FAQs on Zoonotic Influenza

Zoonotic Influenza

Seasonal Influenza

Pandemic Influenza
What is influenza?

Influenza, commonly called “the flu” is an illness caused by influenza viruses that infect the respiratory tract of many animals, birds and humans. Human influenza is highly contagious and is usually spread by the coughs and sneezes of an infected person.

What are the known types of influenza virus?

There are three types of influenza virus types A, B and C that can cause influenza, also known as “the flu”, in humans. Type A causes influenza in humans as well as in animals. Type A influenza in animals such as poultry, pigs and horses are particularly relevant to public health. Influenza viruses that have the potential to cause a pandemic are referred to as “influenza viruses with pandemic potential”. Historical data illustrates the danger of transmission of influenza between animals and humans that can potentially contribute to the emergence of a pandemic.

Types of Influenza Viruses

A responsible for regular outbreaks (Human)
B causes sporadic outbreaks
C common but seldom causes disease symptoms

A/California/4/09-like H1N1 Influenza Viruses
All influenza viruses are genetically labile, that is, likely to change, with mutations occurring from time to time. The constant small changes in the antigenic composition of influenza viruses are known as the antigenic drift. On the other hand, influenza type A viruses, including subtypes from different species, can swap or “re-assort” genetic materials and merge during the re-assortment or mutation process. This phenomenon is known as the antigenic shift.

Influenza type A viruses are classified into subtypes, depending on the combinations of different virus surface proteins known as haemagglutinin (H) and neuraminidase (N). There are 18 different hemagglutinin subtypes and 11 different neuraminidase subtypes. Most subtypes of influenza A viruses have been found in birds, with the exception of subtypes A(H17N10) and A(H18N11) which have only been found in bats. Depending on the original animal host, influenza type A viruses can be classified as avian influenza or swine influenza, and include other types of zoonotic influenza viruses. Examples of zoonotic influenza include avian influenza, also known as “bird flu”, with virus subtypes A(H5N1) and A(H9N2), and swine influenza, also known as “swine flu”, with virus subtypes A(H1N1) and A(H3N2).

Human and swine influenza are sometimes caused by type A influenza viruses that have the same number of hemagglutinin (HA) and neuraminidase (NA) glycoprotein.
How do we know a patient is infected by human influenza or swine influenza virus when it is caused by the same influenza virus?

The type A influenza virus subtypes H1, H2 and H3 cause infections in both humans and pigs and can be differentiated by name. Swine influenza viruses that infect humans through direct contact with infected pigs are considered “variant” viruses. For example, H3N2v is a swine virus that can infect people but is different from the H3N2 human seasonal influenza virus. The names “variant” and “seasonal” are used to differentiate between the known zoonotic influenza viruses, and influenza viruses that cause seasonal respiratory disease in humans. Human infections caused by variant viruses are of concern given that seasonal influenza vaccines developed to fight human influenza viruses are generally not expected to protect people from influenza viruses that normally infect pigs.

Influenza occurs globally with an annual attack rate estimated at 5%–10% in adults and 20%–30% in children. Illnesses can result in hospitalization and death, mainly among high-risk groups (the very young, the elderly, and among the chronically ill). Epidemics can result in high levels of worker/school absenteeism and loss of productivity. Worldwide, these annual epidemics are estimated to result in approximately 3 to 5 million cases of severe illness, and some 250 000 to 500 000 deaths. The most effective way to prevent the disease and/or stave off its severity is through vaccination.

What is the burden of influenza?

What are the types of human influenza?

Human influenza is known as seasonal influenza as it has a seasonal pattern of outbreaks. It may be caused by influenza virus types A, B or C. Human influenza A and B viruses circulate worldwide and can affect anybody in any age group and these viruses can cause annual epidemics that peak during winter in temperate regions. In tropical regions, influenza may occur throughout the year, causing outbreaks more irregularly. Influenza type C infections generally cause a mild respiratory illness and are not thought to cause epidemics. That is why only influenza A and B viruses are included in seasonal influenza vaccines.

Seasonal influenza is characterized by a sudden onset of high fever, cough (usually dry), headache, muscle and joint pain, severe malaise (feeling unwell), sore throat and a running nose.

What is an influenza pandemic?

An influenza pandemic can occur when a novel influenza virus gains the ability for efficient and sustained human-to-human transmission and then spreads globally. Pandemic influenzas are caused only by a new strain of type A influenza virus. Because the virus is new, humans do not have immunity to it and the illness is usually more severe. A pandemic will not be a “one” time event and periods of illnesses may come in two or three “waves” anywhere from three to twelve months apart. With international air flights, a “modern” pandemic is expected to spread to all parts of the world in less than three months.
Zoonotic influenza occurs when humans are infected with influenza viruses circulating in animals. Human infections are primarily acquired through direct contact with infected animals or contaminated environments. This type of infection does not result in the efficient transmission of these viruses between humans.

Historical data shows that all pandemic influenza occurrences originated from animals. All subtypes of influenza type A virus have zoonotic potential. Pigs are ideal candidates for re-assortment or mutation of influenza viruses. Re-assortment creates optimal conditions for influenza pandemics like the influenza A(H1N1)pdm09 pandemic that occurred in 2009-2010. Three sets of barriers must be crossed by a zoonotic influenza virus before it can become a human pandemic virus: animal-to-human transmission barriers; virus-cell interaction barriers; and human-to-human transmission barriers. Human-to-human transmission barriers are rarely crossed by zoonotic influenza viruses, but these are the events that trigger worldwide influenza outbreaks or pandemics.
Historical data suggests that zoonotic influenza originated from influenza type A viruses circulating among birds, pigs and horses. Among them, pigs have receptors to which both avian and mammalian influenza viruses bind, which increases the potential for virus gene substitution to produce new reassortants or noble viruses in pigs.

Avian influenza of subtypes H5N1 and H7N9 are classical examples of direct animal to human transmission. The influenza A(H1N1)pdm09 was initially caused by a new reassortant virus, that is the combination of swine-avian-human influenza viruses, emerging from pigs which later mutated to efficiently become transmissible between humans.
Several zoonotic influenza viruses have recently caused sporadic human infection. Avian influenza types (AI) A(H5N1), A(H5N6), A(H7N7), A(H7N9), A(H9N2), which originated in birds, and swine influenza A(H3N2)v, which originated in pigs, are examples of these types of viruses that have caused disease in people. All viruses have led to human cases in recent years and mostly in Asia. Human infections with swine influenza A(H1N1v) and A(H3N2v) viruses have been reported from a variety of regions, with most notified from North America and Europe.
How is zoonotic influenza transmitted?

Human infection with avian influenza type A viruses are uncommon and mainly result from direct or indirect contact with infected birds or contaminated environments. Studies have shown that people working in live bird markets, poultry farms, and those involved in slaughtering and defeathering poultry are exposed to avian influenza viruses. Human transmission has generally been limited, and unsustained, with the exception of rare instances in which influenza type A viruses have developed the capacity to circulate widely in humans. Similarly, the majority of human cases of swine influenza have been reported among those who work in pig farms or among individuals visiting agricultural fairs which display swine.

Potential emergence of zoonotic/pandemic influenza viruses

Ongoing circulation of viruses within and among animal species = Potential for adaptations and reassortments

Zoonotic animal virus (reassorted or non reassorted)

Potential reassortment of animal + human seasonal viruses

Reassorted virus (may have characteristics of a pandemic virus)

New seasonal influenza strain
What is similar and different between seasonal and zoonotic influenza?

Seasonal influenza viruses are those that have adapted to the human species and apply to the strains of influenza virus types A and B that cause respiratory illnesses in humans annually. Seasonal influenza spreads between humans and can cause mild to severe illnesses.

Zoonotic influenza viruses are influenza virus type A that are transmitted from animals to humans and rarely transmitted from human to human. Zoonotic influenza is also known as non-seasonal influenza as it may be transmitted at any time of the year when people are exposed to animal influenza viruses.

What are the clinical signs and symptoms of zoonotic influenza?

Zoonotic influenza like other influenza causes mild to severe illness in the individuals they infect. It is not possible to distinguish clinical signs and symptoms of seasonal and zoonotic influenza. The signs and symptoms of zoonotic influenza infections in people can range from eye infections (conjunctivitis) or influenza-like illness (e.g. fever, cough, sore throat, muscle aches) to severe respiratory disease (e.g. pneumonia, acute respiratory distress, viral pneumonia). Severe illness can occur if the patient has underlying medical or physiological conditions such as pregnancy or is in an immunocompromised state. In such cases, infection with avian or swine influenza may be fatal to humans.
It is difficult to differentiate seasonal influenza from zoonotic influenza through clinical signs and symptoms. Zoonotic influenza may be suspected based on occupational exposure or live bird markets visits. Laboratory investigation of type A influenza cases and antigenic characterization of influenza viruses help also to diagnose both seasonal and zoonotic influenza.

There is no specific treatment for zoonotic influenza. However, anti-viral agents such as oseltamivir and zanamavir are effective if used in the early stages of infection. People with suspected zoonotic influenza after occupational exposure should be treated under medical supervision. In severely ill A(H5N1) or A(H7N9) patients or in patients with severe gastrointestinal symptoms, drug absorption may be impaired. This possibility should be considered when managing these patients².

H1N1, H3N2, and H1N2 flu viruses are all subtypes of influenza A viruses and these subtypes are common in humans and pigs. Transmission of swine influenza viruses between pigs and humans has been well documented. Swine flu is caused by variant influenza viruses originating from pigs and transmitted to humans by direct or indirect contacts with infected pigs or their environment. Swine flu viruses are not efficient in causing human “to” human transmission.

Even today, the media refers to influenza A(H1N1)pdm09 as swine flu. This is technically incorrect even though it originated from pigs. Influenza A(H1N1)pdm09 is efficient in causing human “to” human transmission without the direct involvement of pigs and is categorized as seasonal influenza virus. The wrong interpretation by the media has created panic among people and pork consumers, and also caused serious damage to the pig industry.
Live bird markets have been shown to contribute to the spread of, and the possible maintenance of, avian influenza (AI) viruses. Poultry, ducks and waterfowls are introduced into typical Asian live bird markets and stocked at a high density on a daily basis. Various studies showed that different subtypes of avian influenza viruses have frequently been detected in live bird markets. Therefore, live bird markets offer optimal conditions for amplifying and sustaining AI virus circulation.

Epidemiological studies clearly demonstrate that human infection with AI A(H5N1) and A(H7N9) has been reported among those who worked in or visited live bird markets. The early closure of live bird markets have prevented possible human infection with AI and sustained poultry transmission as live poultry were brought home by farmers.
Influenza virus infections in swine and poultry are potential sources of virus infection that can cause the next pandemic among humans. The bidirectional transmission of influenza viruses between pigs and humans has been documented. The pandemics of the past appear to have contributed to the introduction of whole or partial avian influenza viruses into a human population. The diversity of avian and other zoonotic influenza viruses that have caused human infections necessitates ongoing surveillance in both animal and human populations, detailed investigation of every human infection and risk-based pandemic planning. Whether and when this will happen, however, is not clear.

It is important to monitor swine influenza as pigs are susceptible to avian, human and swine influenza viruses. This susceptibility has the potential to induce an antigenic shift which can produce potential pandemic strains. It has been documented that pigs can be infected with the current highly pathogenic avian influenza A (H5N1) virus that has been responsible for disease in poultry. These findings suggest that pigs would be the ideal mixing vessel for the creation of new avian/mammalian influenza viruses capable of causing novel diseases with the potential for producing pandemics in the human population.
Influenza vaccination is most effective when circulating viruses are well-matched with vaccine viruses. The WHO Global Influenza Surveillance and Response System (GISRS) constantly monitor the evolution of influenza viruses circulating in humans through a network of national influenza centre and WHO collaborating centres for influenza. For many years, WHO has updated its recommendations on vaccine composition biannually that targets the three (trivalent) most representative virus types in circulation (two subtypes of influenza A viruses and one influenza B virus). Since the antigenic changes in circulating influenza viruses can occur abruptly and at different times of the year, there may be significant differences between prevailing influenza strains in the northern and southern hemispheres. Therefore, the composition of influenza vaccines is reviewed annually, separately for the two hemispheres.

Available seasonal influenza vaccines protect against the strain that caused the 2009 pandemic influenza A(H1N1)pdm09 but does not protect against avian influenza. The seasonal flu vaccine does not protect against influenza C viruses and other infections and illnesses caused by other viruses that also can cause influenza-like symptoms.
Is there a universal vaccine against zoonotic influenza?

Unfortunately, there is no universal vaccine against zoonotic influenza. The major challenge to developing broadly effective vaccines against zoonotic influenza is that within subtypes there are hundreds of strains that may vary slightly and which naturally and frequently mutate to create new strains. There are specific vaccines against particular subtypes such as influenza A(H5N1). Current seasonal vaccines only provide protection when matched with targeted virus strains, which are those predicted to be of concern in the next flu season. However, these they often fail to be protective because the predicted strain(s) changes as the next flu season emerges.

How is zoonotic influenza prevented?

Prevention of human infection with zoonotic influenza is primarily important from a public health standpoint. For instance pigs, are known as a mixing vessel for the various types of influenza viruses of animal origin to humans and the re-assortment of influenza viruses may lead to the emergence of novel influenza viruses with zoonotic or pandemic potential. It is necessary to segregate pig farms from poultry or duck farms. It is very important for pig farms to maintain strict biosecurity protocols for those entering their facilities.

Poultry infection with highly pathogenic avian influenza can be prevented with biosecurity measures and an “all in and all out” policy. Depopulation of poultry and disinfection are the best strategies for control an AI outbreak in a poultry population. Live bird marketing should be discouraged and poultry and ducks should be segregated. If a poultry vaccination strategy is opted for, it must be carried out with a robust surveillance system to monitor for virus drift and strain mismatch.
Control of influenza virus infection in poultry and pigs is critical to the reduction of potential cross-species adaptation and the spread of influenza viruses, which will minimize the risk of animals being the source of zoonotic and pandemic influenza.

Wildfowl, ducks and poultry are key sources of avian influenza viruses which can be transmissible to humans. When there is an outbreak of highly pathogenic avian influenza, it is highly recommended to depopulate the poultry population in organized farms to eradicate the source of avian influenza viruses. Live bird markets are a main source of zoonotic influenza viruses when avian and swine influenza appear in sub-clinical form. Closing live bird markets and introducing days off to improve hygienic and sanitary conditions have reduced the risk of zoonotic influenza.

WHO, in its capacity of providing leadership on global health matters, is monitoring avian and zoonotic influenza viruses very closely. WHO is also developing and adjusting appropriate interventions in collaboration with its partners. Specifically, WHO, the World Organisation for Animal Health (OIE), and the Food and Agriculture Organization of the United Nations (FAO) collaborate to track and assess the risk from avian and other zoonotic influenza viruses of public health concern. Findings that suggest elevated risk of pandemic emergence are shared with Member States to enhance preparedness and response.
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Influenza, commonly called "the flu," is an illness caused by influenza viruses that infect the respiratory tract of many animals, birds, and humans. Influenza occurs globally and historical data illustrates the danger of transmission of influenza between animals and humans that can potentially contribute to the emergence of a pandemic. Avian influenza of subtypes H5N1 and H7N9 are classical examples of direct animal to human transmission. Studies have shown that people working in live bird markets, poultry farms and those involving in slaughtering and processing of poultry are exposed to avian influenza viruses. The differences between seasonal, zoonotic and pandemic influenza and importance of surveillance, laboratory investigation and intersectoral cooperation for prevention and control of zoonotic influenza have been elaborated. The WHO Global Influenza Surveillance and Response System (GISRS) constantly monitor the evolution of influenza viruses circulating in humans through a network of National Influenza Centers and WHO Collaborating Centers for Influenza in order to make recommendation on seasonal influenza vaccine composition biannually. WHO, the World Organisation for Animal Health (OIE), and the Food and Agriculture Organization (FAO) are collaborating to track and assess the risk from avian and other zoonotic influenza viruses of public health concern.