FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

FAQ

Highly Pathogenic Avian Influenza

(HPAI, Fowl Plague, „Bird Flu“)




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Disease and causative agent

What is meant by avian influenza and ‘bird flu’?

Classical avian influenza is a fatal disease of birds that affects in particular chicken and turkeys. Other bird species, such as ducks and geese, are generally less susceptible. The disease is caused by highly pathogenic (HP) avian influenza viruses (AIV) of the subtypes H5 and H7.

Highly pathogenic AIVs evolve from low pathogenic influenza viruses by mutation. Low pathogenic influenza viruses are variants that cause only mild symptoms of disease. Only infections with an HPAIV variant cause dramatic courses of disease with a mortality rate of up to 100 percent. The disease can then spread rapidly and is therefore referred to as fowl plague.

‘Bird flu’ has been the public term for infections of farmed poultry with avian influenza viruses since the first occurrence of the highly pathogenic H5N1 virus from Asia in Europe nearly twenty years ago.

Further information on the symptoms of the disease is available on the FLI website on classical fowl plague.

Why are some influenza viruses particularly pathogenic for birds, while others cause no or only mild symptoms of disease?

Avian influenza viruses belong to the group of influenza A viruses. They have two surface proteins, hemagglutinin (H) and neuraminidase (N), which are important for interaction with cells and thus for their infection. These proteins can occur in different variants (subtypes). In avian influenza viruses, 16 hemagglutinin (H1-16) and nine neuraminidase subtypes (N1-N9) have been described. The subtypes of the virus are designated according to the combination of H and N, such as H5N1, H5N8, H7N3, or H7N7.

Both surface proteins are subject to constant change. This gives rise to new variants which can evade the birds‘ host defence, occasionally infecting new hosts and thus ensuring their spread. Naturally, only the subtypes H5 and H7 can evolve into highly pathogenic variants by spontaneous mutations of low pathogenic viruses (LPAIV) of the same subtypes. While LPAIV replicate only locally in the respiratory and intestinal tract of the birds, HPAIV disseminate throughout the entire body and cause death within 2 to 3 days. The mutations that are partly responsible for this consist in a modification in a region of the hemagglutinin that is important for activation of the protein by protein cleavage.

Purebred poultry is said to be less susceptible to fowl plague than hybrid breeds used for egg and meat production, is that true?

No, fowl plague affects all poultry, also regardless of the husbandry type. The fact that purebred poultry can become infected was impressively demonstrated by more than 50 outbreaks in purebred poultry holdings and hobby poultry farms in several German federal states, which could be traced back to virus transmission at purebred poultry exhibitions.

Distribution

Where do the fowl plague viruses that have occurred in Europe in recent years come from?

From early 2006 through the fall of 2020, several waves of outbreaks occurred in Germany and Europe with various fowl plague viruses of the subtype H5, all of which coincided in time and space with the fall migration of migratory waterfowl from the European part of Russia. In each case, the outbreaks extended into the following spring and then subsided during the summer months.

With the fall bird migration 2020, fowl plague viruses of the subtype H5 were again introduced into Europe presumably via bird migration. This was followed by an epizootic (epidemic in animals) in wild birds, kept birds and poultry in Europe. Various subtypes occurred, until the summer of 2021 predominantly H5N8.
The epizootic gradually quieted in the summer of 2021, but never subsided completely. Over the summer, particularly northern European countries continued to report isolated cases of HPAIV H5 from the breeding sites of geese and ducks wintering on the coasts of Germany. From the fall/winter 2021 on, the fowl plague virus H5N1 emerged from various reassorted viruses of various subtypes and has dominated the epizootic ever since.

How does the current fowl plague situation differ from that in previous years?

Unlike in previous years, the currently dominating fowl plague virus H5N1 was not introduced into Europe with the fall bird migration, but results from fowl plague viruses that have persisted in Europe since 2020/21. While in previous years a significant slowdown in virus activity was observed during the summer months, H5N1 has continuously caused cases of infection in wild birds and outbreaks in poultry since the fall of 2021.

The virus now circulates year-round in wild bird populations in Europe, which was not observed previously. This resulted in a very large number of cases in the early summer of 2022, particularly in seabirds nesting colonially. Along the North Sea and Baltic Sea coasts, heavy losses occurred in terns, cormorants, gulls and northern gannets, sometimes threatening the population.

But the virus also spread rapidly outside Europe: several African countries reported cases in wild birds and outbreaks in poultry. Cases and outbreaks were also reported from Asia, e. g. from Japan, the Philippines, Nepal, India, and Korea. Furthermore, the spread of HPAIV H5N1 across the Atlantic to North America since November 2021 and from there across Central and South America since the fall of 2022 is unprecedented.

How is the fowl plague virus introduced into poultry holdings?

A number of factors may be responsible for the introduction of fowl plague viruses into poultry holdings. In free-range holdings, direct contact of poultry with infected wild birds is possible. However, the virus can also be introduced into seemingly closed animal houses by indirect contact: among other things, the addition of new animals, passenger and vehicle traffic, goods, feed and water pose risks for introduction. In particular, indirect introduction via feed, water, equipment, or litter possibly contaminated with the virus must be taken into consideration. Even traces of virus-contaminated faeces or nasal secretions from wild birds or poultry from other infected holdings are sufficient for transmission.

What is the role of migratory birds in the spread of highly pathogenic avian influenza viruses?

It is scientifically proven that wild birds are a natural reservoir for low pathogenic avian influenza viruses (LPAIV) and spread them. Highly pathogenic variants of the subtypes H5 and H7, however, apparently do not evolve in wild bird populations, but in poultry. From there, however, HPAIV can be transmitted to wild birds which can then spread them further. The spread by migratory birds, e. g., has been studied and described in detail for the highly pathogenic virus H5N8 of 2014, among others by an international research consortium consisting of virologists, epidemiologists, and ornithologists (Global Consortium for H5N8 and Related Influenza Viruses. *Science*. 2016;354(6309):213-217. doi:10.1126/science.aaf8852; Lee DH et al. J *Virol*. 2015;89(12):6521-6524. doi:10.1128/JVI.00728-15).
The introduction and spread of HPAIV by wild birds plausibly explain many of the outbreaks in and outside Europe.

Can infected migratory birds travel long distances at all?

It is not known in detail how far HPAIV-infected wild birds are able to fly. However, several hundred kilometres are conceivable, because a bird that has become infected does not immediately develop severe symptoms of disease, which would render it unwilling or unable to fly. During the so-called incubation period, which can last several hours to 2 days, HPAIV already replicates in the bird, which is, however, still healthy. A single infected bird certainly will not be able to travel several thousand kilometres on its way from Central Asia to Europe. What is crucial however, is that infection chains are established through which the virus is transmitted to different other migratory birds from stopover site to stopover site. Thus, a large-scale, rapid spread of the pathogen as if by relay due to the overlapping migration routes can easily be imagined.

Susceptibility of mammals

Can mammals become infected with H5N1?

There are some reports of infection in mammals worldwide, including foxes, otters, seals, black bears, grizzly bears, and a cat. The infected mammals probably contracted the virus by ingesting dead wild waterfowl carrying the infection. In doing so, they may have ingested large amounts of virus. Scientifically, such infection events are referred to as ‘spill-over’.

Is the detection of the virus in mammals a reason for concern?

The so far small number of isolated cases shows that in principle there is a risk of infection for mammals and that therefore increased surveillance is indicated. This applies in particular to hunters in regions where fowl plague occurs in wild birds. Conspicuous behaviour of animals and the detection of dead wild birds and mammals in connection with an increased mortality of wild birds should be reported immediately to the veterinary authorities to initiate recovery and if necessary examination.

Can mammals transmit the virus?

In late October 2022, Spain reported an outbreak of HPAIV H5N1 in mink in a fur farm. In mink farms, large numbers of animals are kept in confined spaces, which facilitates infection events in these susceptible mammals. In the case of the fur farm, the virus may have been transmitted from mink to mink, in contrast to the isolated cases of infection in individual free-living foxes, martens, raccoons, seals, which had contracted the virus from infected bird carcasses. This is associated with a particularly strong selection pressure towards adaptation to mammals.

Human health risk

Do fowl plague viruses pose a human health risk?

For highly pathogenic avian influenza viruses, there is in principle a risk of infection for humans in the event of intensive contact with infected poultry. Therefore, increased protective measures have been recommended when handling potentially infected poultry and wild birds.

More detailed information can be found on the website of the Robert Koch-Institute.

Have there been any human infections caused by the currently circulating fowl plague virus H5N1?

There have been five reported human infections worldwide as of the end of January 2023, one in the United Kingdom, one in the USA, one in Ecuador, and two in Spain. The individuals had contracted the disease through close contact with infected poultry. Apart from the case in Ecuador, the infections were asymptomatic or very mild. So far, there has been no further spread by human-to-human transmission.

Is the H5N1 virus detected in minks in Spain more easily transmissible to humans?

The transmission between minks observed in Spain does not directly mean that the virus is more easily transmissible to humans. However, a mutation of this virus that could represent an adaptation to mammals has already been detected. A virus that can be transmitted more easily from mammal to mammal may also be able to cross the species barrier to humans more easily.

The properties of this virus need to be studied further in detail to keep track of further adaptations that might increase transmissibility to humans.

Do poultry products pose a health risk for consumers?

Transmission of fowl plague viruses via food products originating from infected poultry is theoretically conceivable, but unlikely in this country. The animal disease control system in Germany ensures that infected poultry is quickly identified and products from infected holdings are not put into circulation. The German Federal Institute for Risk Assessment, which is among other things responsible for food safety, provides information on its website www.bfr.bund.de.

Diagnostics and outbreak investigations

How can the pathogen be detected in wild birds or domestic poultry?

In Germany, the federal states are responsible for the initial investigation of a suspected case. For this purpose, the respective state laboratories use PCR detection as the standard diagnostic method.

For official disease detection, sample material is sent to the National Reference Laboratory for Avian Influenza/Fowl Plague at FLI. More detailed information can be found in the Amtliche Methodensammlung (Official Collection of Methods, esp. item 2: sample material).

Here you can find detailed information on the tests used and an overview of the test procedure. The clarification of a suspected case at FLI takes place within one working day.

Does FLI also investigate dissemination routes of fowl plague pathogens via the transport routes of the international poultry-producing industry?

Yes. When involved in outbreak investigations, FLI investigates all conceivable causes of introduction including the acquisition of live poultry and the introduction of possibly contaminated goods or equip-

ment into the affected holding. In addition, imports and intra-Community movements of birds and animal-derived products are tracked through TRACES, an EU reporting system. Imports of poultry and poultry products from HPAI-affected areas are prohibited. However, illegal imports may pose a non-negligible risk; moreover, this also applies to individual tourist traffic from HPAI enzootic areas. In the context of advisory service provided to the holdings and of epidemiological investigations, the optimization of biosecurity in poultry holdings plays a crucial role: extensive testing and continuous improvements help to increase the protection of the holding from virus introduction

Vaccinations

Why is poultry not vaccinated against avian influenza?

Until now, the vaccination of poultry has been prohibited in Europe. Animal disease control heavily relied on early (clinical) detection of virus introduction; rapid culling and safe disposal of the animals in the affected holdings ensured that a further spread of the virus from holding to holding was prevented. However, this approach was based on the premise that outbreaks were rare events and that the fowl plague virus did not cause large numbers of infections throughout the year. This situation has now changed fundamentally as the virus is detected in wild birds year-round and thus appears to have established itself in the wild bird population. This means that there is increased infection pressure on poultry throughout the year.

Will this change in the future?

Due to this changed epidemiological situation, the possibility to vaccinate poultry and zoo birds against HPAI throughout Europe in the future is being discussed. The legal basis is currently being established; the EU Parliament will decide on a corresponding bill.

Are there suitable vaccines?

Currently, one vaccine is licensed in the EU, which however is based on an antiquated virus strain. More modern vaccines are available and are already being used in North Africa and Asia. In Europe, however, they have not yet been approved by the European Medicines Agency (EMA).

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