Avian influenza

Wetlands associated with poultry farming or used by high concentrations of waterbirds

Wildlife ✓
Livestock ✓
Human ✓

Synonyms: AI, bird flu, fowl plague, highly pathogenic avian influenza, HPAI, low pathogenic avian influenza, LPAI, poultry plague

KEY FACTS

What is avian influenza?

Avian influenza is a highly contagious disease caused by influenza A viruses, affecting many species of birds. Avian influenza is classified, according to disease severity, into two recognised forms: low pathogenic avian influenza (LPAI) and highly pathogenic avian influenza (HPAI). LPAI viruses are generally of low virulence, whilst HPAI viruses are highly virulent in most poultry species, resulting in up to 100% mortality in fully susceptible infected domestic flocks.

The natural reservoir of LPAI viruses is wild waterbirds – most commonly ducks, geese, swans, waders/shorebirds and gulls. These hosts and their viruses have become well-adapted to each other over time and infection does not usually cause overt disease. That said, recent studies indicate that some behavioural changes may occur in response to infection *i.e*. birds may be less likely to feed and move any great distances during the short period of time it takes them to clear infection (~4-10 days).

These low pathogenic viruses replicate mainly in the intestinal tract (and also in the respiratory tract) of aquatic birds. Hence, LPAI viruses may be transmitted in faeces. Thus, transmission in aquatic birds is mainly by the faecal-oral route, *i.e.* wetland habitats provide the natural source of infection for other individuals.

Mammals – most commonly pigs but also humans – can be infected with influenza A viruses.

Eurasian lineage HPAI H5N1 viruses, which emerged in China in 1996, re-emerged in 2003 and have subsequently spread across large areas of Asia, the Middle East, Europe and parts of Africa, are unusual in respect of their significant impacts and broad host range *i.e*. affecting poultry, wild birds, various species of mammal and humans. Broader public health concerns relate to the potential for these, or other, avian influenza viruses to mutate or reassort to create a pandemic strain (*i.e*. readily transmissible between humans and causing widespread disease and socioeconomic problems).

Causal agent

Influenza A viruses. Influenza viruses have a high rate of natural mutation and reassortment. Viruses belonging to the H5 and H7 subtypes (in contrast to other virus subtypes), may become highly pathogenic. The most usual route for emergence of a highly pathogenic strain of virus is following circulation of LPAI viruses in poultry. With conditions that may include high population density, genetically homogenous stock, and different husbandry systems, mutations for pathogenicity may be selected for, and thus an HPAI virus may emerge, causing high morbidity and mortality in susceptible poultry populations.

Species affected

Poultry are very susceptible to avian influenza infection and the disease causes high mortality and/or loss of producitvity.

Most species of wild bird are susceptible to infection, but the majority of

reports are from waterfowl and shorebirds. LPAI viruses are particularly associated with wild ducks and high prevalence may be found in juvenile ducks in particular. Eurasian lineage HPAI H5N1 viruses have also been found in a range of predatory and scavenging birds, and even mammals (both wild and captive), most likely as a result of feeding on infected birds or bird meat.

Humans are, in general, relatively resistant to avian influenza viruses, but in some individuals infection can be severe.

Geographic distribution

Avian influenza is reported globally, including in the Americas, Asia, Middle East, Europe and Africa. The high density duck, and other poultry, farming of eastern and south eastern Asia, including outdoor and backyard flocks, have made these regions prone to outbreaks with Eurasian HPAI H5N1 viruses in recent years leading to endemic status.

Environment

AI viruses have variable environmental survival properties that differ depending on the virus subtype and environmental characteristics including temperature, pH, humidity, salinity and the type of medium the virus is found in *e.g.* water, faeces, fomites *etc*.

TRANSMISSION AND SPREAD

Vector(s)

The disease is not vector-borne, but infected animals, fomites (inanimate objects) or people contaminated with faeces and other infectious secretions can spread infection. Mechanical transfer on the feet of pests *e.g*. rodents in poultry houses is also possible.

How is the disease transmitted to animals?

The viruses have evolved to be transmitted by the faeco-oral and/or respiratory routes *i.e*. in general viruses are passed out with the faeces and/or respiratory secretions and exposed birds then ingest or inhale viruses and, if susceptible, will become infected.

How does the disease spread between groups of animals?

For poultry, infection is primarily spread through the movement and trade of poultry and poultry products locally, nationally and internationally. Live and/or wet markets pose a particular risk. Movements of people, vehicles and fomites contaminated with AI viruses can also spread infection. Hence, good biosecurity and hygiene practices are essential to prevent introduction, and control spread of, AI virus infections.

The practice of outdoor poultry production, including grazing domestic ducks in rice paddies, is considered to be one way in which disease can easily transfer between wild and domestic birds (in both directions).

As has also been found for Eurasian lineage HPAI H5N1 viruses, infection can be spread through the pet bird trade, wild bird trade, the farming of wild birds, and wild bird movements. The relative importance of these routes is often difficult to determine (and will differ by situation, location and time period).

Scavenging and predatory birds and mammals may acquire infection by ingesting infected birds.

The farming of wild birds which have frequent access to wetlands has been highlighted as a means by which AI viruses, including Eurasian lineage HPAI H5N1 virus infection, can be spread to wild bird populations (*Richard Hearn*).

How is the disease transmitted to humans?

Humans can become infected *via* close contact with infected birds or inhalation of aerosols containing virus. In general, humans are relatively resistant to avian influenza viruses. However, situations where there is exposure to high levels of virus, such as during disease control activities or butchering or preparation of infected birds, are of higher risk and appropriate hygiene precautions should always be taken, including use of personal protective equipment.

IDENTIFICATION AND RESPONSE

Field signs

For poultry, LPAI infection may be inapparent or mild. In layer hens a drop in egg production may be seen. HPAI infection is characterised by sudden mortality which can be extremely high, up to 100%.

For wild birds, LPAI infections typically cause no obvious clinical signs. Eurasian lineage HPAI H5N1 virus infections in wild birds can be characterised by neurological signs: trembling, falling over, swimming or walking in circles. For waterbirds, other conditions such as lead poisoning can also cause these signs although this is more likely to be a longer term illness *i.e*. birds tend to be in poorer condition, unlike HPAI H5N1 where infection is acute and birds may be in good condition.

In humans, the symptoms vary from mild to severe including mortality. Symptoms include conjunctivitis, 'flu-like symptoms (including fever), coughing and shortness of breath, diarrhoea, vomiting, and abdominal pain.

Recommended action if suspected

In poultry, both H5 and H7 LPAI and HPAI are notifiable to the OIE and local and national veterinary authorities should be contacted immediately on suspicion of AI infection. HPAI H5N1 is notifiable in wild birds and veterinary authorities should be informed of any unusual mortality event of susceptible species such as waterbirds. Public health authorities should be contacted if there is suspicion of human infection.

Diagnosis

Diagnosis in poultry can be made by either assessment of antibody levels in the blood indicating exposure to AI viruses or detection of the virus, or particles thereof, on swabs taken from the cloaca or throat of birds. Virus detection assays include growing the virus within inoculated fowls' eggs or use of molecular techniques including PCR to detect presence of virus, its type and its pathogenicity – all of which are important for epidemiological investigations and informing disease control responses.

PREVENTION AND CONTROL IN WETLANDS

Environment

Measures should be taken to reduce the exposure of wetlands to poultry manure or outflows from poultry establishments.

Livestock

Poor hygiene and biosecurity, overstocking, and mixing of different animals greatly increases the risk of both introduction and the spread of infection. Primary management efforts must be focused on limiting the opportunity for infection to be introduced. The main recommended courses of action following an outbreak of disease are culling of domestic poultry flocks, implementation of movement restrictions and cleansing and disinfection of affected premises.

Biosecurity

High standards of biosecurity will help prevent introduction of virus:

- Reduce/prevent contact with wild birds (for small scale poultry holders this may involve feeding birds under cover).
- Have disinfection facilities for hands, footwear, clothing, equipment and vehicles/trailers on entering or leaving areas with poultry and after contact with animals.
- Wear protective clothing and footwear, either disposable or if re-useable, easily disinfected (*e.g.* waterproof clothing, face shields, gloves and boots).
- Have separate clothing and equipment for each person using areas with livestock.
- Pest control – although not the most important mode of transmission, controlling rodents will help prevent/reduce mechanical transfer of infection between poultry holdings.
- Disease can be reduced by good hygiene and optimal animal husbandry and by minimising stressful events.
- Isolate newly acquired animals.
- Buy animals or eggs from AI-free sources.
- Ensure water from poultry holdings or untreated manure does not enter wetlands.
- Ensure untreated/unsanitised water is not used for poultry.

Vaccination is not considered an appropriate option as it can 'mask' disease. However, it has been suggested as a control measure in some areas of endemic Eurasian lineage HPAI H5N1 infection in South East Asia, as well as for collections of captive birds.

Monitoring and surveillance

National AI surveillance schemes may help in diagnosis of the disease, but poultry keepers should be vigilant for suspect clinical signs including loss of production or unusual mortality.

In the event of an outbreak

Confirmation of disease usually results in the implementation of sanitary measures comprising the slaughter of infected stock, movement restrictions, and cleansing and disinfection of affected premises.

Wildlife

Generally LPAI viruses do not require disease control responses for wildlife, but for HPAI H5N1 measures should be taken due to the potential for high mortality.

All practical measures to reduce contact between wild and domestic birds in wetlands should be taken:

- Poultry holdings should not be sited at wetlands.
- Ideally domestic ducks should not be reared in areas frequented by wild birds. It may be possible to reduce risks by seasonal use of the wetland *e.g*. removing domestic ducks at times of year when there are high densities of wild birds.
- A zoning approach to use of the wetlands may help although the viruses can be water-borne and thus this could be of limited value.
- The use of live decoy birds for hunting/trapping carries risks of introduction of infection and should be minimised.

At times of higher risk, *e.g.* when infection has been found within country or region, and/or during long periods of extreme weather conditions, stressors to wild bird populations (*e.g*. hunting and other disturbance) should be minimised.

If disease has been confirmed in a region:

- Extra care should be taken regarding potential for introducing infection on fomites such as footwear or vehicle tyres, using disinfection procedures, as appropriate.
- Access should be restricted during these times.
- Hunting, or other disturbing activities, should be suspended.
- Public education to raise awareness of HPAI H5N1, the risks it poses, and some simple precautions and response actions, should be given, including suspension of feeding of wild birds.

Monitoring and surveillance

Wetland managers and users should be aware of, and vigilant for, unusual mortality events of waterbirds and know how, and to whom, to report this. Early warning allows stakeholders to protect themselves and their livestock from any infection in wild birds.

Surveillance from live birds can also be conducted at wetland sites although prevalence to date has been found to be extremely low in wild birds.

Harnessing the eyes and actions of the public for early warning: a sign used at wetlands in Scotland, informing the public about surveillance activities, their role and how to report unusual mortalities (note a phone number is included).

Collecting an oropharyngeal swab from a whooper swan *Cygnus cygnus*. To date, active live wild bird surveillance to date has indicated an extremely low prevalence of HPAI H5N1 virus in healthy birds (*Taej Mundkur*).

Humans

Humans are relatively resistant to AI viruses but high standards of personal hygiene should be used when dealing with poultry or handling wild birds including hand washing and taking care to avoid rubbing eyes and touching the mouth, eating, drinking or smoking until hands are clean. Appropriate personal protective clothing should be worn.

Particular care should be taken for staff involved in disease control operations.

In areas where Eurasian lineage HPAI H5N1 is prevalent, people working in bird markets or preparing food should take particular precautions. All poultry meat and eggs should be thoroughly cooked.

In poor areas where it is typical to eat poultry even if a bird has become ill (to maximise protein availability), public education should be used to warn about the high risks associated with this practice and to minimise them.

IMPORTANCE

Effect on wildlife

LPAI viruses typically have little obvious effect on wildlife.

Eurasian lineage HPAI H5N1 viruses have caused a large number of incidents involving 100s or 1000s of wild bird deaths (mainly wildfowl and grebes). The initial confirmed outbreak in wild birds at Lake Qinghai, China, in 2005, killed 10% of the global population of bar-headed geese *Anser indicus*. The number of large scale incidents reported has declined in more recent times.

Conservation impacts have been varied and include direct mortality of birds, including threatened species. Indirect impacts, some in response to inaccurate representation of risk by media and others, include: killing wild birds as part of ill-advised disease control measures; negative perception and fearfulness of wild birds leading to some killing of wild birds and habitat destruction; the suspension of conservation projects; a reduction in garden bird feeding; a reduction of visitation at nature reserves; and the massive diversion of conservation organisations' resources from existing projects to tackling the various consequences of this disease.

Effect on livestock

The disease causes heavy losses for small scale poultry keepers as well as the poultry industry. Disease control operations involve slaughter and eradication of susceptible birds as well as infected individuals.

Effect on humans

Humans are relatively resistant to AI viruses. With respect to Eurasian lineage HPAI H5N1 viruses (although the total number of reported human cases is relatively low given the period of time it has been prevalent and the broad geographical range of the infection) the mortality rate is high (~60%).

Concerns remain about the potential for any avian influenza viruses providing the precursor for a human pandemic strain of influenza and the extreme social and economic consequences that can cause.

Economic importance

The disease has great impacts on local and national economies both in terms of costs of disease control operations but also lost revenue from trade restrictions. Costs of controlling HPAI H5N1 have run to billions of US$ since its re-emergence in 2003. Public health costs can also be prohibitive.

FURTHER INFORMATION

Useful publications and websites

- The Ramsar Convention on Wetlands. **Handbook no. 4: avian influenza and wetlands**. http://www.ramsar.org/pdf/lib/hbk4-04.pdf [Accessed March 2012].
- 10th meeting of the conference of the parties to the convention on wetlands (Ramsar, Iran, 1971). **Resolution X.21. Guidance on responding to the continued spread of highly pathogenic avian influenza**. http://www.ramsar.org/pdf/res/key_res_x_21_e.pdf [Accessed March 2012].
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- Wildpro. **Avian influenza**. http://wildpro.twycrosszoo.org/S/00dis/Viral/Avian_Influenza.htm [Accessed March 2012].

Further information on disinfectants:

- FAO, Rome. **Manual on procedures and for disease eradication by stamping out**. (2001). www.fao.org/DOCREP/004/Y0660E/Y0660E03.htm [Accessed March 2012].