One Health and Highly Pathogenic Avian Influenza (H5N1):

The Clinical Perspective

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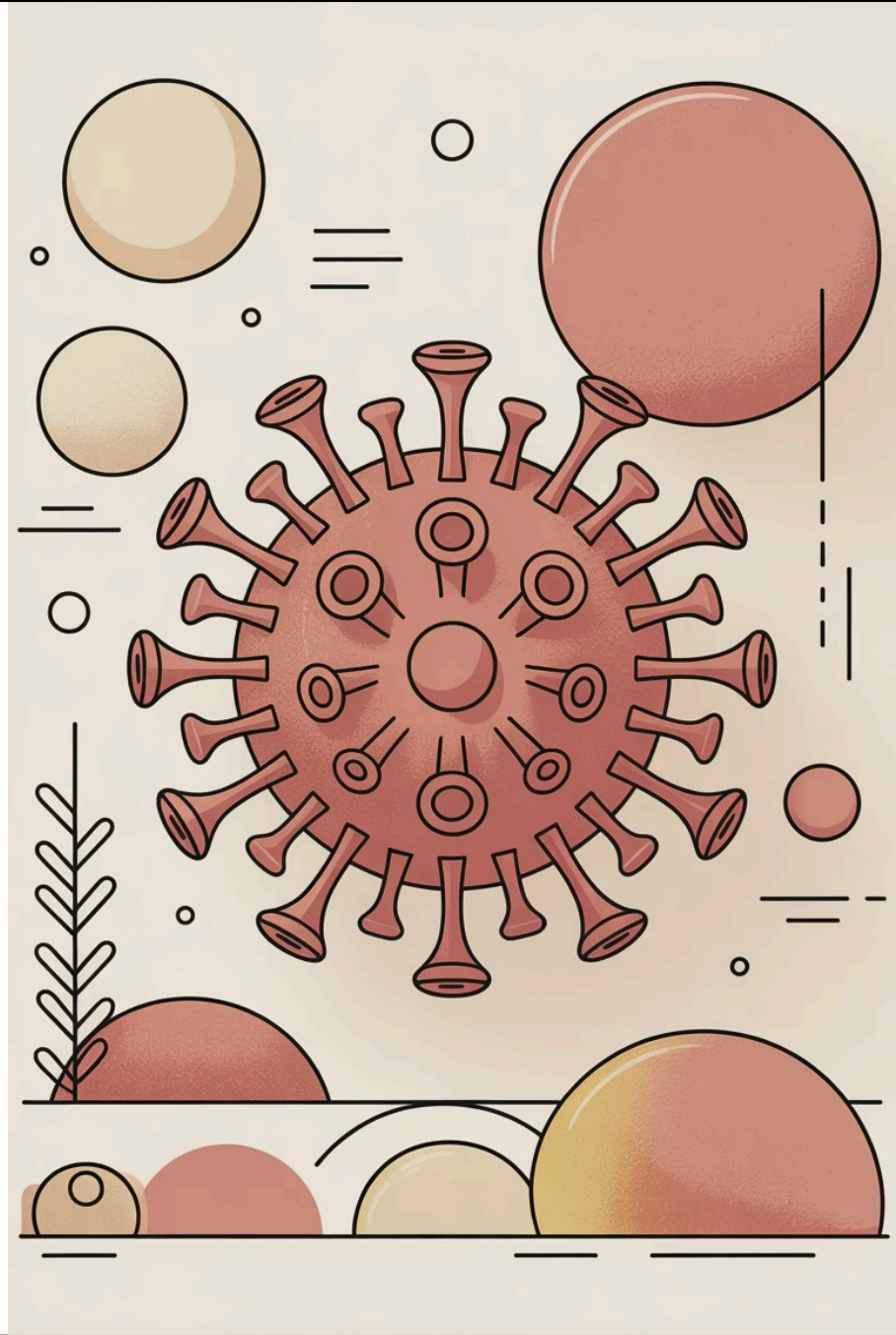

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H5N1: Historical Timeline and Evolution

First Appearance

Highly pathogenic avian influenza A (H5N1) was first identified in geese in Guangdong Province, China in 1991. [1] A cluster of human H5N1 infections occurred in Hong Kong in 1997, resulting in 18 cases with 6 deaths—a case fatality rate of 33%.[2]

Continued Cases

Since 2003, H5N1 has become enzoonotic across Asia and appears regularly in Africa, and Europe.[3] Ongoing sporadic human cases are usually associated with direct contact with infected animals or with a contaminated environment.[4] From 1-1-2003 to 9-29-2025, 991 human cases of H5N1 have been reported to the WHO from 25 participating countries, with a cumulative case fatality rate of 48% (476 deaths). [5]

Current Epidemiologic Context (2025)

Recent US H5N1 cases have shown different clinical patterns than historical cases. 71 cases of H5N1 have been reported from April 2024 to the present. [6] In an analysis of 46 cases, illness was predominantly mild with conjunctivitis (93% of cases), fever (49%), and respiratory symptoms (36%). [7] The current risk to the general public is considered low. [6]

Disease Burden: Global Human Cases

Geographic Distribution

Since 2003, 991 human cases have been reported to WHO from 24 countries globally, with 476 deaths (case fatality rate 51%). [5]

The majority of human H5N1 cases have occurred in Southeast Asia and Egypt, with Indonesia, Vietnam, and Egypt reporting the highest numbers. [8]

Recent years have seen sporadic cases in other regions as the virus circulates in wildlife and livestock populations globally.

991

Confirmed Human Cases Since 2003

48%

Case Fatality Rate

62

Countries Affected Since 2003

Disease Burden: Who Gets H5N1?

High-Risk Exposures [9]

- Direct handling of sick or dead poultry
- Preparation of diseased birds for consumption
- Exposure to live bird markets
- Contact with contaminated surfaces or water
- Occupational exposure (poultry workers, veterinarians)

Of the 71 US cases in 2024-2025, 3 had no known exposure source. [6]

Why H5N1 Matters Clinically

High Global Mortality Rates

Historically, case fatality rates have been 48% globally, far higher than seasonal influenza (<0.1%) or pandemic H1N1 (0.02%). [10] However, recent US cases reported 1 death among 71 cases (1.4% mortality rate), suggesting current strains may cause milder disease. [6]

Pandemic Potential

Concern exists for viral antigenic shift or adaptation that could enable sustained human-to-human transmission, potentially triggering a pandemic with devastating consequences. [10],[11],[12] Early recognition and treatment remain critical. [4],[10]

Occupational Exposure Risk

Healthcare workers face potential nosocomial exposure from unrecognized cases. Adherence to infection control protocols is essential for workforce protection. [13],[14]

Clinical Presentation: Initial Symptoms

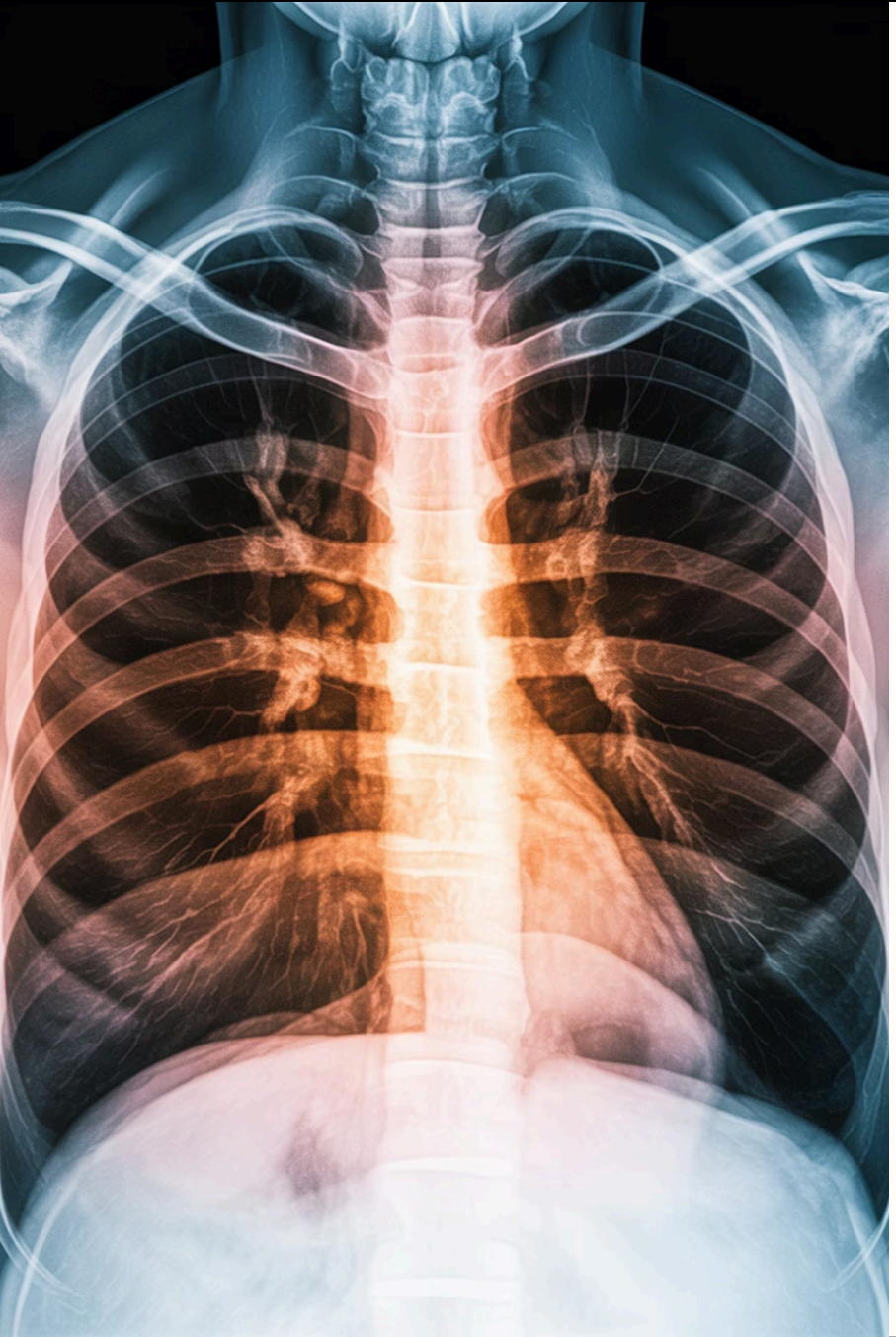
The incubation period for H5N1 is 2 to 7 days, with most patients developing symptoms within 3 days post-exposure. [15] Initial presentation typically resembles seasonal influenza, but may be more severe or progress more rapidly. [8],[15],[16],[17]

Common Early Manifestations[8],[15],[16],[17],[18]

- **High fever** (>38°C/100.4°F) with chills and rigors
- **Respiratory symptoms:** cough, sore throat, rhinorrhea
- **Systemic symptoms:** myalgia, malaise, headache
- **Gastrointestinal symptoms:** diarrhea, vomiting, abdominal pain

ⓘ Recent US H5N1 cases have shown different clinical patterns than historic cases, with conjunctivitis (93%), fever (49%), and respiratory symptoms (36%) being most common. [7],[16]

⚠ Asymptomatic human H5N1 infections have been recently documented. [19]



Disease Progression and Severe Manifestations

Severe cases are most likely in patients under 2 or over 65 years of age, obese patients, immunocompromised patients, and patients with chronic disease. [20]Critical disease is also more common in those with high viral loads and hypercytokinemia. [21],[22]

1. **Early Phase**

   Fever, myalgia, upper respiratory symptoms predominate. GI symptoms may be prominent.

2. **Respiratory Decline**

   Dyspnea, tachypnea develop. Chest imaging shows bilateral infiltrates. Hypoxemia may be present.

3. **Critical Deterioration**

   Acute respiratory distress syndrome (ARDS), multiorgan failure, shock. Mechanical ventilation often required.

4. **Secondary Complications and Mortality**

   Death typically occurs from progressive respiratory failure or secondary complications. Survivors face prolonged recovery.

Complications and Extrapulmonary Manifestations

Acute Respiratory Distress Syndrome (ARDS)

The most common severe complication; characterized by bilateral infiltrates, severe hypoxemia, and reduced lung compliance requiring advanced ventilatory support. [15,22]

Multiorgan Failure

Viral replication has been detected in extrapulmonary sites. Hepatic dysfunction, renal impairment, and cardiac complications have been documented. [23]

Neurological Involvement

H5 viruses may be more neuropathogenic than other influenza A viruses; complications such as encephalitis and seizures have been reported. CNS involvement may contribute to poor outcomes. [24]

Secondary Bacterial Infections

Superimposed bacterial pneumonia is common and may complicate the clinical course and worsen prognosis and long-term recovery. [15,22]

Diagnosis: Clinical Suspicion and Patient History

Key Historical Features

Maintain **high clinical suspicion** in any patient with significant acute respiratory illness and relevant exposure history.

Essential Questions [6, 9]

- Recent travel to H5N1-endemic areas?
- Contact with sick or dead poultry or livestock?
- Visit to live bird markets?
- Occupational exposure to birds or livestock?
- Pet birds or livestock at home?
- Consumption of raw/undercooked poultry, beef, or dairy products?
- Contact with confirmed H5N1 cases?

Laboratory Diagnosis: Testing Strategy

Specimen Collection

Collect **upper respiratory** (nasopharyngeal/oropharyngeal swabs) AND **lower respiratory** specimens (sputum, BAL) if possible. Lower respiratory specimens have higher viral loads. [25]

RT-PCR Testing

Real-time reverse transcriptase polymerase chain reaction (RT-PCR) is the gold standard. Can detect influenza A and subtype H5. Coordinate with public health laboratory for confirmatory testing. [25],[27]

Viral Culture & Sequencing

Send isolates to reference laboratories (CDC or state public health) for viral culture, sequencing, and antiviral resistance testing if subtyping is negative for seasonal strains or high-risk exposure history for H5N1. [25],[27]

Rapid influenza diagnostic tests (RIDTs) have poor sensitivity for H5N1, and have higher odds of false negative results when influenza prevalence is high in the community. Negative RIDT does not exclude H5N1 in a high-risk patient. Always pursue RT-PCR confirmation when clinical suspicion exists. [25],[26],[27],[28]

Supportive Laboratory and Imaging Findings

Laboratory Abnormalities

While nonspecific, certain patterns support severe influenza and help guide management: [29]

- **Leukopenia** with lymphopenia (common early)
- **Thrombocytopenia** (may indicate severe disease)
- **Elevated transaminases** (AST, ALT)
- **Elevated creatinine** and lactate dehydrogenase
- **Elevated creatine kinase** (suggesting myositis)
- **Lymphocyte subsets:** decreased CD4+ and CD8+ counts

Imaging Characteristics

Chest radiography and CT findings evolve rapidly: [29]

- **Bilateral patchy infiltrates** (early finding)
- **Ground-glass opacities** on CT
- **Consolidation** progressing to diffuse alveolar damage
- **Pleural effusions** (less common than in bacterial pneumonia)

Differential Diagnosis

H5N1 must be differentiated from other causes of severe acute respiratory illness, particularly in the appropriate epidemiologic context. Overlapping clinical features necessitate broad initial diagnostic evaluation. [29],[30],[31]

Other Influenza Strains

Seasonal influenza A/B, H7N9, H1N1pdm09, H3N2v—require subtyping to distinguish

COVID-19 and Other Coronaviruses

SARS-CoV-2, MERS-CoV—similar presentation with ARDS; travel and exposure history help differentiate

Bacterial Pneumonia

Community-acquired pneumonia from *S. pneumoniae*, *Legionella*, *Mycoplasma*—may coexist or complicate viral infection

Other Viral Pneumonias

Respiratory syncytial virus, adenovirus, parainfluenza—especially in immunocompromised hosts

Non-Infectious Causes

Acute interstitial pneumonia, pulmonary hemorrhage syndromes, acute eosinophilic pneumonia—consider when exposure history lacking

Antiviral Treatment: Who should receive medication?

High-Risk For Negative Outcomes [30]

Hospitalized Patients - Regardless of age or duration of illness

Severe or Progressive Illness - Regardless of age or duration of illness

High Risk for Complications - Chronic medical conditions, immunocompromised patients, age less than 2 yrs or 65 yrs or older, pregnant or recently (<2 wks) postpartum patients

Other Considerations for Treatment [30]

Recent Onset - Outpatients with illness onset 2 or less days ago

Symptomatic Patients with High-Risk Contacts - Household members who are at high risk for negative outcomes

Symptomatic Healthcare Professionals with High-Risk Contacts - Workers who care for patients at high risk for negative outcomes

Antiviral Treatment: Neuraminidase Inhibitors

Early antiviral therapy is critical and should be initiated in appropriate populations upon suspicion of H5N1—do not wait for laboratory confirmation. Neuraminidase inhibitors are the primary treatment modality. [29,30,32,33]

Oseltamivir (First-Line)

Dosing: 75 mg PO twice daily for 5 days (standard); higher doses (150 mg twice daily) and longer duration (10 days) have been used in severe cases based on limited evidence. [29]

Pediatric dosing: Weight-based (<15 kg: 30 mg BID; 15-23 kg: 45 mg BID; 23-40 kg: 60 mg BID; >40 kg: 75 mg BID)

Initiation: Most effective when started within 48 hours of symptom onset, but may still provide benefit in severe disease even if started later. [29]

Alternative Agents

Zanamivir: 10 mg (two 5-mg inhalations) twice daily for 5 days. Approved for ages ≥7 years. Avoid in patients with underlying airway disease due to bronchospasm risk and poor delivery. [29]

Peramivir: 600 mg IV single dose (may repeat daily up to 5-10 days in severe illness). Useful when oral/inhaled administration not feasible. [29,33]

Baloxavir marboxil: Limited data for H5N1; not currently recommended as first-line therapy. [29,33]

Antiviral Resistance and Monitoring

Resistance Concerns [29]

While H274Y neuraminidase mutations can confer oseltamivir resistance, most currently circulating H5N1 strains remain susceptible to neuraminidase inhibitors. Resistance has been documented primarily in laboratory settings or isolated clinical cases. Resistance testing should be pursued through public health laboratories when possible, particularly for treatment failures.

Clinical Monitoring During Treatment

Serial assessment of clinical status, oxygen saturation, respiratory rate, and work of breathing is essential. Laboratory monitoring should include CBC, comprehensive metabolic panel, and inflammatory markers. Repeat RT-PCR testing may be indicated in severely ill patients to assess viral clearance, particularly if clinical improvement is not observed. [29]

Supportive Care and Critical Care Management

Many hospitalized H5N1 patients require intensive care unit admission. Aggressive supportive care significantly impacts survival. [29,30]

Respiratory Support

Early supplemental oxygen and close monitoring for respiratory failure. Consider mechanical ventilation if severe hypoxemia (PaO_2/FiO_2 <200), respiratory distress or altered mental status. Lung-protective ventilation strategies should be employed.

Hemodynamic Management

Maintain adequate perfusion with judicious fluid resuscitation. Vasopressor support may be required for shock. Monitor for myocardial dysfunction and arrhythmias, which have been reported in severe cases.

Adjunctive Therapies

Corticosteroids: No clear benefit demonstrated and may be harmful; avoid routine use unless indicated for refractory shock or other specific indication.
Antibiotics: Empiric broad-spectrum coverage if bacterial superinfection is suspected, pending cultures.

ECMO Consideration

Extracorporeal membrane oxygenation (ECMO) may be considered for refractory hypoxemia despite optimal mechanical ventilation. Decision should involve multidisciplinary consultation and assessment of candidacy. Limited outcome data specific to H5N1.

Infection Control: Protecting Healthcare Workers

Healthcare-associated transmission of H5N1 has been documented, underscoring the critical importance of appropriate infection prevention measures. All suspected or confirmed cases require strict adherence to enhanced precautions. [34]

Standard and Droplet Precautions

- **Patient placement:** Private room, if possible.
- **PPE requirements:** Mask or N95 respirator for all personnel upon entering the room. Patient should wear a mask if leaving the room.
- **Hand hygiene:** All personnel and visitors should remove PPE and immediately perform hand hygiene after visiting or interacting with the patient.
- **Aerosol-generating procedures:** Limit personnel, ensure all wear appropriate respiratory protection. AGPs include intubation, bronchoscopy, suctioning, nebulizer treatments.
- **Visitor restrictions:** Minimize visitors; those entering must use appropriate PPE and receive instruction.

Post-Exposure Prophylaxis for Healthcare Workers

Healthcare workers with unprotected exposure to a confirmed or suspected H5N1 patient require risk assessment and consideration for post-exposure prophylaxis (PEP) and monitoring. [34],[35]

Define Exposure Risk

High-risk exposure: Unprotected close contact (<6 feet), direct contact with respiratory secretions, or aerosol-generating procedure without appropriate PPE.
Low-risk exposure: Brief proximity with appropriate PPE or no direct contact.

Initiate Antiviral Prophylaxis

Oseltamivir 75 mg PO twice daily for 5-10 days . Should be started as soon as possible after exposure, ideally within 48 hours. CDC recommends PEP for high-risk exposures.

Implement Active Monitoring

Daily symptom monitoring (fever, respiratory symptoms, conjunctivitis) for 10 days post-exposure. Occupational health follow-up. Restrict from patient care if symptomatic; test immediately if symptoms develop.

Coordinate with Public Health

Report exposure to occupational health and local/state health department. Contact tracing may be initiated. Documentation for workers' compensation and epidemiologic investigation.

Healthcare Facility Preparedness [36,37]

Institutional Preparedness Planning

Healthcare facilities should have H5N1 preparedness plans that address surge capacity, PPE stockpiling, staff training, laboratory coordination, and communication pathways. Regular drills and plan updates are essential.

Resource Allocation and Stockpiling

Maintain adequate stockpiles of N95 respirators, PAPRs, gowns, gloves, eye protection, and antiviral medications. Establish supply chain contingencies. Consider Strategic National Stockpile access protocols for pandemic scenarios.

Staff Education and Training

Ongoing education on H5N1 recognition, appropriate PPE use (including donning/doffing procedures), and exposure management is critical. Simulation exercises improve readiness. Update clinical staff on evolving guidance from CDC and WHO.

Key Takeaways for Clinical Practice

1. **Maintain high clinical suspicion**

   Consider H5N1 in any patient with severe influenza-like illness and relevant exposure history, especially travel to endemic areas or poultry contact within 10 days of symptom onset.

2. **Initiate treatment promptly**

   Begin oseltamivir (75-150 mg BID) as soon as H5N1 is suspected. Early antiviral therapy improves outcomes.

3. **Implement strict infection control**

   Use droplet and standard precautions. Promote PPE use and hand hygiene for workers and visitors. Limit aerosol-generating procedures.

4. **Coordinate with outside agencies (One Health)**

   Collect specimens for testing and specific strain identification. Coordinate with public health and agricultural agencies to track the prevalence and spread of H5N1.

5. **Protect healthcare workers**

   Provide PEP (oseltamivir 75 mg BID × 10 days) for high-risk exposures. Implement active monitoring protocols. Ensure facility preparedness plans are current and staff are trained.

References

1. Xu X, Subbarao K, Cox NJ, Guo Y. Genetic characterization of the pathogenic influenza A/Goose/Guangdong/1/96 (H5N1) virus: similarity of its hemagglutinin gene to those of H5N1 viruses from the 1997 outbreaks in Hong Kong. *Virology*. 1999;261(1):15-19. doi:10.1006/viro.1999.9820
2. Centers for Disease Control and Prevention. Isolation of avian influenza A(H5N1) viruses from humans—Hong Kong, May-December 1997. MMWR Morb Mortal Wkly Rep. 1997;46(50):1204-1207. Accessed November 12, 2025. https://www.cdc.gov/mmwr/preview/mmwrhtml/00050459.htm
3. Peiris JS, de Jong MD, Guan Y. Avian influenza virus (H5N1): a threat to human health. *Clin Microbiol Rev.* 2007;20(2):243‐267. doi: 10.1128/cmr.00037-06
4. Centers for Disease Control and Prevention. Current Situation: H5N1 Bird Flu in People. Updated July 7, 2025. Accessed November 12, 2025. https://www.cdc.gov/bird-flu/situation-summary/inhumans.html
5. World Health Organization. Human infection with avian influenza A(H5) viruses. Avian Influenza Weekly Update Number 1022. November 14, 2025. Available at: https://www.who.int/westernpacific/publications/m/item/avian-influenza-weekly-update---1022--14-november-2025
6. Centers for Disease Control and Prevention. H5 Bird Flu: Current Situation. Updated November 14, 2025. Accessed November 16, 2025. Available at: https://www.cdc.gov/bird-flu/situation-summary/index.html
7. Garg S, Reinhart K, Couture A, et al. Highly pathogenic avian influenca A (H5N1) virus infections in humans. *N Engl J Med*. 2025;392(9):843-854. doi: 10.1056/NEJMoa2414610
8. Centers for Disease Control and Prevention. Global human cases with influenza A (H5N1), 1997-2025. Updated September 22, 2025. Accessed November 16, 2025. Available at: https://www.cdc.gov/bird-flu/php/surveillance/chart-epi-curve-ah5n1.html
9. Centers for Disease Control and Prevention. Risk to people in the United States from highly pathogenic avian influenza A (H5N1) viruses. Updated February 28, 2025. Accessed November 16, 2025. Available at: https://www.cdc.gov/cfa-qualitative-assessments/php/data-research/h5-risk-assessment.html
10. Di Guardo, G. Highly pathogenic avian influenza A (H5N1) virus: How far are we from a new pandemic? *Vet Sci.* 2025;12(6):566. doi: 10.3390/vetsci12060566
11. Herfst S, Schrauwen EJ, Linster M, et al. Airborne transmission of influenza A/H5N1 virus between ferrets. *Science*. 2012;336(6088):1534-1541.
12. Kaiser F., Cardenas S., Yinda KC, et al. Highly pathogenic avian influenza (H5N1) virus stability in irradiated raw milk and wastewater and on surfaces, United States. *Emerg Infect Dis*. 2025;31(4):833-837. doi:10.3201/eid3104.241615.
13. Centers for Disease Control and Prevention. Interim infection prevention and control recommendations for patients with suspected or confirmed influenza in healthcare settings. Updated April 28, 2025. Accessed November 12, 2025. Available at: https://www.cdc.gov/flu/hcp/infection-control/healthcare-settings.html
14. Centers for Disease Control and Prevention. Preventing transmission of viral respiratory pathogens in healthcare settings. Updated May 21, 2025. Accessed November 12, 2025. Available at: https://www.cdc.gov/infection-control/hcp/viral-respiratory-prevention/index.html
15. Centers for Disease Control and Prevention. Signs and symptoms of bird flu in people. Updated December 20, 2024. Accessed November 12, 2025. Available at: https://www.cdc.gov/bird-flu/signs-symptoms/index.html

References

16. Rolfes MA, Kniss K, Kirby MK, et al. Human infections with highly pathogenic avian influenza A(H5N1) viruses in the United States from March 2024 to May 2025. *Nat Med*. 2025;31(11):3889-3898. doi:10.1038/s41591-025-03905-2.

17. Ison MG, Marrazzo J. The emerging threat of H5N1 to human health. *N Engl J Med.* 2025;392(9):916-918. doi:10.1056/NEJMe2416323

18. Bullock TA, Pappas C, Uyeki TM, et al. The (digestive) path less traveled: influenza A virus and the gastrointestinal tract. *mBio.* 2025;16:e01017-25. doi:10.1128/mbio.01017-25

19. Dawood, FS, Garg, S, Patel, P, et al. Asymptomatic human infections with avian influenza A (H5N1) virus confirmed by molecular and serologic testing: A scoping review. *JAMA Netw Open.* 2025;8(10):e2540249. doi:10.1001/jamanetworkopen.2025.40249

20. Centers for Disease Control and Prevention. People at increased risk for flu complications. Updated September 11, 2024. Accessed November 12, 2025. Available at: https://www.cdc.gov/flu/highrisk/index.htm

21. de Jong MD, Simmons CP, Thanh TT, et al. Fatal outcome of human influenza A (H5N1) is associated with high viral load and hypercytokinemia. *Nat Med*. 2006;12(10):1203-1207. doi:10.1038/nm1477

22. Jassem AN, Roberts A, Tyson J, et al., Critical illness in an adolescent with influenza A (H5N1) virus infection. *N Engl J Med.* 2025;392(9):927-929. doi:10.1056/NEJMc2415890

22. The Writing Committee of the World Health Organization (WHO) Consultation on Human Influenza A/H5. Avian influenza A (H5N1) infection in humans, *N Engl J Med.* 2005:353;1374-1385. doi:10.1056/nEJMra052211

23. Korteweg C, Gu J. Pathology, molecular biology, and pathogenesis of avian influenza A (H5N1) infection in humans. *Am J Pathol*. 2008;172(5):1155-1170. doi: 10.2353/ajpath.2008.070791

24. Bauer L, Benavides FFW, Veldhuis Kroeze EJB, de Wit E, van Riel D. The neuropathogenesis of highly pathogenic avian influenza H5Nx viruses in mammilian species including humans. *Trends Neurosci.* 2023;46(11):953-970. doi:10.1016/j.tins.2023.08.002

25. Centers for Disease Control and Prevention. Overview of Influenza Testing Methods. Updated August 8, 2024. Accessed November 12, 2025. Available at: https://www.cdc.gov/flu/hcp/testing-methods/index.html

26. Centers for Disease Control and Prevention. Information for Clinicians on Rapid Diagnostic Testing for Influenza. Updated September 17, 2024. Accessed November 12, 2025. Available at: https://www.cdc.gov/flu/hcp/testing-methods/rapidclin.html

27. Clinical practice guidelines for influenza [Internet]. Geneva: World Health Organization; 2024. 10, Recommendations for diagnostic testing strategies in patients with suspected influenza. Accessed November 12, 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK607914/

28. Centers for Disease Control and Prevention. Information for Clinicians on Rapid Diagnostic Testing for Influenza. Updated September 17, 2024. Accessed November 12, 2025. Available from: https://www.cdc.gov/flu/hcp/testing-methods/rapidclin.html

29. Uyeki TM, Peiris M. Novel avian influenza A virus infections of humans. Infect Dis Clin North Am. 2019;33(4):907-932. doi:10.1016/j.idc.2019.07.003

References

30. Uyeki TM, Bernstein HH, Bradley JS, et al. Clinical practice guidelines by the Infectious Diseases Society of America: 2018 update on diagnosis, treatment, chemoprophylaxis, and institutional outbreak management of seasonal influenza. Clin Infect Dis. 2019;68(6):e1-e47. doi:10.1093/cid/ciy874
31. World Health Organization. Clinical practice guidelines for influenza. Published August 17, 2025. Accessed November 14, 2025. Available at: https://app.magicapp.org/#/guideline/9191
32. Schunemann HJ, Hill SR, Kakad M, et al. WHO Rapid Advice Guidelines for pharmacological management of sporadic human infection with avian influenza A (H5N1) virus. *Lancet Infect Dis.* 2007;7(1):21-31. doi:10.1016/S1473-3099(06)70684-3
33. Aldhaeefi M, Rungkitwannanakul D, Saltani I, et al. Update and narrative review of avian influenza (H5N1) infection in adult patients. *Pharmacotherapy*. 2024;44(11):870-879. doi:10.1002/phar.4621
34. Centers for Disease Control and Prevention. Infection prevention and control strategies for seasonal influenza in healthcare settings. Updated April 28, 2025. Accessed November 16, 2025. Available at: https://www.cdc.gov/flu/hcp/infection-control/healthcare-settings.html
35. Centers for Disease Control and Prevention. Interim guidance on influenza antiviral post-exposure prophylaxis of persons exposed to birds or other animals with novel influenza A viruses associated with severe human disease or with the potential to cause severe human disease. Updated July 3, 2025. Accessed November 16, 2025. Available at: https://www.cdc.gov/bird-flu/hcp/clinicians-evaluating-patients/interim-guidance-post-exposure.html
36. US Department of Health and Human Services. Preparedness for Influenxa and other pathogens with epidemic and pandemic potential. Updated November 25, 2024. Accessed November 16, 2025. Available at: https://www.hhs.gov/about/agencies/oga/global-health-security/pandemic-influenza/index.html
37. World Health Organization (2017). Pandemic influenza risk management: a WHO guide to inform and harmonize national and international pandemic preparedness and response. World Health Organization. https://iris.who.int/handle/10665/259893.