



## 2024 Influenza A Virus HPAI H5N1 Outbreak Weekly Report July 17, 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 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)).

This report provides statistics on the public availability of HPAI H5N1 genomic sequences historically, and from isolates collected since 2024.

### Human Cases

Four additional human cases of H5N1 influenza from Colorado have been reported by the CDC in the past week. A fifth case from Colorado was identified in 2022. These five cases were identified in poultry workers. Four human cases of H5N1 due to exposure to dairy cows have been identified since April 2024. One from Colorado, two from Michigan and one from Texas. 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 17, 2024)

The numbers provided below are obtained from the BV-BRC database. These numbers should be equivalent to those available from GenBank with the exception that the BV-BRC database also contains H5N1 sequences assembled from SRA records that have not yet been submitted to GenBank. (See below.)

For the 2024 outbreak, where we have isolate-specific information, we report the number of isolates along with the number of sequenced genomic segments (generally 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	All Influenza A Sequences	All H5N1 Sequences	2024 H5N1 Sequences
May 22	1,061,803	53,046	2,395 (298 isolates) <sup>2</sup>
May 29	1,065,779	54,648	2,579 (320 isolates) <sup>2</sup>
June 12	1,082,514	57,317	5,148 (643 isolates) <sup>2</sup>
June 19	1,087,503	58,061	5,744 (716 isolates) <sup>2</sup>
June 26	1,091,952	59,465	7,112 (889 isolates) <sup>3</sup>
July 3	1,092,769	60,280	7,927 (991 isolates) <sup>3</sup>
July 10	1,096,341	61,469	8,863 (1,108 isolates) <sup>3</sup>
July 17 <sup>1</sup>	1,098,276	63,324	10,534 (1,317 isolates) <sup>3</sup>

<sup>1</sup>The BV-BRC genomic database links provided for these totals, provide summary numbers as of the time the link is followed. Therefore, these numbers will increase over time.

<sup>2</sup>These numbers include 16 sequences from 2 isolates from Kazakhstan.

<sup>3</sup>These numbers only include North American sequences.

### 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 1,671 H5N1 genomic sequences from 209 isolates were identified, assembled, and loaded into the BV-BRC database. These isolates were from cows (67), cat (1) and avian species (141). The states where some of these isolates were obtained were Maine, Massachusetts, New Hampshire, Rhode Island, and Virginia. Eighty isolates did not provide a state designation. All of the isolates from avian hosts other than chickens or turkeys that were reported this past week, were collected from January through April 2024. Most, if not all of these, branch phylogenetically, separate from isolate sequences from the current dairy cattle outbreak. They are located within a separate clade with other previously reported US sequences isolated from avian hosts in 2024. These belong to the 2.3.4.4b clade of H5 viruses as do all other sequences from 2024. (No additional metadata is available for the current batch of sequences isolated from chickens and turkeys. These sequences show greater phylogenetic similarity to sequences from the current dairy cattle outbreak in contrast to the other avian sequences.)

The tables on the next page summarize North American H5N1 2024 isolates collected in 2024 as of July 15, 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 White Pelican	1
American Wigeon	1
Bald Eagle	13
Blackbird	2
Black Scoter	1
CAGO	1
Cat	10
Chicken	78
Common Eider	1
Common Raven	1
Cow	859
Crow	17
Domestic Cat	32
Duck	2
Goat	30
Goose	46
Grackle	4
Great-Horned Owl	5
Gull	10
Harris-Hawk	1
Hawk	13
Herring Gull	10
Hooded Merganser	1
Human	2
Lesser Scaup	1
Loon	6
Mallard	2
Mountain Lion	4
Mute Swan	2
PEFA	1
Peregrine Falcon	1
Pigeon	2
Raccoon	4
Raven	2
Red Fox	5
Redhead Duck	3
Ruddy Turnstone	1
Sanderling	27
Sandpiper	1
Scoter	3
Skunk	18
Snow Goose	6
Turkey	60
Turkey Vulture	1
Vulture	5
Western Gull	1
Wood Duck	1
White-Winged Scoter	16

State	# Isolates
California	8
Colorado	1
Idaho	6
Illinois	2
Indiana	5
Iowa	1
Kansas	15
Maine	1
Maryland	2
Massachusetts	113
Michigan	25
Minnesota	21
Missouri	7
Montana	4
New Hampshire	4
New Mexico	32
North Carolina	12
Ohio	30
Oklahoma	1
Oregon	3
Rhode Island	10
South Carolina	3
South Dakota	21
Texas	139
Utah	2
Virginia	13
Washington	7
USA (no state designated)	830

## 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 17, 2024, and contain the last batch of assembled SRA sequences that were uploaded to the BV-BRC database on July 15, 2024.

## News

Title	Date	Source
<a href="#">Officials probe heat-wave factors in H5N1 spread to Colorado poultry cullers   CIDRAP</a>	July 16	CIDRAP
<a href="#">Tests confirm H5N1 in Oklahoma dairy herd; 13 states now affected   CIDRAP</a>	July 15	CIDRAP
<a href="#">Colorado reports avian flu infections in 5 people who culled sick poultry   CIDRAP</a>	July 15	CIDRAP
<a href="#">US CDC sends field team to aid Colorado's bird flu response   Reuters</a>	July 15	Reuters
<a href="#">Health officials confirm human cases of avian flu in Colorado poultry workers</a>	July 14	CDPHE
<a href="#">US health officials confirm four new bird flu cases, in Colorado poultry workers</a>	July 14	AP
<a href="#">CDC Updates Vaccine Recommendations   NCIRD</a>	July 12	CDC
<a href="#">CDC A(H5N1) Bird Flu Response Update, July 12, 2024</a>	July 12	CDC
<a href="#">Highly Pathogenic Avian Influenza Detected in Oklahoma Dairy Herd</a>	July 12	Oklahoma Dept. of Agriculture, Food and Forestry
<a href="#">Colorado state health officials identify possible cases of avian flu in Colorado poultry workers   Department of Public Health &amp; Environment</a>	July 12	CDPHE
<a href="#">Daily briefing: How nations are preparing for a possible H5N1 bird flu pandemic</a>	July 12	Nature
<a href="#">CDC Issues Updated Guidance to Help Prevent Spread of Flu at Agricultural Fairs   NCIRD</a>	July 11	CDC
<a href="#">H5N1 confirmed in 5 more US dairy herds, more cats   CIDRAP</a>	July 10	CIDRAP
<a href="#">H5N1 strikes dairy herd in Michigan, large poultry farm in Colorado   CIDRAP</a>	July 9	CIDRAP
<a href="#">H5N1 avian influenza: tracking outbreaks with real-time epidemiological data</a>	July 9	The Lancet

## Publications

Title	Date	Source
<a href="#">Avian influenza viruses in wild birds in Canada following incursions of highly pathogenic H5N1 virus from Eurasia in 2021–2022</a>	July 16	ASM mBio
<a href="#">MHC class II proteins mediate sialic acid independent entry of human and avian H2N2 influenza A viruses   Nature Microbiology</a>	July 15	Nature Microbiology
<a href="#">Genomic Characterization of Highly Pathogenic Avian Influenza A H5N1 Virus Newly Emerged in Dairy Cattle</a>	July 15	Emerging microbes and infections
<a href="#">Safety and immunogenicity of the intranasal H3N2 M2-deficient single-replication influenza vaccine alone or coadministered with an inactivated influenza vaccine (Fluzone High-Dose Quadrivalent) in adults aged 65–85 years in the USA: a multicentre, randomised, double-blind, double-dummy, phase 1b trial</a>	July 11	The Lancet
<a href="#">Enhancing cross-protection against influenza by heterologous sequential immunization with mRNA LNP and protein nanoparticle vaccines   Nature Communications</a>	July 10	Nature Communications
<a href="#">Sialic Acid Receptor Specificity in Mammary Gland of Dairy Cattle Infected with Highly Pathogenic Avian Influenza A(H5N1) Virus - Volume 30, Number 7—July 2024 - Emerging Infectious Diseases journal - CDC</a>	July	Emerging Infectious Disease