

Pandemic Plan for the Church

Ministering to the Community in a Time of Crisis

Avian Influenza

Recent genetic sequencing of the circulating H5N1 virus shows mutations that allow it to be more receptive to human cells, bringing it closer to becoming human-to-human transmissible. This is causing great concern in the scientific community.

Avian Influenza (HPAI H5N1)

The highly pathogenic avian influenza (HPAI) H5N1 also known as the Bird Flu, is a zoonotic influenza that naturally occurs in wild aquatic/migratory birds worldwide. These waterfowl are the natural reservoir for this virus, and they are the most resistant to infection.



Migratory Waterfowl
aabeele/Shutterstock¹

It is a type A influenza, with surface glycoprotein subtypes hemagglutinin (HA)5, and neuraminidase (NA) 1, which dictate viral entry and release into host cells. Humans have no immunity to these viruses.

Avian influenza A viruses are classified into two categories *low pathogenic avian influenza* (LPAI), and *highly pathogenic avian influenza* (HPAI). These refer to their ability to

cause severe illness in birds. LPAI may cause no symptoms or just a mild illness, and sometimes it may not even be detected. However, infection with HPAI can cause a rapid onset of disease that affects multiple internal organs that leads to severe illness and rapid death. HPAI can have a mortality that can approach 100%. The differences are due to genetic and antigenic differences between the influenza A virus subtypes. These differences also determine if a virus can infect only birds, or if they can infect birds and people.

It was first identified in China in 1996. It has spread by bird migration and since then, it has become the dominant strain in bird populations worldwide. Although it normally affects wild birds, and domestic poultry, genetic mutations have allowed it to infect other birds and now other animal species.

The virus has also spread widely among birds and other animals across multiple continents. Due to genetic mutations, the H5N1 virus has now been able to infect other species and detections of this virus has been found in both wild and captive mammals.

Qinghai Lake, China

Before 1996, HPAI viruses were largely confined to Southeast Asia. In 2005 an outbreak of H5N1 appeared in Qinghai Lake, China. Qinghai Lake is China's largest inland expanse of salt water and is known for its high diversity of migratory birds. It is a breeding site, and every summer, more than 150,000 migratory birds pass through this region, which sits within the eastern portion of the Central Asian flyway, a migration route which extends from India to Russia. In April 2005, 6,500 birds died on the shores of Qinghai Lake.



From 2003 through 2009, the Qinghai-Tibet Plateau experienced 16 confirmed outbreaks of the virus in wild and domestic birds. Bird flu that spread beyond Asia and into Europe and Africa was later found to have genetically originated in the Qinghai Lake area. A study also

uncovered a migratory link between Qinghai Lake and Mongolia, further suggesting that Qinghai may be a pivotal point of H5N1 transmission. Chinese authorities have denied the outbreak and prohibit news. Below are images of Bird Island taken in 2005.



Bird Island at China's largest inland expanse of salt water, Qinghai Lake.^{ii,iii}

April 2005, 6500 birds died on the shores of the lake.

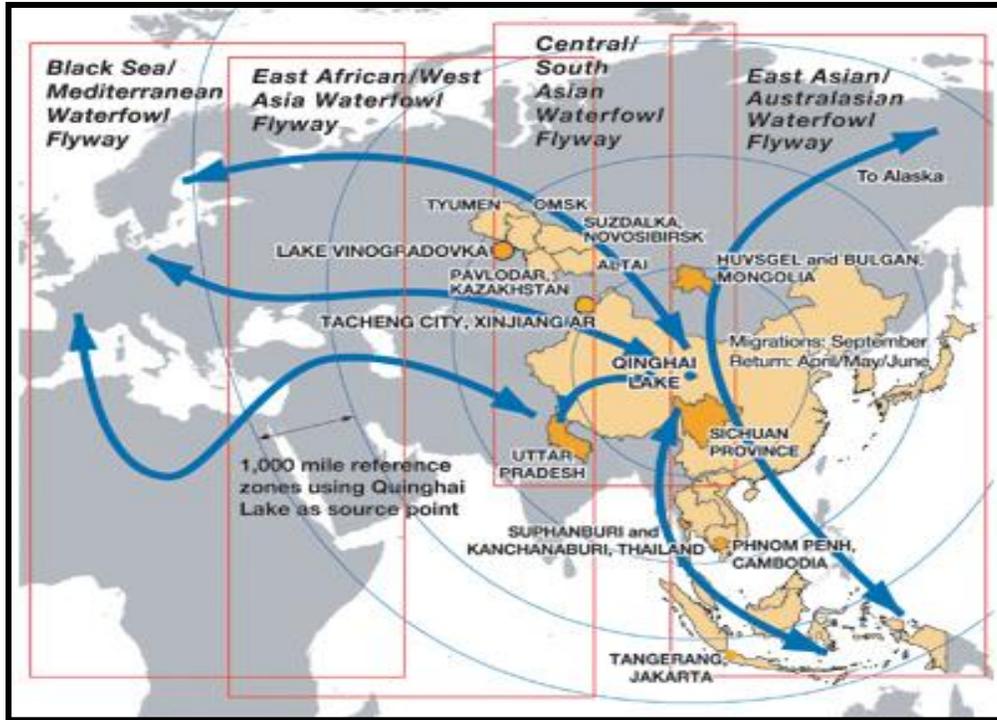
Photos taken June 3, 2005, after Bird Island was placed under quarantine May 27, 2005.

It is believed that the epicenters of both the Asian influenza pandemic of 1957 and the Hong Kong influenza pandemic of 1968 were in Southeast Asia. The H5N1 was first detected in Guangdong Province, China, in 1996, when it killed some geese. This outbreak did not receive much attention until it spread through live-poultry markets in Hong Kong. In May 1997 it spread to humans, killing 6 of the 18 people infected. From 1997 to May 2005, H5N1 viruses were largely confined to Southeast Asia, but after they infected wild birds in Qinghai Lake, China, they rapidly spread westward.

Spread of Avian Influenza

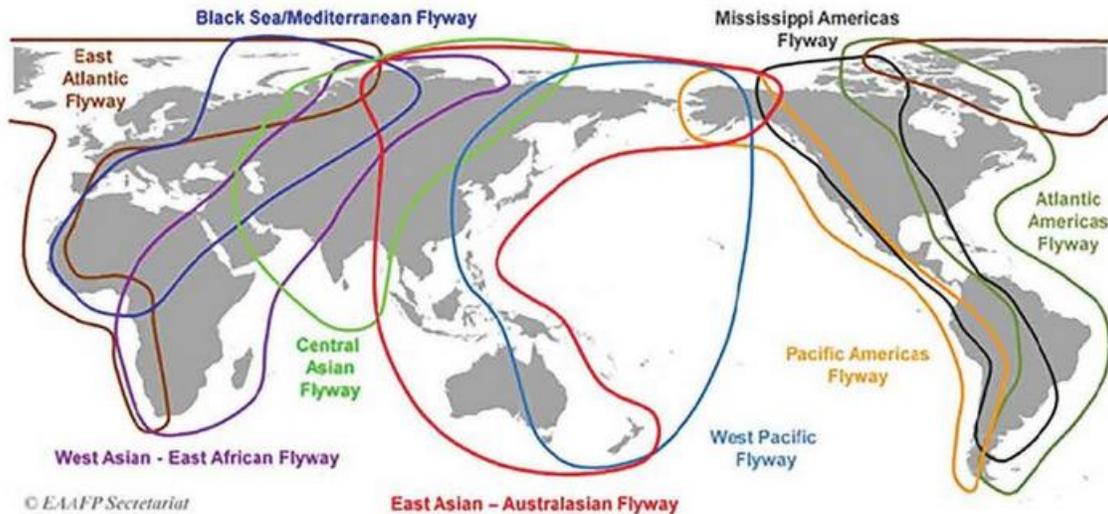
Migratory Flyways

Migratory birds infected with the HPAI H5N1 soon were carrying the virus to various parts of the world. Flyway maps were studied to follow the destination of these birds, and outbreaks ensued in the countries where the birds migrated.



Waterfowl Flyways of the Eastern Hemisphere^{iv}

There is a crossroad of two international flyways. One is on the Asian side and the other on the North American side. Alaska is one of the forefronts where the Avian flu was likely to arrive in the United States because of its position. The U.S. Fish and Wildlife Service watched for birds as soon as they arrived from Asia during spring migration. They looked to identify infected birds that may have been carrying the virus.



Migratory Bird Flyways^v

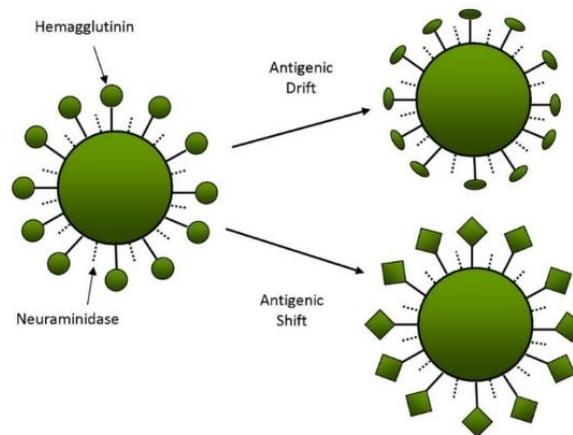
U.S. satellites tracked infected flocks that migrated from Asia and headed north to Siberia and Alaska. In early 2015 the H5N1 reached North America by this crossroad. This occurred by infected birds mixing with other fowl in nesting areas. As these infected birds mingled with flocks from the North American flyways, the virus spread into Canada and the U.S. The H5N1 virus has spread through the avian population, it is speculated that there is no populated area in the world that is not be affected.

Avian Influenza Infections in Humans

Avian viruses are primarily viruses that infect birds and do not commonly infect humans. However, the H5N1 and H7N9 have crossed species barriers due to mutation and the phenomena of antigenic drift and shift. The 1918 Influenza virus was also of avian origin. Studies comparing the reconstructed 1918 virus (an H1N1 strain) to avian H5N1 found certain structural and functional genetic similarities. Both cause severe pulmonary pathology, with both causing rapid, lethal, and intense inflammation in lung tissue.^{vi} While the 1918 virus was highly adapted to humans, the H5N1 has more mutations for efficient human-to-human transmission, though it remains a severe, high-mortality threat.^{vii} Humans have little or no immune protection.

Antigenic Mutation

The protein antigens, hemagglutinin and neuraminidase, are important structures for the spread of the virus. The immune system recognizes viruses by these antigens. When viruses reproduce, the antigens on the new viruses may become slightly different to prevent the immune system from recognizing the virus. This is called mutation and is a normal part of the virus' lifecycle. Slight changes are known as antigenic drift, and much larger, abrupt changes are called antigenic shift and can result in epidemics and pandemics. These mutations can result in influenza viruses jumping between species of animals and even its ability to be transmitted from animals to humans.



Antigenic Drift vs. Antigenic Shift

Antigenic shift has taken place with the HPAI H5N1 virus. The United States Department of Agriculture (USDA) has recorded up to 200 mammal species confirmed to be infected with the H5N1. including, bears, wild and domestic cats, marine mammals, raccoons, mice, skunks, opossums, wild and domestic canines, sheep, alpacas, cows, swine, ferrets, minks, foxes, among others.^{viii} Domestic poultry such as chickens and turkeys are easily susceptible to avian influenza.

Humans living and working in close proximity to infected animals pose a great threat to allowing the virus to jump species. We have experienced this in the United States with dairy workers acquiring the disease from infected cows. Others have become infected by exposure to sick poultry and other affected animals. Human exposure to this virus allows it the opportunity to mutate by antigenic shift which could lead to humans becoming easily infected.

Wet markets, (live animal markets) especially live bird markets in Asia have been identified as a key source of transmission for the avian influenza H5N1. They often house a variety of live animals in crowded unsanitary conditions, including poultry, fish, reptiles, and mammals of every kind. Live birds are butchered and defeathered, allowing for transmission of the H5N1 virus to humans. It was determined that these live markets were the source of the H5N1 influenza virus killing six of 18 people in Hong Kong.^{ix}



Chinese Wet Market^x

Acquiring HPAI H5N1 from Poultry

Another serious concern is backyard poultry in Asia. Outbreaks reported in countries like Vietnam, Cambodia, China, and Indonesia, are usually the caused by both commercial and backyard poultry. They occur through close contact with infected poultry, particularly in backyard settings where there is frequent interaction. Backyard poultry in rural areas is a source of income for families and part of the local economy. Many people do not report illness in their flocks, nor people for fear of government officials confiscating their flock for slaughter.

Due to humans living in close proximity to domestic poultry, conditions are favorable for antigenic shift (mutation). Illness in humans has ranged from mild to severe. In adults, most infections from the H5N1 virus have occurred among those who have removed feathers or slaughtered infected poultry. Children can be infected by playing around sick or dying poultry. The virus is present in droppings, saliva, nasal and respiratory secretions, and blood of infected animals.

The virus can be acquired by touching contaminated surfaces, handling infected birds, touching secretions, inhaling dried feces, and inhaling crystalized secretions. Defeathering, butchering, and consuming infected birds that are not fully cooked can also cause infection.

Feces of infected birds contain the bird flu virus. Bird droppings can contaminate feed, equipment, vehicles, shoes, clothing, soil, dust and water. The feet and bodies of other farm animals can also carry the H5N1 virus. Humans can become infected and ill with avian influenza after coming into contact with infected birds and by doing the following:

- Touching contaminated surfaces
- Touching secretions (saliva or fluids from infected birds)
- Inhaling crystalized secretions
- Touching infected birds including de-feathering
- Being in contact with the feces of infected birds
- Inhaling dried feces dust from infected birds
- Slaughtering or butchering infected poultry
- Preparing poultry for cooking, if the bird was infected
- Visiting markets where live birds are sold. If the birds are infected, those who handle them have a risk of becoming ill

WHO has determined that you cannot become infected if you eat cooked poultry. They instruct that poultry should be cooked to at least an internal temperature of 165 F (74 C). According to experts, humans cannot become infected by eating eggs. Even so, the US Food and Drug Administration says eggs should be cooked until both the white and yolk are firm.

Human Infection Globally

At least 108 countries across five continents have reported HPAI H5N1 outbreaks in animals, over 25 countries have reported human H5N1 cases, and multiple countries including Cambodia, India, Mexico, and the United States have reported human infections in 2025.^{xi} The global spread of H5N1 is a significant pandemic threat. Outbreaks of avian influenza have been taking place throughout Southeast Asia, China, Russia, Arab nations, and Northern Africa for nearly two decades.

Many outbreaks corresponded with the seasonality of HPAI H5N1 outbreaks among poultry. They occur more often, like seasonal flu, during the cooler months. However, human infection can occur at any time, especially in countries where the virus is endemic in poultry.

Since January 1, 2003, the World Health Organization (WHO) reports that as of July 1, 2025, there have been 986 cases of human infections with this virus, including 473 deaths from 25 countries. A fatality rate of 48%.^{xii} Almost all these cases have been linked to close contact with infected live or dead birds, or contaminated environments.^{xiii} Tens of millions of birds have died of H5N1 influenza and hundreds of millions of birds have been culled and disposed of, to limit the spread of H5N1.

In 2025, as of August 4, globally there have been 26 human cases, eleven resulting in death. The deaths occurred in Cambodia, India, and Mexico. Three of these cases were in the United States, which were reported previously.^{xiv}

Cambodia has experienced a surge in human cases of H5N1 since 2023. They have had 35 confirmed infections between February 2023 and March 2026. In 2025 and early 2026, they reported 19 cases of human infection, with nine deaths (case fatality 54.2%). There have been 87 cases which include 50 deaths (case fatality rate 57.5%). Many cases involve children, and nearly all new cases have been linked to contact with sick or dead poultry. Those who were affected had severe or fatal infections.^{xv} This rise in human cases is part of a broader resurgence of H5N1 in Cambodia, with infections spreading across multiple provinces.

Human Infection in North America

In January 2015, a report by The World Health Organization stated that the H5N1 virus was found in a wild green-winged teal in Whatcom County in Washington State. It was determined that this strain resulted from reassortment between a Eurasian virus and North American avian influenza virus.

The following month Canada reported an outbreak of the highly pathogenic bird flu virus H5N1 in a backyard poultry flock in the province of British Columbia. It was stressed that this particular strain of H5N1 could infect humans; fortunately, it had not yet been found in commercial poultry flocks.

Once the virus reached North America, it began to mix with North American fowl and mutated into new viruses which is now found in poultry throughout the United States. The virus has spread to all 50 states, and continues to impact poultry farms, with millions of birds being affected since 2021. This has led to the culling of over 300 million poultry birds and millions of wild birds. The hope is to contain outbreaks and prevent further spread. This has significantly impacted egg prices and the poultry industry.



Commercial Poultry Farm
Sergey Bogkanov/Shutterstock.com ^{xvi}

As of early 2026, the H5N1 virus has been detected in wild birds and poultry across all 50 U.S. states. A multistate outbreak of HPAI A(H5N1) in dairy cows was first reported on March 25, 2025. There are currently (early 2026) 18 states that have reported detections of the virus in dairy herds.^{xvii} This is the first time that these bird flu viruses have been found in cows. Scientists have been trying to determine how the virus spreads on farms. Early on it was thought that contaminated milking equipment, and direct contact with contaminated milk were the sources. However, new findings from California suggest that the virus is airborne, and contaminated wastewater may also play a role.^{xviii}

As of March 6, 2026, there have been 71 confirmed human cases of H5N1 bird flu reported in the United States since February 2024. The vast majority of these cases were among workers exposed to infected dairy cows (41) or poultry (24). Three were from another animal exposure, and three from an unknown source. No person-to-person spread has been identified in the U.S.^{xix}

There have been two deaths reported in the United States from an H5N1 infection. The first was January 6, 2025, in Louisiana. The patient was over 65 years old with underlying conditions.^{xx} Also, a Washington state resident who died on November 21, 2025. The older adult had underlying health conditions and likely contracted the virus from a backyard poultry flock.^{xxi}

While the H5N1 has been found in milk, the risk of contracting it from pasteurized milk is extremely low due to the pasteurization process. Tests show that it effectively kills the virus.

Acquiring HPAI H5N1 from Dairy Cows

People can contract the H5N1 virus from dairy cows primarily through exposure to:

- Infected animal products
- Infected environments
- Raw milk from infected cows:
 - Ingested
 - Splashes into eyes, nose or mouth
- Direct contact with infected cows or contaminated surfaces

The spread of avian influenza A viruses from one ill person to another is rare and has been limited, inefficient and not sustained. However, because avian influenza A viruses have the potential to mutate and gain the ability to spread easily between people, monitoring for human infection and person-to-person transmission is extremely important for public health.

The CDC continues to report widespread occurrence of the H5N1 virus in wild birds, with “sporadic outbreaks” in poultry flocks, and “sporadic infections” in mammals. As of 2024, the United States Department of Agriculture’s (USDA) has recorded around 200 mammal species confirmed as being able to be infected by H5N1.^{xxii}

Current Research

Influenza viruses attach to cells with a surface viral protein called hemagglutinin (HA). The HA latches on to sugar molecule receptors on cells to cause infection. Avian influenza viruses have not infected people often because the human upper respiratory tract lacks the avian-type receptors found in birds. Scientists are concerned that viruses could evolve to recognize human-type cell receptors in the upper airways and acquire the ability to infect people and spread between them.

Dr. Jeffery Taubenberger

The 1918 Influenza virus was obtained from the lung tissue from the corpse of an Inuit woman who died from the disease in an Alaskan village. Her body was retrieved from her grave below the permafrost level by Dr. Johan Hultin in July 1997. The tissue samples were sent to Dr. Jeffery Taubenberger (Armed Forces Institute of Pathology, Acting Director of National Institute of Allergy and Infectious Diseases, National Institutes of Health) who spent ten years reconstructing the virus and sequencing the genome to determine how the virus penetrates and infects the human cell.

Some things that Dr. Taubenberger discovered were that the 1918 Influenza virus had a close resemblance to the H5N1 avian strain circulating today. The 1918 virus had both human and bird flu origins; however, it managed to adapt to humans without acquiring genes from the existing human flu viruses. Several of the same mutations that differentiated the 1918 virus from circulating avian viruses are found in the H5N1 virus today.

Three of eight genes closely resemble each other, and the differences are only a small number of amino acids. This was proof that the 1918 virus was not human adapted but was entirely avian-like virus. There are only ten amino acid changes in genes that distinguish the 1918 virus from current avian viruses. A number of the same changes have been found in the recent circulating HPAI H5N1 virus.^{xxiii}

Avian viruses that are adapted to birds preferentially bind to sialic acid receptors with a specific sugar. Human-adapted influenza viruses preferentially bind with another. The switch from the avian receptor requires only one amino acid change. There is a great likeness between the 1918 virus and the H5N1 avian virus.

“1918 virus is the most bird-like of all mammalian flu viruses.”

Jeffrey Taubenberger
Armed Forces Institute of Pathology^{xxiv}

Dr. Ron Fouchier

Two research labs funded by National Institute of Health of the U.S. government were in the news for creating mutations that enable the virus to be transmissible among mammals via airborne droplets. Scientist, Ron Fouchier from the Erasmus Medical Center in the Netherlands, genetically altered the H5N1 virus to become easily transmissible between ferrets, the animals that most closely mimic the human response to flu. Dr. Fouchier said, “It is probably one of the most dangerous viruses you can make.”^{xxv}

It was determined that it only takes a handful of mutations for the virus to become airborne and easily transmitted from one animal to another. A second study showed those mutations not only can easily occur in nature – they have already started to do so. Through these studies they have determined that not only is a pandemic from this particular strain possible, but it is only a few mutations away from human-to-human transmission – and that it is inevitable.

When the results of this paper became known it was requested that the contents of this study not be published in order to keep such information from those who might use it maliciously. These labs and others around the world went on a voluntary moratorium to cease research in January 2012 that lasted one year. The halt was to give the scientists a chance to explain the research benefits and safety to the public, and to give governments and funding agencies a chance to review their policies.

Thursday June 21, 2012, the long awaited paper “Experimental Adaptation of an Influenza H5 HA Confers Respiratory Droplet Transmission to a Reassortant H5 HA/H1N1 Virus in Ferrets,” was published in *Science* magazine. The results of the research were very enlightening.

January 23, 2013, the moratorium lifted, and scientists resumed work on their research. The controversy unfortunately still remains that the information could get into the wrong hands, and a strain could be developed for the use in a bioterrorist attack. There is also the risk of a lab accident occurring with these dangerous viruses.

Recent Genetic Sequencing

A patient was hospitalized in Louisiana with a severe case of H5N1 avian influenza in December 2024, who later died in January 2025, making it the first human death in the United States. The infection was linked to exposure to sick birds from a backyard flock.

Using an H5N1 virus isolated from this patient, researchers tested the binding capability of the virus to human receptors through genetic sequencing. Compared to previous isolated

viruses, this virus showed signs of development of several mutations thought to affect its' ability to attach to the upper airways of humans. It was determined that only one mutation would be required for the hemagglutinin (HA) protein to attach easier to human receptors. These changes were not found in the virus sequences from poultry samples collected on the patient's property, suggesting the changes emerged in the patient after infection. These mutations allow the H5N1 to be more receptive to human cells, bringing it closer to becoming human-to-human transmissible. This causes great concern in the scientific community.^{xxvi, xxvii}

HPAI H5N1 – Infection in Other Animals

The expanded range of hosts for the H5N1 is raising concerns. While primarily this virus infects birds, the growing range of host mammalian species provides more opportunities for the virus to mutate and adapt to new hosts. Some mammalian adaptations have already taken place, making it possible to become more transmissible and lethal to humans.

Scientists are not able to accurately predict the severity of the virus after gaining human-to-human transmission capability, however, based on the current information, it is safe to assume it is likely to cause more severe disease in humans than COVID-19.^{xxviii}

In addition, because the HPAI H5N1 has been able to infect so many new mammal species, it introduces a new complexity if it were to cause a pandemic. The circulating virus infects both humans and other animal hosts. This would pose significant challenges for mitigation and control efforts. Although human cases are rare, virologists say the trajectory is troubling.

“It’s now a global problem, as a disease of wild animals, it’s completely out of control.

In a sense, the question about reassortment is not,

‘When is it going to happen?’ but ‘Why isn’t it happening all the time?’”

Dr. Ed Hutchinson
Professor of molecular and cellular virology
University of Glasgow^{xxix}

ⁱ aabeele/Shutterstock.com, <http://www.shutterstock.com/pic-30602869.html>.

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