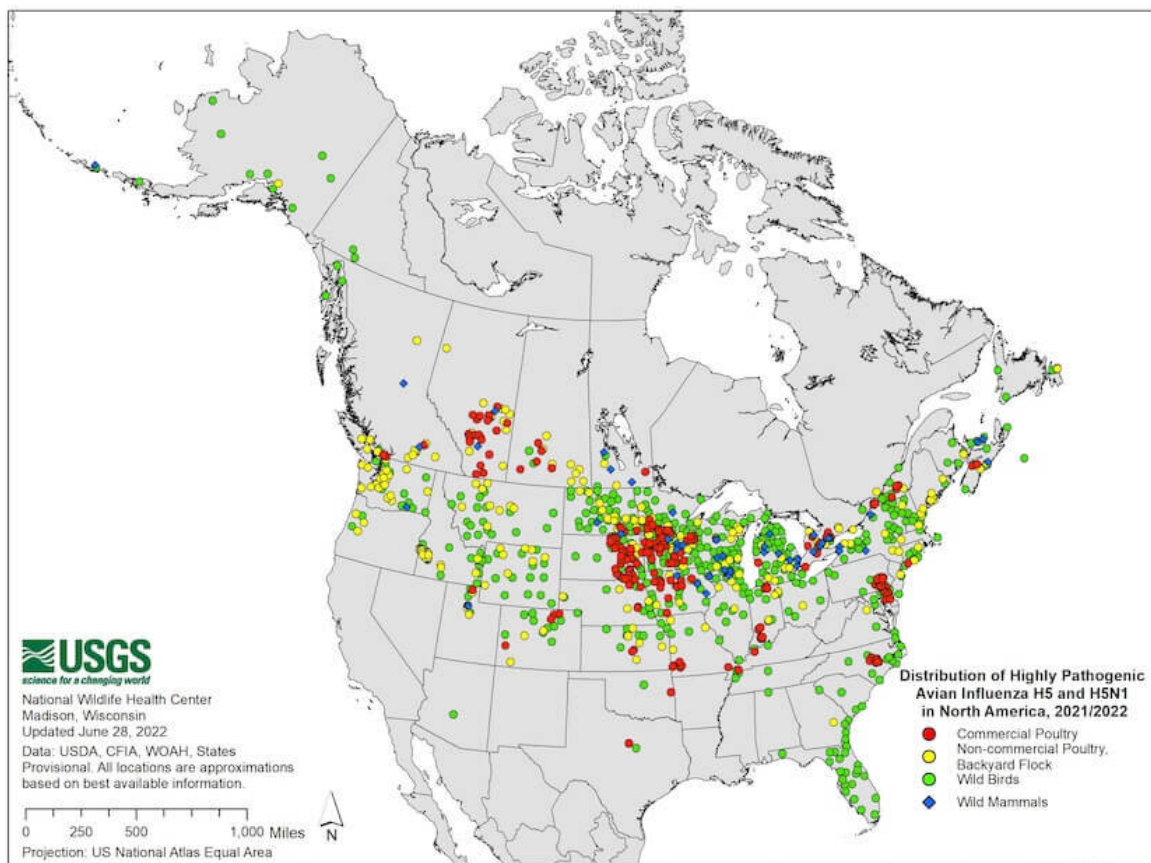


Avian influenza: Past, present, future

July 5 2022



Distribution of Highly Pathogenic Avian Influenza H5 and H5N1 in North America, 2021/2022. Updated June 03, 2022. Credit: USGS

Due to the possibility that bird flu viruses could mutate and gain the

ability to spread easily between people, avian influenza poses a significant pandemic threat to birds and humans alike. [The U.S. Centers for Disease Control and Prevention \(CDC\) has been monitoring for illness among humans exposed to infected birds](#) since outbreaks were detected in poultry and wild bird populations in late 2021-2022. As of July 5, 2022, the U.S. Department of Agriculture (USDA) [reported 40.09 M birds in 36 U.S. states to be infected with highly pathogenic avian influenza \(HPAI\)](#).

Out of the 382 flocks to test positive for the [virus](#), 186 were commercial and 196 were backyard flocks. Yet, only 2 [human](#) cases associated with this particular group of avian [influenza](#) have been detected globally—1 in the U.S. and the other in the U.K. Understanding the history of this virus, as well as current guidelines and recommendations for investigations and response (i.e., monitoring for human infection and person-to-person spread) are extremely important for [public health](#).

History of highly pathogenic avian influenza

It was 1878 in northern Italy, and veterinarian [Edoardo Perroncito](#) observed a problem. A [contagious respiratory disease](#) was spreading among [poultry](#) with a high fatality rate. At the time, "[fowl cholera](#)," a deadly respiratory disease, caused by the bacterium *Pasteurella multocida*, was common and believed to be the culprit of the disease. As other investigators studied Perroncito's findings throughout the 1900s, they determined that [the disease was caused by a virus](#) small enough to pass through a filter, which was later determined to be a highly pathogenic avian influenza (HPAI) and was officially renamed as such in 1981.

As [HPAI continued to spread globally throughout the 1920s](#), sporadic outbreaks occurred, including several in the U.S. [From 1959-1995, the emergence of HPAI across the world was reported on 15 separate](#)

[occasions](#). All infections were caused by the influenza A virus, but the subtypes varied between H5 and H7 groups. (Note: Influenza A virus is divided into subtypes, based on the properties of hemagglutinin (H) and neuraminidase (N) proteins present on the virus's surface). Interestingly, up until 1996 the [U.K. was disproportionately impacted by the disease](#), while only 1 outbreak was known to have occurred in all of Asia.

In 1996, things changed. A new strain of HPAI subtype H5N1 was introduced to poultry via migratory waterfowl in the Guangdong province of China, [resulting in a mortality of greater than 40% in aquatic birds](#). Subsequent reassortment events between HPAI and low pathogenic avian influenza strains (LPAI) led to an HPAI strain that was disastrous for Hong Kong, resulting in the [culling of the entire poultry population, 18 human infections and 6 human deaths](#). This was the first time a lethal case of HPAI in humans had been documented; human infection with HPAI was previously believed to be improbable.

After the outbreak of HPAI in Hong Kong in 1997, things remained quiet until 2003 when 2 humans were diagnosed with HPAI H5N1 after returning from China. From 2003-2018, human cases were reported from 16 countries resulting in hundreds of deaths.

Symptoms and transmission of avian influenza in birds

Fortunately, many avian influenza A viruses exhibit low pathogenicity, causing few signs of disease in infected wild birds. Low pathogenic avian influenza (LPAI) viruses are either asymptomatic or cause mild/subclinical disease (such as ruffled feathers and a drop in egg production) in chickens and poultry.

However, [these viruses are primed for continual emergence and pandemic potential](#), and some low-pathogenic viruses can mutate in poultry into highly [pathogenic avian influenza](#) viruses. HPAI viruses

often cause severe disease and high mortality in infected poultry. HPAI A(H5) or A(H7) virus infections can cause disease that impacts multi-organ systems with [mortality as high as 90-100% in chickens](#), often within 48 hours. HPAI A(H5N1) is one of the most contagious viruses occurring among birds, and the clinical outcome is typically deadly, especially in domestic poultry. However, ducks can be infected without any signs of illness.

HPAI A(H5) and A(H7) virus infections in poultry can also [spill back into wild birds](#), resulting in rapid geographic dissemination of the virus with bird migration. While some wild bird species can be infected with some HPAI A(H5) or A(H7) virus subtypes without appearing sick, other HPAI A(H5) and A(H7) virus subtypes can cause severe disease and mortality in some infected wild birds, as well as in infected poultry.

Transmission of avian influenza from birds to humans

When birds are infected with this virus, they shed bird flu virus through their saliva, mucous and feces. Human infections are likely caused by accidental inoculation of virus into a person's eyes, nose or mouth or via respiratory routes. Inhalation of virus occurs when the virus is in the air (in droplets or possibly dust) and a person breathes it in, or possibly when a person touches a [fomite](#) (contaminated object) that has virus on it then touches their mouth, eyes or nose. No human bird flu infections have been reported [from proper handling of poultry meat or from eating properly cooked poultry or poultry products](#).

Why ONE HEALTH is Important

As Earth's population grows, our connection with animals and the environment changes:



People live closer together



Changes in climate and land use



More global travel and trade



Animals are more than just food

These factors make it easier for diseases to spread between animals and people.

A One Health approach tackles shared health threats by looking at all angles—human, animal, plant, and environmental

www.cdc.gov/onehealth



Credit: CDC

Bird flu [transmission from human-to-human is very rare](#), and [when it has happened](#) it has only spread to a few people. Human infections with bird flu viruses have ranged in severity from asymptomatic/mild illness to severe disease resulting in mortality. [Asian lineage H7N9](#) and [Asian lineage H5N1](#) viruses have been responsible for most human illness from bird flu viruses globally, including the most serious illnesses and illness with the highest mortality.

Research has also reported that [companion animals](#), especially [cats](#), may be at risk of disease and/or death from HPAI. [Dogs](#) may also be susceptible, but only in rare instances. [Some strains](#) of the virus can affect mammals, such as pigs, cats, horses, dogs and ferrets.

Symptoms of avian influenza in humans

[What does a bird flu infection in people look like?](#) The reported signs and symptoms of this type of infection in humans range from asymptomatic to mild (e.g., conjunctivitis/red eye) or mild, flu-like (e.g., upper respiratory symptoms), to more severe (e.g., pneumonia requiring hospitalization). Fever (temperature of 100°F [37.8°C] or greater), cough, sore throat, congestion, [achiness](#), headaches, fatigue and shortness of breath or difficulty breathing are common. Diarrhea, nausea, vomiting or seizures may be observed more rarely.

One Health epidemiology for tracking and prevention

The [One Health](#) initiative is a collaborative, multisectoral and transdisciplinary approach—working at the local, regional, national and global levels—with the goal of achieving optimal health outcomes, recognizing the interconnection between people, animals, plants and their shared environment.

H5N1 is a 1 of many examples that illustrates the ongoing and critical importance of a One Health initiative for zoonotic and/or vector borne diseases that intersect animal and plant health, environmental space and human health. A recent Health Alert Network (HAN) CDC Advisory for [Highly Pathogenic Avian Influenza A\(H5N1\) Virus: Recommendations for Human Health Investigations and Response](#) was released for multiple entities and personnel.

For full guidelines and descriptions of the recommendations, please see the [CDC HAN Advisory](#).

Current state of highly pathogenic avian influenza (HPAI) and prevention

The pandemic risk associated with HPAI is high. [The combination of](#)

[rapid mutations in hemagglutinin and neuraminidase glycoproteins and increased risk of HPAI spillover from poultry to humans](#) is cause for significant concern. H5N1 HPAI was replaced by H5N6 and H5N8 subtypes from 2014 through 2020. However, in 2021 H5N1 emerged again and seemed to be more fit to predominate. [Since early 2021, the new H5N1 HPAI that is responsible for the ongoing outbreak has effectively displaced other H5 HPAI viruses.](#) While the reason for this is not entirely clear, it is believed that the explosion of cases is due to the introduction and spread of the virus by migratory birds. In the U.S. alone, [the current outbreak of HPAI H5N1 has led to the death of over 37 million poultry.](#)

[The first human case of the current avian influenza outbreak in the U.S.](#) occurred in a worker who was culling a flock of poultry with suspected avian influenza in Colorado in April, 2022. The Centers for Disease Control (CDC) stresses that the [increased detection of H5 influenza in birds does not change the risk to the general public's health](#), and the risk of members of the general public acquiring infection with avian influenza is low. While no human-to-human transmission has occurred with the [avian influenza](#) that is currently circulating in the U.S., the CDC is closely watching for signals that might indicate increased risk of infection for the general public.

Although a vaccine against HPAI in poultry is available, [it is not commonly used and presents many challenges](#). Mass poultry vaccination has been successfully accomplished in countries with good veterinary infrastructure, but barriers include regular [reformulation of the vaccine, limited cold chain capacity, government participation and costs.](#) Furthermore, [if vaccination is not performed properly it can contribute to the emergence of new field strains.](#)

The greatest risk of infection is for individuals who directly handle or work around poultry. This is an exceptionally important risk to consider,

given that the [COVID-19 pandemic and fears of food shortages contributed to an exponential increase in backyard poultry ownership](#). The CDC has developed [individual guidance documents](#) for various audiences, which include hunters, the general public, poultry producers (including those who have backyard poultry), poultry outbreak responders and healthcare providers.

Provided by American Society for Microbiology

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