



Highly pathogenic avian influenza H5N1 viruses -

Risks to People, Companion Animals, Poultry and wildlife

Highly pathogenic avian influenza H5N1 viruses (HPAI) were first recognized as human pathogens in Hong Kong in 1997, when they caused 18 cases of respiratory disease, 6 of which were fatal. The outbreak was controlled by intensive culling of poultry in Hong Kong's farms and markets. Since December 2003, outbreaks of HPAI virus have reemerged in poultry in multiple Asian countries. They are being watched with concern by veterinary and medical communities since more than [100 reported human infections](#) have been associated with the virus, with high mortality rates (62%; mortality rate in patients with documented H5N1 infections). The basis for spread of the virus is unclear. **Public health specialists** considered that spread via migratory waterfowl is the most likely route. Ornithologists and veterinary epidemiologists were initially dubious since the HPAI H5N1 is highly pathogenic for many of these species ("dead ducks don't fly"), and the pattern of spread does not correspond to known flyways. The detection of the virus by scientists working for the Wildlife Conservation Society and USDA among dead ducks, gulls, geese, and swans in a remote site in Mongolia suggests that wildlife species are responsible for rapid movement of the agent in Asia and, more recently, in southeastern Europe. Some veterinary virologists in Europe have suggested that the best early warning system for HPAI might be to undertake virological surveillance of critical flyways of migratory birds. The Pacific Flyway is considered the most likely way (other than smuggling or inadvertent introduction of imported poultry or pet birds) that HPAI H5N1 may enter the US. Waterfowl are currently being tested in Alaska and the Aleutian Islands to check for HPAI - to date, it has not yet been detected.

H5N1 disease in people

Clinical signs in people are typical of influenza: fever, cough and shortness of breath, lymphopenia/thrombocytopenia and radiological evidence of pneumonia. A large proportion of patients develop gastrointestinal symptoms (diarrhea, vomiting, abdominal pain). Conjunctivitis is not prominent in H5N1-infected patients. A small proportion of patients present with fever and gastrointestinal symptoms and no respiratory symptoms. The clinical course of the illness is characterized by rapid development of severe bilateral pneumonia necessitating ventilatory support within days after onset. Complications are acute respiratory distress syndrome (ARDS), renal failure, and multi-organ failure. Similar clinical signs, due to lesions of necrotizing interstitial pneumonia, occur in non-human primates following experimental infection. Central nervous system occurs in a small proportion of cases. The most recent estimate of mortality rates (WHO Oct 24 2005) is that approximately one in two people with confirmed infection die of the disease (62 deaths among 121 clinical cases).

H5N1 disease in cats

An unusual property of some H5N1 isolates is that they can infect domestic cats. In a recent study published in *Science*, researchers in Holland demonstrated that cats developed elevated body temperature from 1 day post-infection, with decreased activity, protruded third eyelids/conjunctivitis, and labored breathing. In one small experimental group, one cat died and all inoculated cats had typical influenza-type alveolar damage in lungs. Cats excreted the agent and were capable of infecting sentinel cats. Cats could be infected following exposure to infected chicks. Non-domesticated large feline species are also susceptible. A zoological collection in Thailand lost tigers (*Panthera tigris*) and leopards (*P. pardus*) with clinical signs and lesions typical of influenza. Cats were fed chickens from a local slaughter house that were presumed to be infected with H5N1. H5N1 typical of isolates circulated in Asia were isolated from tissues of these zoo cats.

H5N1 disease in ferrets

Ferrets are susceptible to some human and avian-derived isolates of H5N1. In experimental studies, ferrets inoculated intranasally developed fever, weight loss, anorexia, extreme lethargy, diarrhea, and death. Signs of respiratory disease included nasal discharge, sneezing, and dyspnea. Other signs were yellow-colored diarrhea and transient lymphopenia. Depending on the strain of HPAI virus, ferrets may develop neurological signs. Experimentally these included ataxia, hind-limb paresis, uncontrolled movements, and torticollis.

H5N1 in domestic chickens

Highly pathogenic avian influenza viruses (HPAI) are defined as isolates that under experimental conditions kill 6 of 8 inoculated domestic chicks within 10 days of inoculation. Classical signs of HPAI include high mortality rates and associated clinical signs of decreased egg production, respiratory signs, excessive lacrimation, edema of the head and comb, diarrhea, and neurological symptoms

H5N1 disease in geese

HPAI H5N1 isolates can be highly pathogenic in geese. In some of the original outbreaks in China, up to 40% of geese on some farms died. Experimentally, some isolates are highly pathogenic to geese, which can transmit infection to flock mates. Clinical signs are weight loss, lethargy, and diarrhea.

Current distribution

The H5N1 avian influenza virus has now reached the poultry in Romania and Greece, as well as neighboring Turkey. A ban on poultry imports from Turkey and Romania was introduced in Oct 2005 by European Union officials. HPAI H5N1 does not currently exist in the United States. The major potential portals of entry would be through smuggled infected birds, or from the Pacific flyway. Migratory waterfowl and other avian species are being monitored in Alaska and to date no evidence of the HPAI has been found in the ~5,000 birds that are tested annually by the USDA.

Useful websites with direct links to H5N1 information

[Centers for Disease Control and Prevention](#)
[World Organization for Animal Health](#)
[World Health Organization](#)
[Food and Agriculture Organization](#)
[United States Department of Agriculture](#)
[USGS National Wildlife Health Center](#)

Additional reading:

Maines TR et al: 2005, [Avian influenza \(H5N1\) viruses isolated from humans in Asia in 2004 exhibit increased virulence in mammals](#). J Virol. 2005 Sep; 79(18):11788-11800.
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Govorkova EA et al: 2005, [Lethality to ferrets of H5N1 influenza viruses isolated from humans and poultry in 2004](#). J Virol 79: 2191-2198
Rimmelzwaan GF et al: 2001, [Pathogenesis of influenza A \(H5N1\) virus infection in a primate model](#). J Virol 75: 6687-6691
Zitzow L.A et al: 2002. [Pathogenesis of avian influenza A \(H5N1\) viruses in ferrets](#). J. Virol. 76:4420-4429
Webster RG et al: 2002, [Characterization of H5N1 influenza viruses that continue to circulate in geese in southeastern China](#). J Virol 76: 118-126
Keawcharoen J et al: 2004, [Avian influenza H5N1 in tigers and leopards](#). Emerg Infect Dis 10 2189–2191