in which the virus may evolve.[2]

The situation in Asia is historically unprecedented and extremely challenging. The United Nations 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 scattered throughout rural areas, further complicating control.

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:

- 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.[3]

Both forms are possible in several strains. Strains are identified by two surface proteins designated by the letters H and N.[4] Some low pathogenic strains (H5 and H7) are capable of mutating into highly pathogenic strains, and are thus treated nearly as aggressively. For example, during a 1999-2001 epidemic in Italy, an LPAI virus (H7N1) mutated into HPAI within nine months.

Because LPAI is endemic in wild bird populations, low pathogenicity outbreaks are not uncommon. The 2004 outbreaks in the United States included low pathogenicity

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

[3] Tests for pathogenicity are conducted in two ways. The first is through genetic (DNA) sequencing. The other is 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.

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

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. There have been only three highly pathogenic outbreaks in the United States (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 agricultural organizations such as the FAO.[5]

In the United States, avian flu viruses have been common in live bird markets concentrated in urban areas with ethnic communities. 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 1/4 of 1%), 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. 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 mortality. The human vaccine currently available for mass inoculation in the fall of 2005 is felt to offer little protection against H5N1; vaccine trials and development are underway. Public health professionals are concerned that the virus could mutate or

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

combine with human flu viruses. If such a mutation were to occur, allowing efficient human-to-human transmission, a more serious public health problem would result.

The number of human cases of H5N1 confirmed by WHO during the current outbreak (December 2003-November 9, 2005) totals 125, resulting in 64 deaths (a 51% mortality rate). Four countries have had human cases: Vietnam (92 cases, 42 deaths), Thailand (20 cases, 13 deaths), Indonesia (9 cases, 5 deaths), and Cambodia (4 cases and 4 deaths). 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. The case was not initially diagnosed as avian flu, and CDC first confirmed diagnosis in April 2004.

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 and international organizations. In the United States, the USDA Animal and Plant Health Inspection Service (APHIS) is the lead federal agency.

Internationally, the U.N. Food and Agriculture Organization (FAO) has a joint response plan with WHO for the current outbreak. The $140 million, three-year plan is being implemented but is not fully funded by donor countries. The United States has contributed about $25 million.[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 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

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

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 viable or sufficient control method. Vaccination poses problems for international trade as many countries will not import poultry products from other countries that use vaccination as a means of control, since animals will test positive for antibodies. If vaccination is not administered and monitored correctly, it can also 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) in Ames, IA, conducts confirmatory tests on the pathogenicity and type of virus. USDA also works to limit export restrictions to small geographic areas (such as states or counties) and reopen export markets once outbreaks are eradicated.

Indemnities to Farmers. Compensation programs are desired to encourage farmers to report outbreaks and cooperate with disease control programs. Indemnification programs for low pathogenicity outbreaks generally are managed by the states. 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 standing compensation program for low pathogenicity avian influenza.[8] However, a new program is being developed following increased appropriations for a low pathogenicity program in FY2005. When indemnification is offered by USDA, the standard rate for low pathogenicity programs is 50% of fair market value. For highly pathogenic outbreaks of avian flu, statute allows USDA to offer 100% indemnification (9 CFR 53.2).

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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," Technical Item of the 71st General Session of the OIE, May 2003, [http://www.oie.int/eng/avian_influenza/A_71%20SG_12_CS3E.pdf].

[8] A limited USDA indemnification program was created for an LPAI outbreak in Virginia in 2002 (9 CFR 53.11). The Administration's FY2005 budget request includes a proposal for an LPAI indemnification program.

Economic Impacts

The economic effects of any avian influenza outbreak can be significant. Expenses to conduct depopulation and quarantines, as well as the direct loss of production, affect local farms and regions. However, bigger economic effects come from international trade bans. Localized quarantines and bans on the sale or movement of birds can affect farmers outside the immediate quarantine area.

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 total poultry production was worth $23.3 billion (out of $105 billion for all livestock, and $200 billion total of crops and livestock). Broiler production was valued at $15.2 billion, followed by eggs at $5.3 billion, and turkeys at $2.7 billion. The U.S. exports about 16% of its poultry production.[9]

No estimates of the potential effect from an H5N1 outbreak in the United States are available 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. This was less than 1/200 of 1% of the 8.5 billion broilers slaughtered in the U.S. for food annually. Yet, the effect on local regions and individual farms can was much greater.

Federal Appropriations to Control Avian Flu in Poultry

Federal appropriations for avian influenza have grown significantly in recent years. In FY2004, Congress provided APHIS with $994,000 for avian flu for monitoring and control. Following the 2004 domestic 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 indemnities. For FY2006, the 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.

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 the spread of avian flu. Conferees encourage U.S. cooperation to support FAO and WHO on a joint international plan (the FAO/WHO plan mentioned above).

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

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[9] The top five states in broiler production are Georgia (15%), Arkansas (14%), Alabama (13%), Mississippi (9%), and North Carolina (9%), totaling 60% of U.S. broiler production.