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California Department of Public Health

H5N1 Overview & Microbiology Update

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Center for Laboratory Sciences
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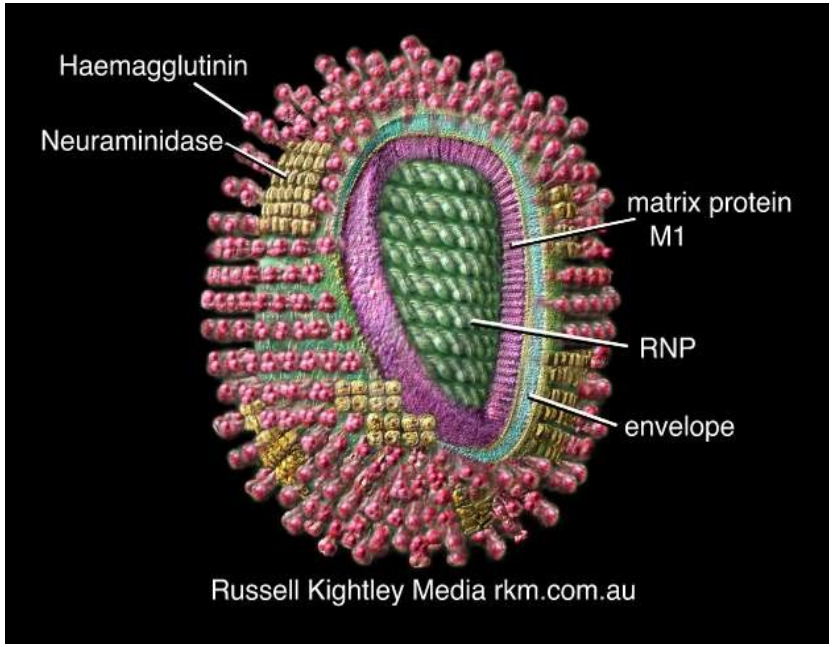
Table of Contents

Avian Influenza

Avian Influenza Viruses

- Avian influenzas: A(H5) and A(H7)
- Not all influenza A(H5) are highly pathogenic avian influenzas
- Highly pathogenic avian influenza (HPAI) = rapid and high mortality in poultry
  - 90-100% mortality in chickens within 48 hours
  - Containment strategy: culling of infected flocks
  - H5 avian influenza virus is therefore listed as an agricultural select agent under Federal Select Agent Program (though reporting requirements exempted through June 2027)



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Avian Influenza Does Not Only Infect Birds

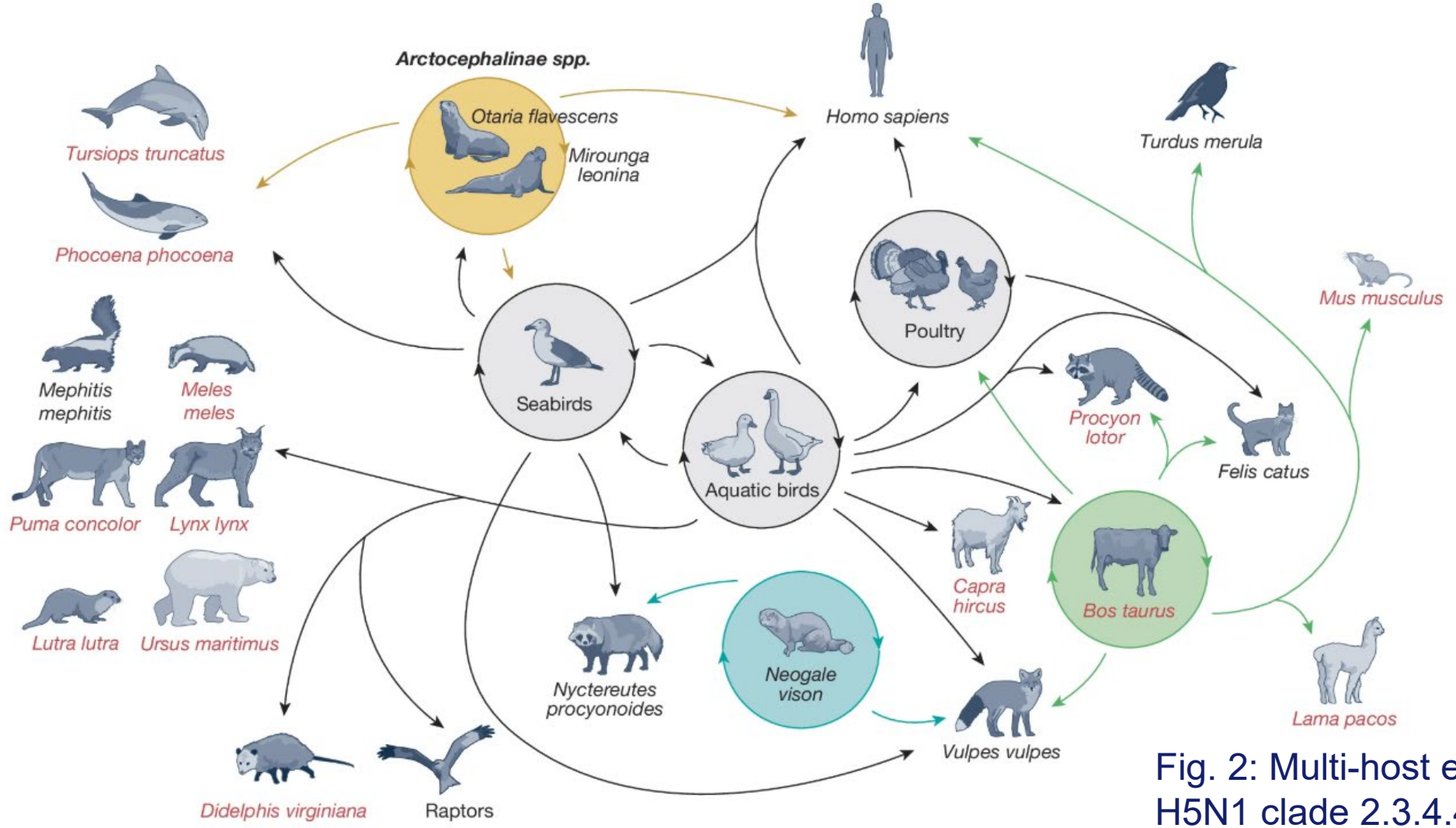

Fig. 2: Multi-host ecology of H5N1 clade 2.3.4.4b since 2020.

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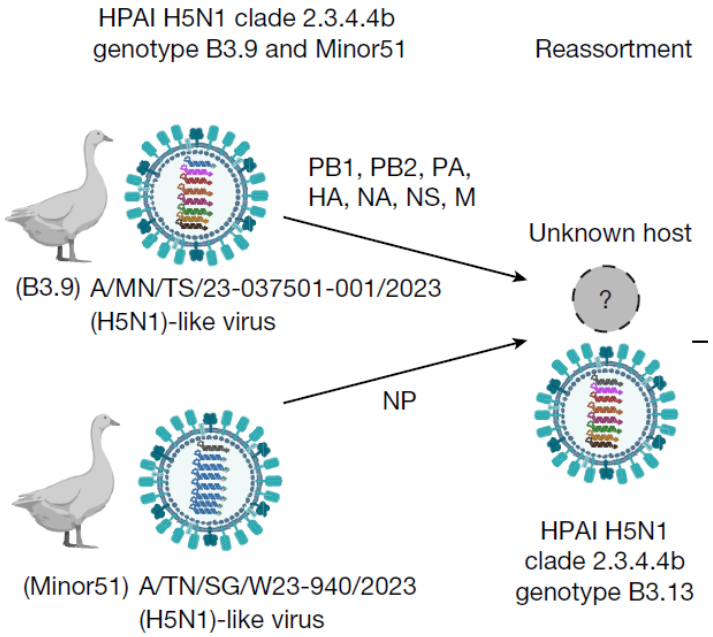
Peacock, T.P., Moncla, L., Dudas, G. *et al.* The global H5N1 influenza panzootic in mammals. *Nature* **637**, 304–313 (2025). https://doi.org/10.1038/s41586-024-08054-z)

Model of spillover and spread of the HPAI H5N1 genotype B3.13 into dairy cattle.



Caserta *et al.* 2024. Nature. https://doi.org/10.1038/s41586-024-07849-4

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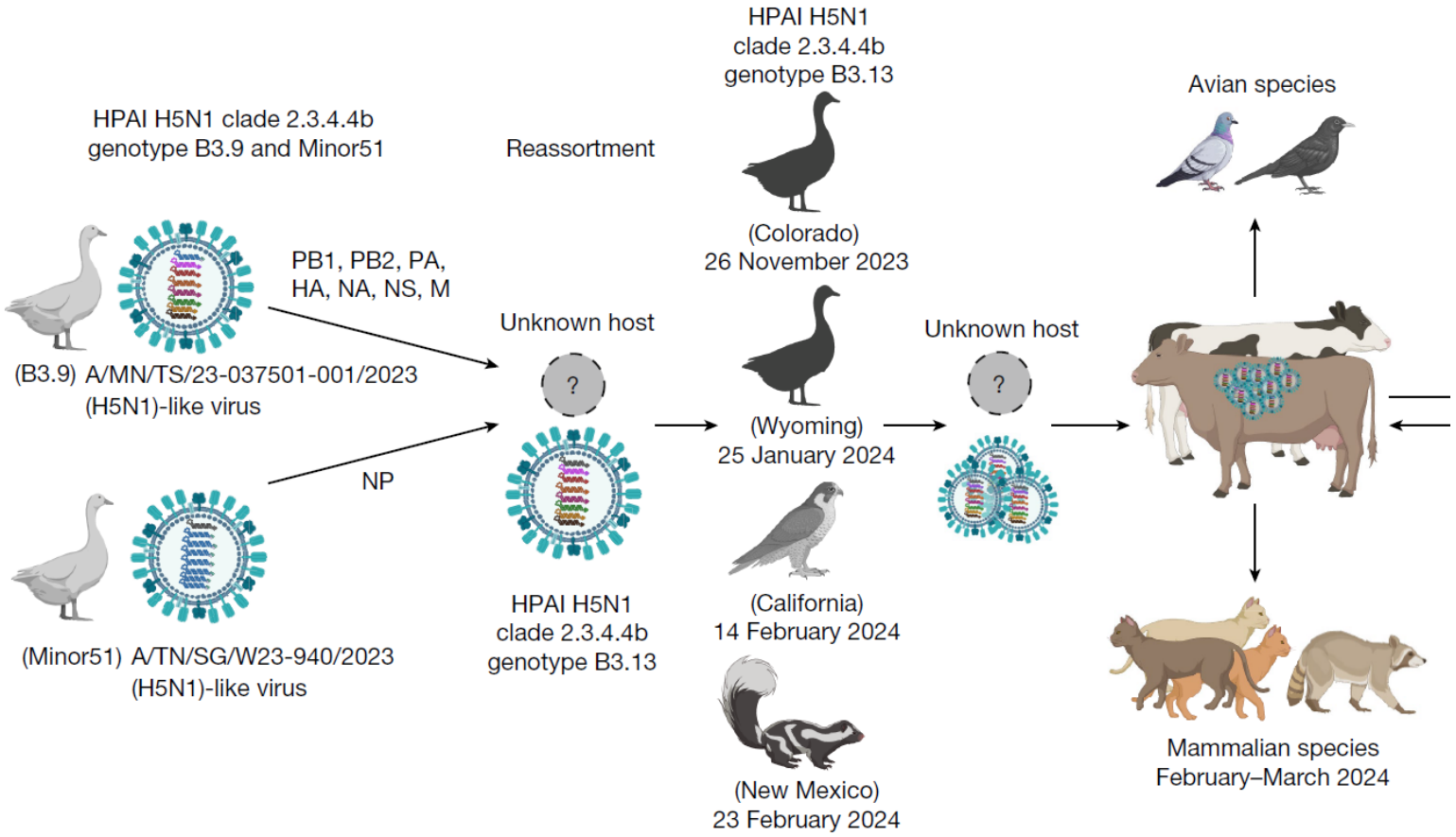

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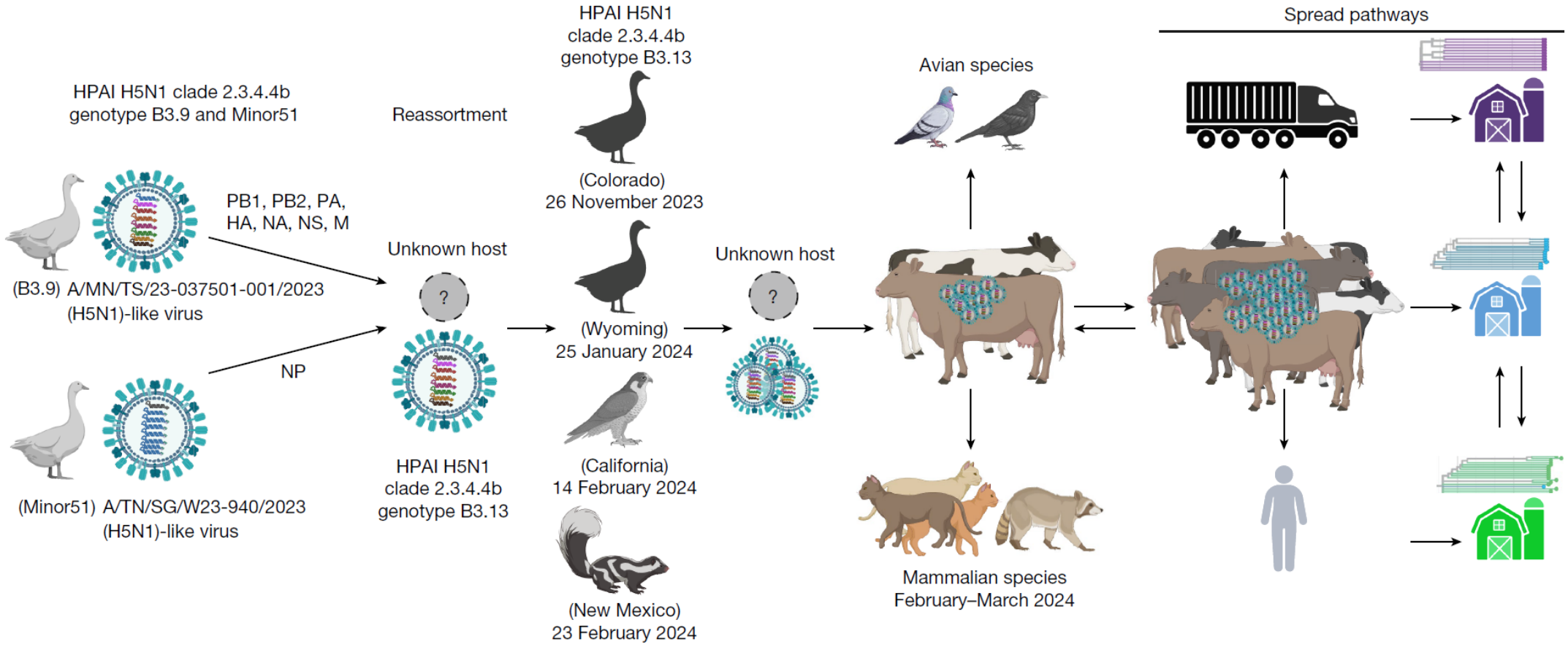

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Caserta *et al.* 2024. Nature. https://doi.org/10.1038/s41586-024-07849-4

3 spillover events introduced H5N1 virus into cattle

- 1st: March 2024 - Texas cattle herds positive for H5N1 (B3.13 genotype)
- 2nd: January 31, 2025 - Nevada cattle herd (D1.1 genotype)
  - First time D1.1 identified in cattle
- 3rd: February 11, 2025 – Arizona cattle herd (D1.1 genotype)
  - Sequencing revealed SNPs that distinguished this D1.1 strain from the Nevada strain

Avian flu strikes more Nevada dairy herds, leading to starling removal

Lisa Schnirring, February 3, 2025

Topics: Avian Influenza (Bird Flu)

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The US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) today confirmed H5N1 avian flu detections in Nevada dairy herds—the state's first since December—along with several more detections in US poultry flocks.

In other developments, European health officials shared more details about the latest UK case, including genetic details, and North Dakota wildlife officials are monitoring a Canada goose die-off along the Missouri River in the central part of the state.

Edijs Kalekaurs / iStock

Targeted starling removal a critical step

Nevada reported its first H5N1 detection in dairy cows in early December 2024, which affected a herd in Nye County, located northwest of Las Vegas.

In two recent statements, the Nevada Department of Agriculture (NDA) said the virus had been detected in dairy cattle in **Churchill County**, which borders Nye County to the northwest. Officials said they, along with USDA wildlife services, are taking additional actions to prevent the spread of avian flu. Dairy cattle in both of the counties have been placed in quarantine, and the USDA investigators begin surveillance and testing wildlife to better determine which strains are circulating and how the virus is spreading.

Federal and state groups will also begin removing non-native European starling populations in Churchill, Pershing, and Lyon counties. The NDA called the starling removal a "critical step" and that due to their large numbers, the birds are a nuisance population that can spread disease and contaminate animals' food and water sources.

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Human-to-human H5N1 Transmission

- **No person-to-person transmission** has been reported **in the US**, and **none globally since 2007**
- Sustained person-to-person transmission has never been documented for H5 influenza viruses

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WHO Disease Outbreak News May 31, 2006; WHO WER October 3, 2008; WHO NEJM 2008; Ungchusak NEJM 2005; Kandun NEJM 2006; Wang Lancet 2007; Bridges J Infect Dis 2000; Crit Care Nurs Clin N Am 2007.

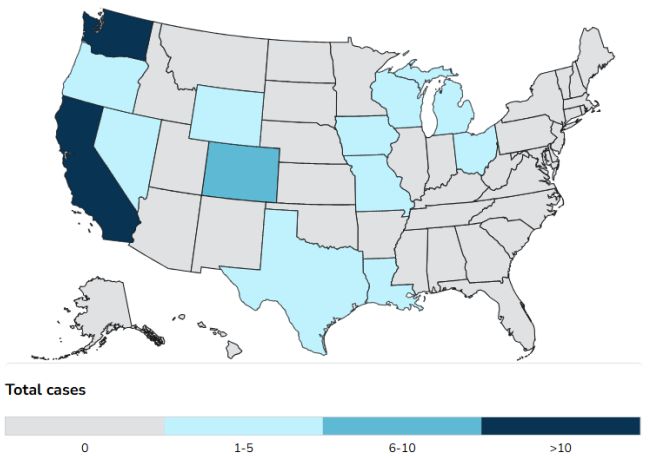
Current Outbreak Overview

U.S. Human Cases of Avian Influenza A(H5N1)

As of 4/23/25: 70 confirmed U.S. human cases

- 24 with poultry exposure
  - CO(9), OR(1), WA(11), IA(1), WI(1), OH (1)
  - Poultry workers have been infected with clade 2.3.4.4b, genotype D1.1 and D1.3 (OH) (genotypes seen in most wild birds)
- 41 with dairy cow exposure
  - **36 in CA** (+1 probable case in CA)
  - 5 in other states: TX(1), MI(2), CO(1), NV(1)
  - All infected with genotype B3.13 in all except the NV dairy worker (genotype D1.1)
- 2 with other animal exposure:* LA(1), WY(1)
- 3 with unknown exposure source: MO(1) and **CA(2)** detected via influenza surveillance

*Exposure was related to other animals such as backyard flocks, wild birds, or other mammals



CDC Bird Flu Situation Summary

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H5N1 Detections in Poultry in California

- California Department of Food and Agriculture (CDFA) is the lead agency
- As of 4/16/25: 105 infected commercial poultry flocks and 39 infected backyard flocks in California since September 2024
- No confirmed human avian influenza cases in California to date related to infected birds.
- Other states have identified H5N1 infections in workers with occupational exposure (largely during culling operations of known infected commercial flocks)

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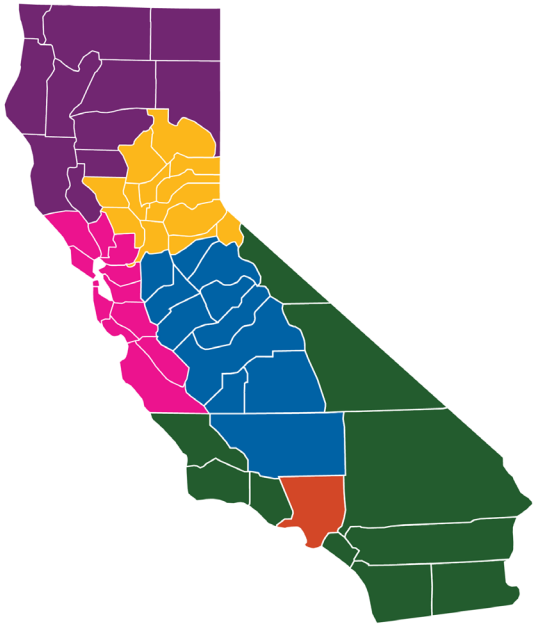
H5N1 Detections in Dairy Cows in California

- California has >1000 dairy farms with >1.7M cows
  - Majority of dairy herds in CA are in the Central Valley
- The first three California dairy farms with infected cows were identified August 30, 2024
- As of 4/17/2025, H5N1 had been confirmed in dairy cows at 764 dairies across California
- California Department of Food and Agriculture (CDFA) is the lead agency



Regional Public Health Office Region Map

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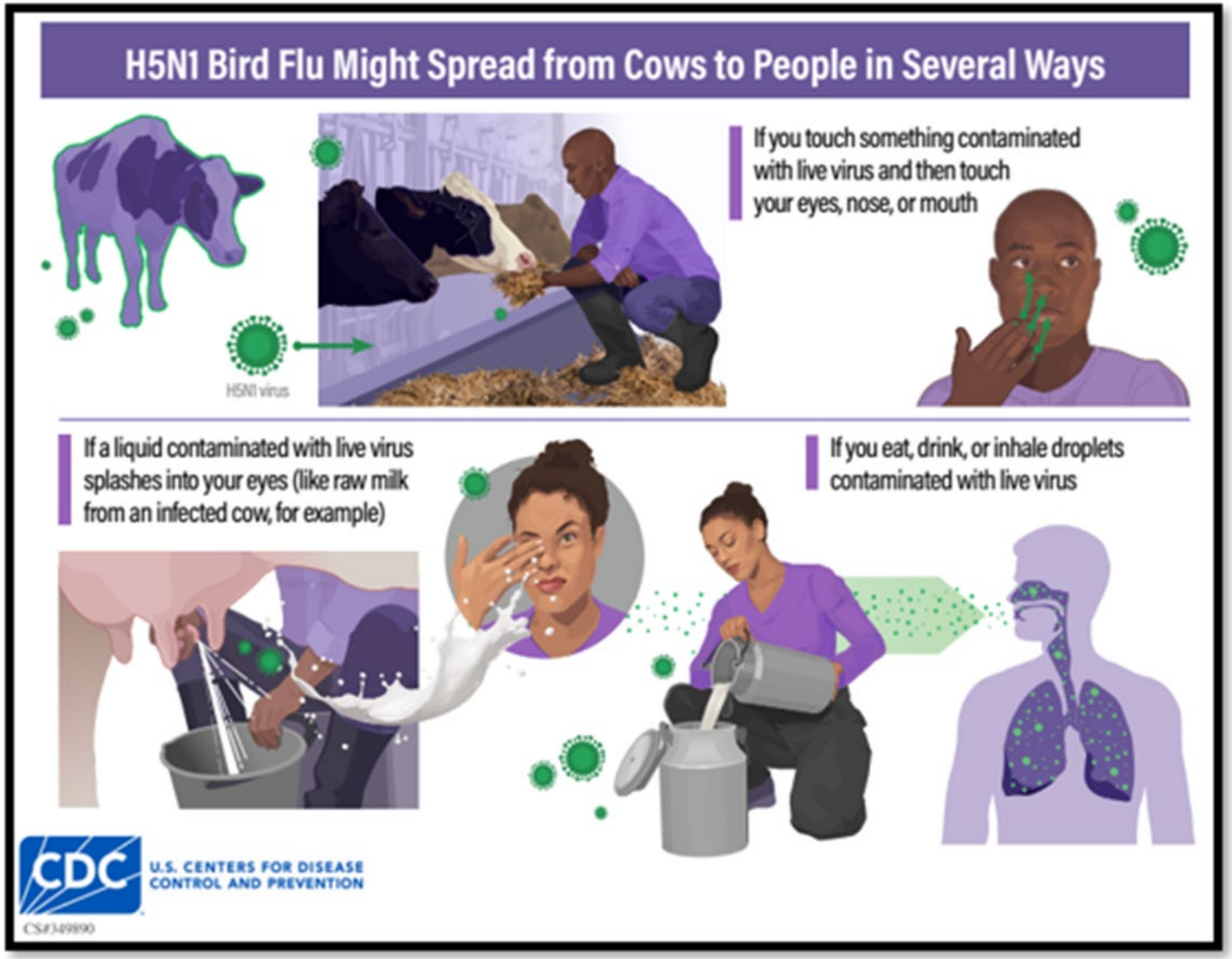
How Avian Influenza Could Spread on a Dairy Farm



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Morbidity and Mortality Weekly Report (*MMWR*)

Search

Human Cases of Highly Pathogenic Avian Influenza A(H5N1) — California, September–December 2024

Weekly / March 13, 2025 / 74(8);127–133

Print

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CDC MMWR - Human Cases of Highly Pathogenic Avian Influenza A(H5N1)

Human Cases of Highly Pathogenic Avian Influenza A(H5N1) — California, September–December 2024

Weekly / March 13, 2025 / 74(8);127–133

TABLE 2. Characteristics and laboratory results of persons with confirmed and probable highly pathogenic avian influenza A(H5N1) virus infection — California, September–December 2024

Characteristic	Confirmed and probable no. (%)
Total	**38***
Confirmed	37 (97.4)
Probable†	1 (2.6)
Median age, yrs (IQR)	43 (32–49)
CDC confirmatory result by testing site¶	
Conjunctival swab (n = 37)	35 (94.6)
Nasal/Oropharyngeal swab (n = 29)	8 (27.6)
Nasopharyngeal swab (n = 37)	5 (13.5)
Nasal (n = 6)	2 (33.3)
Oropharyngeal (n = 4)	1 (25.0)
Clinical signs and symptoms	
Eye irritation or redness	37 (97.4)
Fever**	11 (28.9)
Muscle aches	13 (34.2)
Headache	10 (26.3)
Sore throat	6 (15.8)
Cough	6 (15.8)
Shortness of breath	4 (10.5)
Vomiting	2 (5.3)
Diarrhea	2 (5.3)
Fatigue	7 (18.4)
Dairy farm exposure	37 (97.4)

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Influenza Testing and Subtyping in Humans

Testing Recommendations for H5N1

- Collect respiratory specimens from all suspect cases with:
  - Signs and symptoms consistent with acute respiratory tract infection and/or conjunctivitis; AND
  - A history of exposure in the last 10 days to animals or humans with suspected or confirmed H5N1 influenza infection, or to raw milk.
- Pan-influenza A PCR tests (i.e., tests that detect RNA from any / all influenza A viruses) on specimens collected based on symptoms can rule out influenza A (and therefore H5N1) in people with low suspicion of H5N1 infection.
  - Positive influenza A tests and possible H5N1 exposure should refer testing to a public health laboratory (PHL).

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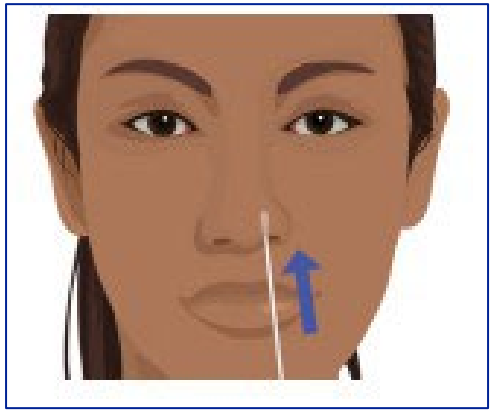
Testing for H5N1: Specimen Collection

- If testing is performed in a public health laboratory*:
  - Conjunctival swab(s) should be collected from anyone with conjunctivitis; and
  - Respiratory specimens should be collected from anyone with respiratory symptoms
  - Separate oropharyngeal (throat) and anterior nares (nasal) swab specimens are preferred, but can be combined in one tube
    - Nasopharyngeal swabs are also acceptable, but to date have had lower yield for positive test results in cases than oropharyngeal or anterior nares swabs
- **If testing is performed in a commercial laboratory respiratory specimens must be collected in addition to conjunctival swab(s) even if the patient does not have respiratory symptoms*

Conjunctival swab



Anterior nares swab

Influenza Subtyping

- Some diagnostic respiratory panels will include testing for seasonal influenza
  - i.e., A(H1N1)pdm2009, A(H3N2)
  - Diagnostic panels may not identify A(H5), but pan-influenza targets can pick up A(H5)
- If a patient under investigation (PUI) only has respiratory symptoms a negative influenza test from respiratory specimen rules out influenza A(H5)
- If a PUI has conjunctivitis, testing respiratory specimens alone may NOT rule out influenza A(H5), depending on exposure risk

Influenza Surveillance - Routine

- Routine surveillance of circulating influenza strains is performed every year during the respiratory virus season
- U.S. Influenza Collaborating Laboratories System (ICLS) and the National Respiratory and Enteric Virus Surveillance System (NREVSS) consist of ~100 public health laboratories and ~300 clinical laboratories across the country that have the capability for characterizing influenza
  - Circulating types, subtypes, and lineages
  - Ages of those affected

  (More information can be found at CDC FluView website)
- For summer 2024, CDC called for “enhanced surveillance activities” for influenza subtyping (during "off season")

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Enhanced Influenza Surveillance – Summer 2024

1. Identification of human infections via symptom monitoring among workers and others with recent exposures to HPAI A/H5 infected animals on farms or other locations.
2. Conduct outreach and education to people exhibiting animals (specifically swine, cattle and avian species) at or attending agricultural fairs.
3. Encourage ongoing influenza testing (preferably RT-PCR) of individuals with compatible illness (e.g. respiratory illness with or without a fever or conjunctivitis) throughout the summer, particularly for persons with recent history of relevant exposures (e.g., dairy cows, raw milk, wild birds, poultry, agricultural fair attendance).
4. Enhance surveillance for novel influenza A detection among severely ill patients by subtyping influenza A positive specimens from patient hospitalized or in the ICU.
5. Enhance surveillance for novel influenza A detections in the community by maintaining the flow of influenza positive specimens to and subtyping of influenza A positives by public health laboratories and investigation of unexplained clusters of respiratory illness.
6. Monitor influenza surveillance data for any unexpected patterns.
7. Local data anomaly detection and investigation.

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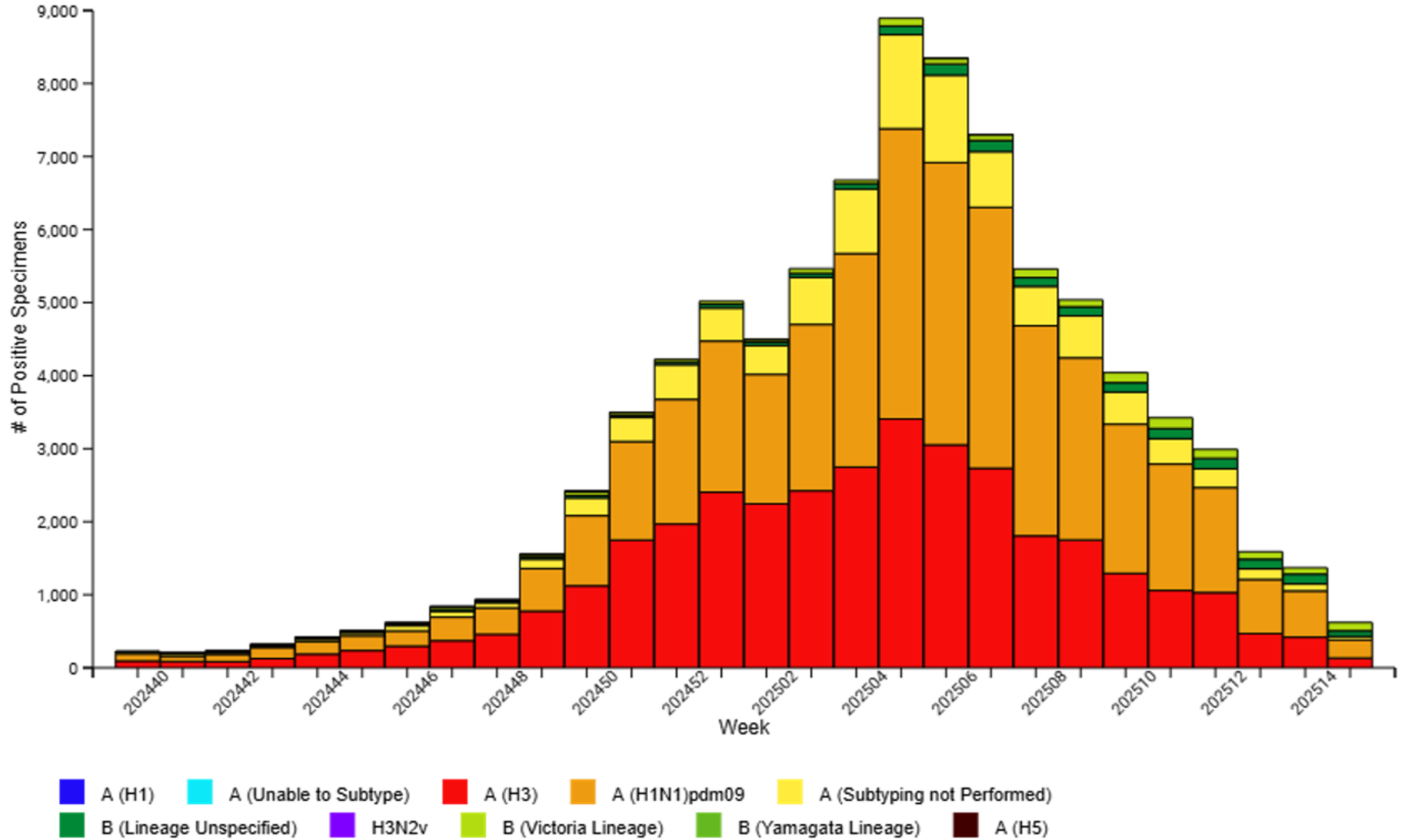
FLUVIEW interactive

CDC U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

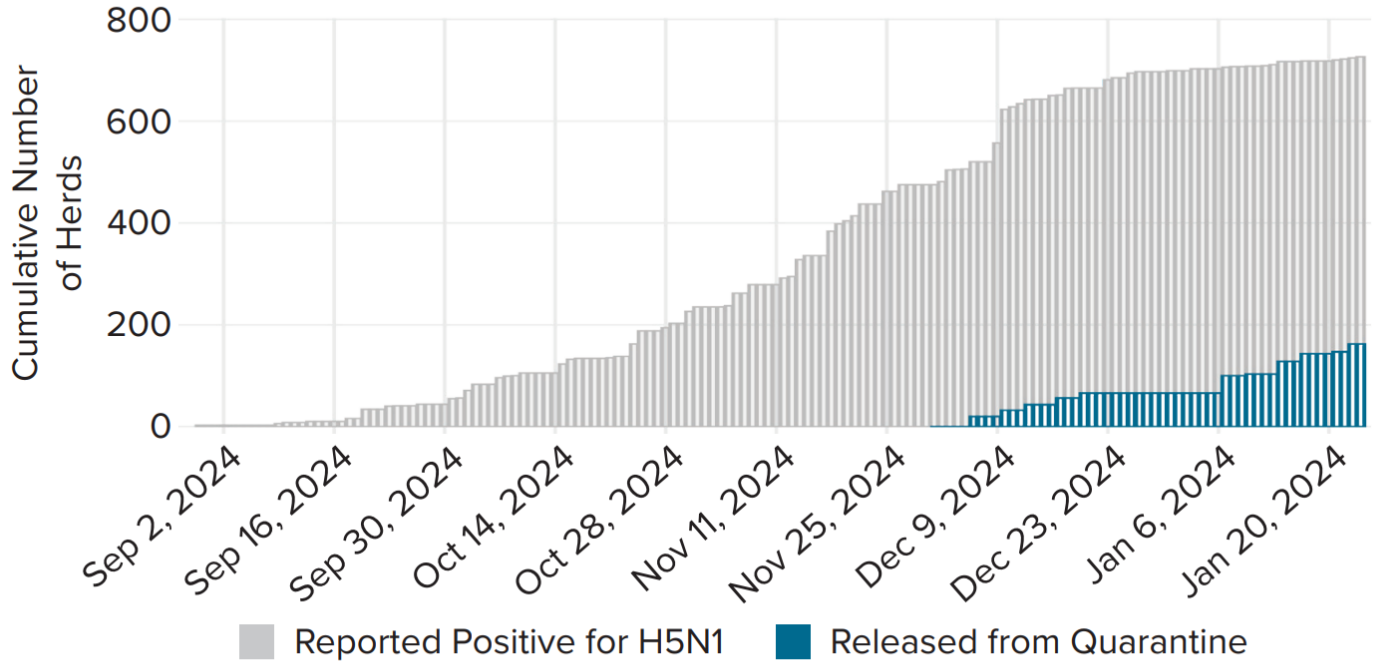
Influenza Positive Tests Reported to CDC by Public Health Laboratories, National Summary, 2024-25 Season, week ending Apr 12, 2025



Good news: dairy herds in California are recovering

- More dairy cattle herds are being released from quarantine than are becoming newly infected in California
- As of 4/17/25, 603 (79%) of 764 affected dairy farms had been released from quarantine.
- CDPH, CDFA, and other Californian agencies will continue to watch as we enter spring and another migration period

Figure 2. Proportion of California Dairy Herds Reporting H5N1 Detection and Release From Quarantine, 2024



Source: USDA Animal and Plant Health Inspection Service and CA Department of Food and Agriculture. Available at: tinyurl.com/255wnhba and tinyurl.com/4tcdx57w.

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Economic Assessment of Avian Influenza on California Eggs and Milk - Article from Agricultural and Resource Economics (3/7/2025)

One Health Response to H5N1 in California

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Resources

- CDPH Bird Flu Website
- CDPH Avian Influenza A(H5N1) Information for Health Professionals
  - Subtyping of Influenza A in Hospitalized Patients
  - CDPH Avian Influenza A Infection Control for Healthcare Providers
  - CDPH Human Avian Influenza A(H5N1) Quicksheet
  - Guidance for People with Possible or Confirmed Bird Flu Infection | Spanish
- CDC: Interim Guidance on the Use of Antiviral Medications for Treatment of Human Infections with Novel Influenza A Viruses Associated with Severe Human Disease
- CDC: Interim Guidance for Infection Control Within Healthcare Settings When Caring for Confirmed Cases, Probable Cases, and Cases Under Investigation for Infection with Novel Influenza A Viruses Associated with Severe Disease

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(happy lab week ☺)