

Avian Influenza

Introduction

Avian influenza (AI) is an infectious zoonotic pathogen caused by subtypes of the influenza A virus, which can cause serious illness in birds and can also infect humans, though rarely. AI occurs naturally among wild aquatic birds around the globe, including waterfowl (e.g., geese, ducks) and shorebirds (e.g., plovers, sandpipers). It is easily transmitted among wild and domestic birds including poultry (e.g., turkey) and has been transmitted to some wild and farmed mammals. The likelihood of severe disease in humans varies by strain of avian influenza as well as human risk factors.

Two public health concerns related to avian influenza are:

- the health risk to the individual, and
- viral reassortment, which could result in pathogen of pandemic potential (i.e., a novel strain of influenza with the ability to infect humans that is easily transmitted human to human). Co-infection with seasonal influenza virus and avian influenza virus may increase the potential for reassortment.

Background

Since fall 2020 there has been a global outbreak of AI A(H5N1) in birds and mammals (domestic and wild), which is ongoing. To date, most international reports of human infections with Influenza A(H5N1) have been associated with close contact with infected poultry, contaminated environments, or exposure to infected cattle. Information on the current AI A(H5N1) outbreak in Canada can be found in the [Latest bird flu situation - inspection.canada.ca](https://inspection.canada.ca/latest-bird-flu-situation).

Nova Scotia (NS) first detected AI A(H5N1) in birds in 2022. Since then, there have been several premises in NS identified by the Canadian Food Inspection Agency (CFIA) where birds, including poultry were infected. Additionally, during this timeframe, AI A(H5N1) has been detected in over 200 wildlife specimens including wild birds and mammals (e.g., red fox, racoon, and striped skunk) in Nova Scotia.

To date, there have been no detections of AI in livestock in Nova Scotia, or Canada. AI A(H5N1) very rarely infects humans in Canada. There was a travel related human case of H5N1 identified in Canada in 2014 and most recently a domestically acquired case in British Columbia in November 2024. The risk of infection to the public remains low. Occupational settings where there could be close contact with infected domestic or wild birds, animals or their environments are at a higher risk for exposure.

Human cases of influenza caused by a new sub-type are notifiable under the [International Health Regulations](#). Provinces are required to report cases to the Public Health Agency of Canada (PHAC) within 24 hours of notification. PHAC is required to report any human case detected in Canada to the World Health Organization.

Case definition

Avian influenza A is a reportable disease in Nova Scotia.

The case definition for Avian Influenza (H5N1) can be found [here](#).

PHAC has a national case definition for Avian Influenza A(H7N9), which can be found [here](#).

The PHAC is currently developing a generic case definition for avian influenza.

Causative agent

AI is an influenza virus that mainly affects wild birds and can infect other mammals and humans. AI viruses are categorized into two types based on pathogenicity in birds; these types are not predictive of severity in humans:

Low Pathogenic Avian Influenza (LPAI): causes mild to no signs of disease in avian species; however, in poultry LPAI can mutate into highly pathogenic avian influenza viruses.

Highly Pathogenic Avian Influenza (HPAI): can cause severe disease and high mortality in avian species including domestic poultry.

In humans the severity varies by subtype. The following classifications may be used to assist in risk assessment:

- subtype is known to cause predominantly mild human illness (e.g., H3N8, H7N3, H7N7, H9N2);
- subtype is known to cause predominantly severe human illness (e.g., H5N1, H5N6, H7N9).
- no data are available on the human illness risk of the subtype;
- subtype has previously been identified in animals and is not known to have caused human illness (e.g., H6N1, H13N6).

More information on case fatality by subtype can be found in the [Emerging Respiratory Pathogens bulletin](#).

Source

Wild birds can transmit avian influenza to domestic poultry as well as other bird and animal species.

Transmission

Infected birds and mammals shed the virus in their saliva, nasal secretions, and feces, and, in dairy cattle, their milk. Transmission of avian influenza virus to humans may occur through close contact with infected poultry or mammals, exposure to highly contaminated environments (e.g. animal farms or live animal markets) or exposure to high-risk environments (e.g. backyard or small flocks). The virus may be carried on soiled objects such as boots, vehicle tires, or other gear, and can survive in water. More information regarding human exposure to AI virus from infected birds or mammals can be found in PHACs [Guidance on Human Health Issues Related to Avian Influenza in Canada](#).

Transmission of the virus occurs through inhalation or mucus membrane contact with infected secretions and excretions. Humans are most likely to be exposed to the virus during slaughter, defeathering, butchering, and preparing for cooking. Following exposure to AI, NSH Public Health conducts an investigation to assess the risk of the transmission of the virus to humans. More information can be found in [Appendix B](#).

There is no evidence to suggest transmission can occur through the consumption of fully cooked poultry, game meat or eggs. Recent research confirmed pasteurization was effective in inactivating avian influenza virus in milk, however the virus has been found in raw milk in the United States.

Communicability

Human-to-human transmission is extremely rare and has not been sustained; however, it is possible in close contact situation without the proper use of appropriate Personal Protection Equipment (PPE).

Determination of the period of communicability is challenging due to the lack of available data; however, it is assumed to be similar to seasonal human influenza (1 day before symptom onset to 7 days after symptom onset).

Incubation

The incubation period of avian influenza in humans is estimated to be 2 to 5 days, with longer incubation periods being reported up to 17 days. This estimation is a more prolonged incubation period than seasonal influenza viruses (i.e. 1 to 3 days).

To allow for inherent variability, recall error and to establish consistency with other emerging respiratory virus monitoring, exposure history based on the prior 10 days is a reasonable and safe approximation.

Signs, symptoms and severity

AI in humans mainly affects the respiratory tract. Signs and symptoms of avian influenza reported in humans have included:

Mild illness, including:

- fever (which may not be present in young children, older persons, and people who are immunocompromised),
- cough,
- sore throat,
- runny nose,
- fatigue,
- muscle pain,
- joint pain,
- headache,
- conjunctivitis,
- Digestive symptoms such as diarrhea, nausea, and vomiting are possible, although less common.

Moderate to severe illness symptoms may include shortness of breath, altered mental status, seizures pneumonia, acute respiratory distress syndrome, respiratory failure, shock, multi-organ failure, meningoencephalitis.

Reported complications of avian influenza have included secondary bacterial or fungal infection.

Diagnostic testing

When AI is suspected based on clinical assessment, notification to both the Medical Officer of Health and the laboratory is needed to ensure efficient laboratory testing is conducted. Specimens submitted to the local laboratory can be processed for initial influenza A testing as per routine procedures. Influenza A positive laboratory specimens will be sent to Central Zone laboratory for influenza A subtyping. Subtyping of Influenza A is needed to differentiate seasonal influenza from AI. Specimens that are non-typeable for seasonal influenza will be reported as a presumptive positive AI. Confirmation testing of AI occurs at the National Microbiology Laboratory (NML). More information on enhanced surveillance for AI can be found in the [Respiratory Surveillance Plan](#).

Nova Scotia sends specimens to NML for further characterization of all suspect avian strains, as well as novel or non-typeable samples. However, given that subtyping assays are usually less sensitive than the identification assays, weak positives may not be able to be typed. Based on local experience, each laboratory should evaluate these on a case-by-case basis with their local clinicians and public health colleagues. More information regarding specimen submission requirements is found in [Appendix A: Specimen Requirements](#)

Treatment

Treatment should be overseen by a clinician and details are out of scope for this document. Consult Infectious Diseases as appropriate for decisions regarding treatment. Most AI A(H5N1), A(H5N6), and A(H7N9) viruses are susceptible to the neuraminidase inhibitors (oseltamivir, zanamivir, and peramivir) and the polymerase acidic endonuclease inhibitor (baloxavir), but they are often resistant to the adamantanes (amantadine and rimantadine).

PUBLIC HEALTH MANAGEMENT & CONTROL

Case management

Upon notification of a human case of AI (presumed or confirmed), Public Health shall immediately initiate an investigation and implement appropriate public health measures to prevent or limit transmission and protect public health. Immediate notification to the Chief Medical Officer of Health team is required to ensure proper notification to PHAC (IHR requirement) and key partners such as the Chief Veterinary Officer:

- Determine potential source of the infection for the case.
- Advise case to isolate at home for 7 days from onset of symptoms (or laboratory identification of infection if asymptomatic) or until symptoms resolve (using the longer time frame), consider wearing a well-fitting medical mask when in public areas from day 8 – 14 after onset of symptoms or laboratory confirmation. If proper isolation is not possible, the case should minimize contact with other household members, where reasonable. Do not attend or visit **any** public places including work, school, etc.; if access to healthcare is required, follow public health measures described in the education section:
 - Isolate separate from other family members and pets, preferably with access to a separate, designated bathroom:
 - When possible, avoid close contact including sharing indoor spaces with household members – watching tv, eating meals at the same table, playing games together, etc. If close contact is necessary for caregiving, discuss with case how to minimize exposure through appropriate use of public health measures.
 - If unable to strictly isolate, maintain a physical distance, use dividers such as curtains if possible, and wear a well-fitting, medical mask when in the shared space. Clean and disinfect surfaces after use with household cleaner followed by household disinfectant with efficacy against influenza.
 - Improve indoor air quality/ventilation by opening windows and/or

doors when appropriate in shared spaces keeping in mind weather, outdoor air quality and safety concerns:

- Ensure heating and cooling mechanical ventilation is functioning properly.
- Turn on bathroom exhaust fan if sharing a washroom with other individuals.
- Self-monitor for worsening of symptoms, including daily temperature checks. Record temperature.
- Provide appropriate education as outlined [below](#).
- Determine seasonal influenza vaccination status of the case, offer vaccination to case and household members when appropriate. This can decrease the likelihood of co-infection with human and avian influenza and minimize the possibility of genetic reassortment if an individual becomes infected with both strains of influenza.
- Conduct monitoring of the case as deemed necessary.
- Complete contact tracing for all contacts during the infectious period of the case.
- Identify other individuals with the same exposure as the case.
- In situations where the source of exposure is unknown, reverse contact tracing and asymptomatic testing of contacts should be considered in consultation with the Regional Medical Officer of Health. In addition, in consultation with the Chief Veterinary Officer, animal testing may be recommended. Regular ongoing communication with the Chief Medical Officer of Health team is indicated throughout the investigation.

Contact Management

Contacts include anyone who has had exposure to the case from 1 day before symptom onset until 7 days after symptom onset, or until symptoms resolve, whichever is longer. See table 1 for exposure risk assessment. There is no defined duration of exposure for contacts, with current evidence supporting the general principle that respiratory transmission is more likely to occur with a longer duration of exposure.

- Once human contacts have been identified, public health will assess the exposure risk level for each contact using the criteria outlined below in [Table 1](#).
- Consider asymptomatic testing of contacts if the case's exposure source is unknown.
- All contacts should monitor and record any signs/symptoms (including daily temperature checks) experienced. The use of fever reducing medications should be avoided as much as possible to prevent the detection of early

symptoms of AI.

- If the contact experiences any signs/symptoms of avian influenza, even mild, the individual should isolate at home away from other household members and contact Public Health for direction on how to access diagnostic testing and when to seek medical care. Asymptomatic testing may be offered at Medical Officer of Health discretion for the purpose of enhanced surveillance. More information about asymptomatic testing can be found [here](#).
- Seasonal influenza vaccination is recommended for all contacts (if not already received) to reduce the potential for human/avian re-assortment of genes should the contact become co-infected with human and avian influenza.
- The individual will be advised to follow the public health measures described below for reducing the risk of further transmission of AI.

NOTE: Contacts that have signs/symptoms consistent with AI should be managed as a case, unless AI is ruled out through testing.

Table 1: Contact exposure risk assessment

Exposure Risk	Description	Examples	Recommendations
High	<ul style="list-style-type: none"> • Direct and/or intimate physical contact with a laboratory confirmed case without proper and appropriate use of personal protective equipment (PPE). • Within 2 metres of a laboratory confirmed case without proper and appropriate use of PPE. • Contact with items/surfaces contaminated with bodily fluids from a laboratory confirmed case without proper and appropriate PPE use. • Spending time in a poorly ventilated, enclosed space with a laboratory confirmed case without proper and appropriate use of PPE. 	<ul style="list-style-type: none"> • Household members sharing a living space with a laboratory confirmed case • Caregivers who had unprotected direct or indirect contact with a laboratory confirmed case and/or their contaminated environment, including bodily fluids (respiratory secretions) • Individuals who had face to face interaction with a laboratory confirmed case • Sitting next to a laboratory confirmed case on an airplane or other mode of transportation. 	<ul style="list-style-type: none"> • Active monitoring for 10 days after last exposure to the laboratory confirmed case • Follow all guidance described in the Public Health Measures to Reduce the Risk of Transmission section. • Wear a well-fitting medical mask when in shared spaces with others • Follow post-exposure antiviral prophylaxis advice. • Maintain a record of contacts during the monitoring period.

Intermediate	<ul style="list-style-type: none"> Limited or intermittent exposure to a laboratory confirmed case without proper and adequate PPE. 	<ul style="list-style-type: none"> Caregivers who had improper and/or inadequate, or breach in PPE use when in direct or indirect contact with the laboratory confirmed case and/or the contaminated environment, and/or bodily fluids. Individuals who shared a living space where interactions with the case and their personal items were limited. Brief social interactions with the laboratory confirmed case 	<ul style="list-style-type: none"> Active monitoring for 10 days after the last exposure to the laboratory confirmed case Follow the guidance described in the Public Health Measures to Reduce the Risk of Transmission section. Wear a well-fitting medical mask Follow post-exposure antiviral prophylaxis recommendations Maintain a record of all individuals during the monitoring period.
Low	<ul style="list-style-type: none"> Limited exposure to a laboratory confirmed case in a shared enclosed space with continued, proper and adequate PPE use. Providing direct care to a laboratory confirmed case with proper and adequate PPE use. 	<ul style="list-style-type: none"> Caregivers who had proper and adequate PPE use when in direct or indirect contact with the laboratory confirmed case and/or the contaminated environment, and/or their bodily fluids. Individuals who share a well-ventilated, enclosed space with a laboratory confirmed case while practicing physical distancing and wearing a well-fitting medical mask 	<ul style="list-style-type: none"> Passive monitoring for 10 days after last exposure. Follow the guidance provided in the Public Health Measures to Reduce the Risk of Transmission section Consider wearing a well-fitting medical mask in public.

NOTE – AI infection in humans is a novel and evolving situation globally. In the event that signals arise indicating increased human to human transmission, isolation of contacts should be implemented at MOH discretion.

Prophylaxis

Post-exposure

Antiviral prophylaxis can be considered for individuals exposed to avian influenza virus, in particular for those who have had a high-risk exposure and/or pre-existing medical conditions that put them at higher risk for influenza complications. Recommendations for post-exposure management of contacts, based on human illness risk and the exposure risks, are outlined in [Table 2](#) below.

Table 2: Risk-based prophylaxis recommendations based on risk

Risk-based Recommendations		Exposure Risk*		
		Low Risk Groups	Moderate Risk Groups	High Risk Groups
Human Illness Risk***	Sub-type has previously been identified and is not known to have caused human illness	No prophylaxis	No prophylaxis	Consider offering prophylaxis
	Subtype is known to cause predominantly mild human illness	No prophylaxis	Consider offering prophylaxis**	Offer prophylaxis
	Subtype is known to cause predominantly severe human illness	No prophylaxis	Offer prophylaxis	Offer prophylaxis

*risk categories are described in Table 1 above

**based on assessment for higher risk of severe disease such as extremes of age and co-morbidities and emerging evidence on AI.

***refer to Causative Agent section

Dosage

Oseltamivir prophylaxis is recommended for persons one year of age and over, who are identified as contacts of a human AI case based on risk assessment above. One dose twice daily of oral oseltamivir (or inhaled zanamivir) for 7 days after last exposure (defined exposure period) or 10 days for ongoing exposures, is recommended for AI exposure – this recommendation is based on limited data that support higher prophylaxis dosing in animals for AI A(H5N1) virus infection in addition

to reducing the potential for development of antiviral resistance. This is an off-label use in Canada however is consistent with recommendations from the US CDC. For exposures in infants <1 year of age, consult Pediatric Infectious Diseases for guidance.

Table 3: Recommended oseltamivir dosage for prophylaxis indications

Population Sub-group		Dosage* bid (twice/day)
Adults (> 13 years)		75 mg bid
Children weight (>1 year of age)	< 15 kg	30 mg/bid
	>15-23 kg	45 mg/bid
	> 23-40 kg	60 mg/bid
	>40 kg	75 mg/bid

*Prophylaxis dosing should be adjusted as appropriate for the individual’s renal function. More details regarding dose adjustments are available in the respective product monographs or in the guidance provided by [Association of Medical Microbiology and Infectious Disease Canada](#).

Immunization

There are currently no avian influenza vaccines available for human use in Canada. If avian influenza vaccines become available, vaccine guidance will be provided.

Ensuring cases, contacts and anyone with potential for exposure to avian influenza are up to date with seasonal influenza immunizations is important. The National Advisory Committee on Immunization (NACI) recommends individuals whose occupational or recreational activities increase their risk of exposure to avian influenza viruses receive an annual seasonal influenza vaccine. The rationale for this recommendation is to minimize the potential for an individual to be infected with both the seasonal and AI strains at the same time. Co-infection with seasonal influenza virus and AI virus may increase the potential for genetic re-assortment. Seasonal influenza vaccine can be accessed outside the traditional influenza season for individuals described above through Public Health.

Reducing the Risk of Transmission for Caregivers

In some circumstances, individuals may require support for daily living from a household member, family member or friend, including children and those who are ill with acute or chronic illness. When this level of support is necessary, one individual should provide caregiving. Ideally, the caregiver should:

- Be lower risk for severe disease outcomes
- Understand the risks and be able to implement the public health measures to reduce the risk of transmission described below. When providing care, the caregiver should:

- Limit physical contact with the case as much as possible.
- Wear a well-fitting medical mask and appropriate eye protection when providing care when direct contact is unavoidable.
- Minimize the interactions need to provide care to as few as possible by grouping care activities.
- Perform proper and frequent hand hygiene before putting on and taking off masks or eye protection as well as before and after providing care and handling the case's belongings/personal items.
- When possible, have the case handle their own laundry, dishware and utensils and clean/disinfect their home. If this is not possible, the caregiver should handle the case's belongings carefully to avoid self-contamination. The caregiver must monitor for symptoms for 10 days **after their last exposure to the case**. Should the caregiver begin to experience signs/symptoms, they should isolate away from others and contact Public Health for instructions on how to access diagnostic testing and when to seek medical care.

Education

Public Health Measures to Reduce the Risk of Transmission

- Avoid direct contact with domestic or wild birds and mammals (susceptible animals can include wild terrestrial and marine mammals, swine, cattle, farmed fur animals) and their living environments.
- Stay up to date with routine immunizations. NACI recommends individuals whose occupational or recreational activities increase their risk of exposure to AI viruses receive an annual seasonal influenza vaccine.
- Do not share personal items with others including linens, towels, dishes, eating utensils, cigarettes or vape products.
- Practice proper respiratory etiquette (covering coughs and sneezes).
- Perform proper handwashing frequently:
 - Wash hand with soap and warm, running water, lathering for at least 20 seconds or
 - Use hand sanitizer containing at least 60% alcohol for 20 seconds or until dry
 - If hands are visibly soiled, remove as much residue as possible before using hand sanitizer.
- Clean and disinfect high touch surfaces and objects (bathroom surfaces, light switches, door handles, kitchen surfaces, etc.) with a disinfect effective against the influenza virus.

- Clothing and linens can be washed using normal routines.
- No additional precautions are necessary for the disposal of household garbage.
- Improve indoor air quality/ventilation by opening windows and/or doors when appropriate in shared spaces keeping in mind weather, outdoor air quality and safety concerns
 - Ensure heating and cooling mechanical ventilation is functioning properly
 - Turn on bathroom exhaust fan if sharing a washroom with other individuals
- When accessing healthcare support or in the event of a medical emergency, the case/contact or their caregiver should:
 - Notify the healthcare facility or the dispatcher for emergency medical services of the avian influenza exposure prior to arrival to ensure appropriate infection prevention and control measures are used.
 - Not use public transportation.
 - Case/contacts and their caregivers assisting with transport should strictly adhere to public health measures to help reduce the risk of transmission. When using a personal vehicle for transportation to healthcare support,
 - Call ahead to inform the healthcare facility the individual has been exposed to avian influenza virus; follow directions given by healthcare facility.
 - Minimize the number of individuals in the vehicle; ideally only the driver and the individual.
 - Maximize the distance between the driver and the case/contact
 - All occupants of the vehicle should wear a well-fitting medical mask, if able to do so safely.
 - Open all windows if safe to do so.
 - Properly clean and disinfect all surfaces or objects the case/contact may have touched (door handle, seatbelt, etc.).

Appendix A: Specimen Requirements

Public Health will coordinate the collection of laboratory specimens for individuals suspected to have had exposure to AI virus. The appropriate specimens to detect AI include nasopharyngeal swab and/or conjunctival sample. Refer to the Provincial Microbiology Users' Manual for guidance on specimen handling and transport. The Microbiology Users' Manual can be found under the Resources section of this link: [Pathology and Laboratory Medicine - Home \(nshealth.ca\)](#).

1. Nasopharyngeal swab collected using a sterile swab, place in the transport vial. For guidance on collection procedure, review the [4 Ds of a quality nasopharyngeal swab](#).
2. Conjunctival sample collection when the individual experiences symptoms of conjunctivitis (eye redness, swelling or discharge). Asymptomatic testing of conjunctival swabs is not recommended. Conjunctival swabs are not routinely tested; to ensure efficient processing, laboratory notification of conjunctiva swab submission is needed.
3. Lower respiratory tract specimens (ex. BAL) are acceptable, if collected.

When coordinating specimen submission, the specimen requisition must include the following information:

- “suspect avian influenza” must be clearly identified on the specimen requisition
- indicate the regional Medical Officer of Health involved in the investigation

This will confirm for the laboratory that Public Health is involved in the investigation.

When a sample is being submitted, advise the local laboratory that a sample is being submitted for AI. The Microbiologist on call should be called through the QEII switchboard when it is received to help coordinate testing. Testing for influenza A can occur at regional labs and if positive, sent to the Central Zone lab for further characterization.

Appendix B: Public Health Response to Human Exposure to Avian or Animal Source of Avian Influenza

The Canadian Food Inspection Agency (CFIA) reports laboratory confirmed AI in poultry and animals, including contact information for the site owner to Nova Scotia Health, Public Health as described in the Nova Scotia [Health Protection Act](#). During regular business hours CFIA will contact the closest Public Health office or utilize the On Call process outlined [here](#).

NSH Public Health shall contact the site owner to identify all individuals that have been or potentially were exposed to avian influenza positive birds, animals or their environments using the NSH checklist:

- a. Explain self-monitoring for symptoms for 10 days after the last exposure/break in contact from the infected animal or environment
- b. Assess risk of exposure and determine if prophylaxis is recommended (section 8.2 of [Guidance on Human Health Issues Related to Avian Influenza in Canada](#)).
- c. Recommend seasonal influenza vaccine, if the client has not already received the influenza vaccine
- d. Explain what to do if symptoms are experienced during the 10-day self-monitoring period

If owners/operators of the site infected with avian influenza require ongoing occupational health support beyond that provided by CFIA, occupational health through Labour, Skills, and Immigration (LSI) may be consulted.

For more information regarding human health considerations following exposure to AI, please visit [Guidance on Human Health Issues Related to Avian Influenza in Canada](#).

REFERENCES

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