

AVIAN INFLUENZA

Animal Group(s) Affected	Transmission	Clinical Signs	Severity	Treatment	Prevention and Control	Zoonotic
Birds, predominantly carried by waterfowl and shorebirds, various mammals	Fecal-oral and fecal-cloacal (i.e., contaminated water), airborne and direct contact through mucous membranes, ingestion of infected tissues, fomites and mechanical vectors	LPAI- typically asymptomatic HPAI- Respiratory, digestive or nervous system signs, sudden death	Asymptomatic to fatal in all animals affected	Anti-viral drugs in humans	Preparedness protocol including guidelines for facility during an outbreak, surveillance techniques and biosecurity protocols. Minimize contact between captive birds and wild birds. Quarantine new birds for at least 30 days.	Yes

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Susceptible animal groups: Avian influenza viruses can infect a wide variety of species. Whereas aquatic birds typically exhibit few signs of infection, once the virus spreads to poultry it can become more virulent and can potentially cause severe disease in mammalian species that may come in contact with them.

Aquatic birds- migratory waterfowl (Anseriformes) and shore birds (Charadriiformes) act as the major natural reservoir species; infection is typically asymptomatic in ducks infected with the low pathogenicity viruses (LPAI); wild birds have only rarely been infected with high pathogenicity viruses (HPAI).

Poultry, other gallinaceous birds- typically mild clinical signs or subclinical with LPAI; some viruses (of the H5 or H7 subtypes) may mutate to HPAI while circulating in a flock, potentially resulting in very high mortality.

Mammals and other avian species- HPAI H5N1 exhibits a wide and growing host range including humans; LPAI viruses may infect mammals and other avian species but infections are typically undetected because they are asymptomatic. Examples of species with confirmed HPAI include primates, suids, felids (domestic house cats and several nondomestic species), pinnipeds, canids (raccoon dogs, rarely in domestic dogs), viverrids (palm civets), mustelids (ferrets, stone martens, mink), lagomorphs (pikas, rabbits), rodents, whales and a broad range of avian species including psittacines.

Causative organism: Influenza A, an enveloped RNA virus in the family Orthomyxoviridae. Influenza A viruses are classified according to subtypes, based on two surface proteins (hemagglutinin (H) and neuraminidase (N)). Avian influenza viruses are further classified according to their virulence in chickens (HPAI or LPAI). Although they are classified as LPAI in chickens, some isolates can still cause disease in other species.

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Disease significance:

- Appearance and spread of HPAI H5N1 in poultry has increased the risk of spillover into human and non-human hosts.
- Poultry farms can sustain very high mortality and morbidity, leading to high costs and trade restrictions on poultry products
- Zoonotic infections of humans may lead to the development of viruses with pandemic potential, especially HPAI H5N1
- LPAI and HPAI viruses may emerge and cause disease in captive and free-ranging wildlife species

Zoonotic potential: Yes

Distribution: LPAI viruses occur worldwide in migrating birds and poultry. Infections have been confirmed in Africa, Asia, Australia, Europe, North America and South America. New HPAI viruses emerge periodically in poultry and HPAI H5N1 has become established in several Asian and African countries

Incubation period: Highly variable; Humans: typically 2-7 days (up to 17 days), poultry: 1-7 days, wild birds: typically 1-7 days. However, the actual incubation period of a given virus in any species (i.e., 9000 species of birds) will vary based on host and virus.

Clinical signs: This virus can infect the respiratory, digestive, or nervous systems, alone or in combination, depending on the host. Signs correlate with the location of the infection, and vary depending on viral subtype, environmental factors, age, health status and species.

LPAI (birds) - asymptomatic to conjunctivitis and mild respiratory symptoms (free-ranging and domestic species), decreased egg production (documented in domestic poultry, may apply to other species)

HPAI (birds)- sudden death of large numbers of birds, especially in poultry; may also see any of the following: marked depression, sinusitis, lacrimation, cyanosis of the head, edema of the head, green to white diarrhea, coughing, sneezing, blood-tinged oral and nasal discharges, podothecal ecchymoses, neurologic disease, decreased egg production, loss of egg pigmentation and deformed or shell-less eggs.

HPAI (mammals)- pyrexia and difficulty breathing or rapid breathing are typically the initial symptoms and may be followed by conjunctivitis, coughing, mucosal bleeding, diarrhea, vomiting, abdominal pain, neurologic signs, multi-organ failure, DIC and death. Morbidity and mortality are variable. Among zoo animals, fatal cases were reported among captive tigers and leopards in Thailand, but captive leopards, tigers, Asiatic golden cats and lions at a wildlife rescue center in Cambodia all recovered after an illness lasting 5-7 days.

Post mortem, gross, or histologic findings: Highly variable in birds, ranging from no lesions in peracute deaths to subcutaneous edema on the head and neck; edema and subcutaneous hemorrhages on the feet; fluid in the nares and oral cavity; conjunctivitis; hemorrhagic tracheitis; lung hemorrhage and congestion; petechiae throughout the abdominal fat, over serosal surfaces and peritoneum; congested kidneys sometimes plugged with urate deposits; hemorrhagic or degenerated ovaries with areas of necrosis; yolk from ruptured ova within the peritoneal cavity; yolk peritonitis and air sacculitis. It is important to note that the occurrence of peritonitis, tracheitis, edema of the wattles or neck, or petechial hemorrhages in the proventriculus may be particularly suggestive of an HPAI infection. Findings in mammals infected with HPAI are also broad-ranging and may include pulmonary congestion and edema, conjunctivitis, multi-organ congestion, widespread internal hemorrhages, encephalitis and myocarditis.

Diagnosis:

- Virus isolation and/or RT-PCR assays can identify avian influenza viruses in clinical samples. These tests can also distinguish some viral subtypes.
- Viral antigens and antibodies can also be detected with ELISAs including rapid tests. As of 2008, the World Organization for Animal Health (OIE) recommended that antigen detection tests be used to identify avian

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influenza only in flocks and not in individual birds.

- Serologic tests including agar gel immunodiffusion, hemagglutination inhibition and ELISAs are useful as supplemental tests. Blocking or competitive ELISAs are species independent and can be very useful for detecting prior exposure to AI virus in wild birds. AGID may be insensitive in some avian species and HI requires the proper viral antigen to be useful. Serology is not useful in the diagnosis of HPAI in susceptible species because they will die before they seroconvert.

Material required for laboratory analysis: Oropharyngeal, tracheal or cloacal swabs or, in small birds or for surveillance, feces may be used in live birds; additionally, organ samples (trachea, lungs, air sacs, intestine, spleen, kidney, brain, liver and heart) can be tested in dead birds. Links to sample collection protocols for the National Wildlife Health Center lab may be found on the USGS avian influenza page:

http://www.nwhc.usgs.gov/disease_information/avian_influenza/

Relevant diagnostic laboratories: Diagnostic testing for avian influenza is generally performed by specialized county, state, regional, or national laboratories, such as the USDA-approved laboratories in the National Animal Health Laboratory Network (NAHLN) (NAHLN@aphis.usda.gov; 515-663-7731). Authorities should be consulted regarding regulations for sending samples to authorized diagnostic laboratories.

Treatment: Four antiviral drugs - amantadine, rimantadine, zanamivir, and oseltamivir - are active against selected human influenza viruses. Studies suggest that these drugs may also be helpful in avian influenza infections in humans although many currently circulating strains are resistant to amantadine and rimantadine. In poultry, HPAI is managed primarily by flock eradication but LPAI may be managed with vaccination, eradication or quarantine.

Prevention and control: Each institution should have general preparedness protocol including advance communication with regulatory officials regarding potential courses of action, guidelines concerning the operation of the facility during an outbreak, surveillance techniques for captive animals and wildlife on the premise, preventative measures to protect public health, vaccination planning and biosecurity protocols (hand washing, disinfecting, quarantine, etc.). Additionally:

- Staff should be provided with information regarding human health precautions and trained for proper use of personal protective equipment.
- Case definition criteria for avian influenza should be established for captive species in order to identify the disease early and institute the biosecurity protocol.
- A testing plan should be established and a laboratory where the testing will be done should be identified.
- The entire collection should be catalogued as influenza susceptible or resistant based on the likelihood of infection in the event of exposure. The expected clinical appearance of infection of the susceptible birds and mammals in the collection should be recorded to prepare for a possible outbreak.
- Minimize contact between captive birds and wild birds
- Quarantine new birds for at least 30 days
- In the face of an outbreak, captive birds could potentially be vaccinated. > 25,000 captive birds were vaccinated with a H5N2 inactivated vaccine in European zoological facilities since 2005. Most birds seroconverted following the second booster vaccination, and semi-annual to annual vaccination is recommended. A negative correlation exists between antibody response and increasing mean body weight. Some species (pelicans and owls), may fail to respond to vaccination. Different species may have differing responses to vaccination, including duration of immunity, which may require regular serologic monitoring and additional booster vaccinations. Approval for zoological institutions to administer vaccinations to birds in the U.S. will be conditional and overseen by a federally accredited veterinarian. Restrictions on transporting vaccinated birds or releasing them back into the wild may be imposed.

Suggested disinfectant for housing facilities: Avian influenza viruses are relatively unstable in the

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environment and are inactivated by extremes in pH, heat, and dryness. The virus may persist for a long time in cool aquatic environments. The virus may survive over 100 days in cool fresh water and indefinitely when frozen. In the presence of organic matter, AI virus can be inactivated by aldehydes. After removal of organic matter, several classes of disinfectants are effective at destroying avian influenza virus: phenolics (One Stroke Environ), quaternary ammonium compounds (Roccal), oxidizing agents (Virkon), dilute acids (eperacetic acid), and bleach.

Notification: Any suspect cases should be reported to the state veterinarian or USDA Veterinarian (USDA Veterinary Services:1-866-536-7593)

Measures required under the Animal Disease Surveillance Plan: None

Measures required for introducing animals to infected animal: Not recommended

Conditions for restoring disease-free status after an outbreak: No official disease-free status offered

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