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Transmission and socioeconomic repercussions of avian influenza

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Influenza in avian species has historically been the most significant threat to domestic poultry production in the world. The disease has the potential to destroy production in a given area and damage international trade in poultry, even in areas unaffected by the disease. Bearing this in mind, no review of avian influenza would be complete without a discussion of the predominating sociopolitical realities that have been imposed upon the topic.

Avian influenza (AI) may be caused by any of the 15 Hemagglutinin or 9 Neuraminidase type A viral subtypes. The vast majority of viral infections in birds result in subclinical or mild disease (low pathogenicity). Rarely, some H5 or H7 avian influenza viral infections may result in severe disease (highly pathogenic). Historically, control of the highly pathogenic avian influenzas (HPAI) has merited the greatest allocation of resources and scientific scrutiny. Although this is still probably the case, new OIE definitions and multiple international interpretations of avian influenza are changing the way the industry in this country has approached this disease.

Transmission of avian influenza

Avian influenza is endemic in many species of wild waterfowl. While mallard ducks are frequently cited as a common source of the virus, *many* species are capable of seroconverting to or propagating avian influenza viruses. Infection and viral shed, typically subclinical, are particularly prevalent in juvenile waterfowl. Bird-to-bird transmission within a flock (waterfowl or poultry) typically results from aerosol or fecal-oral exposure to infectious virus.

Initial introductions of AI viruses into domestic commercial poultry flocks can often be traced to association with wild waterfowl. In Minnesota, historical range rearing of commercial turkeys increased waterfowl/turkey interactions and resulted in large numbers of low pathogenicity avian influenza infections in turkeys. Several Pennsylvania outbreaks of AI in commercial poultry have similarly been attributed to proximity of waterfowl on the farm.

More recently, live bird markets (LBMs), particularly in the northeastern United States, have been shown to be a long-term reservoir of avian influenza viruses. Poultry farms that supply these markets are at increased risk of bringing infectious materials back onto their farms. In particular, improperly disinfected crates, trucks, clothing, footwear, or other fomites are a significant risk to birds remaining on the premise. Viral spread from the LBM system to commercial poultry farms has been demonstrated in several outbreaks.

One of the most common subtypes of influenza in U.S. commercial turkeys is H1N1. Infection with this agent is frequently associated with close proximity of swine populations. Less frequently, H3 subtypes have been similarly associated with swine proximity to turkey flocks.

Initial introductions of AI viruses into commercial poultry have been blamed on proximity of wild waterfowl and introduction via the LBM system. However, once the virus is established into commercial poultry operations, spread of disease is dictated by a different dynamic. This secondary or horizontal spread is typically due to a breach in biosecurity.

In a 1997–98 H7N2 LPAI outbreak in Pennsylvania, the index case involved a commercial layer flock that was suspected to have surreptitiously been selling spent fowl to the New York live bird market system. In total, 25 premises were infected during this outbreak. Sources for exposure in these premises included "area spread" in 9 cases (re-emergence of the virus in a house on the same farm or after facility repopulation), bird depopulation efforts in 6 cases, confirmed association with LBMs in 3 cases, and adjacent spread of infectious manure in 3 cases.[1]

A very large outbreak of H7N2 LPAI occurred in Virginia in the spring and summer of 2002. Ultimately, the outbreak involved 197 farms and resulted in the destruction of over 4.7 million birds. Although no direct link was established, the strain of H7N2 isolated from these flocks was essentially identical to the H7N2 AIV strain circulating in the LBM system in the northeastern US since 1994. Sampling of backyard flocks and wild birds found no evidence of virus. The management practice most closely associated with infection was the transport of daily mortality off the farm to a rendering facility. Similarly, the pattern of infection (large geographical areas bypassed by the virus) suggested a transmission most consistent with fomite, human, or equipment contamination.[2]

Movement of infected animals and equipment has also been identified as the principal cause of propagation of H5N1 HPAI in Southeast Asia (1997–present) and has been implicated in the spread of H7N7 HPAI in the EU in 2003.

Socioeconomic factors influencing avian influenza approach

Changing OIE regulations make it likely that *all* H5 and H7 AIVs (not just HPAIs) will be considered reportable diseases in the future. This is based upon the demonstrated potential of these two subtypes to increase in pathogenicity over time. A new "voluntary" NPIP (National Poultry Improvement Plan) testing program for commercial broilers, layers, and turkeys in the United States will also be going into effect. This program will test relatively small numbers of birds in a standardized national survey.

However, these programs may have little effect on the financial impact of these diseases in this country. Two major factors driving state, federal, and industry responses to AI control are public fears about zoonotic AI and international trading partner requirements for testing.

Public concerns about zoonotic AI in this country were inflamed particularly by the large outbreak of H5N1 HPAI in East Asia. Sensationalized newspaper coverage of common LPAI outbreaks (in PA, DE, NJ, etc.) resulted in undue public fears about zoonotic "bird flu" in this country. In Asia, in spite of widespread virus exposure in a region of approximately 1.5 billion people, the WHO reported 34 official cases of the disease in all countries, with 23 fatalities.[3] Although disease and death in any human being owing to zoonosis is lamentable, the public scrutiny and fear accorded this outbreak is unparalleled. This is particularly remarkable when one considers that, in any given year, 19,000–36,000 people die in the United States as a result of (non-"bird flu") influenza and its complications.[4]

Serologic testing of U.S. swine populations in 1988-89 indicated that more than 50% of market pigs in the upper Midwest had been exposed to H1N1 SIV.[5] A more recent survey (1997–98) suggested a seroprevalence of 27.7%.[6] Since 1974, classical H1N1 SIV has been documented to spread from swine to humans at least 10 times, including five cases involving human fatalities. Were there a major H1N1 human pandemic in this country, what would the collateral damage be on the swine industry?

As the largest exporter of poultry products in the world, the United States is beholden to some rules regarding poultry export that do not appear to be required of other major exporting countries. While OIE standards of "reportable" avian influenza are currently limited to HPAI, poultry product has been embargoed for many years in this country as a result of a variety of LPAIs, particularly H5 and H7 viruses. Recently, Russia embargoed all poultry from PA for a period of two months when that state reported that some commercial layer hens had seroconverted to H2 AI.[7] Russia, Japan, Singapore, Mexico, and numerous other trading partners have consistently embargoed U.S. product based upon the discovery of LPAI viruses (or seroconversion to these viruses). USDA has taken the unusual step of notifying some trading partners directly of any new discoveries of avian influenza, regardless of pathotype.

Due in large part to international export requirements, compounded by public concerns regarding zoonotic avian influenza, more state agencies have elected to depopulate LPAI positive farms en masse rather than permit birds to be processed for food. Much controversy surrounded the decision of Virginia and North Carolina state officials to depopulate approximately 4.7 million birds from 197 different farms[8] owing to H7N2 LPAI in 2002. Such an undertaking cost producers, companies, and taxpayers approximately $149 million (an average of $760,000 per flock).[9] In the past two years, these tactics (depopulation of LPAI cases) have been repeated at least 12 times. Depopulation of flocks for LPAI is seemingly now the default response in many states—a change from the past. In contrast, Minnesota's chosen historical method of monitoring, biosecurity, and controlled marketing has resulted in an average cost of approximately $40,000 per infected flock, 1/19th the price tag of the VA/NC depopulation effort.

In summary, national and state responses to LPAI appear to be increasingly driven by politicized trade concerns and public fears. Such responses come with significant financial, moral, and ethical costs. The swine industry, if it has not already done so, may wish to take note of this changing landscape in the "poultry world." Public, industry, and governmental education efforts, vigorous international trade representation, and a veterinary science based approach to influenza control in swine may reverse or slow this.

References

1. Epidemiology, Production Losses, and Control Measures Associated with an Outbreak of Avian Influenza Subtype H7N2 in Pennsylvania. D.J. Henzler, et. al. Avian Diseases 47:1022-1036, 2003.
2. Low-Pathogenicity H7N2 Avian Influenza Outbreak in Virginia During 2002. B.L. Akey. Avian Diseases 47: 1099-1103, 2003.
3. http://www.who.int/csr/disease/avian_influenza/assessment2004_05_14/en/.
4. http://www.cdc.gov/flu/professionals/diagnosis/.
5. University of Kentucky Herd Health Memo, No. 11, 1997-1998. As reported in Just Pigs ("The Changing Picture of Swine Influenza (SIV)"), March 1998.

6. Virologic and serologic surveillance for human, swine and avian influenza virus infections among pigs in the north-central United States. Olsen, C.W., et. al. Arch Virol. 2000; 145(7):1399-1419.
7. http://www.aphis.usda.gov/lpa/issues/ai_us/ai_trade_ban_status.html.
8. Low-Pathogenicity H7N2 Avian Influenza Outbreak in Virginia During 2002. B.L. Akey. Avian Diseases 47: 1099-1103, 2003.
9. The Economics of Avian Influenza Control. Halvorson, et. al. Proceedings of the Western Poultry Disease Conference, 2003.