



## 2024 Influenza A Virus HPAI H5N1 Outbreak Weekly Report July 26, 2024

### Introduction

In March 2024, several cases of highly pathogenic avian influenza A (HPAI) H5N1 virus were confirmed in dairy cattle in Texas, with cases spreading to at least eight other states (<https://www.biorxiv.org/content/10.1101/2024.05.01.591751v1>). In addition, a human case of influenza from the same clade and genotype was also diagnosed in a dairy worker from Texas around the same time. As part of an effort to track this outbreak, the United States Department of Agriculture (USDA) Agricultural Research Service (ARS) and the USDA National Veterinary Services Laboratories (NVSL) have been working to collect and sequence samples from additional cattle as well as avian species and other animals that also appeared to be infected with HPAI that might be related to the virus from the Texas dairy cattle. The genomic sequences of each virus isolate (consisting of the eight genomic segments sequenced for each individual isolate) are assembled from the sequenced short read data, and after undergoing quality control, are submitted to the GenBank sequence repository where they become publicly available. To enhance the ability of the USDA to rapidly submit sequences to GenBank, personnel from the Bacterial and Viral Bioinformatics Resource Center (BV-BRC) have been collaborating with USDA scientists to assist them with the submission of assembled HPAI genomic sequences to GenBank. The Centers for Disease Control and Prevention (CDC) in a similar manner, track human cases of H5N1 influenza.

The BV-BRC provides a database of complete and partially sequenced microbial genomes from both viral and bacterial pathogens. This data is derived from the GenBank repository and includes metadata obtained from the GenBank record as well as associated NCBI BioProject, BioSample, and SRA repository records. All this metadata provides users with the ability to search for specific datasets from the BV-BRC web site using the filtering and sorting features built into BV-BRC web-retrieval tools. To provide rapid access to sequences and other data and information from the 2024 HPAI outbreak, the BV-BRC provides an outbreak-specific web page with links to this information: ([https://www.bv-brc.org/outbreaks/H5N1/#view\\_tab=overview](https://www.bv-brc.org/outbreaks/H5N1/#view_tab=overview)).

### Human Cases

Human cases of H5N1 Influenza A virus infection reported in 2024 in North America

Case Report Dates	Location (#cases)	Likely Infection Source	Total Number	Number Confirmed by Sequencing
04/01/2024 – 07/03/2024	Texas (1) Michigan (2) Colorado (1)	Dairy cows	4	1 (Texas 2024) 2 (Michigan 2024) 1* (Colorado 2024)
04/28/2022 – 07/14/2024	Colorado (5 or 6)	Poultry	5 or 6	1 (2022); 1* (2024)

\*The sequence metadata does not indicate if these Colorado cases were from an individual exposed to dairy cattle or poultry.

A current summary of human avian influenza virus infections can be found at <https://www.cdc.gov/bird-flu/situation-summary/index.html>.

### Statistics (As of July 24, 2024)

The numbers below provide statistics on the publicly available H5N1 genomic sequences collected from North American isolates in 2024. These sequences are available from the BV-BRC database using the links in the table. We report the number of isolates along with the number of sequenced genomic segments (usually 8 per isolate). These numbers include sequences generated by the USDA and submitted to GenBank by both the USDA and BV-BRC; USDA sequences assembled by the BV-BRC from SRA data not yet submitted to GenBank; and sequences submitted to GenBank from all other sources.

#### Influenza A sequence counts from the BV-BRC database

Outbreak Report Date	All Influenza A virus Sequences	All H5N1 Sequences	2024 H5N1 Sequences
May 22, 2024	1,061,787	53,030	2,379 (296 isolates)
May 29, 2024	1,065,763	54,632	2,563 (318 isolates)
June 12, 2024	1,082,498	57,301	5,132 (641 isolates)
June 19, 2024	1,087,487	58,045	5,728 (714 isolates)
June 26, 2024	1,091,952	59,465	7,112 (889 isolates)
July 3, 2024	1,092,769	60,280	7,927 (991 isolates)
July 10, 2024	1,096,341	61,469	8,863 (1,108 isolates)
July 17, 2024	1,098,276	63,324	10,534 (1,317 isolates)
July 26, 2024 <sup>1</sup>	<a href="#">1,099,887</a>	<a href="#">63,650</a>	<a href="#">10,812</a> (1,350 isolates)

<sup>1</sup>The BV-BRC genomic database links provided for these totals are dynamic and provide current numbers at the time the link is followed. Therefore, these numbers will increase over time.

#### Influenza A sequences from SRA and not yet submitted to GenBank

The BV-BRC checks the sequence read archive (SRA) database each week for submitted raw sequence read data that has not yet been assembled and submitted to GenBank. This past week, an additional 206 H5N1 genomic sequences from 26 isolates were identified, assembled, and loaded into the BV-BRC database. These isolates were from humans (2), cows (21), chickens (2), and turkeys (1). The human sequences were from Colorado and all the others were from the USA with no further information on location. Note that there were additional changes to the BV-BRC sequence records this past week arising from updates to the associated metadata. This has resulted in a further increase in the number of sequence records (72) and isolates (9) beyond the 206 (26) indicated above. These increases are reflected in the data provided in this report.

The tables on the next page summarize North American H5N1 2024 isolates collected in 2024 as of July 24, 2024, and include both GenBank and SRA-derived isolates.

## H5N1 US virus isolates collected and sequenced in 2024, by host and US states

Host	# Isolates
Alpaca	3
American crow	17
American white pelican	1
American wigeon	1
Bald eagle	13
Black scoter	1
Blackbird	2
Brandt goose	1
CAGO	1
Canada goose	48
Cat	10
Cat, domestic	32
Chicken	79
Common eider	1
Common grackle	1
Common loon	6
Common raven	3
Cow	879
Duck	4
Environment	1
Goat	30
Goose	1
Grackle	3
Great black-backed gull	10
Great horned owl	4
Harris hawk	2
Hawk	1
Herring gull	9
Hooded merganser	1
Human	5
Lesser scaup	1
Mountain lion	4
Mute swan	2
PEFA	1
Peregrine falcon	1
Pigeon	2
Raccoon	4
Red fox	5
Red tailed hawk	13
Redhead duck	1
Ruddy turnstone	1
Sanderling	29
Scoter	2
Skunk	18
Snow goose	6
Surf scoter	1
Turkey	61
Turkey vulture	8
Western gull	2
Western sandpiper	1
White-winged scoter	16
Wood duck	1

State	# Isolates
California	8
Colorado	3
Idaho	6
Illinois	2
Indiana	5
Iowa	1
Kansas	15
Maine	1
Maryland	2
Massachusetts	128
Michigan	26
Minnesota	21
Missouri	7
Montana	4
New Hampshire	3
New Mexico	32
North Carolina	9
Ohio	30
Oklahoma	1
Oregon	3
Rhode Island	5
South Carolina	3
South Dakota	21
Texas	138
Utah	2
Virginia	14
Washington	7
USA (no state designated)	853

## Phylogenetic Analysis

The latest phylogenetic trees for all eight segments can be accessed using the URL below, which includes all human isolates with available sequence data [https://www.bv-brc.org/outbreaks/H5N1/#view\\_tab=phylogenetics](https://www.bv-brc.org/outbreaks/H5N1/#view_tab=phylogenetics). These trees were generated on July 25, 2024, and contain the last batch of assembled SRA sequences that were uploaded to the BV-BRC database on July 24, 2024.

## News

Title	Date	Source
<a href="#">With the U.S. bird flu outbreak uncontained, scientists see growing risks</a>	July 24	NPR
<a href="#">Testing transmission and infection of H5N1 from cows   National Institutes of Health (NIH)</a>	July 23	NIH
<a href="#">Avian flu infects two more Colorado poultry cullers, one at second farm   CIDRAP</a>	July 22	CIDRAP
<a href="#">Dairy HPAI Order of Statewide Mandatory Testing.pdf</a>	July 22	CDA
<a href="#">H5N1 strikes another large layer farm in Colorado, dairy herd in Minnesota   CIDRAP</a>	July 19	CIDRAP
<a href="#">Colorado HPAI Situation Report</a>	July 19	CDA
<a href="#">Emergency Use Instructions (EUI) for Oseltamivir   Bird Flu   CDC</a>	July 19	CDC
<a href="#">CDC A(H5N1) Bird Flu Response Update, July 19, 2024</a>	July 19	CDC
<a href="#">Flu Vaccine Protects Nonhuman Primates Against Avian H5N1</a>	July 19	GEN
<a href="#">The Medical Minute: Why experts are watching the H5N1 bird flu so closely - Penn State Health News</a>	July 17	Penn State
<a href="#">Study suggests earlier US-licensed H5N1 vaccines prompt antibodies to current strain   CIDRAP</a>	July 17	CIDRAP
<a href="#">Can H5N1 spread through cow sneezes? Experiment offers clues</a>	July 16	Nature
<a href="#">Update on Highly Pathogenic Avian Influenza A(H5N1) Virus for Clinicians and Healthcare Centers</a>	July 16	CDC
<a href="#">Colorado HPAI Response   Department of Agriculture</a>	-	CDA

## Publications

Title	Date	Source
<a href="#">Spillover of highly pathogenic avian influenza H5N1 virus to dairy cattle</a>	July 25	Nature
<a href="#">First sighting of human H5N1 in Australia: A detailed account and public health implications</a>	July 25	New Microbes and New Infections
<a href="#">Detection and genomic characterization of an avian influenza virus A/mute swan/Mangystau/1-S24R-2/2024 (H5N1; clade 2.3.4.4b) strain isolated from the lung of a dead swan in Kazakhstan</a>	July 22	ASM
<a href="#">Cytomegalovirus vaccine vector-induced effector memory CD4 + T cells protect cynomolgus macaques from lethal aerosolized heterologous avian influenza challenge   Nature Communications</a>	July 19	Nature
<a href="#">Avian influenza overview March–June 2024</a>	July 19	EFSA
<a href="#">Age-dependent heterogeneity in the antigenic effects of mutations to influenza hemagglutinin: Cell Host &amp; Microbe</a>	July 19	cell host & microbe
<a href="#">Experimental reproduction of viral replication and disease in dairy calves and lactating cows inoculated with highly pathogenic avian influenza H5N1 clade 2.3.4.4b   bioRxiv</a>	Preprint	Biorxiv
<a href="#">Public Health Risk Assessment associated with the spread of zoonotic avian influenza A(H5N1) clade 2.3.4.4b in the Region of the Americas - 12 July 2024 - PAHO/WHO</a>	July 12	PAHO
<a href="#">Wastewater Surveillance to Confirm Differences in Influenza A Infection between Michigan, USA, and Ontario, Canada, September 2022–March 2023</a>	July 10	Emerging Infectious Disease