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Avian Influenza: Multiple Strains Cause Different Effects Worldwide

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Summary

Since the fall of 2003, highly pathogenic avian influenza (H5N1) has spread throughout Asia, infecting mostly poultry but also a limited number of humans. Officials are concerned that the virus could mutate to allow human-to-human transmission. The situation in Asia has raised the awareness of this disease in the U.S.

In February and March 2004, a low pathogenicity avian flu surfaced in Delaware, Maryland, and New Jersey (H7N2), and another strain was found in Pennsylvania (H2N2). One highly pathogenic strain (H5N2) surfaced in Texas. In British Columbia, Canada, a highly pathogenic strain (H7N3) was discovered in March, and an H5 strain was found in May. While low pathogenicity avian flu (LPAI) is not uncommon, the strain in Texas is the first highly pathogenic (HPAI) case in the U.S. since 1983-1984. Federal and state officials have responded by depopulating (destroying) flocks, imposing quarantines, conducting extensive surveillance, and providing funding.

On April 1, USDA announced that the HPAI outbreak in Texas was eradicated. In Canada, however, the disease has spread extensively and depopulation is underway.

Only a few strains of avian flu have been known to affect humans, and no humans in the U.S. have been known to be infected. In Canada, however, two workers in the response were infected and have recovered. Because human infection is possible, public health guidelines have been published. This report will be updated as events warrant.

Types of Avian Influenza

Many different strains of avian influenza (avian flu) virus exist throughout the world. Avian flu is a form of the Influenza A virus that infects birds, and certain strains have been known to infect both animals and humans.¹ The Centers for Disease Control and Prevention (CDC) notes that avian flu viruses rarely infect humans, but recommends that those involved in control efforts engage in activities to minimize their risks. Officials are concerned that the virus could mutate and cause a pandemic through human-to-human

¹ The primary focus of this report is the effect on agriculture.

transmission. The Office International des Epizooties (OIE) and World Health Organization (WHO) conclude that poultry products from affected countries do not pose any human food safety risk, and CDC recommends standard food safety practices.²

Wild birds are the primary natural reservoir for Influenza A and are often the vector that introduces new outbreaks into domestic flocks. The virus can be highly contagious in domestic poultry, which are not as resistant as wild birds. Avian flu is spread by contact with infected feces, nasal or eye excretions, or equipment, vehicles, or clothes. Once present in domestic flocks, human activity becomes a risk for further transmission.

The virus has been common in live bird markets concentrated in urban areas with ethnic communities. The U.S. Department of Agriculture (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.

Two Forms with Many Strains. Avian influenza has 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. Both forms are possible in several strains. Strains are identified by two surface proteins designated by the letters H and N.³ Some LPAI strains are capable of mutating into HPAI.⁴ Thus, LPAI is treated nearly as aggressively as HPAI. LPAI is not required to be reported to the OIE, but USDA does report it to OIE as a practical matter.

In addition to the HPAI strains of H5N1 in Asia, H5N2 in Texas, and H7N3 in British Columbia, other recent occurrences of HPAI include Hong Kong in 1997, and the Netherlands in 2003. Before 2004, the last U.S. outbreak of HPAI was in 1983-84, when cases of H5N2 caused the destruction of 17 million birds and cost \$65 million.

Because LPAI is endemic in wild bird populations, outbreaks are not uncommon. In addition to the current LPAI strains of H7N2 and H2N2 in U.S., other recent LPAI outbreaks in U.S. poultry include H7N2 in Connecticut and Rhode Island during 2003, and in Virginia, West Virginia, and North Carolina in 2002.⁵

² For more information about avian flu, please see the U.S. Department of Agriculture (USDA) at [http://www.aphis.usda.gov/lpa/issues/ai_us/ai_us.html], the World Health Organization (WHO) at [http://www.who.int/csr/disease/avian_influenza/en/], the Centers for Disease Control (CDC) at [<http://www.cdc.gov/flu/avian/index.htm>], and the Office International des Epizooties (OIE) at [http://www.oie.int/eng/avian_influenza/home.htm]. The United Nations Food and Agriculture Organization (FAO) website also includes several maps showing the situation in Asia at [http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/special_avian.html].

³ 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.

⁴ For example, during a 1999-2001 epidemic in Italy, an LPAI virus (H7N1) mutated into HPAI within nine months. More than 13 million birds died or were destroyed.

⁵ For a more complete list, see USDA at [http://www.aphis.usda.gov/lpa/issues/ai_us/ai_us.html].

Because the virus is highly contagious and easily spread, the most common method of control is culling (depopulation, or killing) the infected flocks,⁶ and quarantine of affected areas until the disease is no longer present. While vaccination is possible and has been tested on a small scale, it is not widely considered a viable control method.⁷ After the contaminated flock is depopulated, 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 70 degrees C, or 160 degrees F).

Avian Flu in the United States

In February and March 2004, a number of LPAI outbreaks occurred in Delaware, Maryland, Pennsylvania and New Jersey, and an HPAI strain was found in Texas. These outbreaks are unrelated to the H5N1 virus in Asia.

LPAI. On February 6, 2004, a flock of 12,000 chickens in Kent County, Delaware, tested positive for H7N2. The flock was destroyed and composted. On February 10, 2004, a commercial flock tested positive for the same strain about 5 miles from the first outbreak. Delaware depopulated that 73,800-chicken flock, temporarily banned live poultry sales, and expanded the quarantine to about 80 farms in a six mile radius. On February 12, four live bird markets in New Jersey were discovered with the same H7N2 strain, and a link was found to the first case in Delaware. Also on February 12, a flock in Lancaster County, Pennsylvania, tested positive for H2N2. Later, on March 5, a commercial flock of about 330,000 chickens in Pocomoke City, Maryland, tested positive for H7N2 and was subsequently destroyed.

All subsequent tests of farms in Delaware, Maryland, and Pennsylvania have been negative for the disease. At least 1,736 farms and 4,242 chicken houses have been tested (counting initial and repeated tests), and all had negative results. Background testing continues and flocks going to slaughter receive pre-movement avian flu testing.

HPAI. On February 17, a flock of 6,600 chickens in Gonzales County, Texas, was found to be positive for an H5 strain of avian flu. The flock was depopulated on February 21. The same strain was also found in two live bird markets in Houston, and those birds were depopulated along with birds at three other Houston live bird markets. USDA tests confirm that the strain is H5N2 and genetic indicators suggested that the virus was highly pathogenic by OIE standards.⁸ USDA activated its response system and established an incident command post in Texas. Five rounds of surveillance testing followed and all had negative results. The quarantine was lifted March 29 and the command post closed. On April 1, USDA notified OIE that the HPAI outbreak was eradicated. Routine surveillance will continue until mid June. No commercial poultry flocks were infected in Texas.

⁶ See 9 CFR 53.4, "Destruction of animals."

⁷ Ilaria Capua and Stefano Marangon. "The Use of Vaccination as an Option for the Control of Avian Influenza," OIE International Committee 71st General Session, May 18-23, 2003, at [http://www.oie.int/download/71SG_2003/A_71%20SG_12_CS3E.pdf].

⁸ Test 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.

Federal Response. In this recent U.S. outbreak, the disease has been managed through state-level responses in terms of depopulation and quarantines. USDA's Animal and Plant Health Inspection Service (APHIS) provided personnel and equipment to advise and supplement state resources. For the HPAI strain in Texas, USDA set up an incident response center on site. The USDA National Veterinary Services Lab (NVSL) in Ames, IA, conducted confirmatory tests on the pathogenicity and type of virus for all cases.

USDA also is working to reopen export markets in countries that have banned poultry imports from the U.S. or certain states. Reopening trade in LPAI cases is easier than under HPAI cases. Generally, once a third confirmation test for LPAI is completed (about two weeks after the initial outbreak) and no further cases are found, negotiations to reopen trade can be resumed. Similar eradication efforts are undertaken for HPAI, but importing countries often are more reluctant to lift trade restrictions. USDA is working to preserve exports for states and regions not infected with avian flu by encouraging countries to limit their bans to affected areas rather than the entire United States.

Avian Flu in Canada

On March 9, Canada discovered avian flu in southern British Columbia. The highly pathogenic H7N3 virus has since spread throughout the Fraser Valley area. The Canadian government initially depopulated 9,000 birds, and then another 275,000 birds on March 24. But the virus continued to spread and, as of May 12, has been confirmed on 40 farms. On April 5, the Minister of Agriculture announced the depopulation of all commercial and backyard poultry flocks in the Fraser Valley "control area." Approximately 19 million birds will be destroyed, although non-infected flocks can be sold under certain conditions. Unlike in the U.S., where birds were composted on site, Canada is trucking carcasses to incinerators or landfills, and this poses additional risks for spreading the virus. The U.S. has increased surveillance in Washington state, placed a ban on live poultry imports from British Columbia, and tightened restrictions for poultry products. Although no new H7 cases have been found since April 29, an H5 virus was discovered on a Fraser Valley farm on May 11. Further genetic tests will confirm the strain and pathogenicity.

Avian Flu in Asia

As of April 1, 2004, 10 Asian countries have reported current outbreaks of HPAI. Nine countries have confirmed subtype H5N1, including Cambodia, China and Hong Kong, Indonesia, Japan, Laos, South Korea, Thailand, and Vietnam. Pakistan had an outbreak of HPAI H7. Though progress in controlling the virus is reported in some areas, Vietnam and Thailand have had small scale recurrences. The U.N. Food and Agriculture Organization (FAO) estimates that over 100 million birds have died or been culled. The United States has imposed trade restrictions.

The situation in Asia is historically unprecedented and extremely challenging. Some countries were reluctant to acknowledge the disease for fear of economic consequences.⁹ In some of these countries, around 80% of the poultry are produced in small backyard farms scattered throughout rural areas, further complicating control.

⁹ For more about the political impact of avian flu in China, see CRS Report RL32227, *SARS, Avian Flu, and Other Challenges for China's Political, Social, and Economic Transformation*.

Human Infection

Avian flu can infect humans through poultry-to-human transmission, usually through contact with fecal matter or other live bird excretions. The first such transmission was in 1997 in Hong Kong with H5N1 (18 cases, 6 deaths). Two other strains have been 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). The human disease caused by H5N1 differs from typical human flu. H5N1 can replicate in a wide range of cells, resulting in a severe disseminated disease affecting multiple organs and causing high rates of mortality. Public health professionals are concerned that the virus could mutate or 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 human vaccine currently available is felt to offer little protection against this strain.

In the current outbreak, as of April 5, Thailand and Vietnam have reported 34 human cases of H5N1 infection, resulting in 24 deaths. In Canada, two humans who had separate exposure to infected birds tested positive for H7 infection. Both experienced mild symptoms and have fully recovered.

In the U.S., the 2002 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 believed to be avian flu, and CDC first confirmed the H7N2 diagnosis in April 2004. Officials have not determined how the man contracted the disease.

Economic Effects

Indemnities to Farmers. The economic effects of any avian influenza outbreak can be significant, particularly given the standard depopulation method of control. So far in 2004, over 422,000 chickens have been depopulated in the U.S. as a result of avian influenza.¹⁰ Localized quarantines and bans on the sale or movement of birds can affect farmers outside the immediate quarantine area in affected states.

Indemnification programs for LPAI generally are managed by the states. While USDA can offer indemnities to farmers whose flocks are destroyed due to HPAI, USDA does not have a standing indemnification program for LPAI.¹¹ When indemnification is offered by USDA, the standard rate is 50% of fair market value (FMV), but a 100% indemnification rate is allowed for HPAI (9 CFR 53.2).

Poultry Supply and Demand. In the mid-Atlantic region, Delaware, Maryland, Virginia, and Pennsylvania account for about 10% of U.S. broiler production. Texas accounts for about 7% of broiler production. Thus, while production in these areas is not

¹⁰ For perspective, 8.5 billion broilers were slaughtered for food in the U.S. in 2003. The current depopulation statistic is about 1/200 of 1% of that annual slaughter number.

¹¹ 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.

insignificant, the affected states are not among the major poultry producing states in the U.S.¹² In areas affected by quarantines, non-infected flocks will eventually be marketed once officials determine that it is safe to transport the birds. Thus the overall supply of poultry to the U.S. market is not expected to decrease noticeably. In terms of domestic consumption, avian flu is not expected to reduce consumer confidence in poultry, given the steady demand for beef even after the discovery of BSE in the U.S. in December 2003. However, in Asia, anecdotal evidence suggests declining poultry supplies due to widespread Asian depopulation efforts is causing poultry prices to rise there.¹³

The U.S. exports about 16% of its poultry production. The largest importer is Russia, accounting for about 30% of poultry exports in 2003. Other primary importers of U.S. poultry products include Mexico, Hong Kong, Canada and Japan. As of May 11, 50 foreign countries have imposed restrictions on importing U.S. poultry and poultry products. At this point, Canada has lifted its restrictions, and Russia and the European Union have only regional restrictions. However, Mexico, Japan, and South Korea, among others, have placed country-wide bans on U.S. poultry, affecting over 10% of such exports. USDA negotiates with each country regarding easing restrictions, especially after the disease is contained and assurances can be provided for the safety of U.S. products.

Feed and Other Inputs. The outbreak of avian flu in Asia had an impact on U.S. exports of feed ingredients (especially soybeans and soybean meal) to the region. Yet despite the potential for lower exports of soybeans to Asia, soybean prices in the U.S. are at (or near) record highs because unusually low domestic supplies and strong domestic demand were already forecast to cause a shortage of soybeans during the summer of 2004. Thus, avian flu is not expected to significantly affect U.S. soybean prices since the tight domestic market situation is of greater magnitude.

Federal Appropriations to Control Avian Flu in Poultry

For FY2004, Congress appropriated APHIS \$994,000 for avian flu (primarily for control in live bird markets), and the Agricultural Research Service (ARS) \$2 million for research. On May 12, 2004, USDA released \$13.7 million of Commodity Credit Corporation (CCC) funds to begin a larger, national LPAI program (\$10.8 million) and assist Texas with the HPAI outbreak (\$2.9 million). This CCC transfer effectively accelerates the APHIS plan to increase its avian flu program, as described below.

For FY2005, APHIS requested a significant increase to expand its avian flu program from \$1 million to \$12.7 million. This is a rare increase in the FY2005 APHIS pest and disease management function, which otherwise is flat or shrinking in the Administration's proposal. About half of the funding would be used for indemnities when flocks are destroyed. Other initiatives include cooperative agreements with states, increased monitoring, a bird identification system, laboratory support, and vaccine development. ARS requests \$2 million for avian flu research in FY2005. A "Dear Colleague" letter by Representatives Etheridge and Pickering began circulating in the House at the end of March requesting \$25 million for avian flu at APHIS in FY2005.

¹² 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.

¹³ World Perspectives, Inc. "Ag Perspectives," February 20, 2004.