Influenza at the human-animal interface
Summary and risk assessment, from 4 May to 7 June 2024

• New human infections: From 4 May to 7 June 2024, four human cases of infection with influenza A(H5N1) viruses, one human case of infection with an influenza A(H5N2) virus, two human cases of infection with influenza A(H5N6) viruses, and three human cases of infection with influenza A(H9N2) viruses were reported officially.

• Circulation of influenza viruses with zoonotic potential in animals: High pathogenicity avian influenza (HPAI) events in poultry and non-poultry continue to be reported to the World Organisation for Animal Health (WOAH). The Food and Agriculture Organization of the United Nations (FAO) also provides a global update on avian influenza viruses with pandemic potential.

• Risk assessment: Based on information available at the time of the risk assessment, the overall public health risk from currently known influenza viruses at the human-animal interface has not changed, and the occurrence of sustained human-to-human transmission of the viruses is currently considered unlikely. Although human infections with viruses of animal origin are infrequent, they are not unexpected at the human-animal interface.

• IHR compliance: All human infections caused by a new influenza subtype are required to be reported under the International Health Regulations (IHR, 2005). This includes any influenza A virus that has demonstrated the capacity to infect a human and its haemagglutinin gene (or protein) is not a mutated form of those, i.e. A(H1) or A(H3), circulating widely in the human population. Information from these notifications is critical to inform risk assessments for influenza at the human-animal interface.

Avian influenza viruses in humans

Current situation:
A(H5N1), Australia
Since the last risk assessment of 3 May 2024, one human case of infection with an A(H5N1) influenza virus was notified to WHO from Australia on 22 May 2024.

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1 This summary and assessment covers information confirmed during this period and may include information received outside of this period.
2 For epidemiological and virological features of human infections with animal influenza viruses not reported in this assessment, see the reports on human cases of influenza at the human-animal interface published in the Weekly Epidemiological Record here.
6 World Health Organization. Case definitions for the 4 diseases requiring notification to WHO in all circumstances under the International Health Regulations (2005). Case definitions for the four diseases requiring notification in all circumstances under the International Health Regulations (2005).
The patient, a 2-year-old girl, with no underlying medical conditions, traveled with family to Kolkata, India, from 12 February to 29 February 2024. On 25 February, she developed fever, cough and vomiting while in India. Medical care was sought on 28 February in India. On 2 March, healthcare was sought again, and she was admitted to the hospital on the same day. On 4 March, she was transferred to the intensive care unit (ICU) at a referral hospital due to worsening symptoms. Samples collected on 6 March and 7 March tested positive for influenza A at the hospital. The samples were sent to the WHO CC for Reference and Research on Influenza in Australia on 3 April. Genetic sequence data obtained from the samples confirmed the subtype A(H5N1) and indicated that the haemagglutinin (HA) gene belonged to clade 2.3.2.1a, which circulates in Southeast Asia in birds and has been detected in previous human infections.

No close family contacts of the case developed symptoms at the time of reporting. Additional information provided by the family indicates that the patient did not travel in India beyond Kolkata or have known exposure to sick persons or animals while in India. The patient was discharged from hospital and has fully recovered.

This is the first human infection with A(H5N1) virus notified by Australia. Previously, India has reported human infections with A(H5N1) viruses, most recently in 2021. India has reported detections of avian influenza A(H5N1) in domestic birds in 2024 to the World Organization for Animal Health (WOAH). In this case, the exposure likely occurred in India where A(H5N1) viruses have been detected in birds in the past, although the likely source of exposure to the virus in this case is currently unknown.\(^7\)

**A(H5N1), notified by China in a person from Viet Nam**

In the previous reporting period, one human case of infection with an A(H5N1) influenza virus was notified to WHO from China on 2 April 2024. Influenza A(H5N1) virus was detected in a respiratory sample collected from a person from Viet Nam who worked as a cargo delivery worker. The sample was collected as part of routine random sampling and testing at a port of entry, between China and Viet Nam, in Guangxi Autonomous Region on 28 March. Reverse transcription-polymerase chain reaction (RT-PCR) testing was positive on 28 March for A(H5N1) at the laboratory of the port of entry. After delivering cargo at the port of entry, the person returned to Viet Nam without further movement elsewhere in China. According to initial epidemiological investigations in China, the case had been exposed to live poultry in Viet Nam prior to the onset of illness and no further cases associated with this person were detected. On 30 March, the WHO Collaborating Centre for Reference and Research on Influenza at the Chinese National Influenza Center (CNIC) confirmed the detection of influenza A(H5N1) in the sample collected at the port of entry.

This information was shared with the International Health Regulations (2005) (IHR) focal point in Viet Nam and Viet Nam shared additional information on the case. The case is a 33-year-old woman residing in Quang Ninh Province, Viet Nam. She developed a cough on 26 March. She travelled to China on 28 March and returned to Viet Nam on the same day. On the same day, after receiving information from the port of entry in China, local health authorities in Viet Nam visited her residence, transferred her to a health clinic for examination and isolation after receiving information from the port of entry in China, and collected additional respiratory samples. These samples tested negative by RT-PCR at the Quang Ninh Province Disease Control Center. Results were received the same day, testing negative for A(H5N1), SARS-CoV-2, respiratory syncytial virus, and influenza A and B viruses on 28 March. The local investigation found that six close contacts, including her household members, remained healthy and the case did not develop any further symptoms. Around three

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\(^7\) World Health Organization (7 June 2024). Disease Outbreak News; Avian Influenza A (H5N1) in Australia. Available at: [https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON519](https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON519).
weeks prior to illness onset, she purchased a chicken from a local market, cooked and consumed it with her family members at her residence.

**A(H5N1), United States of America (USA)**

Since the last risk assessment of 3 May 2024, two human cases of infection with A(H5N1) influenza viruses were notified to WHO from the USA on 22 and 30 May 2024.

Both cases were in adults residing in the state of Michigan. Both were working on different dairy farms where A(H5N1) virus had been identified in cows. The first case developed conjunctivitis on 13 May following exposure to infected milk while not wearing full personal protective equipment. On 14 May, a nasopharyngeal specimen and a conjunctival specimen were collected from the patient. The nasopharyngeal specimen tested negative for influenza A virus at the Michigan Public Health Laboratory using a US Centers for Disease Control and Prevention (CDC) assay. Both specimens were sent to CDC on 20 May for further testing. The conjunctival specimen was positive for A(H5) virus using diagnostic real-time RT-PCR, and the respiratory specimen tested negative for influenza A and A(H5) virus on 22 May. On 23 May, the US CDC confirmed the neuraminidase (NA) of the virus as N1 and published the results of additional genetic analysis of the conjunctival specimen.

The virus HA gene was identified as clade 2.3.4.4b with each individual gene segment closely related to genotype B3.13 viruses detected in dairy cows available from United States Department of Agriculture (USDA) testing. No amino acid changes were identified in the HA gene sequence from the Michigan patient specimen compared to the HA sequence from the human case previously detected in Texas and only minor changes were identified when compared to sequences from cows. The genome of the human virus from Michigan showed a molecular change in the PB2 gene known to be associated with viral adaptation to mammalian hosts. The remainder of the genome is closely related to sequences detected in infected dairy cows.\(^8\)

The second case developed upper respiratory tract symptoms (cough without fever) and eye discomfort with water discharge in the week ending 18 May following direct contact with an infected dairy cow while not wearing full personal protective equipment. In the week ending 25 May, nasopharyngeal, oropharyngeal and conjunctival specimens were collected and tested at the Michigan Public Health Laboratory. The nasopharyngeal specimen was presumptive positive for influenza A(H5) and the oropharyngeal and conjunctival specimens were negative for influenza A virus using a Centers for Disease Control and Prevention (CDC) assay. All specimens were then sent to CDC for further testing. The nasopharyngeal swab specimen was positive for influenza A and A(H5) virus using diagnostic RT-PCR, and the oropharyngeal and conjunctival specimens tested negative for influenza A and A(H5) virus on 29 May. Partial HA and full-length NA genetic sequence data confirmed the virus belonged to clade 2.3.4.4b and was closely related to viruses detected in dairy cows.\(^9\)

The patients were not hospitalized, were offered antiviral treatment following US CDC guidance and have recovered. Household contacts of the patients have not reported illness. Symptom monitoring among workers exposed to infected cattle at the same farms has not identified additional persons

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who had symptoms. No additional cases of human infection with A(H5N1) virus associated with these cases have been reported.

A(H5N1) virus infections in dairy cattle continue to be reported in the USA.\(^{10}\)

**Further details are included in a joint FAO/WHO/WOAH preliminary assessment of recent influenza A(H5N1) viruses published on 23 April 2024\(^{11}\) and in the genetic and antigenic characteristics of clade 2.3.4.4b A(H5N1) viruses identified in dairy cattle in the United States of America published on 22 May 2024\(^ {12} \).**

**A(H5N2), Mexico**

Since the last risk assessment of 3 May 2024, one human case of infection with an A(H5N2) influenza virus was notified to WHO from Mexico on 23 May 2024.

On 17 April, a 59-year-old male resident of the State of Mexico developed fever, shortness of breath, diarrhea, nausea and general malaise. The case had multiple underlying medical conditions and the case’s relatives reported that the case had already been bedridden for three weeks, for other reasons, prior to the onset of acute symptoms.

On 24 April, the case sought medical attention, was hospitalized at the National Institute of Respiratory Diseases “Ismael Cosio Villegas” (INER per its acronym in Spanish) in Mexico City and died the same day. Results from RT-PCR of a respiratory sample collected and tested at INER on 24 April indicated a non-subtypeable influenza A virus. On 8 May, the sample was sent for sequencing to the Laboratory of Molecular Biology of Emerging Diseases Center for Research in Infectious Diseases (CIENI per its acronym in Spanish) of INER, which indicated that the sample was positive for influenza A(H5N2). On 20 May, the sample was received at the Institute of Epidemiological Diagnosis and Reference (InDRE per its acronym in Spanish) of the Mexico National Influenza Centre, where RT-PCR confirmed an influenza A virus. On 22 May, sequencing of the sample confirmed the influenza subtype was A(H5N2).

Although the source of exposure to the virus in this case is currently unknown, A(H5N2) viruses have been reported in poultry in Mexico. Genetic analysis performed by the national authorities identified that the virus from the patient has a 99% similarity with the strain obtained during 2024 in birds in Texcoco State of Mexico.

No further cases were reported during the epidemiological investigation. Seventeen contacts at the hospital where the man died and 12 additional contacts near his residence tested negative for influenza viruses. Samples from these persons were taken a month after the acute disease onset in the patient with confirmed influenza A(H5N2) infection. The results of the serological samples are pending.


\(^{12}\) World Health Organization. Genetic and antigenic characteristics of clade 2.3.4.4b A(H5N1) viruses identified in dairy cattle in the United States of America, 22 May 2024. Available at: [https://www.who.int/publications/m/item/genetic-and-antigenic-characteristics-of-clade-2.3.4.4b-a(h5n1)-viruses-identified-in-dairy-cattle-in-the-united-states-of-america](https://www.who.int/publications/m/item/genetic-and-antigenic-characteristics-of-clade-2.3.4.4b-a(h5n1)-viruses-identified-in-dairy-cattle-in-the-united-states-of-america).
This is the first laboratory-confirmed human case of infection with an influenza A(H5N2) virus reported globally, and the first A(H5) virus infection in a person reported in Mexico. Avian influenza A(H5N2) viruses have been reported in poultry in Mexico.\textsuperscript{13, 14}

**A(H5N6), China**

Since the last risk assessment of 3 May 2024, two human cases of infection with A(H5N6) influenza viruses were notified to WHO from China.

On 8 May 2024, an infection with an A(H5N6) virus was reported in a 52-year-old woman from Fujian Province who had an onset of illness on 13 April 2024 and presented with symptoms of fever and shortness of breath. She had no underlying medical conditions. Her health condition worsened, and on 22 April she was admitted to the Intensive Care Unit due to severe pneumonia. On the same day, samples were taken, and she was administered antiviral drugs. The A(H5N6) virus was confirmed on 24 April through whole-genome sequencing. She passed away on 30 April. Prior to onset of illness, the case had exposure to backyard poultry. At the time of reporting, no family members developed symptoms. A total of 12 close contacts were identified. An investigation was conducted by the local Chinese Center for Disease Control (CDC), and samples were collected from close contacts, poultry and the environment. All samples have tested negative for influenza.

On 5 June 2024, an infection with an A(H5N6) virus was reported in a 41-year-old male from Fujian Province who had an onset of illness on 8 May 2024. The patient was hospitalized on 11 May with severe pneumonia and subsequently passed away. The case had exposure to backyard poultry. Samples from the close contacts and the environment tested negative and no further cases in the family of the patient were reported.

According to reports received by WOAH, various influenza A(H5) subtypes continue to be detected in wild and domestic birds in Asia, Europe and the Americas. Infections in non-human mammals are also reported, including in marine and land mammals.\textsuperscript{15} A list of bird and mammalian species affected by HPAI A(H5) viruses is maintained by FAO.\textsuperscript{16}

**Risk Assessment for avian influenza A(H5) viruses:**

1. **What is the public health risk of additional sporadic human cases of infection with avian influenza A(H5) viruses?**

Most human cases so far have been sporadic infections in people exposed to A(H5) viruses, for example, through contact with infected poultry or contaminated environments, including live poultry markets, and occasionally infected mammals and contaminated environments. While the viruses continue to be detected in animals and related environments humans are exposed to, further human cases are expected but unusual. The impact for public health if additional sporadic cases are detected is minimal. The overall public health risk of additional sporadic human cases is low.

\textsuperscript{13} World Health Organization (5 June 2024). Disease Outbreak News; Avian Influenza A (H5N2) – Mexico. Available at: [http://www.who.int/emergencies/disease-outbreak-news/item/2024-DON520](http://www.who.int/emergencies/disease-outbreak-news/item/2024-DON520).

\textsuperscript{14} World Health Organization (14 June 2024). Disease Outbreak News; Avian Influenza A (H5N2) – Mexico. Available at: [https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON524](https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON524).


2. What is the likelihood of sustained human-to-human transmission of avian influenza A(H5) viruses?
No sustained human-to-human transmission has been identified associated with the recent reported human infections with avian influenza A(H5). There has been no reported human-to-human transmission of A(H5N1) viruses since 2007, although there may be gaps in investigations. In 2007 and the years prior, small clusters of A(H5) virus infections in humans were reported, including some involving health care workers, where limited human-to-human transmission could not be excluded; however, sustained human-to-human transmission was not reported.

Available evidence suggests that influenza A(H5) viruses circulating have not acquired the ability to efficiently transmit between people, therefore sustained human-to-human transmission is thus currently considered unlikely at this time.

3. What is the likelihood of international spread of avian influenza A(H5) viruses by travellers?
Should infected individuals from affected areas travel internationally, their infection may be detected in another country during travel or after arrival. If this were to occur, further community-level spread is considered unlikely as current evidence suggests these viruses have not acquired the ability to transmit easily among humans.

A(H9N2), China
Since the last risk assessment of 3 May 2024, two human cases of infection with A(H9N2) influenza viruses were notified to WHO from China on 5 June 2024.

A 6-year-old boy from Anhui Province had an onset of mild illness on 2 January 2024. He reportedly had exposure to a live poultry market. This case was previously included in the risk assessment of 26 February 2024.17

A 3-year-old boy from the Guangxi Autonomous Region had an onset of mild illness on 2 May 2024. He reportedly had suspected exposure to a live poultry market.

In both cases, environmental samples tested positive for A(H9) and samples from close contacts tested negative for influenza and no further cases in family members were reported.

A(H9N2), India
Since the last risk assessment of 3 May 2024, one human case of infection with an A(H9N2) influenza virus was notified to WHO from India on 22 May 2024.

A four-year-old boy residing in West Bengal state in India, near the border with Bangladesh, initially presented for healthcare with fever and abdominal pain on 26 January 2024. He had previously been diagnosed with hyperreactive airway disease. On 29 January, he developed seizures and was brought to his healthcare provider. On 1 February, he was admitted to the pediatric ICU due to the persistence of severe respiratory distress, recurrent fever and abdominal cramps. He was diagnosed with post-infectious bronchiolitis caused by viral pneumonia. On 2 February, samples collected from the patient tested positive for influenza B and adenovirus at the local government hospital. The patient was discharged from the hospital on 28 February 2024.

On 3 March, with the recurrence of severe respiratory distress, the patient was referred to another hospital, admitted to the pediatric ICU and intubated. On 5 March, a nasopharyngeal swab was sent to the Kolkata Virus Research and Diagnostic Laboratory and tested positive for Influenza A (not sub-typed) and rhinovirus. The same sample was sent to the National Institute of Virology (NIV) in Pune for subtyping. On 26 April, the sample was subtyped as influenza A(H9N2) by RT-PCR. On 19 April, a second sample was sent to the Kolkata Virus Research and Diagnostic Laboratory and tested negative for influenza A and Rhinovirus. On 1 May, the case was discharged from hospital with oxygen support.

The patient had exposure to poultry at home and in the surroundings, as reported by family members. At the time of reporting, there was no known case reporting symptoms of respiratory illness in the family, the neighborhood, or among health care workers where the patient was treated.

This is the second human infection of avian influenza A(H9N2) notified to WHO from India.18

**Risk Assessment for avian influenza A(H9N2):**

1. **What is the public health risk of additional sporadic human cases of infection with avian influenza A(H9N2) viruses?**
   Most human cases follow exposure to the A(H9N2) virus through contact with infected poultry or contaminated environments. Most, human infections of A(H9N2), to date, have resulted, in mild clinical illness in most cases. Nearly 130 human infections with A(H9N2) cases have been reported to date since 2003, and six of these have been severe or fatal and three of these were known to have underlying medical conditions. Since the virus is endemic in multiple continues in Africa and Asia19, further human cases can be expected but remain unusual. The impact to public health if additional sporadic cases are detected is minimal. The overall public health risk of additional sporadic human cases is low.

2. **What is the likelihood of sustained human-to-human transmission of avian influenza A(H9N2) viruses?**
   At the present time, no sustained human-to-human transmission has been identified associated with the event described above. Current evidence suggests that influenza A(H9N2) viruses from these cases have not acquired the ability of sustained transmission among humans, therefore sustained human-to-human transmission is thus currently considered unlikely.

3. **What is the likelihood of international spread of avian influenza A(H9N2) virus by travellers?**
   Should infected individuals from affected areas travel internationally, their infection may be detected in another country during travel or after arrival. If this were to occur, further community level spread is considered unlikely as current evidence suggests the A(H9N2) virus subtype has not acquired the ability to transmit easily among humans.

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18 World Health Organization (11 June 2024). Disease Outbreak News; Avian Influenza A (H9N2) in India. Available at: [https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON523](https://www.who.int/emergencies/disease-outbreak-news/item/2024-DON523).

Overall risk management recommendations:

**Surveillance and investigations**

- Due to the constantly evolving nature of influenza viruses, WHO continues to stress the importance of global strategic surveillance in animals and humans to detect virologic, epidemiologic and clinical changes associated with circulating influenza viruses that may affect human (or animal) health. Continued vigilance is needed within affected and neighbouring areas to detect infections in animals and humans. Close collaboration with the animal health and environment sectors is essential to understand the extent of the risk of human exposure and to prevent and control the spread of animal influenza.

- As the extent of influenza virus circulation in animals is not clear, epidemiologic and virologic surveillance and the follow-up of suspected human cases should continue systematically. Guidance on investigation of non-seasonal influenza and other emerging acute respiratory diseases has been published on the WHO website.

- Countries should maintain enhanced surveillance in domestic and wild birds, including HPAI as a differential diagnosis in non-avian species, including cattle and other livestock populations, with high risk of exposure to HPAI viruses; monitor and investigate cases in non-avian species, including livestock, report cases of HPAI in all animal species, including unusual hosts, to WOAH and other international organizations, share genetic sequences of avian influenza viruses in publicly available databases, prevent the introduction and spread in animals by implementing through strict biosecurity measures in livestock holdings, employ good production and hygiene practices when handling animal products, and protect persons in contact with suspected/infected animals.

- When there has been human exposure to a known outbreak of an influenza A virus in domestic poultry, wild birds or other animals – or when there has been an identified human case of infection with such a virus – enhanced surveillance in potentially exposed human populations becomes necessary. Enhanced surveillance should consider the health care seeking behaviour of the population, and could include a range of active and passive health care and/or community-based approaches, including: enhanced surveillance in local influenza-like illness (ILI)/severe acute respiratory infection (SARI) systems, active screening in hospitals and of groups that may be at higher occupational risk of exposure, and inclusion of other sources such as traditional healers, private practitioners and private diagnostic laboratories.

- Vigilance for the emergence of novel influenza viruses of pandemic potential should be maintained at all times including during a non-influenza emergency. In the context of the co-circulation of SARS-CoV-2 and influenza viruses, WHO has published practical guidance for integrated surveillance.

**Notifying WHO**

- All human infections caused by a new subtype of influenza virus are notifiable under the International Health Regulations (IHR, 2005). State Parties to the IHR (2005) are required to immediately notify WHO of any laboratory-confirmed case of a recent human infection caused

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21 World Health Organization. Case definitions for the four diseases requiring notification in all circumstances under the International Health Regulations (2005).

by an influenza A virus with the potential to cause a pandemic. Evidence of illness is not required for this report.

**Virus sharing and risk assessment**

- It is critical that these influenza viruses from animals or from people are fully characterized in appropriate animal or human health influenza reference laboratories. Under WHO’s Pandemic Influenza Preparadness (PIP) Framework, Member States are expected to share influenza viruses with pandemic potential on a **timely basis** with a WHO Collaborating Centre for Influenza of GISRS. The viruses are used by the public health laboratories to assess the risk of pandemic influenza and to develop candidate vaccine viruses.


**Risk reduction**

- Given the observed extent and frequency of avian influenza in poultry, wild birds and some wild and domestic mammals, the public should avoid contact with animals that are sick or dead from unknown causes, including wild animals, and should report dead birds and mammals or request their removal by contacting local wildlife or veterinary authorities.

- Eggs, poultry meat and other poultry food products should be properly cooked and properly handled during food preparation. Due to the potential health risks to consumers, raw milk should be avoided. WHO advises consuming pasteurized milk. If pasteurized milk isn’t available, heating raw milk until it boils makes it safer for consumption.

**Trade and travellers**

- WHO advises that travellers to countries with known outbreaks of animal influenza should avoid farms, contact with animals in live animal markets, entering areas where animals may be slaughtered, or contact with any surfaces that appear to be contaminated with animal excreta. Travelers should also wash their hands often with soap and water. All individuals should follow good food safety and hygiene practices.

- WHO does not advise special traveller screening at points of entry or restrictions with regards to the current situation of influenza viruses at the human-animal interface. For recommendations on safe trade in animals and related products from countries affected by these influenza viruses, refer to [WOAH](http://www.who.int/news-room/fact-sheets/detail/influenza-(avian-and-other-zoonotic)) guidance.

**Links:**

- WHO Protocol to investigate non-seasonal influenza and other emerging acute respiratory diseases [https://apps.who.int/iris/handle/10665/25940](https://apps.who.int/iris/handle/10665/25940)

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23 World Health Organization. Pandemic influenza preparedness framework for the sharing of influenza viruses and access to vaccines and other benefits, 2nd edition. Available at: [https://iris.who.int/handle/10665/341850](https://iris.who.int/handle/10665/341850)

24 World Health Organization. Operational guidance on sharing influenza viruses with human pandemic potential (IVPP) under the Pandemic Influenza Preparedness (PIP) Framework (2017). Available at: [https://apps.who.int/iris/handle/10665/25940](https://apps.who.int/iris/handle/10665/25940)
https://www.who.int/publications/i/item/WHO-WHE-IHM-GIP-2018.2
WHO Public health resource pack for countries experiencing outbreaks of influenza in animals:
https://www.who.int/publications/i/item/9789240076884
Cumulative Number of Confirmed Human Cases of Avian Influenza A(H5N1) Reported to WHO
https://www.who.int/teams/global-influenza-programme/avian-influenza/avian-a-h5n1-virus
Avian Influenza A(H7N9) Information
https://www.who.int/teams/global-influenza-programme/avian-influenza/avian-influenza-a-(h7n9)-virus
World Organisation of Animal Health (WOAH) web page: Avian Influenza
https://www.woah.org/en/home/
Food and Agriculture Organization of the United Nations (FAO) webpage: Avian Influenza
OFFLU
http://www.offlu.org/