MCEIRS
PANDEMIC H1N1 2009
INFLUENZA TRAINING

Individual Study Guide
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Epidemiology and Surveillance of pH1N1 2009 Influenza Among Animals

Minnesota Center of Excellence for Influenza Research and Surveillance
Epidemiology and Surveillance Among Animals

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INTRODUCTION

**pH1N1 2009 Influenza Virus: Epidemiology and Surveillance Among Animals**

This module will familiarize you with the occurrence and clinical presentation of pH1N1 2009 influenza among animals. A timeline of pH1N1 2009 influenza events among animals and influenza surveillance activities and challenges in different animal species will also be presented.
LESSON 1: TIMELINE OF pH1N1 2009 INFLUENZA AMONG ANIMALS

In this lesson, we will cover:

• Timeline of Key Events

TIMELINE OF KEY EVENTS

MAR 17 - First human case of pH1N1 2009 influenza; Mexico.

APR 1 - A nasal swab is collected from a patient in San Diego, CA that contains the first pH1N1 2009 virus to be isolated and genetically characterized. This isolation and characterization enabled the development of laboratory assays to detect the virus.

APR 29 - WHO raises the level of influenza pandemic phase from 4 to 5. (Phase 5: An animal or human-animal reassortant virus is causing sustained community outbreaks in two or more countries in one WHO region.)

MAY 2 - First cases of pH1N1 2009 influenza in swine are detected in a commercial swine herd in Alberta, Canada.

JUN 11 - WHO declares pandemic influenza phase 6. (Phase 6: A reassortant virus is causing sustained community level outbreaks in two or more countries in one WHO region AND at least one other country in another WHO region.)

JUN 24 - Pigs on a farm in Argentina test positive for pH1N1 2009 following exposure to humans with influenza-like illness.

JUL 6 - Alberta, Canada, swine herd involved in the May 2 detection of pH1N1 2009 is reported to have been destroyed the previous week.

JUL 31 - Pigs on a farm in Australia test positive for pH1N1 2009 following exposure to humans with influenza-like illness.

AUG 20 - First cases of pH1N1 2009 influenza among poultry are reported on two turkey breeder farms near Valparaiso, Chile. The outbreak started at the end of July.

AUG 27 - SEP 7 - Six pigs on exhibit at the Minnesota State Fair are the first US swine to test positive for pH1N1 2009 influenza. The pigs showed no signs of illness.

SEP 3 - pH1N1 2009 virus is reported in live pigs imported to Singapore from Indonesia.

SEP 17 - Five pigs on a farm in Northern Ireland are first European swine to test positive for pH1N1 2009.
SEP 29 - First cases of pH1N1 2009 on a commercial swine farm in Ireland are reported following exposure to a human with influenza-like illness.

OCT 5 - Clinically ill pet ferret in Oregon tests positive for pH1N1 2009 following exposure to a human with influenza.

OCT 12 - First cases of pH1N1 2009 on a commercial swine farm in Norway are reported following exposure to a human with influenza-like illness. More than 20 outbreaks are subsequently reported; the initial preventive measure of herd depopulation was halted on OCT 15.

OCT 20 - pH1N1 2009 influenza is reported in an Ontario, Canada, turkey breeder flock.

OCT 22 - First US cases of pH1N1 2009 on a commercial swine farm occur in Indiana and first cases among commercial swine in Japan are reported.

OCT 30 - Clinically ill pet cat in Iowa and a post-mortem specimen from a pet ferret in Nebraska test positive for pH1N1 2009 following exposure to humans with influenza. The cat recovered.

NOV 5 - More than 150 symptomatic piglets in Taiwan test positive for pH1N1 2009 influenza. The animals recovered and monitoring initiated on swine farms within 3 km.

NOV 25 - Two dogs in China become first reported cases of pH1N1 2009 among canines.

NOV 30 - The first case of pH1N1 2009 in a captive exotic animal is reported in a cheetah from a wildlife preserve in California. The cheetah recovered. First cases of pH1N1 2009 influenza among poultry in the US are reported on a turkey breeder farm in Virginia. The only sign of illness was decreased egg production.

DEC 7 - Two cats from different households are diagnosed with pH1N1 2009 in Colorado.

DEC 21 - Clinically ill pet dog in Bedford Hills, New York, tests positive for pH1N1 2009 following exposure to a human with influenza. The dog recovered.

DEC 28 - Additional cases of pH1N1 2009 influenza among poultry in the US are reported on a turkey breeder farm in California’s Central Valley.

NOV 09 - JAN 10 - Additional reports of pH1N1 2009 on swine farms were reported in Norway, China, Indonesia, Finland, Russia, Mexico, Italy, South Korea, Denmark, France, and Italy.
LESSON 2: OCCURRENCE OF pH1N1 2009 INFLUENZA IN ANIMALS

In this lesson, we will cover:

- Background
- Animals Commonly Infected with Influenza A Viruses
- Other Animals Susceptible to Influenza A Viruses
- Animals with Documented pH1N1 2009 Influenza A Virus Infection

BACKGROUND

Current understanding of influenza, particularly pH1N1 2009 influenza, among domestic and wild animals is incomplete due to sporadic surveillance for the virus in animal populations.

In the lessons that follow we will review the occurrence and clinical features of pH1N1 2009 influenza in various animal species, the assumed routes of transmission, and interspecies transmission.

Humans may have introduced pH1N1 2009 influenza to animal populations or this particular strain of virus may have been circulating undetected in another mammalian species before appearing in humans. Later in this module, we will discuss what surveillance activities are being (or have been) conducted and some of the practical challenges encountered.

ANIMALS COMMONLY INFECTED WITH INFLUENZA A VIRUSES

- Aquatic birds (waterfowl and shorebirds)
- Humans
- Horses
- Pigs
- Aquatic mammals (whales and seals)

OTHER ANIMALS SUSCEPTIBLE TO INFLUENZA A VIRUSES

- Poultry (chickens, turkeys, quail, pheasants)
- Cats, leopards, tigers
- Civets
- Dogs
- Small mammals (e.g., mink, stone marten, ferrets)
- Red foxes (experimental infection following feeding of infected bird carcasses)
- Calves (experimental infection)
ANIMALS WITH DOCUMENTED pH1N1 2009 INFLUENZA A VIRUS INFECTION

Infection with pH1N1 2009 influenza has been documented in several types of animals through February 2010.

Most cases of pH1N1 2009 in animals have presented with mild respiratory illness or no illness at all and most have fully recovered. In some cases, the animals have remained asymptomatic.

Swine (naturally occurring disease)

- Example 1: (Oct 19, 2009) The USDA confirmed the presence of pH1N1 2009 influenza virus in 6 samples collected from 45 healthy show pigs at the Minnesota State Fair. The pigs remained asymptomatic.
- Example 2: (Nov 5, 2009) On November 5, Taiwan submitted a report to the World Animal Health Organization (OIE) confirming pH1N1 2009 in a swine herd in T’ai-Tung County. Illness was first observed on October 19 and tests confirmed pH1N1 2009 influenza on November 2. Clinical signs observed included coughing and diarrhea. All pigs recovered from the illness.
- Example 3: (Nov 30, 2009) Finland reported an outbreak of pH1N1 2009 influenza in a commercial swine herd. The farmers had been ill with influenza-like symptoms several days before the pigs became ill. Clinical signs observed in the pigs included fever, loss of appetite, and mild respiratory signs. All pigs recovered within 1-2 days.

Swine (experimental infection)

- Example: In a study by Lange et al (2009), five 10-week-old pigs were intranasally exposed to pH1N1 2009 influenza virus. Virus excretion was detected in nasal swabs from 1-day post-infection onwards and the pigs developed generally mild symptoms including fever, sneezing, nasal discharge, and diarrhea. Contact pigs, but not chickens, became infected. Virus transmission to contact pigs occurred rapidly; by just 3 days after contact, all 3 naive pigs began to shed virus.

Poultry - Turkeys (naturally occurring disease)

- Example 1: (Aug 20, 2009) In response to an observed decrease in egg production that began in late July, Chilean authorities tested and confirmed the presence of pH1N1 2009 influenza virus in turkeys on 2 breeder farms near Valparaiso, Chile.
Example 2: (Dec 28, 2009) Tests confirmed the presence of pH1N1 2009 influenza virus in a turkey breeding flock in California's Central Valley (US). No clinical signs of illness were reported other than a decrease in egg production.

Poultry (experimental infection)

Example 1: (Chicken, turkey hens, domestic duck, quail) In a study by Swayne et al (2009), pH1N1 2009 influenza virus failed to produce infection in experimentally inoculated chickens or turkey hens. One intranasally-inoculated domestic duck showed evidence of infection, but exhibited no clinical illness. Japanese quail became infected, but showed minimal viral replication and shedding with no reported quail-to-quail transmission; no clinical signs of illness developed in any of the birds.

Example 2: (Quail) Based on a study conducted by Ilyushina et al (2010), the authors concluded the A/California/04/2009 strain of pH1N1 2009 virus showed minimal replication and no transmission in chickens and ducks (domestic and wild), but the virus replicated and had limited transmissibility in quails. None of the experimentally-infected birds exhibited any clinical illness.

Domestic pets

Example 1: (Nov 4, 2009) A 13-year-old cat in Iowa (US) developed signs of a respiratory infection after several people in the household were ill with influenza-like illness. Preliminary testing was positive for pH1N1 2009 on October 29 and the results were confirmed on November 2. This is the first report of a cat infected with the pH1N1 2009 influenza virus. The cat fully recovered.

Example 2: (Dec 8, 2009) France's Director General of Health announced that a cat in France tested positive for the pH1N1 2009 virus. The cat (a 5-year-old, neutered, domestic shorthair) developed respiratory illness after 2 children in the household had been ill with influenza-like illness. The cat recovered in 6 days.

Captive wild, Cheetah

Example: (Dec 11, 2009) 4 cheetahs in a private zoo setting developed respiratory disease. In late November the first cheetah exhibited lethargy, coughing, nasal discharge, and decreased appetite. The second cheetah exhibited similar clinical signs approximately 6 days after the first cheetah, and the third and fourth cheetahs became ill 9 and 11 days (respectively) after the first. The clinical signs exhibited by the last 2 cheetahs were more severe than those of the first 2, and included harsh coughing, increased respiratory rate, and a rough haircoat. All cheetahs recovered from illness in 5-16 days. A nasal swab taken from 1 of the 4 cheetahs tested positive for the pH1N1 2009 influenza virus.
virus. Although the origin of the cheetahs' infections has not been conclusively identified, investigators suspect a handler was the source.

Domestic pets

- Example: (Dec 21, 2009) A 13-year-old dog in Bedford Hills, New York (US) became ill after its owner was ill with confirmed pH1N1 2009 influenza. The dog was lethargic, coughing, not eating, and had a fever. Radiographs (x-rays) showed evidence of pneumonia. The dog was treated with intravenous fluids, antibiotics, nebulization, and other supportive care, and was discharged from the hospital after 48 hours.
- Example: (Oct 9, 2009) A ferret with a respiratory infection was examined by a Portland, Oregon, veterinary clinic on October 5, 2009. After learning the ferret's owner had recently been ill with influenza, the veterinarian contacted the Oregon State Veterinarian's office and submitted a nasal swab from the ill ferret. Infection with the pH1N1 2009 influenza virus was reported by the Oregon State University lab on October 8 and confirmed by a US Department of Agriculture lab on October 9. The ferret fully recovered.

Research animals (experimental infection)

- Example: In a study by Munster et al (2009), ferrets intranasally exposed to pH1N1 2009 influenza virus became infected and began shedding virus 1 day post-inoculation; shedding continued through day 7. All ferrets exhibited signs of clinical illness including lethargy, sneezing, ruffled fur, decreased interest in food, nasal discharge, and weight loss.
LESSON 3: pH1N1 2009 INFLUENZA TRANSMISSION IN ANIMALS

In this lesson, we will cover:

- Interspecies Transmission in Animals
- Introduction of pH1N1 2009 Influenza to Animal Species
- Routes of Influenza Transmission Between Animals

INTERSPECIES TRANSMISSION IN ANIMALS

Interspecies transmission may lead to the introduction and establishment of a novel influenza strain in a species that has limited or no pre-existing immunity to the new virus.

This could lead to a devastating pandemic in humans or a panzootic in animals.

Interspecies transmission can facilitate genetic reassortment of influenza viruses from different species.

This process could result in the occurrence of a novel strain that could be more virulent or more transmissible than the original viruses.

INTRODUCTION OF pH1N1 2009 INFLUENZA TO ANIMAL SPECIES

Naturally occurring infections among animal populations appear to have originated from exposure to humans shedding pH1N1 2009 influenza virus.

Commercial and companion animals may have first become infected via airborne transmission or droplet exposure of mucosal surfaces (e.g., nose, mouth, and eyes) by respiratory secretions from humans who were coughing or sneezing while ill with pH1N1 2009 influenza.

ROUTES OF INFLUENZA TRANSMISSION BETWEEN ANIMALS

Intraspecies transmission of the virus has been documented in ferrets (experimental). Outbreaks of pH1N1 2009 have been documented on commercial swine and turkey breeder farms. For susceptible species, the modes of transmission for pH1N1 2009 are assumed to be similar to those of typical influenza A viruses. These include:

- Airborne transmission, in close proximity, is a recognized route of transmission between animals.
- Airborne transmission of influenza virus over longer distances, such as from one swine farm to another, has not been well documented. Work by Dee et al (2009)
demonstrating airborne transport of porcine reproductive and respiratory syndrome virus (PRRSV), a virus with environmental persistence similar to that of influenza, over long (>4.5 km) distances suggests that such transmission may be possible for influenza viruses.

• Direct contact with contaminated respiratory secretions, fecal material, or fomites, are recognized routes of influenza transmission between animals.

• Vertical transmission has not been demonstrated. However, a study by Pantin-Jackwood et al (2010) demonstrated that the pH1N1 2009 virus can infect turkey hens by the reproductive route, causing decreased egg production. Turkeys infected by the reproductive route excreted virus by the respiratory route.
LESSON 4: ANIMAL INFLUENZA SURVEILLANCE CHALLENGES

In this lesson, we will cover:

- Attributes of Disease Surveillance Systems
- Animal Influenza Surveillance Challenges
- Examples of Common Barriers to Conducting Routine Animal Surveillance

ATTRIBUTES OF DISEASE SURVEILLANCE SYSTEMS

Attributes of disease surveillance systems whether among humans or animals include the following:

- Simplicity
- Flexibility
- Acceptability
- Timeliness
- Completeness
- Representativeness

Simplicity refers to the surveillance system’s structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.

Flexibility reflects the ability of the system to adapt to changing needs such as the addition of new data-collection elements.

Acceptability reflects the willingness of individuals and organizations to participate in the surveillance system (e.g., veterinarians, domestic animal production facilities, or laboratory personnel who are asked to report cases of disease in animals).

Timeliness of the system typically refers to how quickly after initial diagnosis cases are reported to the coordinating agency. Timeliness can also refer to the overall time between onset of infection, time of diagnosis, time of case report, and time of data dissemination to guide public or animal health action.

Completeness is reflected by the proportion of all cases of disease in a specified population that are detected by the surveillance system.

Completeness of a surveillance system is affected by the likelihood that:

- Animals with infection or disease are tested
• The condition is correctly diagnosed (skill of veterinary care provider, accuracy of diagnostic tests)
• The case is reported to the surveillance system once it has been diagnosed
• A representative surveillance system accurately describes the occurrence of disease over time and its distribution in the specific animal population or populations by place, species, and severity. Consideration of this attribute is especially important because most systems simply cannot detect every single case of infection or disease.

ANIMAL INFLUENZA SURVEILLANCE CHALLENGES

Implementing surveillance activities among animals can be hindered by a number of barriers.

Conducting routine surveillance among a wide variety of wild and domestic animals may not be immediately possible or practical for economic, social, or political reasons. These practical concerns can result in a low level of “acceptability by participants which may undermine the representativeness and/or completeness of a surveillance system.”

Recognizing the many practical challenges to implementing routine disease surveillance in animals helps put the current state of influenza surveillance among animals in context and sheds light on issues to address moving forward.

Recall that the overall effectiveness of a surveillance system is reflected by how well the system meets its objectives. Weaknesses in one or more of the previously listed attributes can compromise the usefulness of the system.

EXAMPLES OF COMMON BARRIERS TO CONDUCTING ROUTINE ANIMAL SURVEILLANCE

Inadequate resources

Wildlife can be widely dispersed, highly mobile, and difficult to capture and handle, making routine surveillance among wild animals logistically challenging, which in turn increases the financial and human resource burden.

Increasing the number of species and geographic areas covered by routine influenza surveillance with limited resources is an ongoing public health challenge.

Economic risk to commercial animal industry

Although agricultural animals do not pose the same logistical challenges as wild animals, other variables interfere with conducting representative and timely influenza surveillance.
For example, in early May 2009 US pork producers lost about $8 million per day because of the erroneous belief among the public that eating or handling supermarket-bought pork would put them at risk for the so-called “swine flu.” In one survey, consumer tracking showed that 25% of US consumers thought you could contract pH1N1 2009 influenza from eating pork. Although this was a myth, the significant financial impact on the agricultural industry of even a perceived human health risk from eating or handling commercial pork or poultry products is a potential deterrent to voluntary participation in routine influenza surveillance.

H5N1 HPAI (highly pathogenic avian influenza) has had a similar impact on poultry consumption and market disruption in many of the countries that experienced outbreaks.

*Lack of enforceable reporting rules at the local or national level*

Disease reporting rules set out legal requirements for responsible agents, e.g. veterinarians, to report cases or suspected cases of specific diseases to a government agency.

Barriers to conducting representative influenza surveillance in animals can include the absence of routine reporting rules or the existence of inflexible rules that do not accommodate special circumstances. For example, in the US, swine influenza virus (SIV) - of any subtype - is not legally reportable to the USDA. Therefore, participation in the SIV surveillance program is voluntary, but “highly recommended” by the USDA Animal and Plant Health Inspection Service (APHIS) Veterinary Services Branch “due to the pandemic potential of new influenza virus infection in people [e.g., pH1N1 2009] and the subsequent economic impacts to the swine industry.”

Even when flexible reporting rules are in place, local and national government offices do not have sufficient human or financial resources to fully enforce all animal and human disease reporting rules.
LESSON 5: ANIMAL SURVEILLANCE FOR pH1N1 2009 INFLUENZA IN THE UNITED STATES

In this lesson, we will cover:

- Laboratory Testing of Animal Specimens
- Surveillance for Influenza in Swine
- Surveillance for Avian Influenza (AI) in Poultry
- Surveillance for pH1N1 2009 Influenza in Poultry

LABORATORY TESTING OF ANIMAL SPECIMENS

USDA maintains a National Animal Health Laboratory Network (NAHLN) of veterinary diagnostic laboratories.

The NAHLN is a cooperative effort between the USDA and the American Association of Veterinary Laboratory Diagnosticians. It is a multifaceted network comprised of sets of laboratories that focus on different diseases, using common testing methods and software platforms to process diagnostic requests and share information.

The state/university laboratories in the NAHLN perform routine diagnostic tests for endemic animal diseases as well as targeted surveillance and response testing for foreign animal diseases. State/university laboratories also participate in the development of new assay methodologies.

At the federal level, the USDA National Veterinary Services Laboratories (NVSL) serves as the national veterinary diagnostic reference and confirmatory laboratory. NVSL coordinates activities; participates in methods validation; and provides training, proficiency testing, assistance, materials, and prototypes for diagnostic tests.

SURVEILLANCE OF INFLUENZA IN SWINE

Swine Influenza Virus Surveillance Program

In August 2009, the US Department of Agriculture published a national surveillance plan for swine influenza virus (SIV), including the pH1N1 2009 strain. This plan is based on a pilot SIV surveillance program initiated in July 2008.

The goals of the program are to:

- Determine if the pH1N1 2009 virus is present among US swine.
- Detect any new influenza strains in swine in a timely manner.
• Determine the distribution of new influenza strains in swine, including pH1N1 2009, to inform further policy decisions.
• Determine genetic characteristics of new viruses to inform vaccine and diagnostics development.

Participants in the swine influenza virus surveillance system include swine owners, growers, and producers; auction houses; markets; fairs; exhibitions; university, state, and private diagnostic laboratories; USDA; and CDC.

Swine owners, growers, and producers are encouraged to report signs of illness, such as barking cough, nasal discharge, and sneezing, that may indicate the presence of influenza virus in swine. Reports may go to the producer’s private veterinary practitioner, the State Veterinarian, or the USDA-APHIS (Animal and Plant Health Inspection Service) Area Veterinarian-in-Charge.

Auction houses, markets, fairs, exhibitions, and state or university diagnostic laboratories may also report signs of ILI in pigs to the State Veterinarian or the USDA-APHIS Area Veterinarian-in-Charge.

Participation in the SIV surveillance program is voluntary, but highly recommended by the USDA APHIS Veterinary Services Branch in light of the recent human influenza pandemic and potential economic impacts to the swine industry.

COMPONENT 1

Strategy: Surveillance of swine populations epidemiologically linked to a human case of swine influenza virus or swine-origin influenza virus (such as pH1N1 2009).

Animal health officials, in cooperation with public health investigators, may collect samples from swine that are known to be linked with a human case. The extent of swine sampling as a result of human exposure is decided on a case-by-case basis and is performed in conjunction with the licensed veterinarian who has an existing relationship with the owner/operation.

COMPONENT 2

Strategy: Surveillance of specimens submitted to veterinary diagnostic laboratories from farm pigs showing influenza-like-illness (ILI).

This component is primarily aimed at commercial swine populations.

Producers, veterinarians, or other personnel who monitor animal health on farms should collect samples for SIV testing from pigs showing an ILI. Samples include nasal swabs from live sick pigs or lung tissues from mortalities meeting the case definition for SIV
(including pH1N1 2009 virus). Samples should be submitted to the local veterinary diagnostic laboratory.

COMPONENT 3

Strategy: Surveillance of sick swine at first points of commingling events such as auctions, markets, fairs, or other swine exhibition events.

This component primarily targets small farm and backyard herds.

Animal health officials or licensed veterinarians who observe pigs with ILI at these events should be aware of influenza virus in pigs and the potential for certain strains in humans to infect pigs and vice versa. When off-loaded pigs or groups of swine exhibit ILI, nasal swabs or lung tissue should be collected and submitted to a participating veterinary diagnostic laboratory. Any positive results are reported to the State Veterinarian or the USDA-APHIS Area Veterinarian-in-Charge.

SURVEILLANCE FOR AVIAN INFLUENZA (AI) IN POULTRY

The USDA APHIS Veterinary Services National Poultry Improvement Plan (NPIP) coordinates efforts by state officials and commercial industry on programs to monitor and test domestic poultry to detect the occurrence of avian influenza. One of these industry partners is the National Chicken Council (NCC), which represents the US broiler (a type of chicken raised for meat production) industry and conducts rigorous testing for AI. The NCC Avian Influenza Monitoring Plan focuses on extensive private laboratory testing in which every participating company tests all broiler flocks before slaughter.

Similar programs are in use by the turkey and egg layer industries.

These testing programs are likely to detect presence of pH1N1 2009, along with avian influenza viruses.

SURVEILLANCE FOR pH1N1 2009 INFLUENZA IN POULTRY

In October 2009 USDA released a publication highlighting key questions and answers related to pH1N1 2009 which included information related to poultry.

Because of concern that birds might be affected by the pH1N1 2009 influenza virus, USDA conducted a susceptibility study.

- USDA experts at the Agricultural Research Service Southeast Poultry Research Laboratory used a pH1N1 2009 virus isolate from a human case to inoculate 4 species of birds - ducks, chickens, turkeys, and quail.
• None of the bird species became clinically ill nor did they shed significant amounts of virus after exposure. The researchers concluded that these 4 species of birds are not likely to be vehicles for transmission of the pH1N1 2009 influenza virus.
• Through its ongoing influenza surveillance program, USDA continues to monitor the evolution of influenza viruses in birds in case changes occur and the pH1N1 2009 influenza virus adapts and is able to spread in poultry.

USDA is conducting ongoing research with the pH1N1 2009 virus and turkeys because of the documented occurrence of the virus in flocks on several turkey breeder farms. Infection of turkeys by the reproductive route followed by excretion from the respiratory route has been demonstrated.
LESSON 6: GLOBAL ANIMAL SURVEILLANCE FOR pH1N1 2009 INFLUENZA

In this lesson, we will cover:

- Global Animal Surveillance for pH1N1 2009 Influenza

Global Influenza Surveillance Network

OFFLU is sponsored by the World Organization for Animal Health (OIE) and the Food and Agricultural Organization of the United Nations (FAO) and functions as a joint network of influenza experts and veterinary laboratories.

OFFLU was established in 2005 to support international efforts to monitor and control infections of avian influenza in poultry and other bird species, and to share biological material and data to support early development of human pandemic vaccines.

OFFLU has coordinated global surveillance for highly pathogenic avian influenza (HPAI) in domestic and wild birds for many years, particularly H5 and H7 viruses, but also other subtypes.

HPAI viruses and low pathogenic avian influenza viruses (LPAI) of subtypes H5 and H7 in domestic poultry, and influenza in horses are OIE reportable diseases.

Historically, H1N1 viruses among swine or other animals have not been reportable to OIE.

However, because the pH1N1 2009 strain was so transmissible among humans and contained genes of swine, avian, and human influenza virus-origin, pH1N1 2009 became reportable to OIE as an “emerging disease” in animals that could pose a risk to human health.
GLOSSARY

**Antigens** - Any foreign substance, usually a protein, that stimulates the body's immune system to produce antibodies.

**Breeder** - A type of turkey bred and raised for the production of hatching eggs from which meat-type turkeys are hatched and raised. Female breeders are called hens and male breeders are called toms. Artificial insemination is performed routinely, usually on a weekly basis.

**Broiler** - A type of chicken specifically bred and raised for meat production. Modern commercial broilers grow much faster than egg or traditional dual purpose breeds. They are noted for having very fast growth rates, efficient conversion of feed to meat, and low levels of activity. Broilers often reach a harvest weight of 4 to 5 pounds in only eight weeks.

**Cull** - In reference to livestock, this term means to remove and destroy animals from a flock or herd, e.g. due to specific diseases of concern or old age.

**Disease surveillance** - The ongoing systematic collection, analysis, interpretation, and dissemination of health data in a population of organisms.

**Epidemic** - A disease occurring suddenly in humans in a community, region or country in numbers clearly in excess of normal.

**Epizootic** - A disease occurring suddenly in animals in a community, region or country in numbers clearly in excess of normal.

**Hemagglutinin (HA)** - An important surface structure protein of the influenza virus that is an essential gene for the spread of the virus throughout the respiratory tract. This protein enables the virus to attach itself to a cell in the respiratory system and penetrate it. It is used to name influenza A subtypes and is referred to as the "H" in the influenza virus subtype (e.g., H5N1). To date, 16 different influenza A hemagglutinin antigens have been identified.

**Host** - An organism on or in which a parasite lives.

**HPAI (Highly Pathogenic form of Avian Influenza)** - Often fatal in chickens and turkeys. HPAI spreads more rapidly than LPAI and has a high mortality rate in domestic birds.

**ILI** - Influenza-like illness.

**Infection** - Invasion of the body or a part of the body with a pathogenic organism, which multiplies in the
host. A person or animal with an infection may or may not exhibit signs or symptoms. An infection without signs or symptoms is called subclinical.

**LPAI (Low Pathogenic form of Avian Influenza)** - Naturally occurs in wild birds and can spread to domestic birds. In wild birds, LPAI strains generally do not cause signs of infection. In domestic birds, the illness is not severe and mortality rates are low. These strains of the virus pose little threat to human health. LPAI H5 and H7 strains have the potential to mutate into HPAI and are therefore closely monitored.

**Morbidity** - Disease; morbidity rate is the incidence or prevalence of disease in a specific population during a specified interval of time or a specific point in time.

**Mortality** - Death; mortality rate is a measure of the number of deaths in a population during a specified interval of time.

**Neuraminidase (NA)** - An important surface structure protein of the influenza virus that is an essential enzyme for the spread of the virus throughout the respiratory tract. This protein enables the virus to escape the host cell and infect new cells. It is used to name influenza A subtypes and is referred to as the "N" in the influenza virus subtype (e.g., H5N1).

To date, 9 different influenza A neuraminidase antigens have been identified.

**Outbreak** - The occurrence of a disease or health-event in a specific geographic area or population in excess of normal expectancy; cases are usually related in time and space.

**Pandemic** - A worldwide outbreak of a disease in humans in numbers clearly in excess of normal. A global influenza pandemic may occur if three conditions are met:

- A new subtype of influenza A virus emerges for which there is little or no immunity in the human population.
- The virus can spread easily from person to person in a sustained manner.
- Infection results in moderate to severe disease.

**Pandemic Phase Alert** - A naming system developed by the WHO to characterize the level and nature of influenza activity in the world.

- Phase I: No viruses circulating among animals have been reported to cause infections in humans.
- Phase II: An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans, and is therefore
considered a potential pandemic threat.

• Phase III: An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.

• Phase IV: Verified human-to-human transmission of an animal or human-animal influenza reassortant virus is demonstrated to cause community-level outbreaks.

• Phase V: Human-to-human spread of the virus into at least two countries in one WHO region.

• Phase VI: The pandemic phase, characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase indicates that a global pandemic is occurring.

Panzootic - A worldwide outbreak of a disease in animals in numbers clearly in excess of normal expectancy.

Pathogenic - Causing disease or capable of doing so.

Prevalence - The proportion of individuals (humans or animals) in a population having a disease or specific characteristic (such as a positive antibody test to a particular pathogen).

Strain - Influenza virus subtypes are further characterized into strains. New strains of influenza viruses replace older strains through the process of antigenic drift (i.e., small mutations in the genetic material of the virus).

Swine Flu - A respiratory disease in pigs caused by influenza A virus. Outbreaks in swine herds are common; the illness is relatively mild, and most animals recover. Domestic birds can be a source of influenza A in swine, and transmission from humans to swine and from swine to humans has occurred.

SIV - Swine influenza virus. Also see Swine Flu.

Virulence - A pathogen's ability to invade host tissues and the severity of disease produced.

Virulent - Highly lethal; causing severe illness or death.

Virus - Any of various simple submicroscopic parasites of plants, animals, and bacteria that often cause disease and that consist essentially of a core of RNA or DNA surrounded by a protein coat. Unable to replicate without a host cell, viruses are typically not considered living organisms.
WHO Region - The World Health Organization (WHO) Member States are grouped into 6 geographical regions: AFRO (Africa), AMRO (Americas), EMRO (Eastern Mediterranean), EURO (Europe), SEARO (South-East Asia) and WPRO (Western Pacific).

Zoonoses - Diseases that transfer from animals to humans.
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